EFFORTS TO MANAGE DISPUTES IN THE CONSTRUCTION INDUSTRY: A COMPARISON OF THE NEW ENGINEERING CONTRACT AND THE DISPUTE REVIEW BOARD

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ABSTRACT

The construction industry has been plagued with an increasing number of claims and high litigation costs. How do we reduce conflict and litigation in the construction process? On one hand, leaders of the construction industry in the United States (US) focused their efforts on improving alternative dispute resolution mechanisms. For instance, the American Society of Civil Engineers has introduced the Dispute Review Board (DRB) as a complementary provision to standard US construction practices. The establishment of the DRB to solve construction disputes on the job, avoid claims, and reduce project costs has proven considerable success. On the other hand, construction industry leaders in the United Kingdom (UK) have focused some of their efforts on improving general contract conditions. The Council of the Institution of Civil Engineers of the UK has introduced the New Engineering Contract (NEC) to the construction industry as an alternative to presently used contracts. The NEC proposes to be an innovative, non-adversarial mechanism to resolve disputes on the job, avoid and reduce claims, and to assuage rising litigation costs in the construction industry. It too has proven considerable success in its efforts. This research concentrates on the DRB and the NEC as attempts by construction leaders to modernize and improve construction practices. In summary, the research compares the success stories of the DRB and the NEC as approaches to combating the adversarial nature, increasing number of disputes and rising litigation costs in the construction industry. The main conclusions ascertained in this research are as follows. Despite coming from similar business environments, construction industry leaders in the US and the UK embarked on different methods to address the issues plaguing the industry and to improve construction practices. Both in the US and the UK, construction leaders were mostly influenced to proactively seek and implement change in construction practices by experts from within the engineering and construction industry vanguard. The undertaking of these changes have shown similar success stories and the results have produced substantial impacts on the construction process. In conclusion, the efforts of construction leaders to implement the DRB and the NEC have provided effective mechanisms in improving communication and relations, and managing disputes in a timely fashion at the job site level.

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Chapter 1. Introduction

This chapter introduces the thesis by providing a brief discussion of the issues involved in the research. The scope, objectives, and research methodology are presented with an outline of the thesis.

1.1 History

In a typical construction project, the Owners, Project Manager, field Engineers, general Contractor, Subcontractors, and Suppliers are the primary stakeholders. The Owners invest capital and provide the economic power. The Project Manager and field Engineer (e.g. Owner and Contractor representatives) maintain efficient progress on a project. The general Contractor and Subcontractors provide services, skills, and knowledge towards achieving a successful project, that is, a project completed on time, on budget, and of the best quality. The direct relationships between the primary stakeholders are a necessary interactive process to achieve a successful project. Fair compensation, secure economic support, and cooperative working environments are expected and required for prosperity in the construction industry.

1.1.1 Common Environments in British and American Construction Industries

Contract relationships in the United Kingdom (UK) and the United States (US) have become increasingly strained in recent years in the construction industry. This has resulted in a substantial increase in the use of the judicial system for the settlement of contractual disagreements. The construction industry has become increasingly adversarial in both the public and private sector contracting. Among the stakeholders, the working relationships, the communication, and the commitment to a successful job and each other are often not performed in good faith. For all parties involved, these predicaments cause difficulties and additional costs to accomplish the construction activities.

The UK and US construction industries are plagued by a progressive disease of heighten adversity and rising litigious occurrences between parties participating on civil engineering projects. In a report prepared by the UK National Contractors Group of the Reading University Centre for Strategic Studies in Construction, it is declared that " 'Over the past 20 years, loss and expense [due to] contractual claims have attacked British [and American] industry like a cancer' " ("Another lead on dispute resolution" 1991). In the UK, increasing contractual disputes, adversarial natures, and poor project management contribute to the current adverse climate in the construction environment. In both, the UK and the US construction industries, the number of claims and cost of litigation has dramatically risen. In 1991, the *Military Engineer* reported that in the US, "it became apparent that litigation was taking an increasing toll in the contract claims area. Claims for additional costs were increasing" (Edelman 1990). A *New Builder* survey reports that in the UK, "Construction costs are currently being boosted by up to 30% as key personnel struggle with the claims-ridden nature of the modern [construction] industry" (Middel 1990). In the same report, one company director states that in the early fiscal quarters of 1990, every project over £1 million had involved lawyers to settle a dispute. Both in the UK and US construction sectors, adversity and disputes arise primarily due to lack of communication, distrust, misinterpretations of contracts, uncertainties of roles and responsibilities, and "us vs. them" attitudes due to an imbalance of risks allocations.

1.1.2 Construction Environment in the United Kingdom

In the UK, adversarial natures and gamesmanship are evident in portions of the construction environment, analogous to the US. On UK construction projects, disputes generally arise between any combination of Clients (Owner, as referred to in the US), Contractors, and Consultants. Like in the US, delays, litigation, and additional costs are the consequences of disputes. Stakeholders, in the UK construction industry, have been investigating possibilities to rectify the expensive and time-wasting source of conflict. Equivalent to the US, Partnering demonstrates to be instrumental in the UK at addressing the conflicts before and after they occur. Likewise, Mediation and Arbitration exhibit

benefits to projects in dealing with disputes. At the same time, parallel efforts of construction industry participants in the US and the UK to implement ADR procedures have met with the same dilemma: with the complexity and rising costs of projects, the ADR mechanisms have, on occasions, become as costly and time-consuming as litigation. Hence, a common sentiment in the UK is that the participants in any project are "locked into an archaic contractual framework, which fosters an adversarial role for each of the parties to the contract" (Allen 1991). Consequently, the leaders of the UK construction industry focuses its efforts on developing and improving general contract conditions, like the New Engineering Contract (NEC). The drafters of the NEC believe that the cause of all the ills of the industry is not entirely on account of traditional contracts. But, a new form of contract is probably the most effective way to bring about significant general improvements.

In 1986, the legal affairs committee of the Council of the Institution of Civil Engineers (ICE) of Great Britain (UK) commissioned work to begin on the development of an alternative contract for civil engineering design and construction projects. Dr. Martin Barnes of Martin Barnes Project Management was the lead architect of the New Engineering Contract (NEC). As a project management expert, Barnes led a writing team of ICE members, contractor representatives, consulting engineers, and members of the legal profession to draft a new and innovative style contract.

Owners, Engineers, and Contractors in the UK propose the NEC "family" of documents as an innovative, non-adversarial mechanism to reduce claims and to assuage rising litigation costs in the construction industry. Unlike traditional contracts, the NEC attempts to achieve improvements in contractual relationships, managerial practices, and business values. The NEC reallocates the risk amongst the stakeholders, such that they are motivated to cooperate to secure their vested interest. Furthermore, the NEC is designed to enhance the stakeholder management effectiveness. The NEC guidelines promote foresight, cooperation, and specific responsibilities to everyone involved, thus reducing the ambiguity of who is to do what, when, and how.

The question that still may remain is what exactly is the NEC. In short, the NEC is a system of general conditions of contract documents that differ from the standard forms currently used in construction practice today. The NEC differs mostly in the following six ways:

1. The Owner (Client or Employer, as referred to in the UK) is expected to be in charge of a project. The NEC provides the contract mechanisms, which holds the Owner (the largest risk-taker on a project) in charge.

2. The NEC establishes the script for the actual orderly and practical conduct of the project, rather than concentrating on legal rights, responsibilities, and duties.

3. The NEC clearly divides the roles of contract participants, thereby removing the issue of conflicting interest.

4. The NEC establishes a workable system by which calculations for pricing and extension of time can be determined in the same manner for scope of original work and changed work.

5. Through its proactive and mandated procedures, the NEC encourages and supports good project management to the benefit of participants (i.e. Contractor and Project Manager) of the contract.

6. The NEC is an integrated system of contract documents. Because of its uniformity and consistency of concepts, terms, and procedures, the NEC contract documents can be used in all levels of construction interfaces (Groton and Thompson 1998).

Using the NEC, the construction industry expects to reduce cost-risk, time overruns, and inadequate performance, and to increase the success rate of construction projects, thereby increasing the profitability for the Contractor, the Subcontractor, the

Suppliers, and satisfying the commitment to the Owner. To date, the NEC is primarily used in the United Kingdom. Yet, it is intended to be general contract conditions that are easily adaptable for use on engineering and construction projects worldwide. The many aspects of the NEC are examined throughout this study. Chapter 2 and Chapter 3 expand more on the development and impact of the NEC on the construction industry.

1.1.3 Construction Environment in the United States

Over the past years, there has been a break down in relations between parties involved in the construction process. James J. Adrian, Ph.D., PE, CPA reports that a popular sentiment in the construction industry is "that a construction claim has become as much a part of a construction project as is the pouring of the concrete" (Adrian 1993). Adrian's illustration in Figure 1.1 shows a rising number of claims in the construction industry. Changes in construction technology and the complexity of projects have made building more complicated. Present used contracts and project management techniques are struggling to keep up with the dynamics of the industry. In addition, Owners have become highly leveraged with tighter budgets and restricted cash flow. Pressures to get projects up and running have led to tighter time schedules and experiments with new accelerated project delivery methods. As a result, the cumulative effect of these factors has caused traditionally cooperative relationships to deteriorate, and be replace by adversarial, antagonistic relationships, "win-lose" attitudes, and general dissension

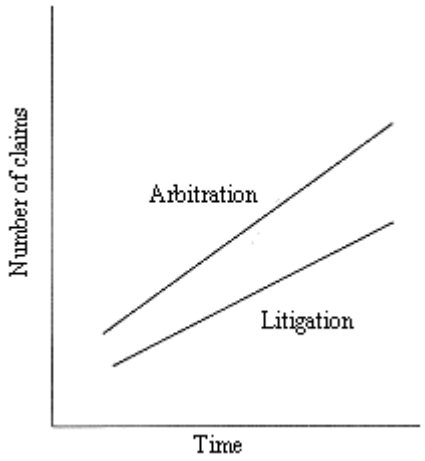

Figure 1.1 – *Increasing number of construction claims (Adrian 1993)*

The Center for Public Resources states that "the adversarial nature of this [the construction] industry takes a terrible toll on the economy of the United States" ("Preventing and Resolving Construction Disputes" 1991). Many construction participants "resort to claims of changed conditions and constructive changes to try to recoup some of their losses" (Groton 1996). The Construction Industry Institute (CII) states that "litigation related to design and construction continues to increase" (Hancher 1991). The adverse impact of the failure of parties to work together and resolve disputes during the construction process makes it imperative that the industry uncovers new ways to achieve "real time" resolutions.

In the US, the construction industry is committed to strong and mutually beneficial business relationships. On a construction project, all the stakeholders have a vested interest in mutual cooperation to meet the needs of the binding contract and the individual needs of each involved. Therefore, US construction industry leaders have developed procedures to address the conflicts and disputes before and after they occur. The construction industry focuses its efforts on developing and improving alternative dispute resolution (ADR) mechanisms, like Partnering, Dispute Review Boards (DRBs), Mediation, and Arbitration.

When the parties are unable to resolve a dispute after exhausting efforts to negotiate, they still may find themselves proceeding to litigation. In the US construction business, ADR is meant to deter and prevent the on-set of disputes and to address disputes early on to settle rapidly. Furthermore, ADR tries to eliminate the escalation of antagonistic relations that lead to a break down in reconciliation, leading to the courts as the last resort. ADR methods are informal and formal procedures that serve as alternatives to litigation. Also, ADR procedures demonstrate to be a less time consuming and less costly option to litigation procedures.

One of the ADR mechanisms employed by participants of the US construction sector is Partnering. Partnering is defined by the construction industry as creating a working relationship among all parties involved with a project in order to avoid and prevent disputes. The techniques of Partnering are aimed at building trust, teamwork, and cooperation among the parties involved on a construction project. Next, the Dispute Review Board (DRB) is a mechanism established to assist in the resolution of disputes and claims arising out of the work of a project. The DRB acts as a mediator, providing expertise to assist in and facilitate the resolution of disputes, claims, and controversies between contracting parties in an effort to prevent construction delay and cost overrun. Then, there is Mediation and Arbitration. Mediation is a procedure in which uncompromising parties submit a dispute to a neutral third party that attempts to guide the parties to reach a mutually acceptable solution. Similarly, Arbitration is a process in which a quasi-formal hearing occurs. The conflicting parties present their case to a neutral individual or group who renders a binding or non-binding decision regarding the merits of the dispute. ADR efforts have lived up to its promise to foster productive negotiations, leading to mutually acceptable conflict resolutions in the construction industry. But, question remains: is ADR not simply addressing the symptoms of ailment, and not the disease itself?

Due to its impressive display of effectiveness and practicality, leaders in the US construction industry have invested much attention to the ADR option, known as the DRB. In 1989, a contracting committee of the American Society of Civil Engineers

(ASCE) released a report entitled Avoiding and Resolving Disputes in Underground Construction. It is the first publication that made reference and provided a guide to DRBs. Since then, guides for DRBs have been developed for use on various projects. When using the DRB, construction projects are provided "a forum to foster cooperation between the Owner and the Contractor, and means for promptly and equitably resolving disputes, claims and other controversies" (ASCE 1991). The committee believed that an ADR mechanism needed to be in place to address the issues leading to a dispute or litigation immediately during construction to be more effective.

Since using the DRB concept, there has been considerable progress made to alleviate the dilemmas plaguing the construction industry. The DRB procedure is designed to provide early attention to disputes arising during construction. When conflicts do arise, the DRB is expected to act quickly in recommending a settlement before belligerent attitudes prohibit the parties from reaching a reasonable compromise. In the US, industry procedures, guidelines, and specifications that complement existing contractual proceedings support the implementation of DRBs on construction projects. Chapter 4 and Chapter 5 examine the development and impact of the DRB on the US construction sector.

Over the last two decades, the lost money, time, and productivity consumed by litigation on a construction project has dramatically risen. As shown in Figure 1.2, Adrian suggests that there is a correlation between time, cost, productivity, and claims. This prevailing crisis has motivated the leaders in various construction industries to devise new and innovative operations that is intended to improve the process and procedures for preventing, managing, and amicably settling of altercations that occur in the construction process.

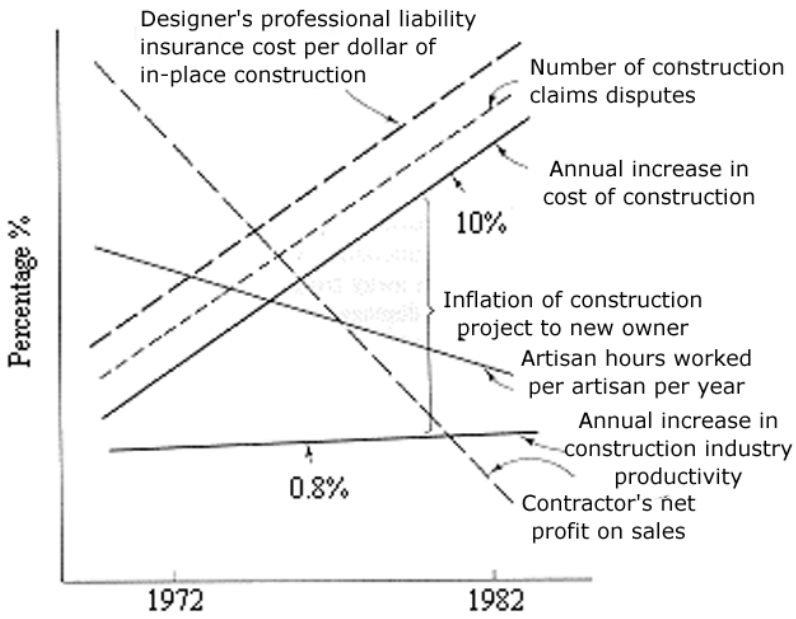

Figure 1.2 – *Low productivity in the construction industry (Adrian 1993)*

1.2 Statement of Opportunity

The fact that various sectors in the construction industry have adopted very different approaches to deal with the common problems of claims, disputes, and litigation provides an opportunity to investigate and compare the contrary pursuits. This research undertakes the opportunity to investigate and compare the approaches of the vanguards of construction industry's endeavors to remedy the affliction of increasing number of claims and escalating litigation cost. On one hand, the construction leaders of the UK concentrate on studying and improving the general conditions of contract. On the other hand, the thrust of the vanguards of the US construction sector is to study and improve alternative dispute resolution mechanisms. Figure 1.1 represents the dilemma that the construction industries face.

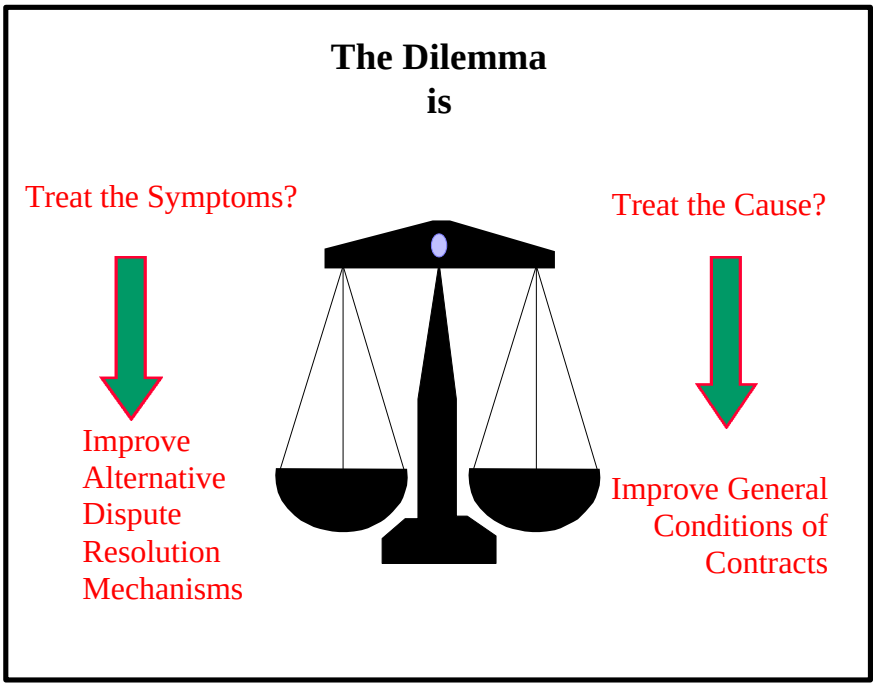

Figure 1.3 – *Dilemma between strategies to reduce conflict and litigation*

Despite the evidence that the construction industry and its practices in the UK and the US are under the same conditions, their respective journeys to an improved construction environment and practices are different. This research examines and compares the success stories of the different approaches, to improve ADR mechanisms (like the DRB in the US) and to improve general contract conditions (like the NEC in the UK). A comparison of the contrasting processes and their respective favorable results are made in Chapter 6 and Chapter 7. Figure 1.2 is an illustration of the scope of this research.

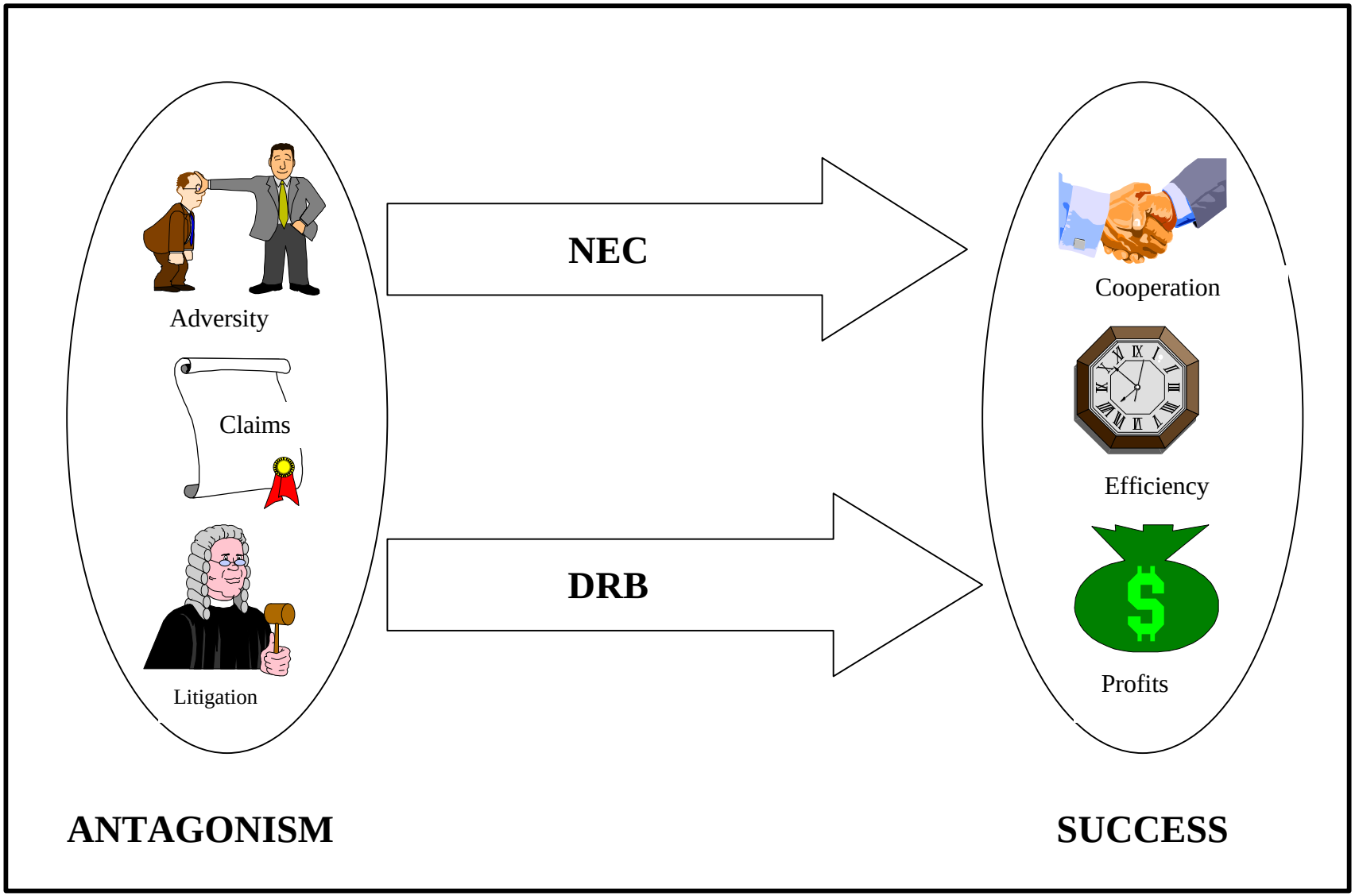

Figure 1.4 – *Illustration of the scope of research*

1.3 Objectives of Research

The three objectives of this research are as follows:

1. To describe the process used to develop and implement the NEC in the UK construction industry,

2. To present the results of the work done to measure the impact of the use of the NEC in the construction process in the UK and around the world, and

3. To compare the development and impact of the NEC used in the construction industry with the development and impact of the DRB used in the construction industry.

1.4 Methodology of Research

The methodologies of research are as follows:

1. Study the NEC and the results achieved,

2. Visit the UK to meet and interview persons that developed, use, and/or support the NEC,

3. Study the DRB and the results achieved, and

4. Synthesize Results.

1.5 Scope and Limitations of Research

The observations made in this thesis are based on the information available to date. Both the NEC and the DRB are relatively new concepts in the engineering and construction industry. Much of the information available for analysis is from secondary sources. The scope and limitations of this research are as follows:

1. The scope of this research is limited to the study of DRBs and the NEC.

2. The information available on the NEC is limited to the published material and information received from a visit to the UK, and

3. The information available on the DRB is limited to the published material.

1.6 Outline of Thesis

Figure 1.3 is a flowchart of this thesis. The thesis consists of four main segments. These are:

1.6.1 Part I. Understanding the Challenge.

This segment introduces the foci of the research. A historical review of the foci is discussed. The goals undertaken for this thesis are presented in Chapter 1.

1.6.2 Part II. The New Engineering Family of Contracts.

This section presents the results of the research methodology by establishing the industry's understanding of the NEC. As stated in Section 1.4, much of the resulting information for this treatise was gained during a visit to the

United Kingdom and conversations with key people in the UK construction industry. Also, the present status of the NEC is also addressed. The two chapters of this segment are:

- Chapter 2, the development and implementation of the NEC and
- Chapter 3, the impact of the NEC.

1.6.3 Part III. Dispute Review Boards.

This section presents the results of the research methodology by establishing the industry's understanding of the DRB. Also, the present status of the DRB is addressed. The two chapters of this segment are:

- Chapter 4, the development and implementation of the DRB and
- Chapter 5, the impact of the DRB.

1.6.4 Part IV. Comparison.

This section contains:

- Chapter 6, the comparison of the NEC with the DRB in construction practice and
- Chapter 7, the conclusions.

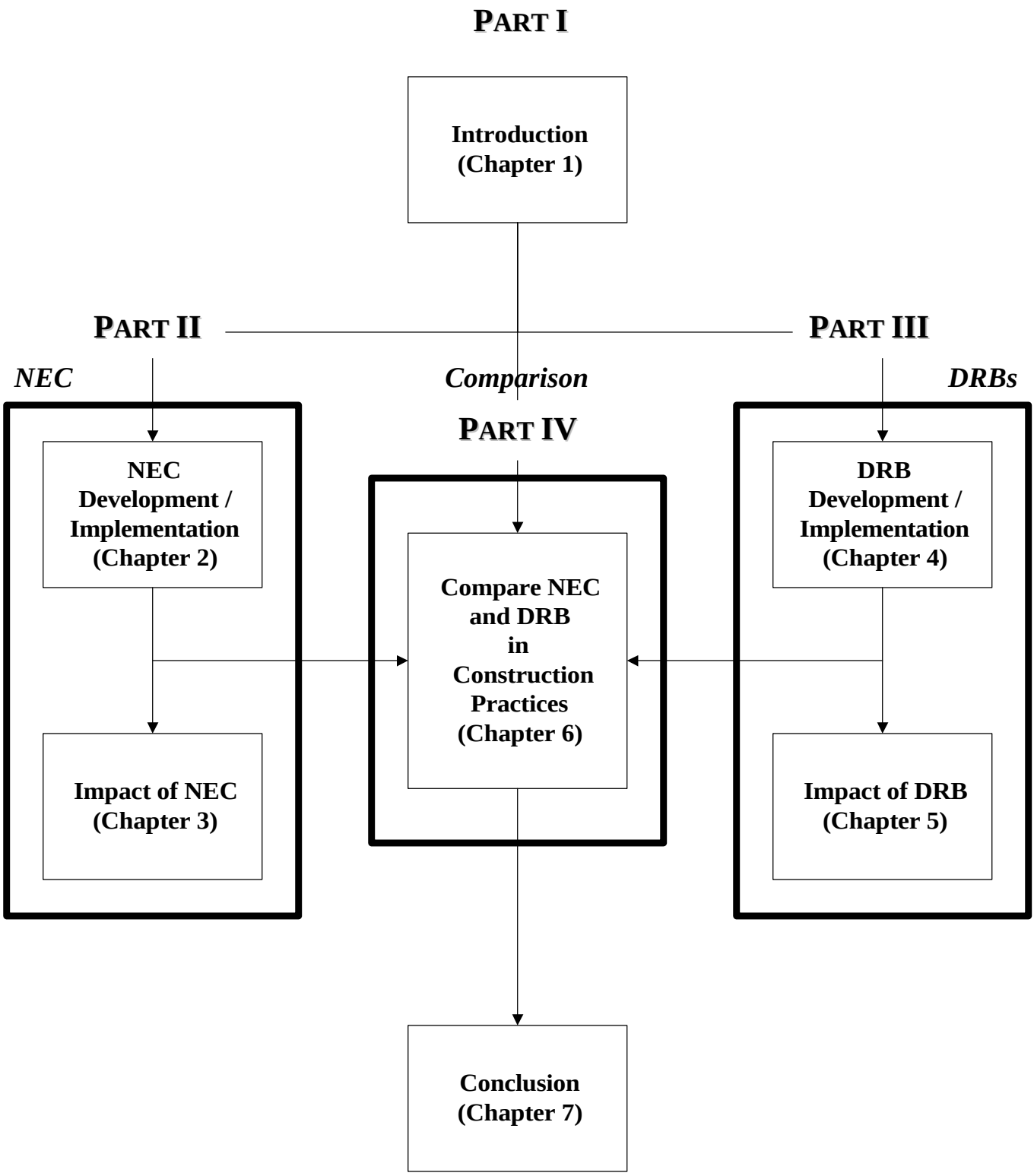

Figure 1.5 – *Flowchart of Thesis.*

Chapter 2. Development and Implementation of the New Engineering Contract

This chapter provides information on the New Engineering Contract (NEC). It looks at how the NEC was created and implemented in the United Kingdom (UK) as a response to the UK construction industry's problems with adversarial relations, claims, and litigation. Also, the chapter reviews the status of the implementation of the NEC in the construction industry to date.

2.1 Introduction

The UK construction sector has moderately conducted business under an adversarial state of affairs as described in Chapter 1. The Institution of Civil Engineers (ICE) claims that the increasing number of contractual disputes "cost the UK industry millions of pounds in claims. The fact has to be faced that in the UK contractual relationships have become highly adversarial" (Allen 1991). A large amount of time and effort is wasted arguing over contractual issues, which often generate poor relationships between the parties, delays the work, and devalue the completed project. Thereby, the current market conditions are making construction firms and Clients much more legally minded. And, modern Alternative Dispute Resolution mechanisms have not satisfied or diffused the augmenting litigious nature of the industry. Thus, the UK construction stakeholders followed the leadership of respected members of the industry and developed ingenious and cooperation-inducing new general conditions of contracts. The result is the New Engineering Contract (NEC) system or "family" of contracts. This chapter explores the history and ideology that promoted the NEC development and the product of its development. The process of implementing the NEC and the magnitude of its status in the construction industry is also investigated. Much of the information here was obtained by a visit to the United Kingdom. During the visit, interviews were conducted with the founding fathers, past and present users, and the ICE members who provide administrative support for the NEC.

2.2 United Kingdom Industry Conditions

In the UK construction industry, contractual relationships have become highly adversarial. Conflicts have risen significantly in engineering and construction practices ("Another lead on dispute resolution" 1991). The general sentiment is that too much time and energy goes toward settling disputes, instead of toward completing the projects. Furthermore, the increase in litigation is steady. Some of Britain's most prestigious construction achievements have been marred by the aftermath of claims and counterclaims. In the UK, there is an onerous tradition of claims and counter-claims in the engineering and building enterprises that have costs millions. *New Builder* declared that "in 1992, the amount spent on resolving contractual disputes in construction was approximately £3000 million or 7% of the total turnover of the [UK] industry" (Doyle 1993). Like in the US as illustrated in Figure 1.2, the claims-based nature of construction is adding up to escalating costs and lost profits. Instead of good faith negotiations, the "I'll see you in court" ultimatum is a common step taken towards resolving conflicts. Excessive legalism is perceived as central to the problems plaguing the UK construction industry. Many UK companies are losing much, if not all, of their profits on legal fees. Legal expense fees and long waiting times for a court date are troublesome to business.

In response to the litigious nature of business practices, UK construction industry participants have implemented Alternative Dispute Resolution (ADR) initiatives. The industry has implemented modern resolution practices, like Arbitration, Mediation, and others with mild success. However, in the UK, ADR efforts have become just as involved and laborious as litigation. The construction industry participants in the UK are dissatisfied with the existing mechanisms for resolving conflicts. "Laudable though it is, ADR will not solve the basic problems created by using contracts that do little to end confrontation" ("Kiss and make up" 1991). ADR mechanisms have been moderately successful in its endeavors to combat the adversity and rising litigation in engineering and construction practices.

In the UK, the Client (Owner), Engineer, and Contractor perform work under traditional contract conditions, which have evolved little over the years. The general conditions of a construction contract are the provisions that establish the legal responsibilities and relationships among the parties involved on a project. The contract specifies the procedures for schedules, payments, and contract administration. There is a proliferation of contract forms across the UK construction industry, because typically, each Client wants to have their own contract. UK Contractors deal with a variety of forms of contracts, originating from different sources with different texts. Since 1965, the Institute of Civil Engineers (ICE) general conditions and standard forms of construction contracts have traditionally been used for the majority of engineering work in the UK. In 1993, the 6th edition of the ICE Conditions of Contracts was released. Progressively, the revisions to traditional contracts have made the conditions of contracts more dispute-oriented than management-oriented. The National Contractors Group (NCG) and the Construction Management Forum of the UK aspired for a different form of contract; one that is more client-oriented and curtails adversity in the construction process. The wording of most existing contracts, typically inscrutable legalese and cross-referencing, tends to promote confusion which can lead to disputes. In practice, contracts are just legal documents that are left in the drawer and brought out only to provide protection and assign blame when things go wrong. At present, contract documents do little to minimize adversarial thinking, while providing too little incentive for avoiding disputes.

Another ill plaguing the UK construction industry is insufficient project management and planning. Construction firms in the UK have identified late completion as a major cause of rising legal costs (Doyle 1990). Not enough effort is put into the scheduling aspects of construction. Therefore, Clients have great uncertainty that their projects will be delivered within the proposed objectives of time, cost, and quality. In 1990, a *New Builder* survey reported that nearly half of central London's major construction projects miss their original completion dates. One Architect claimed that all litigation involving late completion was due to lack of management on behalf of Contractors. Doyle explained that if a Client were financially pressured and/or under a

time constraint, he/she would most likely take legal action and would put increasing responsibility and risk on the Contractor and Architect (Doyle 1990). For example, typically, in the UK, when the Engineer issues a variation order (a change order), the Contractor dutifully complies and the added costs of changes are analyzed long after they occur ("A Civilised New World (on paper)" 1991). This business practice is troublesome and inefficient. The motivations to apply modern principles of good construction management are not encouraged by the process.

2.3 Process of NEC Development

In the UK, some construction industry stakeholders and constituents are of the opinion that improved contracts will better govern the management of projects and control disputes. The New Engineering Contract (NEC) is recommended for use in the construction industry, as a unique and necessary basis which to improve contractual relations in engineering and construction project. This section studies the history and philosophy behind the development of the NEC process.

2.3.1 History

In the last two decades, productivity in the UK construction sector was considered low (Latham 1994). Consequently, significant improvements to construction practices are critical for the stamina of the UK construction sector. Increasingly, culture, cooperation, quality management, team skills, and problem-solving capabilities are vital to the prosperity of construction businesses. In the UK, more and more construction related work is contracted out in both the private and public sectors. Therefore, improved and efficient project strategy and project management by Clients, Contractors, Suppliers, and other participants are increasingly important in achieving successful projects.

In September 1985, at the persistence of Dr. Martin Barnes, a leading Construction/Project Manager, Fellow of the Council of Institution of Civil Engineers (ICE), and founder and chairman of the UK's Association of Project Managers, the ICE requested that its Legal Affairs Committee review best practice strategies of alternative contracts. In July 1986, under the persuasion and inspiration of Barnes, the ICE legal affairs committee commissioned work to begin on the development of an alternative contract for civil engineering design and construction projects. With the assistance and collaboration of Professor John Perry, Head of the Civil Engineering Department of the University of Birmingham, Barnes, starting with "a blank piece of paper", authored the original specifications for the New Engineering Contract (NEC). Thereafter, as a leading and respected Project Manager and contract expert, Barnes led a writing team of ICE members, contractor representatives, consulting engineers, and members of the legal profession in drafting a new and innovative style contract. Also, the National Contractors Group (NCG), which represents Britain's largest building companies, supported the development of the NEC. The NCG saw the NEC as something that realistically could be implemented. Besides, they shared the sentiment that necessary radical changes to general contract conditions were essential to create a more efficient industry.

In January 1991, the consultative version of the NEC was completed and released to the construction industries of the UK, Africa, Hong Kong, and South America for use and review. It was also sent out for review to members of the ICE, Contractors, Engineers, and various other construction participants i.e. surveyors, suppliers, and lawyers. This version was issued to solicit comments, objections, and advice on the new alternative general conditions of contract. Thereby, the construction industry was able to contribute extensive feedback that was received, investigated, and required changes to be made to the developing document. Finally, the first edition was published in March 1993 for widespread use.

In July 1994, Sir Michael Latham issued a historic report issued by the UK Government, stating that the NEC should be adopted in both the private and public sectors and should become the national standard contract. Furthermore, Latham believes that "widespread use of the NEC will reduce the number of disputes in the [engineering and construction] industry" ("Support grows for the NEC" 1995). In the report, which was funded by industry and government, Latham identified thirteen principles, which should be included in an "effective form of contract in modern conditions." Table 2.1 lists the thirteen principles.

Table 2.1: Principles of an Effective Contract

The most effective form of contract in modern conditions should include:
1. A specific duty for all parties to deal fairly with each other, and with their subcontractors, specialist and suppliers, in an atmosphere of mutual cooperation.
2. Firm duties of teamwork, with shared financial motivation to pursue those objectives. These should involve a general presumption to achieve "win-win" solutions to problems, which may arise during the course of the project.
3. A wholly interrelated package of documents, which clearly defines the roles and duties of all involved, and which is suitable for all types of project and for any procurement route.
4. Easily comprehensible language and with Guidance Notes attached.
5. Separation of the roles of contract administrator, project or lead manager and adjudicator. The Project or lead Manger should be clearly defined as client's representative.
6. A choice of allocation of risks, to be decided as appropriate to each project but then allocated to the party best able to manage, estimate and carry the risk.
7. Taking all reasonable steps to avoid changes to pre-planned works information. But, where variations do occur, they should be priced in advance, with provision for independent adjudication if agreement can not be reached.
8. Express provision for assessing interim payments by methods other than monthly valuation i.e. milestones, activity schedules or payment schedules. Such arrangements must also be reflected in the related subcontract documentation. The eventual aim should be to phase out the traditional system of monthly measurement or remeasurement but meanwhile provision should still be made for it.
9. Clearly setting out the period within which interim payments must be made to all participants in the process, failing which they will have an automatic right to compensation, involving payment of interest at a sufficiently heavy rate to deter slow payment.
10. Providing for secure trust fund routes of payment.
11. While taking all possible steps to avoid conflict on site, providing for speedy dispute resolution if any conflict arises, by a pre-determined impartial adjudicator/referee/expert.
12. Providing for incentives for exceptional performance.
13. Making provision where appropriate for advance mobilisation payments (if necessary, bonded) to contractors and subcontractors, including in respect of off-site prefabricated materials provided by part of the construction team.

Latham's report then concluded that the NEC "contains virtually all of these assumptions of best practice" and suggested seven alterations "to bring it [the NEC] fully within those principles" (Latham 1994).

The seven modifications of the NEC suggested by the Latham Report are:

1. A change in the name of the main contract from the New Engineering Contract to the Engineering and Construction Contract, because "it can equally be used for building projects";

2. A provision of a secure trust fund to provide greater confidence for Contractors and Subcontractors;

3. A review of payment periods, especially to Subcontractors;

4. A statement within the NEC on fairness, mutual trust and cooperation between the Parties;

5. An express provision that none of the core clauses can be amended and that the use of the NEC subcontract is mandatory;

6. A full matrix of Consultants and Adjudicators terms of appointment should be published;

7. A minor works document (Latham 1994).

In June 1995, the second edition of the NEC was published and released. This edition was improved, rewritten, and the name changed. This edition takes into account most of the suggestions made in the Latham Report, together with others suggestions by users' experiences. The main document is now called the Engineering and Construction Contract (ECC), referred to in practice as "the black book"; and, the entire package of contract documents is called the NEC

system or "family" of contracts. At this time, the family of contracts consists of the ECC, the Engineering and Construction Subcontract (ECS), the Professional Services Contract (PSC), and the Adjudicator's Contract (AjC). Section 2.4 discusses the products of the development of the NEC system of contracts.

As mentioned, the second edition includes amendments and improvements developed by the NEC panel as a result of feedback from users. At the same time, the NEC also incorporated most of the Latham Report's suggestions. A few of the suggestions in the Latham Report were seen to be impractical. First, the NEC Panel (Section 2.5 explains the function of the NEC Panel) decided that making the use of the complementary ECS mandatory is impractical, as it would not be acceptable to very small Subcontractors, especially in building contracts. Second, the Panel considered the suggestion of drawing up a list of NEC Adjudicators (Section 2.4 describes the role of the Adjudicator and others in the organizational structure of the NEC). The decision was made to leave it up to the ICE to set qualifications and create a list, if deemed necessary.

To complete the NEC system of contracts, the NEC Panel determined that a contract, in a similar style to the ECC, was needed for the appointment of the Project Manager, Supervisor, and Adjudicator. Peter Higgins, member of the ICE and Director of Contracts of the Travers Morgan Consulting Group, was appointed chairman of the drafting team for a Professional Services Contract (PSC). Early in 1992, the drafting team met several times to identify the criteria and provisions to be included in the contract. Primarily, drafting of the contract was left until the NEC was finalized. Nevertheless, in the event that the publication of the NEC was delayed, to continue progress, it was necessary to compose the PSC in parallel with the development of the first edition of the NEC. Each drafter was given a framework for a particular section of the PSC, a copy of the then current draft of the NEC, and an example section drafted by an ICE "working group" on the NEC. When the drafts were completed, they were consolidated and edited for consistency. Later, it was determined that it was

necessary for the Adjudicator's contract to be separate. Comparatively, the duties of the Project Manager and the Supervisor are entirely different from the Adjudicator's duties. The PSC and Adjudicator's Contract (AjC) were launched as consultative versions in June 1992.

During the consultation period, discussions were held with an ICE Legal Affairs Panel, considering the conditions of contract for practical use. In addition, "Some 34 substantive responses were made, varying in detail from a brief of one page note from a quantity surveying consultancy to some 25 pages of detailed commentary from the Association of Consulting Engineers" (Higgins 1994). At that time, the comments were categorized and collected. The drafting team, under the advisement of Barnes, analyzed and proposed ways of dealing with the information gathered particularly the problems highlighted and the points of conflict with the principles of the NEC.

In February 1994, final drafts of the Professional Services Contract (PSC) and the Adjudicator's Contract (AjC) were presented to the ICE for approval and publication. However, further changes to the PSC were requested. These changes were necessary because of the evolution and amendments to the NEC as a result of its first edition release in March 1993. Allison Staniforth, a Partner in the Leeds office of Eversheds Hepworth and Chadwick, highlighted the issues in a legal check sponsored by the ICE. Furthermore, the purpose of expanding the contract was to include other professionals potentially involved in the NEC, e.g. Designers and Surveyors, even before a Contractor was appointed. At the same time, the legal brief recommended that the PSC develop to cover the appointment of professionals where the NEC may not be used. As a result, the contract is suitable even when no construction work is to take place. Section 2.4 further details the results of the development of the PSC and AjC.

2.3.2 Philosophy

Analogous to the historical evolution, the process of the NEC development was motivated to achieve certain criteria for a new and improved contract. One of the goals was to develop a system of operations that attempts to do away with the adversarial nature of current contract conditions. Presently, the "us vs. them" and arms-length approach to management is, unfortunately, the standard custom in which business is operated in the construction sector. The drafters of the NEC were of the opinion that managers of organizations work as a team, if they are motivated to do so. Therefore, the framework of the new contract was intended such that the parties can and/or motivated to work together. A contracting system, which is not adversarial, can get projects completed on time and on budget.

Another aim of the NEC development process was to stimulate good project management. The design of the NEC necessitates a revolutionary change to the way in which engineering and construction business has been historically conducted. "Developments in project management techniques and their implementation over the last twenty years have moved faster than the evolution of the traditional forms of contract" (Thomas Telford 1997). In creating the NEC, the UK construction industry participants believed that "only radical reforms can cure the serious ills of the industry that was already widespread" (Barnes 1994). Consequently, the NEC is entirely radical and designed to meet the demands of modern project management techniques. It was constructed to inspire the parties involved in a project, e.g. Client, Designer, Contractor, Subcontractors, and Suppliers, to be anticipatory and cooperative in their managing strategies. Most importantly, it was designed to contribute to the effectiveness of management and improve relations in the life of a project. In this way, the NEC aims to promote the better management of projects.

Besides stimulating good relations, the framework of the NEC was developed to provide the means necessary for the Contractor and Client to ensure the job was finished on time and on budget. The authors of the NEC wrote under the notion that if a difficulty arises between parties during the construction process, " 'you stop, agree on the costs in advance, agree on alterations in retrospect and get on with it' " (Whitelaw 1991). Hence, the NEC is also aimed at making construction quicker and cheaper.

In engineering and construction practices, there is a great concern for the inefficiency and contractual disputes infesting projects. One of the reasons that the ICE supported the creation of a new contract, like the NEC, is its premise to reduce the total amount of litigation in the construction sector. Barnes suggested that "the construction industry has claimed too much attention from the legal profession in recent years, and it ought to be possible for construction to proceed with cooperative management, rather than adversarial management" (Barnes Fall 1997). One of the primary intentions of the NEC is to reduce disputes and eliminate litigation.

Lastly, the NEC was designed to be easily adaptable for most types of work. Unlike traditional construction contracts, the NEC was drawn up to have wide applications in management under various scopes and values of work. It can be transferred to projects that might otherwise be undertaken under a multiple range of contract forms. Section 2.4 discusses the manifestation and end products of the premises and motivations behind the NEC.

2.4 Product of NEC Development

This section discusses the following headings relative to the NEC contract documents:

- Publications
- Organization
- Supporting Materials
- Roles and Responsibilities
- Adjudicator
- Language
- Risk Allocation
- Stimulus to Good Management.

2.4.1 Publications

In the UK, the New Engineering Contract (NEC) system or "family" of contracts is offered as an alternative to the traditional standards of the ICE conditions of contracts. The principles and objectives driving the development for new conditions of contracts are accomplished by the existence of the NEC family of documents. To date, the NEC contract documents consists of the Engineering and Construction Contract (ECC), the Engineering and Construction Subcontract (ECS), the Professional Services Contract (PSC), the Adjudicator's Contract; and, other contracts are under development. Besides the publications, the unique creation of the NEC, in terms of its format, makeup, language, and mechanisms to stimulate cooperation and good project management, is examined in this section. The information provided here is adapted from the NEC Guidance Notes and Thomas Telford Electronic Publishing.

First and foremost, there is the Engineering and Construction Contract (ECC), also, known in practice as the "black book". It is the nucleus to the NEC family of contracts. It was designed under the assumption that the work defined

in the scope of the contract may be subcontracted. Therefore, the Engineering and Construction Subcontract (ECS) was developed to complement the ECC. In the ECS, the respective names of the parties are changed and provisions appropriate to subcontracting are applied. Both the ECC and the ECS are used for engineering and construction works of different size, complexity, and duration. The ECC and ECS are used for civil and building projects, electrical and mechanical projects, and other related work. However, it is not mandatory to use the ECS when the ECC is not the main contract. It is an option that is a links, builds, and supports the aims of efficiency and good project management. Table 2.2 gives a matrix of the ECC main options and their different arrangements for payment and allocation of risk. Appendix B lists the main and secondary options available for the ECC and provides a matrix and guidance for its use. The concept of the main and secondary options is described further later in this section.

Table 2.2: ECC Main Options

Type of Contract	Main Option	Payment	Risk
Priced Contract	A and B	Paid for work at tendered (bid) Prices	Largely borne by *Contractor*
Target Contract	C and D	Cost shared between *Employer* and *Contractor*	Shared between Employer and Contractor
Cost Reimbursable Contract	E	Paid for properly expended costs	Largely borne by *Employer*
Management Contract	F	Paid for Actual Cost and Fee	Largely borne by *Employer*

The next document in the "family" of contracts is the Professional Services Contract (PSC). It is used to contract for professional services, such as Architects, Designers, Supervisors, or Project Managers under the NEC. Nonetheless, the PSC is also applied for the appointment of professional services, independent of employing the NEC as the main contract. Likewise, the contract documents are suitable even when no construction work is to transpire. This

contract follows the same philosophy as the other NEC documents. Clearly, the PSC is a part of the NEC family with the same stipulations and similar language. The parallel development of the PSC to the other documents in the NEC is an example of an attempt at creating integration between consultancy and construction contracts. The main options available with the PSC are:

- Main Option A Priced Contract with Activity Schedule
- Main Option B Time Based Contract
- Main Option C Target Contract
- Main Option D Term Contract

Appendix C lists the main and secondary options available for the PSC and provides information for its use. In addition, Kelvin Hughes, NEC Manager, reports that the PSC 2nd Edition was approved by the NEC Panel for publication on March 5, 1998 and is subject to ICE Executive and Council approval for publication by Thomas Telford Limited in May/June 1998 (Hughes and Thompson 1998). The NEC Manager and Thomas Telford Limited are described in Section 2.5.

To further integrate the system of contract documents under the NEC, the Adjudicator's Contract (AjC) was developed. In the Latham Report on the procurement and contractual arrangements in the UK construction industry, Latham concludes that the adjudication process developed in the NEC system is the optimum way of resolving disputes (Latham 1994). The AjC is for the appointment of an Adjudicator under the ECC, the PSC, and with minor changes to terminology, the ECS. (Section 2.4 describes the role of the Adjudicator). Also, Hughes reports that the AjC 2nd Edition was approved for publication by the NEC Panel on March 5, 1998 and, as of April 1, 1998, has received approval by ICE Executive and Council to be published by Thomas Telford Limited in May/June 1998 (Hughes and Thompson 1998).

In 1996, the Plant Contract was published as a consultative version. This contract also follows the same philosophy as the other NEC documents. Comments and suggestions from a large number of organizations and individuals are under consideration for improving the practical application of the Plant Contract in the construction sector. The Plant Contract is intended for use with plant supply contracts, where the primary activity takes place at the manufacturer; and, there is little or no work on site. Hughes also reports that the NEC Plant Contract has completed its consultative period. It is up for review by the NEC Panel in July 1998 and is likely to be launched for widespread use in late 1998. The main options available with the Plant Contract are:

- Main Option A Priced Contract with Activity Schedule
- Main Option B Target Contract with Activity Schedule
- Main Option C Cost Reimbursable Contract
- Main Option D Term Contract with Price List.

Appendix D lists the main and secondary options available for the Plant Contract and information for its use.

Lastly, the ECC Short Contract was published as a consultative version in March 1997. The Short Contract is based on the Engineering and Construction Contract and is intended for use on simple and low risk projects. The Short Contract is simpler in content to other NEC contracts. Although it has provisions common to the rest of the family of contracts, it uses a Price List to govern payment to the Contractor and does not include Secondary Options. Hughes reports that the Short Contract has completed its consultative period. It will be reviewed by the NEC Panel in July 1998 and is likely to be launched for widespread use in September 1998 (Hughes and Thompson 1998).

The NEC Panel has decided that preliminary drafts of an NEC Maintenance Contract and an NEC Product Contract (for design and supply only) are to be drawn up and circulated for consultation. At present, the Panel has not

yet decided its policy on a Minor Work form, as has been suggested by industry participants.

2.4.2 Organization

In establishing the NEC, the format for all contract documents is similar. The purpose is so that knowledge of the system of contract documents is facilitated. Words in Italics are contract terms, and words with initial capital letters are defined terms. For example, the Engineering and Construction Contract (ECC) reads:

> In these conditions of contract, terms identified in the Contract Data are in Italics and defined terms have capital initials (ECC Clause 11.1).
>
> (1) The Parties are the *Employer* and the *Contractor*.
> (2) Others are people or organisations who are not the *Employer*, the *Project Manger*, the *Supervisor*, the *Adjudicator*, the *Contractor*, or any employee, Subcontractor or supplier of the *Contractor*.
> (3) The Contract Date is the date when this contract came into existence" (ECC Clause 11.2).

Each contract is divided into three main sections: 9 Core Clauses (identical for each contract), main and secondary options (different for each contract). The main options differ in that "each option uses different arrangements for payment to the Contractor as each option allocates risk differently between the Employer and the Contractor" (ECC, Guidance Notes 1996).

The 9 Core Clauses are:

1. General: This clause identifies and defines terms, communication procedures, and other generic ideas.

2. The Contractor's Main Responsibilities: This clause details responsibilities, such as design, people, and subcontracting.

3. Time: The Accepted Programme (project schedule) and other aspects of time, like possession and take, over is detailed here.

4. Testing and Defects: Aspects of quality, tests and defects are detailed here.

5. Payment: This clause details who pays what and what the payments are based on. (The NEC tenet is that the Employer's greatest responsibility is to pay the Contractor).

6. Compensation events: This clause details what compensation events are and how to deal with them. (A compensation event is something that causes the contract to change in some way due to actions of the Employer or the Contractor).

7. Title: This clause details who has title to what, and in what circumstances title changes.

8. Risks and Insurance: This clause details risks. The Employer's and the Contractor's risks are set out, as well as what the insurance is required for each.

9. Disputes and Termination: This clause details the procedures for dispute resolution, as well as the procedures for termination. (Disputes occur in any contract and it is vital to have a procedure, whereby the resolution of conflict is explicit).

Table 2.3 provides a summary of the NEC contract documents and the available main options. Appendix A is a complete matrix of the NEC "family" of documents and the availability of main and secondary options.

Table 2.3: NEC Contract Documents and Available Main Options

Contract	Activity Schedule	Bills of Quantity	Target	Cost Reimbursable	Management	Term	Time Based
Engineering and Construction Contract	YES	YES	YES	YES	YES	NO	NO
Professional Services Contract	YES	NO	YES	NO	NO	YES	YES
Plant Contract	YES	NO	YES	YES	NO	YES	NO
Short Contract	Price list covers payment by activity schedule, lump sums, bill of quantities, schedule of rates per hour or per day.						

2.4.3 Supporting Materials

An innovation of the design and compilation of the NEC is that Flowcharts and Guidance Notes accompany the contract. Flowcharts are provided for the main document, the ECC. The Flowcharts outline all the steps and procedures that are undertaken from acceptance of the contract until final payment is made. It shows who does what and when in plain and simple terms, and indicates the consequences for each course of action and what should follow that chosen action (Barnes and Thompson 1997). Unambiguous roles, responsibilities, and procedures are vital links to a successful and effective contract. Guidance Notes are provided for the ECC, the PSC, and the AjC. The Guidance Notes provide explanations and principles for the provisions and procedures, and how to apply them. The Flowcharts and the Guidance Notes are not parts of the contract, but assist the management of the project.

The Guidance Notes are often used to settle a difference in interpretations of a clause. Using a more traditional form of contract, if interpretation is disputed, "it is normally settled by referring to case law and they cannot do this with the NEC" (Broome 1998). After having a basic familiarity with the NEC,

the Flowcharts help participants understand how the various procedures fit together. Project Managers have stated that "the Flowcharts form a good basis for discussion and then a decision on our approach. It helps to think through the implications of [our] actions under a specific clause" (Broome 1998).

2.4.4 Roles and Responsibilities

The NEC contract documents aim to improve the management of the whole engineering and construction process. To achieve this, the NEC provides a clear division of function (role) and responsibilities, which interfaces with the parties' title and their contractual link as set out in the organizational structure. "The contractual role(s) of [the parties] is defined in terms of the actions and decisions he is to take" (ECC, Guidance Notes 1996). The organizational structure resulting in the development of the NEC consists of the Employer (also known as, the Client or the Owner), Project Manager, Contractor, Supervisor, and Adjudicator. Figure 2.1 is the organizational structure linked with the contractual relationships under the NEC.

Explicit and definitive roles and responsibilities are critical to the organization of a project. Under the NEC, the parties have a better understanding of who is to do what and when, and what the consequences are for action or lack of action. The key player in the NEC system is the Project Manager (PM). Under the NEC, the Consultant or PM is an extension of the Employer. The duty of the PM is to manage the project on behalf of the Employer, acting in the best interest of the Employer's business objectives (ECC, Guidance Notes 1996). The contract gives the PM considerable authority, but is designed to prevent unreasonable behavior by spelling out how decisions are to be made. Contrary to the ICE contracts, the Consultant or Engineer is no longer in an inopportune position of independence between the Employer and the Contractor. "The Project Manager acts unequivocally for the employer but constrained to act fairly" ("Aiming for the fairway" 1991). By the same token, the Supervisor who is appointed by the

Employer acts in a role similar to that of a Resident Engineer or Architect. Basically, his duty is to inspect the technical quality of the work. Where it is in the best interest of the Employer's objectives, the roles of the PM and the Supervisor may be combined. Also, in-house personnel of the Employer may be appointed to the Contractor, PM, and/or Supervisor roles.

2.4.5 Adjudicator

If negotiations in the contractual chain break down, the Adjudicator is responsible for the settlement of disputes. The Adjudicator acts independently and not as an arbitrator. The Adjudicator provides non-binding independent judgment of any disputes that may arise within a contract. The Adjudicator is jointly appointed and equally expensed by the Employer and Contractor (or Consultant). The NEC system requires parties to notify each other of disputes and resolve them through adjudication without delay. Typically, in the NEC, if a dispute is not notified to the Adjudicator within four weeks of it arising, it cannot, in the future, be notified. Hence, the parties are understood to have agreed the matter and it is no longer disputed. The Adjudicator is an integral link in the organizational structure of the NEC.

2.4.6 Language

Another distinctive aspect of the collaboration of the NEC is the language. It is ordinary and simple enough to be understood by the working parties. The wording of the NEC documents is in ordinary language. The purpose is to minimize the incidence of disputes arising from ambiguous meanings. The ICE believes that "the contract's simplified language, together with an absence of any assumptions concerning knowledge of surrounding English statues, will make [the NEC system] ideal for use…" (Yuille 1991). Except in the insurance clause, there is no legal terminology, thereby, reducing the need for legal counsel. It is

written straightforwardly with few long words and no long sentences. Actually, the sentences were written to have no more than 40 words at a time. Also, NEC language is mandatory. For instance, Clause 10.1 of the ECC states "The *Employer*, the *Contractor*, the *Project Manager* and the *Supervisor* shall act as stated in this contract and in a spirit of mutual trust and cooperation. The *Adjudicator* shall act as stated in this contract and in a spirit of independence." The language is intended to be familiar to the language of builders and other people in the construction industry worldwide.

Consistent with the unequivocal language, the NEC is designed in a bulleted structure that is easy to read. Unlike traditional contracts, there is no cross-referencing. Many of the customary legal concepts and forms of words are discarded in the interests of better communication and management of projects. Thus, the NEC can be used and employed by persons of various experiences and knowledge of construction practices. Essential to the success of the construction enterprise, the contract documents are easy to read and understand, which are means to increased efficiency and better management of projects.

2.4.7 Risk Allocation

As discussed in Section 2.3, the NEC seeks to create a less adversarial approach by a fairer allocation of risks. The NEC accomplishes this by unambiguously allocating to one party or the other, all the commonly identifiable construction risks. In an interview with Barnes, he stated that the NEC was written to "reallocate the risk so that people were motivated to cooperate" (Barnes Fall 1997). This is a welcomed development in the construction industry. For instance, a Contractor can properly estimate and weigh the risk of a job. At the same time, reduction of risk carried by the Contractor does not necessarily mean that the Client gets a worse deal. In effect, Clients decide what risks they will carry and what is an acceptable level of risk for the other parties. Appendix B provides information on the risk that is correlated with the available contractual arrangements.

2.4.8 Stimulus to Good Management

Use of the NEC is designed to reduce risk of cost, time overruns, and poor performance. It aims to increase the likelihood of achieving a satisfactory completed project for the Client and profit for the Contractor, Subcontractor, and Suppliers. To attain this, the most important objective to the authors of the NEC is to stimulate good management. One of the vehicles to accomplish this is the "Early Warning" provision. The Early Warning provision provides for a binding obligation for either party, subject to the contract, to present anything that may affect the cost, time and quality of the work. The parties are motivated to comply, because it is in their best interest to communicate, to be aware of potential obstacles, and to act quickly. In the NEC, "Every procedure has been designed so that its implementation should contribute to rather than detract from the effectiveness of management of the work" (Thomas Telford 1997). The Early Warning provision is a practice the NEC implements to promote communication and stimulate good project management.

As it was intended, the NEC is used for any type of engineering or building project. Barnes, the lead architect of the NEC, states that the "objective is to produce a flexible form of engineering contract, which can be used as the basis of a management contract, a construction management agreement or design and build, as well as for conventional lump-sum contracting. It is a multi-purpose form of contract, perhaps the first major effort to curb the proliferation of so many different forms" (Allen 1991). The NEC contracts are multidisciplined and used for a variety of projects, with little or no change to the conditions of contract. It is a set of contract documents that is designed to suit building and civil engineering projects in any of the various management forms in the UK and overseas. Most importantly, as Barnes stated, "It is human to argue, but it is not necessary. The designers of the NEC were looking from the viewpoint of how a construction management system, through a fair contract, will help to produce a successful outcome for all concerned, e.g. the Employer, Contractor, and Subcontractor, by

preventing disputes and being a vehicle for positive collaboration and effective project management" (Barnes and Thompson 1997). Section 2.6 provides examples of how the NEC is used to date.

2.5 Process of NEC Implementation

This section looks at institutions and organizations endorsing and supporting the implementation and effectiveness of the NEC in the engineering and construction industry. The main groups discussed here are:

- Institution of Civil Engineers
- Thomas Telford Limited
- NEC Panel
- NEC Users' Group.

2.5.1 Institution of Civil Engineers

Appropriately, the implementation of the NEC was pioneered by the ICE, the "oldest Chartered Engineering Institution in the world" (Giles 1996). The ICE was up to the challenge of introducing a new and revolutionary approach to contracting. With the support of the ICE and numerous construction industry constituents and stakeholders, the impact of the NEC in engineering and construction enterprises is growing. The growth in use and acceptance of the NEC was endorsed by the publication of the historic Latham Report. Considered the most thorough analysis of the construction UK industry, the report sets the standards for an effective contract. Based on those criteria, the NEC is an overdue remedy for the apparent ills of the engineering and construction industry (Latham 1994). To "spread the fire", many entities provide support and administration for the NEC "family" of contract documents.

2.5.2 Thomas Telford Limited

On behalf of the ICE, Thomas Telford Limited (Telford) provides administrative support for the NEC. Telford is owned by the ICE and functions as its commercial branch. It is managed by a Board of Directors appointed by the ICE. Telford's fundamental purposes are to serve the needs and to facilitate advancements in the engineering and construction profession throughout the UK. They are the leading providers of information and services for the UK construction enterprise. They provide training, recruitment, publications, and symposiums on engineering and construction issues. As an example, in an interview with the training manager for Telford, Malcolm Moorely, he stated that the NEC Introduction class is in high demand. "Telford went from providing 2 courses for 12 – 16 people per year to 4 – 6 courses for 20 – 25 over the past 2 years" (Moorely 1997). Lastly, all profits generated by Telford are endorsed back to the ICE.

2.5.3 NEC Panel

The ICE's official advisory committee for the NEC is the NEC Panel. The NEC Panel is composed of senior members of the construction industry, representing Employers (Clients), Consultants, Contractors, and associated professional bodies. Appendix E is a list of the current panel members. Many of the Panel members were on the original NEC drafting team. Their primary task is to continuously review the existing documents in response to users' needs and comments, and changing legislation. The Panel is not only interested in how the NEC contracts are working in practice, but also where users find a discontinuity in the system, such that they are unable to use the NEC documents for their projects. To advance their objectives, the NEC Panel meets on a regular basis to study suggestions for new additions, improvements, and expansions of the system of documents. The Panel exists to improve the NEC and broaden the range of contracts and supporting documents making up the "family" of contracts. Further

tasks include the publication of additional Guidance Notes (described in Section 2.4) and any corrigenda, as the need becomes apparent to complement the contract documents. The Panel maintains close ties with the NEC Users' Group to maintain a free flow of information about the pragmatic use of the contract documents.

2.5.4 NEC Users' Group

The NEC Users' Group is a forum for users and potential users (Clients, Designers, Project Managers, Contractors, and Researchers) of the contract documents to exchange ideas and experiences. The group started with 12 members: Royal Hong Kong Jockey Club (first member to join), Union Railways, London Underground, Mott MacDonald, UK Department of Transport, National Rivers Authority, Railtrack, British Airport Authority (BAA), Travers Morgan, Yorkshire Water Services, Scottish Hydro-Electric, and ESKOM of South Africa. It has since grown to approximately 100 members. The Users' Group is run and guided by and for the users. Leadership is directed by a chairman who is selected from within the group. The aims of the Users' Group are:

- to offer guidance on the practical applications of the NEC,
- to disseminate information about NEC development and applications, and
- to bring NEC users together (Thomas Telford 1997).

As a by-product, the Users' Group also gages the success and/or failures of the NEC. Mainly, the Users' Group exists for people and organizations that are interested in learning about, participating in, and supporting the development and success of the NEC. Appendix F is a list of the current NEC Users' Group membership.

2.5.5 Other Support and Implementation Strategies

In addition, the ICE, under Telford, has appointed a full-time NEC Manager, who is also Secretary for the Users' Group. As NEC Manager, he or she is responsible for the worldwide promotion and development of the New Engineering Contract. As Secretary, he or she is the liaison between the Users' Group and the NEC Panel. As demand for training grows, as indicated in Section 2.5.2, the number of users and use of the NEC also grows. The NEC Manager is integral component to supporting the use and continued development of the NEC.

Presently, a database of use of NEC documents is being established. The database contains information on users (existing and past) and their corresponding project scope and project value. This information gives the ICE a picture of how much use the documents of the NEC is getting, in what forms they are being used, and how successful they are in operation.

To promote and implement the NEC with modern mode of technology, the NEC Home Page on the Internet was constructed. The address is

http://www.t-telford.co.uk/Nec/nechome.html.

This enables inquirers throughout the world to find out more about the NEC and the Users' Group. The Internet homepage attracts a great deal of interest coming from South America, Russia, Japan, and many more. The homepage provides information on the NEC "family" of contracts, the NEC Users' Group newsletter, and other valuable information for current and potential NEC users.

2.6 Status of NEC Implementation

With all the support and effort in the creation and implementation of the NEC, how far "has the fire spread"? The worldwide interest in this new approach to the procurement and management of projects is growing as evident by the examples presented in this section. In the UK and abroad, there is positive response from participants and constituents of the construction sector to the endeavors of the NEC to lead to less confrontation and better project management. Furthermore, it is used for a full range of engineering and construction projects, as was intended. To date, the NEC has been used worldwide on over 5500 reported projects, varying in scope from rail stations, airports, highway, power plants, et cetra. In the UK alone, the value of completed projects from 1993 – 1997 totals to more than £1 billion (Hughes and Thompson 1997). Overall, the support and effort in creating and implementing the NEC has paid off; it has found tremendous acceptance and success throughout the construction sector in the UK and other countries in the world. This section gives insight into some of the variety of implementations of the NEC by describing a few of the notable projects and users to engage the contract documents.

2.6.1 Royal Hong Kong Jockey Club

The vanguard of NEC users is the Royal Hong Kong Jockey Club. The Royal Hong Kong Jockey Club (Jockey Club) has been using the NEC since 1993. Their first NEC project was valued at HK$30 million, a 36-hole golf course. Because of a time constraint, this project was contracted out without prior agreement of the cost. As reported by Gary Yau, the Project Manager, "the contractor worked in good faith – for example, in one place he found unexpected rock, the quantity of which was unknown and rates were agreed without delay." Afterwards, the same contractor was awarded another HK$30 million project to build a racecourse that was let as a compensation event to extend the first contract ("NEC in Hong Kong" 1996). Under the NEC, the Jockey Club has built seven stables, a training track, and a golf course. All in all, they have used the

contracting system for both civil and building works, major redevelopment, and demolition work.

2.6.2 ESKOM of South Africa

At present, the largest user of the NEC is considered to be ESKOM. ESKOM is South Africa's national electricity supply utility company. It supplies more than 90% of the electricity used in South Africa. ESKOM is the fifth largest electric company in the world. Like in the UK, South Africa was plagued with a proliferation of conditions of contracts. At the time the NEC was being drafted, ESKOM was also working on its own new form of contract. Coincidentally, many of the same objectives as those of the NEC were being considered. After hearing of Barnes' initiatives and the ICE's support, the Management Board of ESKOM (ESKOM Board) appointed its Corporate Contracts Consultant, Andrew Baird, to investigate the new contract. Subsequently, Baird became an integral participant of the NEC's development by joining the original drafting team led by Barnes. In the meantime, an implementation plan was devised to gradually move ESKOM toward a single set of conditions of contract. Ultimately, the ESKOM Board selected the NEC as the most satisfactory contract. Since 1992, ESKOM has used the NEC on thousands of contracts, mainly in connection with electrification and power plant construction (Bell 1995).

ESKOM has vast experience with the NEC. For example, extensive use with the NEC contracts is gained on the Majuba Power Station project, which comprises of six generators of 660 MW each. With a project time span of 20 years, the project has been put on hold various times due to slow electricity sales. The completion date is in the year 2002 and final cost is estimated to be £2.25 billion. Since development of the NEC, the Majuba project has adopted it as the system of contracts. Contracts under the NEC are awarded from very high-tech electronic work to standard pipelines and earthworks. In addition, "all technical disciplines from electrical to civil are covered and virtually the full range of

[NEC] contracts from consultancies to activity-based contracts are encountered (Steyn 1995)." Since 1993, ESKOM has used the NEC system of contracts on 100% of its work. As of 1995, a total of 33 contracts with a value of £38,810,000 have been awarded.

2.6.3 Channel Tunnel Rail Link

Most notably, the NEC is used on the £30 billion Channel Tunnel Rail Link Project. The use of the NEC for this prestigious project is of international interest. The project scope is to build a 68-mile long high-speed rail link between London and the Channel Tunnel. Once operational in 2003, the journey from London to Paris will take about 2 hours and 20 minutes, cutting 40 minutes off the current times. The Channel Tunnel Rail Link is being built by London & Continental Railways Limited through its subsidiary Union Railways Limited (Union Railways). Rail Link Engineering (RLE), which is a joint venture of Ove Arup & Partners, Bechtel, Sir William Halcrow & Partners and Systra, has the contract for design and project management of the project for Union Railways. RLE's Project Director, Ken Turnbull, states that " 'the project is complex and we will require substantial input from Contractors experienced in various types of construction. We expect that the NEC form will provide the flexibility not only to accommodate different types of construction, but also to allow for possible alternative contracting strategies as each of the packages is developed.' " In the same context, Mike Attridge, Senior Contracts Manager for Union Railways, justifies the choice of using the NEC documents by stating that "it will be very important to use an approach to managing all the different interfaces and to use a system, which stimulates collaborative problem solving" (Hughes 1997). Certainly, the organization and versatility of the NEC is being fully used on this enormous project. Union Railways anticipates many benefits and rewards for utilizing the NEC approach to contracting.

2.6.4 1999 Rugby World Cup Millenium Stadium

Equally as noteworthy, the £114 million redevelopment of the Welsh National Rugby Stadium (Millenium Stadium) at Cardiff Arms Park in Cardiff, Wales is using the NEC. The project is applying the NEC Engineering and Construction Contract Main Option C (target contract with activity schedule), but with the addition of a Guaranteed Maximum Price provision. The completion of this project is critical; it must be completed in time for the opening game of the Rugby World Cup in September 1999. When the existing stadium was completed 13 years ago, it was one of the best facilities in the world. However, with the continuing public demand for sporting facilities and stricter safety regulations, the redevelopment is past due. The new Millenium Stadium will be one of the world's most advanced stadiums. It is designed as a new 75,000-seat stadium, with spectator facilities, including bars and restaurants, a rugby museum, riverside walk and public plaza, and many technological features, such as an acoustically insulated retractable roof system and a state of the art public announcement system. The Designers are the Lobb Partnership who is also responsible for the design of the Sydney Olympic Stadium. The Welsh Rugby Union and Cardiff County Council are the Clients; John Laing Construction Company is the Contractor; and, O'Brien-Kreitzberg is the Project Manager. O'Brien-Kreitzberg was also the Project Manager for the Atlanta Olympic facilities (Hughes 1997).

2.6.5 Other UK Projects and Users

In the UK, British Airport Authority (BAA) is one of the biggest users of the NEC. In 1996, David Williams, Construction Director of BAA, reported that "BAA has used the NEC for more than 40 contracts, ranging in value from £60,000 to £50 million in Britain alone" (Giles 1996). In like manner, Anglian Water's senior engineer, Paul Glass declared that the NEC had been used successfully over 20 projects worth between £500,000 and £2 million, and the work ranged from sewage treatment works to laying pipelines (Barrie 1995). As

well as Anglian Water's, Union Railways has successfully employed the NEC system of contracting on its £60 million Heathrow Express Tunnel project. Additionally, J. Sainsburys, a major grocery chain and well-respected construction Client, uses the ECC Option F for all new stores and extensions to existing stores where a management Contractor is employed. In the UK, the NEC has surely achieved ample use by a variety of private sector construction stakeholders.

Besides private entities, in 1995, UK Government agencies began to use the NEC contract documents. Initially, three different areas of government employed the contract. First, the Prison Service used the ECC for £6 million worth of modernization projects and for construction of new structures. Second, the Highway Agency, Department of Transport, used the NEC on major highway improvement projects. Lastly, there is the Building Research Establishment (BRE), an executive agency of the Department of Energy. It employed the NEC on its project to build a new 21st Century office building at its headquarters. It is a three-story office building with a seminar facility. Its final cost is £2.6 million ("Government trials of the NEC" 1995). Due to successful outcomes, the joint perspective of the private and public sectors of the UK is that there are clear advantages to working with the NEC for the future development of the British infrastructure.

2.6.6 International Users

As stated earlier, the worldwide interest in this new approach to contracting and management of projects has been tremendous. The NEC has been used in Thailand and Belize. And, major Clients, such as the Government of New South Wales, National Power, the Asian Development Bank, Scottish Hydro-Electric, and the British Government's Overseas Development Agency continue to initiate use of NEC contract documents on their major projects. With large respected Clients in the forefront and positive responses from Contractors,

continued increasing use and success of the NEC system of contracts are inevitable.

2.7 Conclusion

Adversity, extensive delays, and rising litigious activities and costs plague the UK construction industry. With his expertise and experience, Barnes convinced leaders in the construction industry and the Institution of Civil Engineers in the UK that innovative and non-adversarial conditions of contracts, aimed at better management of projects, are the cure for the disease afflicting the construction industry. The product of these innovations is the New Engineering "family" of Contracts (NEC). Owners, Engineers, and Contractors of the UK endorsed the development and implementation of the NEC. In addition, the Latham Report spearheaded the support and acceptance for the ingenuity and effectiveness of the NEC. After the historic report, an increasing number of Clients, both private and public, adopted the new contract system. Since the release of the consultative version in 1991, the NEC has rapidly increased its use in the UK and around the world. It is used on a wide variety of engineering and construction works.

As a modern and innovative contracting system, the NEC attempts to eliminate the time and effort (very often arising as a result of poor management and unfair contracts) expended on disputes and litigation. The founders of the NEC believe much can be achieved in cost savings and in a reduction of adversity and litigation through the application of good project management and a fair contract. In the words of a Contractor, Peter D. Park of P. Trant Ltd. affirms that the NEC "is a breath of fresh air in that is radically more flexible, simple and clear in use than other forms of contract. It stimulates good management by reducing the "them and us" that has built up between project teams. By addressing risk more fully than other forms of contracts in common use, confrontation and the subsequent waste of skilled management resources have been reduced" (Park 1994). The NEC is not just a legal document, but a series of management procedures that proactively prevents disputes by encouraging teamwork between Contractor, Designer,

and Employer. As Barnes asserts, "it does not coerce cooperation; however, it reinforces, stimulates, and encourages all parties to cooperate. It is an effective interface of management" (Barnes and Thompson 1997). As intended, it is a set of contract documents that is compatible with modern project management techniques, forward thinking, and has the necessary tools to promote positive attitudes and cooperation. Clearly, the NEC has demonstrated success in its attempts to achieve improvements in contractual relations, managerial practices, and equity in the business environment.

Chapter 3. Impact of the New Engineering Contract

This chapter looks at research and survey information gathered to assess the impact of the New Engineering Contract (NEC) "family" of documents on engineering and construction practices. It provides a summary on how the implementation of the NEC system of contracts have impacted the culture and methods used in modern contract and project management.

3.1 Introduction

The NEC was introduced to the engineering and construction industry for use in 1993. Therefore, research and publications on the NEC are limited because of its newness to the practice of engineering and construction. Hughes contends that supporters of the NEC would "like to think that …people are busy using it, rather than writing about it" (Hughes 1997). At the same time, academics and the ICE monitor and analyze the impact of the NEC. This section presents the findings of research to date on whether the NEC system of contracting has impacted and/or fulfilled the needs of the industry and the objectives it desires.

The first research summary presented here was conducted by Jonathon C. Broome, Civil Engineer and Academician. Broome studied the impact of the NEC on the construction industry. This treatise reports on two aspects of Broome's work:

1. The impact of structural changes implemented by the NEC.
2. The impact of secondary changes inspired by the NEC.

In addition, the results of two other investigations are presented. Studies on the results of implementation generated by the NEC were conducted by:

- Thomas Telford Limited (on behalf of ICE) and
- Denise Quigley, Civil Engineer.

3.2 Broome Survey

Jonathan C. Broome is a Ph.D. candidate in the Project and Construction Management Group of the School of Civil Engineering at the University of Birmingham in Birmingham, England. He works under the advisement of Professor John G. Perry, co-founder of the NEC. Perry is also an active member of the NEC Panel, which as discussed in Section 2.5 on the process of NEC implementation, is responsible for the continuing technical development of the NEC system of contracts. As a catalyst between industry and academia and to assist the development and improvement of the NEC system, Perry and Broome launched a research project, which focused on an evaluation of the use and effectiveness of the NEC system of contracts in the current engineering and construction environment (Broome 1998). This section gives an insight into Broome's research from an interview conducted in the UK in November 1997 and from abstracts of his dissertation research and other publications.

The methodology adopted for Broome's dissertation combined two approaches: variable analysis and interpretative approach.

> Variable analysis is the reduction of the inputs and outputs of a project to a measurable scale or classification. The questions and answers can be in three basic forms: factual, classification, and attitudinal. The interpretative approach justifies discussions of examining practice in a social context. Researchers argue that the social context cannot be measured in the same way as a laboratory experiment. Instead, the research process [the interpretative approach] is iterative, with the researcher attempting to attain an idealistic state of "informed neutrality" while involving himself in face to face interviews, shadowing individuals, and working and observing in the environment gaining rich qualitative insight on a subject (Broome 1998).

Broome and Perry devised 150 different parameters and classifications on which the NEC can be tested on, from which a questionnaire was developed. Some of the questions measured the financial and time performance of NEC projects, but the majority called for anecdotal and attitudinal responses supported by industry experience. Twenty-eight interviews were conducted with Employers' (Owners') representatives and 18 contractors' representatives (Broome 1998).

Primarily, Broome's research is based on the effectiveness of the NEC in achieving its objectives of clarity, flexibility, and stimulus to good project management as compared to existing forms of contract. In the implementation of the NEC system of contracts, structural changes are introduced. The structural changes presented in Broome's research are:

- Roles and Staffing
- Early Warning Procedures for Change
- Compensation Events and Schedule of Cost Components
- Accepted Programme (Project Schedule)
- Time Periods

3.2.1 Roles and Staffing

"Research has found widespread agreement that the clarity of the roles and the practicality of how the named individuals [e.g. PM, Supervisor, and Adjudicator] are meant to function are an improvement [on other existing forms of contract]." The administration of an NEC contract also calls for different skills and qualities from the individuals involved on both sides and also require changes in the way they perform their duties compared with other forms of contract (Broome and Thompson 1997).

As described in Section 2.4.4 on the resultant roles and responsibilities of NEC development, the PM role is to manage the project on behalf of the Employer and is unequivocally defined in the contract. Broome's research reveals that "[s]ome project managers have expressed mild relief that they are no longer both expected to act on the Employer's behalf and to be (simultaneously) independent" (Broome and Perry 1995). Because of the discipline imposed by the procedures of the NEC, it is envisaged that the PM should be physically close to the work, have single point responsibility, and, above all, be empowered to make decisions (Broome 1998).

The Supervisor's role "appears to lie somewhere between that of the traditional Resident Engineer and Clerk of Works" (Broome and Perry 1995). In regards to the roles and responsibilities described in Section 2.4.4, the Supervisor, while acting for the Employer, has a clear technical role in deciding if what has been built is to the quality stated in the Works Information. From his research, Broome recounts that some supervisors have complained that the way the NEC contract defines their authority is a demotion of their former role. However, the NEC makes it possible for the day-to-day project management responsibilities for the running of the project to be delegated to the Supervisor. Supervisors believe this compensates for the perceived demotion.

The impact of the role of the Adjudicator is "akin to that of a nuclear deterrent – to encourage people to sort of out their own disputes" ("Aiming for the fairway" 1991). NEC contract participants are drawing some comfort from the perception that if they make a decision, which is challenged, they have an Adjudicator to decide whether the action was correct. By engaging the Adjudicator, the parties of the contract avoid having to involve the Employer in an expensive full-scale litigation or arbitration (Broome and Perry 1995).

Early experience with the NEC system of contracting is producing strong evidence that its innovative procedures are generating different roles and a need for different skills with benefits to the overall management of the project. Therefore attention needs to be given to job descriptions, skills, and authority levels within an organization or project, before the contact starts. Additionally, job site representatives of both Employers and Contractors are motivated to work within the tight time periods in the contract to solve issues and respond to the other parties' communications.

3.2.2 Early Warning Procedures for Change

Broome reports that in practice, it appears that the Early Warning procedure is not being followed precisely. However, the concept has been enthusiastically endorsed. For instance, investigations reveal that Contractors have thoroughly gone through the details of the Works Information at the start of a contract, looking to sort out inconsistencies and ambiguities early on, rather than to discover them during construction (Broome and Perry 1995). When an ambiguity is discovered, it is assessed on "the interpretation most favourable to the contractor" (ECC, Clause 63.7 1995). This is another reason why the preparation of the contract documentation has to be thorough. On the other hand, if the Contractor only makes the PM aware of a problem at the time of construction, it could be deemed his liability. Both the Employer and Contractor interviewees agree that "the early identification and resolution of a problem has avoided additional expenditure by either party" (Broome 1998).

3.2.3 Compensation Events and Schedule of Cost Components

The ECC Guidance Notes define Compensation Events as "events which, if they occur, and do not arise from the Contractor's fault, entitle the Contractor to be compensated for any effect the events has on the Prices and the Completion Date." In other words, the contractor, when a defined event occurs which is at the Employer's risk, is entitled to extra payment and/or a delay to the completion date. The entitlement is determined through a quotation by the Contractor for the time and cost impact of the problem and its solution. The Compensation Event is then implemented upon the PM notifying the Contractor of an accepted entitlement. Table 3.1 lists the Compensations Events listed in the ECC Main Clause 6.

Table 3.1: Lists of Compensation Events

The following are compensation events identified in ECC, 60.1:
(1) The Project Manager gives an instruction changing the Works Information except • a change made in order to accept a Defect or • a change to the Works Information provided by the Contractor for his design, which is made at his request or to comply with other Works Information provided by the Employer. (2) The Employer does not give possession of a part of the Site by the later of its possession date and the date required by the Accepted Programme. (3) The Employer does not provide something, which he is to provide by the date for providing it required by the Accepted Programme. (4) The Project Manager gives an instruction to stop or not to start any work. (5) The Employer or Others do not work within the times shown on the Accepted Programme or do not work within the conditions stated in the Works Information. (6) The Project Manager or the Supervisor does not reply to a communication from the Contractor within the period required by this contract. (7) The Project Manager gives an instruction for dealing with an object of value or of historical or other interest found within the Site. (8) The Project Manager or the Supervisor changes a decision, which he has previously communicated to the Contractor. (9) The Project Manager withholds an acceptance (other than acceptance of a quotation for acceleration or for not correcting a Defect) for a reason not stated in this contract. (10) The Supervisor instructs the Contractor to search and no Defect is found unless the search is needed only because the Contractor gave insufficient notice of doing work obstructing a required test or inspection. (11) A test or inspection done by the Supervisor causes unnecessary delay. (12) The Contractor encounter physical conditions which • are within the Site, • are not weather conditions and • which an experience contractor would have judged at the Contract Date to have such a small chance of occurring that it would have been unreasonable for him to have allowed for them. (13) A weather measurement is recorded • within a calendar month, • before the Completion Date for the whole of the works and • at the place stated in the Contract Data the value of which, by comparison with the weather data, is shown to occur on average less frequently than once in ten years. (14) An Employer's risk event occurs. (15) The Project Manager certifies take over of a part of the works before both Completion and the Completion Date.

Table 3.1: Lists of Compensation Events continued,

(16) The Employer does not provide materials, facilities and samples for tests as stated in the Works Information.
(17) The Project Manager notifies a correction to an assumption about the nature of a compensation event.
(18) A breach of contract by the Employer which is not on of the other compensation events in the contract.

Broome reports that the clause has been extensively tested on various contracts and has not produced any significant problems (Broome and Thompson 1997). From his research, Broome discovered that construction participants have found that the list of Compensation Events in one section, as in ECC Clause 60.1, is a general improvement in clarity, than is the case with other forms of contracts. Thus, compared to other forms of contracts, a higher level of front-end administration is needed to prepare and evaluate the time and cost impact of Compensation Events. Therefore, due to the mechanisms in the NEC system, a major effort has been involved in the earlier stages of contract negotiations to forecast labor costs for particular workers which is required in order to estimate total costs for Compensation Events (Broome and Perry 1995). As an example, experienced employers are now looking to agree standard rates for different categories of labor; either early on in the contract or before the contract is signed. Agreeing the problem, defining its solution, and stating assumptions that are to be made before the Contractor prepares his quotation, rather than after, is the result of the NEC objective to be an impetus to good project management. In the same manner, both PMs and Contractors express the view that "while they each feel that they will get fair recompense for a Compensation Event, it is much harder for contractors to recover any shortcomings in their tenders [bids] as they now have to justify any additional costs more rigorously" (Broome 1998).

Most importantly, from his research, Broome discovered that "almost all NEC contracts appear to be achieving much earlier settlement of the final account than under other forms of contract. Settlement is commonly achieved within a

few months of completion, which is an indicator that the compensation event procedure is achieving its objectives" without arbitration or litigation (Broome 1998). Broome infers that the Compensation Event procedure has had a significant impact on construction practices.

3.2.4 Accepted Programme (Project Schedule)

The Accepted Programme (Project Schedule) is central to the management of NEC projects. Generally, it is updated at monthly intervals and includes among other things, float time, construction methods, and resource levels for each operation. In addition, the schedule gives the Employer milestone dates i.e. inspections, access, and possession. The drafters of the NEC intended for the required schedules "to assist the Contractor to prepare and the PM to assess the time and cost impact of any potential compensation event, as well as giving much greater confidence in forecasts of completion" (Broome 1998).

Lack of compliance with the Accepted Programme procedure places the Contractor in a weaker position in the assessment of a compensation event. Broome suggests that "The Contractor does not fully recognize the benefits of an up to the date and realistic plan. As the initiator of the Accepted Programme, the Contractor has the opportunity to take control and really drive the project. The Contractor will be making the Employer and his PM perform at a high level in order not to hinder the project's progress and will be able to claim fair recompense if they do not meet their responsibilities" (Broome and Perry 1995). Therefore, the NEC commands that both the Contractor and the Employer carefully monitor the project.

During Broome's interviews, Contractor's personnel at job site level have stated that the schedule that they are required to prepare is "more thorough and more carefully thought out." From his interviews, Broome reports that the consensual observation among Contractors and PMs is that "the NEC does not

treat programming as an art, but purely as a science and makes no allowance for the effect of general disruption to the critical path" (Broome 1998). Therefore, Broome concludes that the contractor is motivated to do the work in accordance with the Accepted Programme.

While some contractors complain of the effort required to prepare the Accepted Programme, others do not resent having to do it, because of the benefits it produces in terms of cost and time savings in evaluating compensation events and as a tool for good project management (Broome and Thompson 1997). Broome's research has discovered that there is virtually complete agreement that if there are extra personnel costs, they are outweighed by the benefits brought to the project. As a project manager stated "You might as well pay a good project manager or planner at the time that he can do something, rather than pay a claims type person at a later date" (Broome and Perry 1995).

3.2.5 Time Periods

The NEC system of contracting consists of demanding time periods in which each party has to respond to the other. For instance, in accepting a programme (a project schedule), the PM has effectively committed himself, the Employer, or other to do certain actions at the times stated on the programme. Failure to do so can lead to a compensation event. Broome reports that these factors prompted a senior PM to say "you need to hit the ground with your feet running because where you get hit hardest is in the early stages" (Broome 1998). This observation also applies to the Contractor.

The impact of the firm time periods established in the NEC highlight the need for adequate preparation for the management of projects. For example, Broome concludes, "Contractors need more time to mobilize. Personnel close to the project need to be empowered to make decisions and have clear lines of communication to higher levels when their own authority is exceeded" (Broome

1998). As mentioned earlier, both Clients and Contractors recognize that more front-end pro-active management and administration is needed during the construction phase to fully benefit from the management techniques incorporated in the NEC contracting system.

Equally important, the NEC was deliberately drafted to provide an interlocking set of procedures to stimulate good project management of contracts by both parties and to avoid disputes. While conflict, disagreements, and changes do arise on any project under any form of contract, it is generally agreed that the NEC creates a better framework for their management and resolution (Broome and Thompson 1997). Broome analyzed the most important secondary change due to the implementation of the NEC system of contracts. The secondary changes examined are clarity and logic.

3.2.6 Clarity and Logic

As has been previously discussed, one of the major aims of the NEC is to be an improvement in clarity compared with existing forms of contract. Broome's research identified that at job site level, it is agreed that compared to previously used contracts, the NEC is easier to read. The site personnel interviewed affirm that there are few disagreements over the meaning of clauses. Some senior personnel expressed the view that "it is the first contract which they can actually understand" (Broome and Perry 1995). From the international construction environment, one project director for a contractor involved in a large and complicated project told Broome, "for the first time in his experience, engineers from non-English speaking countries were actually referring to the contract document."

The Guidance Notes, which accompany the contract, are generally seen as helpful in understanding the contract and the implications of each clause. In comparison, the Flowcharts appear to be used less, but also help users to

understand the interactions between clauses. Like any tool, its effectiveness depends on how well it is used. Broome's investigation uncovered that money issues are the source of most disagreements and the NEC method of working out the cost of a Compensation Event by the Schedule of Cost Components has caused the most problems (Broome and Perry 1997). In the first edition of the NEC, the Guidance Notes were initially deficient in explaining this method. Due to the improvements made in 1995 in the second edition, there are greater understanding and reduced problems. Broome predicts that as use of the contract progresses, use of the Guidance Notes and the Flowcharts will generally decrease (Broome and Thompson 1997).

Furthermore, research and interviews indicate the following improvements in clarity due to the logic, procedures, and language of the NEC:

- Ease of understanding,
- Clearer text,
- Clearer risk allocation,
- Clearer roles,
- Clearer procedures,
- Reduced sources of conflict,
- Reduced gamesmanship,
- Clearer payment for change,
- Clearer dispute procedures, and
- Clearer guidance (Broome and Hayes1997).

In conclusion, having interviewed users at different stages of a project, Broome noticed how attitudes, appreciation, and understanding of the NEC become more positive as the project progresses. Virtually all interviewees, once they have overcome the initial learning curve, think the NEC is easier to work with on site than with traditional contracts. Both Contractors and PMs frequently observed that after having had experience with the NEC, their efficiency and performance improved on later NEC projects (Broome 1998).

In Broome's research, the following improved practices resulting from the structural and secondary change were discussed:

- Attitudes and Motivation
- Tender (Bid Document) Preparation and Assessment
- Valuation.

3.2.7 Attitudes and Motivation

During his research, Broome discovered that on successful projects, effort has been put into educating the staff, not only in the contract itself, but also in the concepts behind it and in establishing a good working relationship between the parties' pre-contract activities. It is discovered that some contractors and clients have consciously selected personnel whose attitudes are more suited to the new culture and style forged by the NEC (Broome 1998). Subsequently, there has often been an attitude of trust in and respect for the other parties' objectives that has not been observed under the traditional contracts.

Furthermore, there is evidence to suggest that use of the NEC motivates a cooperative attitude on the job site. The research suggests that the NEC system helps to perpetuate, reinforce, and over time, enhance the spirit of co-operation established at the project's pre-contract events. Broome proclaims, "The NEC is based more on incentives than penalties, aiming to motivate people positively to work together" (Broome and Thompson 1997). It is clear from the research that the commitment to a changed culture in the engineering and construction environment, which the NEC promotes and encourages, must stem from the Employer. Training of project staff and thorough pre-contract preparation are emerging as essential elements for achieving this commitment.

3.2.8 Tender (Bid Document) Preparation and Assessment

The contract documentation required by the NEC system differs from the conventional contracts in a number of ways. For instance, greater rigor and precision are needed in the preparation of NEC bidding documents, because it is believed that "the ECC [Engineering and Construction Contract] is more likely to highlight [Employer's or Contractor's] errors in the management process" (Broome and Perry 1997). Greater discipline is required in preparation of information to make sure it is full, clear and unambiguous at the time of bidding. Clauses, which rely on subjective judgement such as "to the engineer's satisfaction", are eliminated. As a senior company manager stated, "the NEC forces a discipline on the Employer to ensure… the specification is well written" (Broome and Perry 1997).

Furthermore, Broome received feedback that indicates this may increase costs at the start of the project for the Employer, but should reduce the construction costs, save bid document preparation time for the Contractor, and save bidding evaluation time for the Employer. Broome reports that "Because of the tightness required in an ECC specification compared to a normal one, a number of Designers have estimated that it takes between 5% and 10% more time to prepare [contract documents]. The Employer has to spend more money prior to the contract being let; the Designers felt that the process should produce a better and more buildable design, resulting in a reduced and more certain cost" (Broome 1998).

In regards to the Contractor, he/she needs to think much more about his bid documents, especially in the preparation of the project schedule, cash flow, and method of work before the job starts. Therefore, the number of man-hours needed to put together an NEC tender (bid documents) may be greater than normal. Broome deduces that this extra work considered by the developers of the NEC, produces benefits, which out weigh the work, involved (Broome and Thompson 1997).

3.2.9 Valuation

Under the NEC, the PM assesses the amount due at each assessment date, but has to consider it with and justify it to the Contractor. Payment is certified within one week of the assessment date. The impact of this shorter time period, compared with other forms of contract, encourages people to agree quantities and completed activities at the time the work is completed. Payment is made within four weeks of the assessment date and interest is added both to the late certification and late payments.

In addition, Broome's research shows that in regards to NEC contracts that Activity Schedules (Cost Loaded CPMs) are effective tools for projecting cash flows. The question of what constitutes completion of an activity has been raised on some contracts and indicates the need for the end of an activity to be clearly defined by the person preparing the Activity Schedule. At the same time, the respondents of Broome's research interviews believe that in term of good project management, the time spent measuring, preparing, and agreeing quantities [and Activity Schedules] is greatly reduced (Broome and Perry 1995).

3.3 Telford Survey

In June and July of 1997, Thomas Telford Limited (Telford) administered a survey to evaluate the use of the NEC contract documents, the benefits and dilemmas experienced, and views on the training, software, and new additions to the NEC "family". A questionnaire was sent to 2000 purchasers of NEC documents. In the end results, there are 364 respondents: 18% Clients, 29% Contractors, 29% Consultants, 8% Surveyors, 1% Designers, and 15% Others. Of the respondents, 41% of them used or are currently using NEC documents ("NEC Survey" 1997). Appendix G is the result of the survey provided by Telford.

The salient points are:

Regarding use of NEC contracts:

- Of the 59% who responded that they had not or are not currently using the NEC range of contracts, 71% replied that they "envisage usage in the future."

- Of those that have no working experience with the NEC, 56% suggest that it is because they "have not been asked to undertake a project using it."

- Most companies use the NEC contracts with only minor, if any modifications (54%). The Building Research Establishment (BRE) reported that they "only needed to make slight alterations to the NEC…'we asked contractors to say if there was anything in the NEC they didn't think would work on a building project, but there were not serious objections'. The only major changes needed were to formalise sections covering loss of working time due to bad weather" ("Building first for NEC" 1996).

Regarding benefits of NEC contracts:

- The majority of companies state that the NEC has benefited their projects (72%). The benefits identified are better management procedures (32%), easier handling of problems (31%), time savings (15%), cost savings (12%), and others (10%). See Appendix G for more details.

Regarding pitfalls of NEC contracts:

- Nearly half of those using the documents believed that the NEC had caused problems (46%). The users suggest that this is predominantly due to the fact that the parties were not yet familiar with the contract, rather than the contract failing to live up to expectations (59%). Also, based on the comments, the procedures and time restraints involved in handling the compensation events, i.e. notices and responses, were cumbersome and too short.

Regarding dollar value of contracts under the NEC:

- The range of values of contracts, under the NEC system, is reported to vary from under £100K to over £10 million per contract.

Regarding NEC support tools:

- Regarding the Guidance Notes and their usefulness, the responses are 93% used the Notes and of those, 59% found them "useful".
- Regarding the Flowcharts and their usefulness, the responses are 42% used them and of those, 68% found them "useful".
- 69% of the repliers to the survey have had their staff trained in the use of the NEC.
- Of the repliers, 84% are members of the NEC Users' Group.

The various respondents had many experiences to share regarding their use with the NEC. One of the reasons that the Jockey Club prefers the NEC is "because it reinforces the role of the Project Manager (PM) in the early design and construction phases. [In the opinion of the PM on the golf course project], 'the use of the NEC smoothed the golf course contract considerably and engendered a team spirit with the contractor which helped solve the problems that arose with the second project' " ("NEC in Hong Kong" 1996).

In addition, ESKOM representatives assert that the major area of impact of the NEC is "a major cultural shift" (Steyn 1995). The consensus among the managers for ESKOM is that the previously used contracts are based on moderately adversarial approaches, while the NEC procedures focus strongly on working together to complete a project. Ben Steyn, PM on the Majuba Station Project, declares that the "It [NEC] is solution focused, rather than problem orientated."

To improve the impact of the NEC, Telford is exploring these responses and comments. In conjunction with the NEC Panel, Users' Group, and the ICE executive council, Telford administers suggestions and improvements for the "family" of documents to assist companies who wish to be supported in integrating the NEC system into their business.

3.4 Other Published Work

Besides the interests of academicians, industry participants, and investors in the NEC, many future architects and engineers in the UK are becoming aware of the impact of the contracting improvement movement in the UK engineering and construction process. In 1997, Denise Quigley (presently working for Turner and Townsend Chartered Quantity Surveyors in Manchester, England) was a student of the University of Salford. She conducted her research project on the NEC. The objectives were "to establish whether the ECC was an improvement on the established forms of contract or not" and to determine whether the ECC was indeed a "better" contract (Quigley 1997). For purposes of the research, a "better" contract was defined to be one that "avoided the failings of others without creating other, worse failings [as identified in the Latham Report] (Quigley 1997).

The following results and conclusions in this section are drawn from a brief of Quigley's research submitted to the NEC Users' Group:

Questionnaires were submitted to various Employers (Owners), Contractors, and Consultants. They were asked to give opinions as to the innovations in the ECC and the improvements they make (or not) to the construction process. "The results were all positive." The respondents indicate that the contract is an improvement in all areas. The Employers are least impressed by the novelties of the contract documents and forms, "considering the improvements to be only moderate." The Contractors and the Consultants imply that improvements are quite significant, particularly with respect to clauses on payment and program management. The question still remains: how does the ECC impact the construction process.

In regards to the construction process, Contractors consider "there to be disproportionately high improvements in relation to the reduction of disputes and conflicts, and increased openness and trust." The research shows that Contractors understand the terms and the relationship between the contractual elements and procedures. Quigley concludes that the ECC creates among Contractors "a more pro-

active attitude towards reducing conflicts and disputes."

Furthermore, from the questionnaires, it is concluded that the ECC "avoids the failings of the other contracts and provides a moderate to significant improvement, depending on your viewpoint, and [the consensus ascertain] that the greatest improvements being in teamwork and collaboration." Also, the question of whether greater failings have been created is examined. Quigley concludes that despite some potential failings, "none were of such a magnitude as to detract from the improvements considered made by those using the contract; and, thus it was concluded that the contract was "better"."

3.5 Conclusion

The NEC has introduced some real structural changes to the process of construction contract administration. Those structural changes are:

- Roles and Staffing
- Early Warning Procedures for Change
- Compensation Events and Schedule of Cost Components
- Accepted Programme (Progress Schedule)
- Time Periods.

As a consequence of the above changes, a secondary change in clarity and logic have emerged in the improvement of language and procedures in the contracting process. As a result of the structural and secondary changes, the NEC has demonstrated improved practices in areas of:

- Attitude and motivation
- Tender (Bid document) Preparation
- Valuation.

Attitude, experience, effort, and communication are needed to effectively implement the NEC procedures in engineering and construction practices. Comments made by Employer and Contractor interviewees, coupled with limited analysis of financial data, reveal that in the majority of cases the NEC is helping to deliver projects on time and on budget. From the Employer's perspective, with use of the NEC, he/she is gaining greater certainty of his objectives. From the Contractor's perspective, the ultimate benefit has been in the swiftness of settlement of the final account. To quote a senior project manager, "It is an engineers contract, a project managers contract and not a lawyers contract..." (Broome 1998).

Despite the unconventional contracting practices of the NEC, popular sentiment among engineering and construction industry participants is that "The NEC is an improvement on other forms of contract" (Broome and Perry 1995). Early experience is proving that this new form of contract is making considerable contribution and impact to improvements in the ways that projects are managed, thus benefiting the productivity of the industry and the competitiveness of its clients.

Understanding and appreciating the innovations and cultural changes encouraged by the NEC in the industry is critical to its success. Broome writes, "The NEC is completely new, not just in the language that it uses, but in its fundamental concept and ideas. To quote a senior Project Manager (PM) [from an interview], "we like it because its so radical and different…if it was a slight change, everybody would carry on the same way. The fact that it is so radical has made us think differently" (Broome and Perry 1995).

Chapter 4. Development and Implementation of the Dispute Review Board (DRB)

This chapter provides information on the Dispute Review Board (DRB or Board) process. It looks at the motivations and methodology behind the creation and implementation of the DRB in the United States (US) as a response to the US construction industry's problems with adversarial relations, claims, and litigation. Also, the chapter reviews the status of the implementation of the DRB process in the construction industry to date.

4.1 Introduction

This chapter develops an understanding of the adversarial conditions and unsuitable practices of the US construction industry. As a response to the condition and practices, certain sectors of the industry in the US centered its efforts toward dispute resolution prevention and resolution mechanisms and developed the idea of using a three-person standing neutral group known as the DRB. The history and ideology that promoted the creation of the DRB process and the products of its development are valuable to understanding its contribution to the construction industry in the US. The process of implementing the DRB and the magnitude of its impact in the construction industry to date is also investigated in this chapter.

4.2 United States Industry Conditions

Like in the UK, the nature of disputes in the US construction industry is fueled by a prevailing adversarial climate. The American Society of Civil Engineers (ASCE) states that "The construction industry has been unable to reduce the number and magnitude of disputes between contractors and owners. Disputes result in a substantial dilution of effort and diversion of capital from what should be the goal of the industry, creation of works and structures to serve the public" (ASCE 1991).

Also, like in the UK, there is a proliferation of different contracts. In the US, every government entity has its own contract; and, in the private sector, the standard contracts traditionally used are written by the American Institute of Architects (AIA) and the Engineers Joint Contract Document Committee (EJCDC) of the National Society of Professional Engineers (NSPE). Construction disputes and litigation are not diminishing under the procedures of these ever-revised contracts. On one hand, Contractors feel that they "have been injured by one-sided, unfair and unreasonable contracts and contract administration" (ASCE 1991). Research and experience shows that Contractors defend against this situation by pricing their bids selectively and increasing their bid prices as the owner's reputation for fair play diminishes. A second defense is to engage labor-intensive, expensive, and uncertain litigation to resolve conflicts. While these defensive techniques have spread, they are not required or used in dealing with reasonable owners. On the other hand, some Owners have perpetuated the practice by using of one-sided, unfair and unreasonable contracts and contract administration. In addition, Owners historically tend to submit disputes to mediators, arbitrators, or the courts for resolution, instead of cooperatively working with the Contractor to keep an issue to a minimum and to resolve it at the job level.

The Dispute Prevention and Resolution Task Force within the Construction Industry Institute (CII) identifies three basic factors as the prevailing causes of disputes that plague the US construction industry. These factors are summarized as follows:

1. Uncertainty arising from pre-existing conditions and complexity which cause changes beyond the expectation of the parties.

2. Problems in the contracting process, including imperfect contracts drawn by people who are unanticipatory and unwilling to reason or communicate, incomplete scope definition, unrealistic expectations with regard to cost or completion date and poor performance in executing the work.

3. Issues and problems arising between people as a result of poor interpersonal skills, poor communication, lack of responsiveness and unethical or opportunistic behavior (Vorster 1993).

In the US, these factors have brought forth a number of approaches for avoiding litigation.

James P. Groton, a respected and leading lawyer who has spent forty-three years in law practice representing construction industry clients, was interviewed for this research. He provided this treatise with a brief review of approaches attempted in the US to avoid and resolve disputes on construction projects. To begin, Groton recounts that a hundred years ago or more, the US began using Arbitration as a way of resolving disputes. It was seen as an avenue to bring expertise and informality into what had previously been a strict legal adjudication process. Whenever parties to a construction contract could not reach an agreement, Arbitration was a means to obtain a quick impartial expert decision so that "the parties could put the dispute behind them and move on with the work" (Groton 1998).

The construction industry has also used the Architect or Engineer (A/E) during the construction phase as the on-site arbitrator in an effort to avoid Arbitration altogether. Groton claims that lawyers realized that the use of the A/E as a referee and the ad hoc arbitrators were both fragile techniques for resolving disputes. And, once lawyers began to become heavily involved in dealing with construction disputes, they exploited the weaknesses of both techniques. Groton goes on to state that in dealing with construction disputes, since the A/E is hired by the Owner and is frequently ruling on the adequacy of the his own designs, lawyers attack the A/E's role as the interim adjudicator as an "inherent conflict of interest". Also, lawyers convince their clients that in the event of a dispute, no matter how small, "it is "unthinkable" and "inefficient" for a client to subject itself to Arbitration without the "protection" of a lawyer. Instead, lawyers advocate that clients "reserve their right," "put the dispute on the shelf," and defer any Arbitration until the end of the project, when enough disputes would have accumulated to make it

worthwhile to have a "really efficient" Arbitration" (Groton 1998). Unfortunately, these practices overlook the fact that unresolved disputes tend to poison relationships on a project and that deferring resolution until after the project has ended means that facts are forgotten, witnesses have moved on to other jobs, and that costs of reconstructing the facts is expensive.

Furthermore, Groton recounts that the postwar period [after World War II] ushered in a tremendous expansion of the construction industry accompanied by a corresponding growth in transportation and communication facilities. As a result, contractors became more mobile, venturing without hesitation into unfamiliar regions and seeking work from owners who were new to them. As competition became increasingly keen, profit margins were further eroded, particularly during periods of rapid inflation. "Contracts became much more complex and the construction process was burdened with nontechnical requirements such as environmental regulations and third-party interventions. Contractors were compelled to pursue all available means to maintain their financial well-being, and a growing body of lawyers and consultants stood ready to accommodate them" (Matyas 1996). As a result, the construction industry continued to pursue sensible solutions to the deteriorating business environment.

About ten years ago, Groton describes the industry as beginning to turn to Mediation as a less adversarial and less expensive way to resolve disputes because of the horrendous expense of project-end Arbitration. The industry experienced that Mediation resolved about 80% of the disputes referred to this technique (Groton 1998). Again, lawyers suggested to their clients that Mediation be deferred until the end of the project. When the end of the project came, the lawyers told their clients that "they were uncomfortable mediating a dispute unless they had established all of the important facts" (Groton 1998). Therefore, it became necessary to conduct a certain amount of discovery so that the essential facts could be reconstructed before Mediation. Arguably, the investigations improved the quality of the result in Mediation, but it meant that the preparations for Mediation became almost as expensive as for Arbitration.

Presently, research shows "substantial evidence that the incidence and cost of dispute resolution has reached a level where many participants in the construction process believe there must be a change in the way the industry settles its differences" (Vorster 1993). Like in the UK, Owners, Contractors and Engineers in the US have developed an interest in Alternative Dispute Resolution (ADR) procedures, like Arbitration and Mediation. ADR takes various forms, but like litigation, are typically employed a substantial time after the work has been completed, and the decisions are often made by persons who have limited background in the type of work involved, and have no first hand familiarity with the specific project.

Among the various ADR efforts, Owners, Contractors, and Engineers have developed many ways to supplement contract provisions and administration procedures for managing disputes. Among these is a technique known as the Dispute Review Board (DRB). The DRB process is a prompt and expert method to handle disputes during the construction phase of a project. The DRB consists of a three-person group of independent, pre-selected neutrals that provide on-going assistance with dispute resolution in parallel and throughout the construction process. A useful by-product of the DRB is the fact that the mere existence and availability of the DRB prompts parties to deal with each other and deal with conflict realistically, candidly, and promptly, thereby avoiding enlisting the services of the DRB at all. This process serves as an efficient dispute resolution devise.

4.3 Process of DRB Development

In the US construction enterprise, progress is being made towards a more equitable allocation of risk between the Contractor and the Owner. Unfortunately, "the progress has been more than offset by an increase in the parties resorting to litigation to resolve disputes" (ASCE 1991). The construction process needs preventative steps to control or avoid disputes or at least minimize the heavy transaction costs of resolving them.

DRB is recommended, for use in the construction industry, as a unique and proven form of ADR to settle disputes that arise during the construction phase of a project. This section studies the history and philosophy behind the development of the DRB process.

4.3.1 History

Al Mathews, a highly respected and leading Construction Engineering Consultant in the US, is considered the forefather of the DRB process. Mathews was Chairman of the US National Committee on Tunneling and Technology, Standing Subcommittee No. 4, Contracting Practices, which generated the 1974 publication *Better Contracting for Underground Construction* (Section 4.5.3 provides additional information on this publication). That publication set the stage for many of the concepts and practices employed today (ASCE 1991). Shortly after publication of *Better Contracting for Underground Construction*, the DRB concept began to be utilized in construction practice.

The industry was slow to take advantage of the process. Mathews promoted the development and implementation of the contracting procedures and contract provisions of the DRB with his influence in the US engineering and construction sector. Mathews has played a key role in convincing Owners, Engineers, and Contractors of the benefits of adopting these provisions in their contracts. He also has convinced the legal profession that procedures for implementing DRB contract provisions is necessary and can be incorporated in respective contracts. "The first recorded use of the DRB concept was applied [in 1975] to the construction contract for the second bore of the Eisenhower Tunnel, in Colorado" (Matyas 1996). From 1975 to 1985, DRBs were initiated on five tunnel projects and four heavy construction projects. The success of early uses eventually convinced a growing number of Owners and Contractors that DRBs yielded benefits in the prevention and management of disputes on projects.

Although the DRB process was first implemented on tunnel projects, other construction work, i.e. heavy construction and process industries, began to follow suit. A number of tunneling organizations (i.e. the Moles and the Beavers) were interested in advocating a basic contracting policy involving the cooperation and better management of risk. In 1989, under the inspiration of Mathews', ASCE's Technical Committee on Contracting Practices of the Underground Technology Research Council (UTRC) published Avoiding and Resolving Disputes in Underground Construction (ARDUC). It was the first reference and guide on DRBs. Consequently, the concepts advocated in ARDUC received increasing acceptance on construction projects other than the underground work on which it was initially implemented. Gradually, within the construction industry, a movement began to develop to reduce adversarial attitudes, opportunistic practices, and disputes in construction practices. "Consequently, with the original printing nearly depleted, it was decided to revise the [ARDUC] report to incorporate the latest experiences, and to broaden the focus" (ASCE 1991).

In 1991, the UTRC consisted of owner representatives, contractors, legal professionals, and consultants on construction disputes and those who had served on a DRB. Appendix H is list of the members of the 1991 Underground Technical Committee. Sponsored by the ASCE and the American Institute of Mining, Metallurgical, and Petroleum Engineers, the UTRC updated, revised, and renamed the 1989 edition to Avoiding and Resolving Disputes during Construction: Successful Practices and Guidelines (ARDC). In the revised publication, "the subject matter and the title were expanded to make clear the concept was not limited to underground construction" (Matyas 1996).

From 1988 to 1994, the use of DRBs increased exponentially. In 1988, 7 DRB projects were completed and 16 recommendations for resolution were issued and accepted, with no litigation. Likewise, in 1994, 68 DRB projects had been completed and 211 disputes were settled (Matyas 1996).

4.3.2 Philosophy

As was described in Section 4.3.1, many different ADR methods have been used to resolve disputes and avoid litigation in US construction practices. One of the purposes behind the very existence of the Board is to be a deterrent. The existence of a DRB on a project is meant to encourage the parties to view their differences objectively and to resolve them without engaging the Board at all. The basis is that the Board, consisting of management, engineering, and contractual experts, could establish a rapport and a level of understanding and trust among the project participants to work together to successfully complete a project. When utilized, the Board deals with contractual issues in a timely manner and helps to improve communications and cooperation between the contracting parties. The principle underlying DRBs is that prompt resolution of dispute results in a better job (ASCE 1991). An unsettled dispute inhibits communications and fosters an adversarial relationship between Owner and Contractor, often resulting in even more disputes. Therefore, the DRB functions as a impartial and objective forum to foster cooperation between the Owner and the Contractor, and is a means for prompt and equitable resolutions to disputes, claims, and other controversies.

The primary emphasis of DRBs is to settle disputes "as soon as possible". Contrary to at the end of a project (as described in Section 4.2), the drafters of the DRB process intended "as soon as possible" to mean bringing a dispute to the Board as soon as the contracting parties sense that they are unable to reach a satisfactory solution. Also, "as soon as possible" has come to mean when the facts and personnel involved are readily available, not sketchy or have moved on, respectively. Whenever possible, the Board is to be incorporated early enough in the project so that they can visit the site on regular occasions and view the conditions on which potential disputes may occur. "Virtually, all other ADR concepts address problems underlying the dispute long after it has surfaced, and usually after the project is completed" (ASCE 1991). Conversely, the philosophy

of the DRB concept advocates that problems be brought "out in the open" during construction. Most importantly, disputes are settled soon after they occur, before they escalate and become a source of friction and ill will that lasts for the duration of the contract.

Another objective of the DRB process is to provide a rational, impartial review of disputes by mutually accepted experts. The concept upholds the principles of cooperation and equitable risk sharing by the parties to construction contracts. The objective of the drafters was to create an impartial and objective dispute resolution mechanism that would be instrumental in "avoiding litigation and returning construction back to the engineer and construction professionals" (ASCE 1991). Furthermore, Avoiding and Resolving Disputes during Construction: Successful Practices and Guidelines (ARDC) insists that designers and construction managers directly involved in day-to-day decision making are often ineffective in resolving disputes. It is stated that pride of authorship and direct involvement often prevents one from being objective enough to "distinguish the forest from the tree". Thus, it is believed that it is hard to concentrate on resolving disputes when one is totally occupied with getting the job built.

With a DRB in place, both parties have an opportunity to present their differences informally and frankly, when facts are still fresh, to trusted peers who quickly understand the problem (ASCE 1991). The authors of the DRB process believed that with a Board of experienced and qualified industry experts in place on a project, the process could be tailored to fit any existing contract. With a DRB, this process best satisfies the need for an effective resolution procedure to eliminate the customary wasted time and energy in litigation. A by-product DRBs is a reduction in the time and costs of dealing with disputes. Disputes often escalate and persist throughout construction, causing tempers to flare and the job to suffer. Many eventually result in project delays and/or litigation. (Section 4.4.4 reviews the DRB hearing process)

Also, there is the question of whether a Board's decision should be admissible in evidence in a subsequent Arbitration or court trial. If the contractual parties know in advance that the Board's decision and rationale will be received in evidence in the event the dispute is not resolved amicably, parties have a greater incentive to adopt the Board's recommendation. Thus, UTRC strongly believed that as a consequence, the effectiveness of the DRB will be maximized (ASCE 1991). The philosophy is that inasmuch as the Board's investigation and analysis of facts will have been made contemporaneously with the events, the facts are more likely to be accurate, and therefore should be known to and considered by a court, jury, or arbitrators. (Section 4.4.4 discusses deliberations and recommendations administered by the DRB)

4.4 Product of DRB Development

Typically and to be most effective, the DRB is organized before construction begins. A DRB consists of three members selected and approved by both the Contractor and the Owner. Prospective members, whose background or current affiliation and activities (both professionally and personally) are questionable with respect to the project, should be considered only after detailed scrutiny. Both the Owner and Contractor must have complete confidence in the impartiality of the DRB. Primarily, DRB members are selected for their knowledge and technical expertise in the type of project to be constructed. Each member is expected to exercise sound judgement when considering engineering, construction, and contract administration matters.

The concept of DRBs has produced measures, which facilitate resolution of disputes at the job site level. This section reviews the general DRB specification, the role of the DRB, and its organization and procedures. Much of the information detailed here is from the Construction Dispute Review Board Manual (DRB Manual).

4.4.1 DRB Specification

The ASCE has prepared a guide specification for inclusion of a DRB on engineering and construction projects. The specification was written based on extensive discussion and consideration by the founding fathers of the DRB and individuals experienced in its use. "The guide [specification] provides tested and reliable, simple, and straightforward procedures which are known to facilitate smooth and responsive DRB functioning" (Matyas 1996). In practice, it is suggest that changes should not be made without a complete understanding of the nuances of the entire DRB process. On occasions, some ill-informed changes to the suggested specifications have severely compromised the effectiveness of the dispute resolution process.

4.4.2 Role of DRB

The role of the DRB is to provide an independent assessment on the merits of disputes. Unlike Arbitration or litigation, which involves a panel or judge with limited construction experience and no first-hand experience, the Board is organized soon after award of the contract, ordinarily before dispute arises. And, under practices, like Arbitration, conflicting descriptions and interpretations of events are resolved long after they have occurred. Lost over the passage of time, the facts are often sketchy and misunderstood. Contrary, the Board acts quickly to resolve disputes, before the parties adopt rigid positions leading to adversary relationships and litigation. Typically, this may involve interpretations of the contract documents, delays, acceleration, scheduling extra work, differing site conditions, or design changes. Another Board function is to hear disputes in an informal and communicative atmosphere and to provide recommendations for timely resolution. The Board provides an authoritative and knowledgeable resolution of the disputes. (Section 4.4.4 details the deliberation and recommendation procedures)

In summary, the DRB has the following responsibilities:

1. Visit the site periodically.

2. Keep abreast of job activities and developments.

3. Encourage the resolution of disputes among the parties themselves.

4. When a dispute is referred to it, conduct a hearing, complete its deliberations, and prepare a recommendation in a professional and timely manner (Matyas 1996).

The DRB Manual suggests the following steps for organizing a DRB:

1. Owner evaluates applicability of DRB.

2. Owner decides to use DRB.

3. Owner coordinates DRB provisions with standard contract language and includes DRB specification and three-party agreement in bidding documents.

4. After contract award, each party nominates one DRB member.

5. Contractor and owner each approve other's nominee.

6. Owner provides first two members with contract documents.

7. First two DRB members confer and select third member.

8. Both parties approve third member.

9. Owner provides third member with contract documents.

10. Three-party agreement signed.

11. Organizational meeting held at site (Matyas 1996).

Another practice is to organize the Board in the beginning of the project, but to put it on standby until needed e.g. no periodic progress meetings. The creators of the DRB process do not support this idea. Putting the DRB on standby forsakes most of the advantages of an ongoing DRB. At the same time, while this loses the early benefits of a contractually provided Board, it is certainly better than losing the benefits altogether. In summary, even though the DRB concept is not implemented in the beginning, it can usually produce significant benefits at almost any stage of the project (ASCE 1991).

4.4.3 DRB Procedures

The DRB concept can be divided into three principal components:

1 . People---impartial, technically proficient, project knowledgeable, and mutually selected.

2. Procedures---simple, straightforward, fair, and efficient, providing for prompt consideration and resolution of disputes.

3. Results--- (a) encouragement of early dispute resolution (before referral to the Board); (b) nonbinding recommendations framed to explain the Board's logic and to encourage acceptance by both parties (Matyas 1996).

This section addresses in more detail the Board membership and operation, the procedures for referrals, hearings, deliberations and recommendations of disputes, and finally, the cost of this ADR mechanism.

4.4.3.1 Membership

The critical element in the DRB process is the selection of Board members. It is important to be able to depend on all members "to consider objectively all sides of the issue and to serve both parties equally and impartially" (ASCE 1991). The most desirable Board members are experienced in the type of construction involved in the project, in the related engineering principles, in cost and scheduling considerations relevant to the project, in interpretation of contract documents, and in claims analysis. Each Board member may not have all of these qualifications, but all of these qualifications should be represented on the Board. Each member should have an understanding of both the Owner's and the Contractor's perspective of construction. Also, it is helpful if at least one Board member has served on a prior Board.

As stated earlier, the Owner and Contractor approve each other's nominees, as well as the third member selected by the two nominees. "There should be no hesitancy for either party to reject a nominee if they have any doubt on qualifications or impartiality" (ASCE 1991). Even so, anytime during the project, if the Owner or Contractor loses confidence in the impartiality of the Board's judgment, to the extent that he/she feels that the dispute resolution process has been or may be compromised, it should be brought to the attention of the entire Board and a satisfactory solution must be reached by the Owner and Contractor. Doubt concerning the impartiality or judgement of any member of the Board should never be allowed to hinder or defeat the dispute resolution process.

It is advantageous to begin selection of Board members early. Some agencies use the normal consultant selection process i.e. advertising in trade journals. Many owners get suggestions for members from their design consultants. Others have views from previous contacts with the construction community.

4.4.3.2 Operation

DRB meetings are held at the job site as often as necessary to stay abreast of the operations of the project. Frequency depends on the size and complexity of the project. For example, meetings are usually every three or four months, but less often if there are no problems, no dispute-prone operations in progress, and during the remainder of the contract.

In addition, Board members are provided with periodic progress reports. Progress reports are furnished to the Board members periodically, i.e. weekly. Commonly, the Owner's standard weekly report is used. This operation is pertinent, because it enhances the Board's understanding of the project.

With an established Board to address disputes as they arise, construction may continue with the Contractor's and Owner's efforts focused on the work, not on the claims. Shutdowns and delays can be avoided and costs kept under control. For instance, expensive and time-consuming preparations for litigation become unnecessary. Moreover, the contractor can continue the work, secure in the knowledge that he/she will receive fair treatment by the Board.

To avoid any suggestion of partiality, there should be no individual communication between Board members and employees of the Contractor or Owner during the life of the Board. Communication with the Owner or Contractor, outside DRB meetings or hearings, should only be handled by the designated Board chairman.

4.4.3.3 Referral of a Dispute to the Board

In the spirit of prompt on-site resolution, disputes should be taken to the Board as soon as either party recognizes that a negotiated settlement is unlikely. For example, when a dispute involves an issue which the contract specifications may not clearly address, timely submission of the issue to the Board may be the only way to keep the job moving. At the same time, "it has been repeatedly found that the presence of the Board encourages the participants to resolve their differences and thus avoid disputes. The DRB should encourage the parties to negotiate in good faith and not simply refer all disputes to the Board" (Matyas 196).

4.4.3.4 Hearing of Disputes

In keeping with the philosophy of the DRB process, resolution of disputes should be done at the job level. A hearing before a group of knowledgeable people is generally recognized as a fair opportunity. The hearing operation is an informal, but orderly, questioning and discussion between the contracting parties. During hearings, owner and contractor representatives fully present their respective cases. Each party is given adequate and equal time to thoroughly cover all issues.

Each party may prepare a separate position paper, including written arguments, for presentation to the Board for review prior to the hearing. The position papers are simultaneously provided to the Board members and to the other party, in time for adequate review before the hearing. To minimize duplication of effort and to expedite review by the Board, the Owner and Contractor are strongly encouraged to jointly prepare a single compilation of relevant background documents and exhibits to accompany the position papers for presentation to the Board.

Sometimes, during this process, the parties, in discussing the issue, settle and resolve the dispute themselves.

Also, all hearing participants and attendees should be identified to all parties prior to the hearing. It may be appropriate for outside technical consultants to present expert opinion on technical aspects of the case, but their participation should be limited. Generally, attendance by legal counsel is discouraged at the hearings. The presence of attorneys can inhibit free and open exchange and may introduce an adversarial mood, which could severely handicap the resolution process (ASCE 1991).

For complex hearings, a court reporter has been used as a means of assisting the Board in note taking. It is believed that verbatim recording tends to inhibit free and open discussion. Therefore, a court reporter should be used only when absolutely necessary and with the agreement of the Board and both parties. Video and audio recordings should not be allowed.

4.4.3.5 Deliberation and Recommendation

After the hearing, the Board deliberates in private to formulate and write its recommendation. The recommendations are submitted to both parties. Typically, the recommendation includes a factual discussion and technical analysis that fully explains the suggested settlement. After presentation of the written recommendations, the Owner or Contractor may request clarification or further reasoning. Keeping with the restriction of communication, the Board, as a body, not individually communicates whatever explanation is needed. The recommendations for settlement must be agreed to by both contracting parties. Appendix I is a sample format of a standard recommendation.

The Board, if asked, can make recommendations on the merit of disputes along with guidelines for settlement of quantum. The owner and contractor, using these guidelines, then negotiate the cost settlements without assistance from the Board. When requested, the DRB can consider the quantum issues in the beginning of a hearing or later following additional testimony. Appendix I is a sample format of a standard recommendation prepared by a DRB.

4.4.3.6 Cost

The DRB Manual reports that the direct costs of the DRB include the fees and expenses of the Board members. The DRB process requires that the Owner and the Contractor share all DRB fees and expenses equally. In terms of procedures, in many cases, the Contractor pays the DRB invoices and then charges the Owner for fifty percent of the cost. In other cases, each DRB member separately invoices each party equally.

The time spent by employees of the contracting parties in preparing for and participating in DRB meetings is not a significant burden when compared with the time both parties devote to internal claims negotiations and other conflicting matters. The DRB informs that CII "characterizes the expense of [the] regular site visits as prevention costs, yielding the benefit of prevention as a result of the Board's presence. Although the value of the benefit cannot be quantified, Owners and Contractors who have used the DRB process generally agree that the value far exceeds the cost" (Matyas 1996).

"Total cost over the life of the contract has ranged from 0.04 to 0.51 percent of the total contract cost…The cost more than offset by the contractor's lower bid prices, which do not need to include contingencies to cover less effective dispute resolution procedures" (ASCE 1991). In

conclusion, the cost of special meetings to hear disputes and the cost of preparing recommendations are very small compared to litigation.

4.5 Process of DRB Implementation

Typically and often, on the suggestion of the designer, the owner decides to provide for a DRB on a project and usually incorporates the required provisions in the bidding documents. The provisions for implementing the DRB are also included in the contract documents. As mentioned, the Board is organized shortly after the contract is awarded. Also, the DRB is active throughout the construction period with or without hearing disputes. This section looks at the events and organizations, depicted in the DRB Manual, that pioneered the implementation of the DRB.

4.5.1 Boundary Dam, State of Washington

In the mid-1960's, Seattle City Light was constructing the Boundary Dam and Underground Powerhouse complex, located about 100 miles north of Spokane, Washington, near the Canadian Border. The Contractor on the project was behind schedule and in an unstable financial situation. The parties were unsuccessful in settling large claims and the Contractor was threatening to restrain the work. Seattle City Light, recently coming out of a major legal battle on another project, "suggested that each party [on the Boundary Dam project] appoint two people to a four-person "joint consulting board", which would make recommendations regarding conflicts on the job site and contractor's claims" (Matyas 1996). The recommendations of this newly formed board of experienced construction professionals was declared to be nonbinding and could be accepted or denied by either contracting party. In the end, "several administrative procedures on the job were streamlined, relations between the contractor and the owner were improved, and several claims were settled. After the job was

completed, all remaining claims were resolved without litigation" (Matyas 1996). This was the start of the DRB concept.

4.5.2 Better Contracting for Underground Construction

As mentioned in Section 4.3.1 on the history of the DRB, Matthews was Chairman of the US National Committee on Tunneling Technology, Standing Subcommittee No. 4, Contracting Practices (USNC/TT). USNC/TT was organized in 1972. Similar to the Latham Report in the UK, their purpose was to study contracting practices throughout the world. USNC/TT acknowledged that "contracting practices in the United States were inadequate for current conditions and constituted a serious barrier to the application of new technology and to the containment of rapidly escalating construction costs and contract disputes" (Matyas 1996). Therefore, like the Latham Report, the objective of their study was to develop recommendations for improved contracting methods in the United States.

After a comprehensive review of contracting practices throughout the world, USNC/TT identified deficiencies in US construction practices and developed a set of conclusions and recommendations i.e. the DRB process. The results of the committee's work were detailed in *Better Contracting for Underground Construction*, which was published in 1974 by the US National Academy of Sciences. Over the years, this publication was well received and increasing numbers of consulting engineers and owners adopted its recommendations in their construction practices. "There is no question that this report exposed many of the problems facing the construction industry and increased awareness of the high cost of claims, disputes, and litigation to the industry and the public" (Matyas 196). Shortly after the publication of the report, the DRB concept appeared in the US practices.

4.5.3 ASCE's Technical Committee on Contracting Practices of the Underground Technology Research Council (UTRC)

The leading organization advocating the DRB concept is the UTRC. They promote the use of the DRBs on various projects and monitors the results achieved. Furthermore, the UTRC seeks ways to implement the concept across a broad range of construction projects.

As cited in previous sections, the UTRC, sponsored by ASCE, published the first reference and user's guide on DRBs in 1989 entitled Avoiding and Resolving Disputes in Underground Construction. In keeping with its function and purpose to improve and expand the use of DRBs, UTRC updated the publication and renamed it Avoiding and Resolving Disputes during Construction.

These publications are important to the process of implementing the DRB. UTRC, under the auspices of ASCE, recommend DRBs on all projects. For better understanding and acceptance in the construction environment, these publications describe DRBs in detail and "present(s) a method for developing cooperative, problem-solving attitudes on projects through a basic risk sharing philosophy between the owner and contractor. [Also], Special [DRB] contracting provisions and practices that have been, and are being, used successfully on over 100 projects (over $6 billion of construction) to avoid or resolve disputes without resort to litigation are explained" (ASCE 1991).

4.5.4 Other Support and Implementation Strategies

In 1996, following publication of the Construction Dispute Review Board Manual (reviewed in Section 5.3.2), the Dispute Review Board Foundation (DRB Foundation) was founded in Seattle, Washington. The DRB Foundation is a nonprofit corporation "dedicated to fostering the use of DRBs around the world and educating construction industry personnel on how to use them" ("Review Boards Multiply as Means of Resolving Construction Disputes." 1998). To

accomplish this purpose, in February 1998, the DRB Foundation began conducting one-day workshops on DRBs around the country. The workshops are intensive programs designed to provide basic skills to those interested in using or serving on DRBs. The workshops consist of presentations of "case studies, a lecture, demonstrations, exercises, an exchange of experiences, and suggestions for changes to improve the process. Among the topics being covered: the proper role of the DRB – and its members – in the construction process; selection and compensation of members; ethics and conflicts of interest; guidelines for board administration and membership; and operation of the DRB board" ("Review Boards Multiply as Means of Resolving Construction Disputes." 1998). Also, to support its efforts, the DRB Foundation publishes a quarterly newsletter, entitled *Dispute Review Board Foundation Forum*. The newsletter reports information on the use of DRBs in the construction industry, as well as articles on DRB practice and issues affecting those who use or serve on DRBs. Since 1996, the DRB Foundation has grown to include more than 300 members from the US and 18 other countries.

A unique strategy of supporting and implementing the DRB concept is to provide construction participants with the opportunity to observe the process in action on an active project. The theory behind this strategy is that Owners who are not familiar with DRBs may not be convinced of their usefulness by the anecdotal testimonies or recorded results. Therefore, it is suggested that Owners sit in on a DRB meeting to get a better understanding and insight for the technique and atmosphere of the innovative process. This suggestion has been successful. For example, "Sitting in on a Seattle Bus Tunnel DRB meeting convinced the Alaska Power Authority to use a DRB on the Bradley Lake Power Tunnel and Dam contract" (ASCE 1991). To experience a DRB in practice, interested parties are encouraged to contact one of the past Committee members for assistance in locating a DRB meeting to attend.

4.6 Status of DRB Implementation

DRBs were first employed on underground projects. Now, DRBs are being used on the construction of other types of projects, such as:

- public auditorium
- basketball arena
- paper mill
- grading and drainage
- subway stations
- highways and freeway interchanges
- bridges and
- dams (ASCE 1991).

UTRC reports that over one-half of tunnel projects bid in the US in 1990 had DRBs. To date, the DRB concept has had a dramatic success rate in US construction practices. In 1991, the total value of completed, on going, and planned projects with DRBs exceed $ 6 billion. DRBs were on 21 completed projects and 63 recommendations for settlements had been made and accepted, with no litigation. Many of these were major disputes and, without the DRB process, probably would have resulted in litigation (ASCE 1991).

Equally impressive is the indication that on many of these projects, the presence of the DRB was instrumental in avoiding disputes. Experience denotes that just the existence of the DRB effects the reduction of disputes; but, when they do arise, the DRB is able to recommend settlement quickly, before adversarial attitudes toughen and grow. Lastly, the cost of implementing a DRB is insignificant when compared with the cost of the litigation.

In a response to confront the inordinate number and high cost of claims in construction, the following Owners have used DRBs on contracts for subsurface construction and for other large or complex construction projects:

- Alaska Power Authority
- Baltimore Metropolitan Transit Authority
- California Department of Transportation
- City of Anchorage
- City of Colorado Springs
- City and County of Honolulu
- City of Kansas City
- City of Rochester (New York)
- Colorado Department of Highways
- Hawaii Department of Transportation
- Massachusetts Water Resources Authority
- Monroe County Pure Waters District (Rochester, New York)
- Municipality of Metropolitan Seattle
- Pennsylvania Turnpike Commission
- U.S. Army Corps of Engineers
- Washington State Department of Transportation (ASCE 1991).

4.6.1 Owner's Perspective

From the Owner's perspective, pay back of the implementation of a DRB process is substantial and occurs many times through the life of the project. It is believed that the Board provides constant insulation from unfair treatment for both the Owner and the Contractor. "The DRB process relieves the Owner's representative of the duty to act as "appeals judge" as well as Owner's advocate" (Matyas 1996). Consequently, a much less adverse climate is created for negotiating claims before they escalate. Equally important, "From the beginning of the project, the contractor sees that the owner is committed to resolving problems before they become legal battles with no winner in the end (ASCE

1991). In Owners' experiences, this sentiment is reflected in the lower bid prices where there is an absence of contingent cost for future litigation.

4.6.2 Contractor's Perspective

Due to the implementation of a DRB on a project, Contractors state their bid prices are significantly reduced, because DRB provisions were included in the contract documents. To the Contractors, providing a DRB indicates the Owners' desire to be fair in solving problems and to pay valid claims promptly during the course of the work, rather than by litigation long after construction is complete (Matyas 1996). Thus, to the benefit of the Contractor, prompt settlement of disputes significantly enhances cash flow. In short, "Contractors have taken a positive attitude toward DRBs" (ASCE 1991).

4.6.3 DRB member's Perspective

The DRB functions as a whole and must always appear an objective, impartial, and independent body. In upholding the tenet of the DRB, it is emphasized and understood that the Board members are not the "representative of " or "advocate for" either party, even the one that nominated them (Matyas 1996). In doing so, "The Board must never give consulting advice for the solution of problems on the job" (ASCE 1991). The agreement establishing the Board specifically prohibits the Board or individual members from providing such advice to either party. Providing advice that later becomes involved in a dispute would destroy the usefulness of the Board.

4.6.4 Attorney's Perspective

With a DRB on a project, Attorneys are still involved in the construction process. However, their time and effort is now directed towards dispute resolution, rather than litigation. Attorneys often hear from clients that litigation is too costly and decisions take too long. The DRB process cost immensely less than a lawsuit and less time to achieve a resolution. In the event the dispute is not resolved, Attorneys are better prepared to litigate the case sooner and with less cost with contributions of the records from the DRB hearings and recommendations. Each party has a clearer understanding of the facts and issues and is able to agree on many of the facts, reduce discovery costs, and proceed with less animosity.

4.7 Conclusion

As result of the construction industry's' commitment and efforts through the inspiration of professionals, like Mathews, and publications and studies by the ASCE, UTRC, and USNC/TT, the number of projects incorporating the DRB contract provisions is ever increasing. Formation of a three-member DRB at the beginning of construction assists in avoidance of disputes and, if necessary, provides timely and equitable recommendations for nonbinding resolution. The DRB utilizes experienced and trusted construction professionals with appropriate technical backgrounds to address prevention and resolution of disputes. As a result of the improved communication, cooperation, and information gathering inspired by the DRB provisions, problems and conflicts are dealt with and resolved more quickly, if not completely avoided. "All owners that have used DRBs endorse the use of this method of dispute resolution" (ASCE 1991). Hence, the continued success of projects employing the DRB process will promote greater acceptance and use throughout the US construction industry.

Chapter 5. Impact of the Dispute Review Board

This chapter looks at research and survey information gathered to assess the impact of the Dispute Review Board (DRB) on engineering and construction practices. It provides a summary on the effect of implementation of the DRB process on contract administration practices.

5.1 Introduction

The DRB concept is a recently established method of alternative dispute resolution (ADR) to the US engineering and construction industry. This section presents the results, related findings and publications of research to date on whether the DRB process has fulfilled the needs of the US industry and satisfied the objectives to successfully negotiate early ends to disputes and reduce escalating, time-consuming, and expensive resolution options (e.g., arbitration and litigation).

The first study that is presented was directed by construction consultant, P. E. (Joe) Sperry. From Sperry's work, the outcome is the most comprehensive summary of DRB projects and their status on record from 1994 – 1996. In this report, this study will be referred to as the Sperry Data or the Sperry Report.

In addition, the publication results of two other investigations are presented. The publications produced by the Construction Industry Institute (CII) and ASCE are:

- *Dispute Prevention and Resolution*, and
- Construction Dispute Review Board Manual.

5.2 Sperry Data

To date, Joe Sperry (Additional information on Sperry is provided in Section 5.3.2) gathered the most comprehensive summary of the status and quantitative impact DRB projects have had in the US construction industry. The information presented here

is from the results of his investigation, published in Construction Dispute Review Board Manual (discussed in Section 5.3), of DRB activities from 1994 – 1996:

Projects

- 68 completed projects
- 98 ongoing projects
- 162 planned projects

"In 1993, it was expected that DRBs would be used on 60 percent of the tunnel and underground projects bid in the United States, representing over 70 percent of the dollar value."

Value

- $3 billion worth of construction on completed projects
- $22 billion worth of construction on completed, on going, and planned projects combined

DRB recommendations

- Of the 68 completed projects, 120 recommendations for settlements were made and accepted by the parties
- Of the 98 ongoing projects, 88 disputes settled

"Many of these were major disputes that, without the DRB process, would have resulted in litigation. Equally impressive is the belief, on most of these projects, that the mere presence of the DRB was instrumental in avoiding additional disputes."

Litigation

- Zero litigation

"No disputes submitted to a DRB have been litigated."

Because of the industry's affliction of adversity and expensive and cumbersome claims, many Owners are implementing the DRB process in their contracting practices as demonstrated in Section 4.6 on the status of DRB implementation. The Sperry Report has verified that the DRB concept has made a significant impact in managing disputes in the construction industry. "The DRB process has proved itself beyond all expectations" (Matyas 1996). Appendix J is the tabulation of the Sperry Data on DRBs.

5.3 Other Published Work

The Technical Committee on Contracting Practices of the Underground Technology Research Council (UTRC) of the American Society of Civil Engineers (ASCE) are the leaders in monitoring and studying the effectiveness of the DRB process. Research has shown that the DRB concept has made a significant impact on US construction practices. CII's research on the existing ADR techniques, emphasizing the DRB concept, is presented here. And, ASCE's effort to contribute to literature on construction practices, highlighting the DRB process, is described here.

5.3.1 Dispute Prevention and Resolution

In 1990, the Dispute Prevention and Resolution Task Force of CII launched a research project to investigate ADR concepts in construction. The report of the research effort and its findings were made public in July 1993. The result is an extensive structured study of the DRB process in practice. The effort was headed by Dr. Michael C. Vorster, Professor of Civil Engineering at Virginia Polytechnic Institute and State University in Blacksburg, Virginia. The project reviewed the full spectrum of ADR techniques, but place emphasis on DRBs "because of their documented success in resolving disputes at the project level" (Vorster 1993).

5.3.1.1 Objectives

These specific research objectives were identified:

1. Understand the nature of disputes.

2. Identify the steps needed to prevent and resolve disputes.

3. Study the growing field of ADR techniques in construction.

4. Study the DRB process.

5. Determine whether DRBs are appropriate for the private, commercial, and industrial sectors of the industry.

5.3.1.2 Conclusions

The research led to the following main conclusions regarding the understanding of disputes in the construction industry:

- DRBs are successfully working on construction projects. DRBs emphasize the early and continuing involvement of a neutral third-party expert to facilitate the timely job-level resolution of disputes.

- It is very critical to timely and successful resolution that the project manager and others directly involved in a particular dispute play an important role in resolving the dispute.

- Implementing a comprehensive and systematic approach to prevention and resolution is the Owners responsibility. Operating and upholding the procedures are the duties of the Owner and Contractor.

The research led to the following conclusions regarding ADR techniques used in the construction industry:

- Pre-construction Techniques – "Much can be done during the pre-construction engineering and documentation stage to minimize disputes and to develop guidelines for managing any that do occur."

- Dispute Resolution Techniques – Since disputes arise between project personnel in the field, the project personnel is essential to and responsible for resolution. On some occasions, it may be necessary for a neutral party

intervention to resolve disputes when the project personnel can not come to an agreement.

- Conflict Resolution Techniques – The aim is to "reach a negotiated settlement or final resolution in the event that disputes cannot be resolved on-site using existing procedures…All [existing conflict resolution techniques] share one characteristic: the neutral or group of neutrals involved are appointed on an issue-by-issue basis. They have no involvement with project other than that required for the resolution of the defined conflict and are appointed and briefed accordingly" (Vorster 1993). In conclusion, to be effective, ADR techniques need to be used systematically throughout the life of a project to avert conflict and litigation.

The research led to the following conclusions from its investigation of the DRB process in the construction practice:

- From the results of studying the DRB process, Vorster and the Task Force developed a checklist for assessing compliance of DRB procedures with the classic DRB methodology in which UTRC intended. Compliance with the list increases the effectiveness (corresponding to the DRB procedures described in Section 4.4.3) and success rate of the process. The checklist is outlined in Appendix J.

- In studying the DRB process, investigations indicate that on occasions, owners have made changes to the classic DRB provisions suggested by UTRC. This practice is discouraged. Experience has shown that when altered, the process is less effective and invites failures. Vorster writes "Changes, and especially those which show a lack of trust in the process [as is], can affect what is essentially a simple and trusting method for dispute resolution" (Vorster 1993).

In regards to the adaptability of DRBs in various construction sectors, the research led to the following conclusions:

DRBs have played a major role in preventing and resolving disputes in the construction industry (Vorster 1993). Research shows that they can be successfully used in the private commercial and industrial sector for the purposes in which they are intended as described in Chapter 4 on the development and implementation of the DRB. Based on the CII research results and the other conclusions stated above, practical guidelines were developed for implementing a DRB on a given project and for administering the process in an effective manner. As it is beyond the scope of this thesis, a full discussion of these guidelines is provided in Chapter 7 of *Dispute Prevention and Resolution* titled "DRB Implementation Guidelines".

5.3.2 Construction Dispute Review Board Manual

It is believed that the construction industry contributes the greatest percentage of one industry to the gross national product of the US. Hence, the editor of the DRB Manual states that "the construction industry needs and deserves a literature of its own, beyond reworked civil engineering texts and trade publication articles" (Matyas 1996). Therefore, the DRB Manual is a part of a series of construction books, published by McGraw-Hill, on a variety of topics. The series of construction books was written "by constructors for constructors".

5.3.2.1 Authors

The authors of Construction Dispute Review Board Manual (DRB Manual), published in 1996, are members of the ASCE Task Committee on Dispute Review Boards. They are:

- Robert M. Matyas
- Al A. Mathews
- Robert J. Smith
- P. E. (Joe) Sperry.

Matyas is a construction management consultant and retired vice president for facilities and business operations at Cornell University. He is also a past chairman of the Task Committee on Dispute Review Boards of the ASCE. Mathews is a construction engineering consultant specializing in feasibility, design, construction, and contractual problems on dams, tunnels, and other large civil engineering projects. Smith is a practicing attorney and a principal of Construction Strategies, Inc., a subsidiary of Wickwire Gavin, P.C., providing dispute avoidance, dispute resolution, and contract review services. Sperry is a construction consultant with more than 30 years of experience in tunnel construction. He is a member and former chairman of the Underground Technology Research Council of the ASCE (Matyas 1996).

5.3.2.2 Contributions

The authors prepared the DRB Manual with contributions from many sources from various sectors of the industry. Persons who had served on DRBs supplied papers on their experience, observations, and informed opinions of the process. "They represent service on more than 100 dispute review boards. Additional review comments and suggestions

were received from owners, designers, contractors, and attorneys involved with over 120 owner and design professional organizations, contractors, and contracting agencies both in the US and abroad" (Matyas 1996). In addition to the manual, these contributions were instrumental in the preparation of DRB specifications and the three-party agreements.

5.3.2.3 Purpose

As described in the history of the DRB in Section 4.3.1, the DRB concept was introduced to the construction industry for use in 1991. Since then, the use of DRBs as a means of dispute prevention and resolution has grown across the US in various industry applications. Important factors, like the growing use and the impressive outcome of the DRB process, led the industry to believe that a broadened and modernized guide would be beneficial.

5.3.2.4 Scope

The DRB Manual is intended primarily as a reference and a user's guide for all construction professionals. It is directed toward Owners, Construction Managers, Architects, Engineers, Contractors, Attorneys, and others who are presently or intend to employ the process. The DRB Manual describes how the DRB helps settle disputes during the construction phase of a project. It provides a guide specification for including a DRB in the construction contract. Also, it gives the steps of how to implement and operate a Board during the construction phase. It explains the benefits, points out the pitfalls and describes the procedures necessary to employ the DRB process. Further, case studies, guide documents for implementation, and a tabulation of projects utilizing the DRB system are provided.

> "Whether you're an owner, contractor, construction manager, attorney, or construction lender, this time- and money-saving sourcebook offers you the most complete guidance now available on the successful establishment and practice of a Dispute Review Board during construction" (Matyas 1996).

5.4 Conclusion

CII's research results, *Dispute Prevention and Resolution*, is the most comprehensive examination of the DRB concept published to date. After examining the volume of work which has been done in the industry on efforts to reduce conflicts and litigation, Vorster and the Dispute Prevention and Resolution Task Force of CII concluded, "DRBs can be successfully implemented in the private commercial sector of the industry" (Vorster 1993).

"Considering the successful record of the DRB process, it can be safely predicted that this concept will continue to grow in popularity both in the US and internationally" (Matyas 1996). Due to the increasing interest and success, a how-to book was needed to assure the DRB concept is effectively implemented. Hence, the DRB Manual, endorsed by ASCE, is a book on how to use DRBs effectively to solve construction disputes on the job, avoid claims, and thereby reduce project costs.

In conclusion, in the US, leaders in the engineering and construction industry have responded to the need for cost-effective alternatives to litigation and arbitration by studying and implementing various ADR procedures. In the US, the growing level of interest and success of the DRB process has caused an increase in its use in construction contracting. Most notably, the impact of DRBs is seen as more of a claims prevention technique, than just another contractual procedure. Therefore, many US engineering and construction participants and constituents are endorsing the DRB concept as a viable ADR mechanism to integrate with existing contracting practices and procedures.

Chapter 6. Comparison of the New Engineering Contract and the Dispute Review Board in Construction Practice

Considering the information provided in the previous chapters, this chapter offers a comparison of the New Engineering Contract system with the Dispute Review Board process. It examines the similarities and differences between the two approaches, the DRB and the NEC, taken to address the construction industry's problems with adversarial relations, claims, and litigation.

6.1 Introduction

As discussed in the introduction of Chapter 1 of this thesis, both the US and UK engineering and construction industries are plagued by environments of similar adversity, non-cooperation, increasing claims, and rising litigious activities. Yet, construction industry leaders of the US and the UK have taken different approaches to addressing the affliction. Both the NEC and the DRB have been hailed by its founders and supporters as the cure for the disease afflicting the construction industry. In the UK, the construction industry proclaims that the NEC directly addresses the problems of the industry, rather than the symptoms. In the US, the DRB is endorsed by industry participants as a process complementary to existing contracts that addresses the predicaments of the industry. This section analyzes the similarities and differences of the effectiveness and impact between the NEC and the DRB concepts in construction practices.

6.2 Processes for NEC and DRB Development

Sections 2.3 and 4.3 encompass the process of development for the NEC and the DRB by looking at the history and the philosophy behind their creation. The NEC system and the DRB process comparatively have equal similarities and differences in the process in which they were developed.

6.2.1 Similarities

- Construction industry environment --- The UK and US construction industries have a comparable working environment of adversity, high number of disputes and claims, and rising litigation. Due to this climate, the stakeholders and constituents of construction enterprises suffer many setbacks in efficiency, costs, and profits of projects.

- Motivations --- The UK and the US construction participants are frustrated with the almost inherent adversity in the industry. This frustration manifests itself into the motivation to change and improve the status quo. For many construction personnel, change is long over due. As projects become larger and more complex, the traditional way in which the industry has conducted its business will not suffice in the future.

6.2.2 Differences

- Philosophy --- Despite the similarities in the climates of the construction industries, the construction industry leaders in the US and the UK have taken different courses to address and improve its practices. As discussed in Section 4.3.2, industry leaders in the US have taken the philosophy that improving ADR mechanisms is the key to improved construction relationships and practices. The DRB concept is an ADR method, which complements the existing contractual practices. It adds improvements to the procedures in which business is already conducted. On the other hand, the development of the NEC takes the philosophy that the contract is the root cause of the afflictions of the industry. As reported by Richard Bliss (present Chairman of the NEC Users' Group), common sentiments in the UK construction industry are typically as follows:

  > [C]onstruction contracts were lengthy and complex with clauses to cover every possible outcome. That led to both sides [of the contracting parties] seizing on a legal loophole to guarantee a financial

advantage. The vast number of contracts that emerged over the years created more confusion and strained relationships (Bliss and Thompson, Fall 1997).

- Objectives / Role --- Because of the differences in philosophy, the objectives and roles of these two commendable approaches to the industry's plights are slightly different. The primary objectives and role of the NEC are:
    - ♦ To promote and motivate parties to work cooperatively, encouraging amicable business relations, and a reduction and timely resolution of disputes.
    - ♦ To stimulate good and efficient project management, leading to the successful completion of a project.
    - ♦ To provide "rules of the game" that are flexible, clear, and logical, ensuring that cooperative and good project management is attainable.

  The primary objectives and role of the DRB are:
    - ♦ To facilitate and encourage positive relations, open communication, and cooperation when contentious issues arise among the parties during a project.
    - ♦ To provide timely, independent assessments on the merits of disputes.
    - ♦ To reduce the delay and cost impact of disputes on projects by avoiding litigation.

6.3 Products of NEC and DRB Development

The similarities and differences of the end products discussed in Sections 2.4 and 4.4 that are attributable to the development of the NEC and DRB are covered here.

6.3.1 Similarities

- New contract specifications --- The NEC and the DRB are not simply matters of verbal intent. As illustrated in Sections 2.4.1 and 4.4.1, the result of the invention of the NEC system and the DRB process required new contract specifications. First, the NEC is a complete authoring of new general conditions of contracts. Likewise, to implement as special provisions to current general contract conditions, the DRB process required writing of additional specifications. For both the NEC and the DRB, engineering and construction stakeholders and constituents, utilizing years of experience and a diversity of backgrounds, accomplished the task of writing the new contract specifications. In summary, the authors, who were needed to write the resultant specifications of the NEC "family" of contracts and the DRB guidelines, represented experience, observations, and opinions from Owners, Designers, Contractors, and others that work in the construction field.

- Flexibility / Adaptability --- Both the NEC system and the DRB process are flexible to be adapted to all sorts of projects within various sectors of the engineering and construction industry. For instance, the widespread uses of the NEC are evident, as shown in the examples provided in Section 2.6. The full integration of the NEC "family" of documents and its flexibility are strong advantages towards the success of the system. These advantages allow it to be applied on a wide range of projects and under a variety of procurement practices. As well, vast uses of the DRB are seen in Appendix I. Because of its flexibility, the use of a DRB should be

considered regardless of the size of the contract or the experience of the Owner and/or Contractor.

6.3.2 Differences

- Completely new contract "versus" special provisions to a contract --- As has been mentioned, the NEC is an attempt to revolutionize the industry by suggesting that an entirely new general conditions of contract is in order. The NEC is an integration of contractual procedures as illustrated in Section 2.4.1 on the publication materials acquired from NEC development. Whereas, the DRB process attempts to reform construction practices by initiating special conditions, as cited in Section 4.4.1 on DRB specifications, to complement present-use contracts. Adding the Board to a project does not replace any part of the existing claims administration process. Standard contract documents should be reviewed and amended to provide this additional step without conflicting with succeeding measures. From a review of Appendix I, the DRB has been mainly implemented in the US by government entities. Most likely, the reason for this is because the DRB is a supplement to their individual standard contract; so, any change for the sake of improvements can not be too drastic as to effect their familiar and traditional contract.

- Organization --- In regards to the NEC and DRB objectives of timely, on-site, amicable resolutions, the organization of the respective procedures are different. On one hand, as described in the section on the Adjudicator's role in Section 2.4.5, the NEC has a mandatory adjudication process requiring the use of a one-person Adjudicator. On the other hand, the DRB adjudication process functions with a three-person adjudication, as indicated in the brief on the US construction conditions in Section 4.2.

6.4 NEC and DRB Implementation

In regards to implementation, the NEC and DRB strategies are comparatively more similar, than different.

6.4.1 Similarities

- Pioneers --- Both the NEC and the DRB were the "brainstorms" of prominent individuals with many years of experience in the engineering and construction field. In the UK, Barnes' ideas and innovation led to the manifestation of the NEC "family" of contracts. While in the US, Mathews led the industry to his unique idea of the DRB process.

- Endorsements --- The implementation of the NEC and the DRB was endorsed by the primary engineering organizations involved in the construction process. The NEC and the DRB were both generously endorsed by the ICE and the ASCE, respectively.

- Industry Support --- The growth of the NEC and the DRB are supported by various engineering and construction participants. As stated to in Section 6.3.1, the NEC and the DRB procedures were not written in a vacuum. For example, the NEC "family" of contract procedures was written by respected and knowledgeable personnel in the business. Similar to the NEC, the DRB is an innovation of a leading professional in the construction industry and, through initiation and support of industry participants, has found widespread use on various projects. In summary, the source of the support given to both the DRB and NEC is from the industry participants themselves, stakeholders and constituents alike.

6.4.2 Differences

- Initiation of use --- The NEC was introduced in practice on low risks and low value jobs. The UK industry leaders expected the unique method of contracting to prove itself effective in improving the construction practice and achieving its objectives. This implementation began with small projects expanding use to larger projects over time before the industry embraced the idea. Conversely, the DRB received its orientation on a major project as stated in Section 4.5.1. The Boundary Dam and Underground Powerhouse project in the state of Washington was a big project for the new process. Because of its impressive initial success on such a high profile project, many industry participants were willing to try the new ADR method on their projects.

6.5 Impacts of NEC and DRB

As proclaimed in Chapter 3 on the impact of the NEC and Chapter 5 on the impact of the DRB, both the NEC and the DRB have had substantial and unique impacts on engineering and construction practices. This segment looks at the similarities and differences of the impacts in the following areas:

- Improved Practices
- Structural Changes
- Secondary Changes.

6.5.1 Improved Practices

6.5.1.1 Similarities

- Attitudes --- Even though it is difficult for new and innovative changes to penetrate the industry, the acceptance of the DRB and the NEC as viable measures to manage disputes are positive. In

the US and UK, some lawyers have also welcomed the reforms, which the DRB and the NEC offers and recognizes them as forward steps. Notably, having a DRB on a project or using a NEC contract "creates a dynamic situation in which the participants in the project unconsciously change their relationship and their attitudes toward each other [and the project]" (Groton 1996).

- Communication --- The NEC system and the DRB process, by their very nature, help improve "people" relationships by fostering communication and trust. Because of the provisions involved in the NEC and the DRB as described in Chapter 2 on the development and implementation of the NEC and Chapter 4 on the development and implementation of the DRB, the improved communication in the construction process greatly contributes to successful early and job-site resolution of disputes.

- Stimulus to good project management --- Both the NEC and DRB encourages communication. Therefore, for the sake of good project management, parties identify problems early and deal with them promptly. As stated in the Quigley findings of Section 3.4, the NEC is considered a "better" contract. It avoids the failings of the other contracts and provides a moderate to significant improvement, in teamwork and collaboration. Likewise, the DRB procedures provide a stimulus to improve teamwork and collaboration. The parties using either the NEC or the DRB are encouraged to deal with one another straightforwardly, reducing gamesmanship and posturing.

- Preventative costs --- The start-up cost of a project may increase for the Employer who implements the NEC. As disclosed in Broome's research, it may be due to the increased expectations on the Employer for design and tender documents, but the construction costs should be reduced, save bid document preparation time for the Contractor, and save bidding evaluation time for the Employer. Similarly, the DRB has preventative aspects. The Boards are required to meet regularly from the start to the end of a project, regardless of whether disputes are presented to them. The "omnipresence" of the Board encourages the disputants to work together and resolve their issues without the assistance of the Board. These attributes "effectively eliminates unnecessary delaying tactics...[and] ensures that issues raised [to the Board] have merit and eliminates speculative ventures" (Vorster 1992). Thus, preventing unnecessary delays and subsequent costs.

- Reduction in litigation --- The procedures for the NEC and the DRB are designed to assuage disputes and reducing litigation. Both have standard, time tested procedures that if changed makes the system fail. From the investigations for this research, it has been shown that if used properly, the NEC and the DRB are successful in achieving those objectives.

6.5.1.2 Differences

- Increased expectation on the Owner (Client) --- On a construction project, the NEC forces both contractual parties, but especially the Owner, to clarify their needs. Unlike present used standard contracts, there is a greater demand on the Owner to know what he/she wants, thereby, defining clear risk allocation and precise

bidding documents. These expectations force the Owner to do more thorough preparation of specifications and bidding documents. As mentioned in Section 6.5.1.1 on preventative cost, this emphasizes the greatest single opportunity for cost saving from up-front, early planning and fewer problems after contract award. In addition, there is better accountability for design specifications as well. If a project were audited, the NEC provisions would easily identify the neglected specifications or design.

6.5.2 Structural Changes

- The greatest impact and distinctive aspect of the NEC are the structural changes. There are no structural changes in the DRB. Therefore, there are no similarities in this area.

- The structural changes introduced in Chapter 3 which discussed the impact of the NEC are in the areas of roles and staffing, early warning procedures, compensation events procedures, accepted programme procedures, and time period procedures. The contemporaneous, "real time" features of the NEC procedures distinguish it from other contract documents and ADR techniques. The structural changes enhance the accuracy of any fact-findings and get them on the table without delay. In addition, strong program management provisions, pre-pricing of changes, and payment systems based on milestones rather than interim measured valuations are prominent structural changes that differ it from other contract provisions.

6.5.3 Secondary Changes

6.5.3.1 Similarities

- Clarity and logic --- The procedures for the DRB and the NEC are clear and logical. DRBs are "fairly easy to understand and relatively simple to implement" (Groton 1996). One of the NEC's primary objectives is to be clear and logical as discussed in Section 3.2.6 on clarity and logic.

- Adjudication --- The DRB and NEC adjudication processes are similar in the following ways:
  - The standing neutral(s) should be familiar with the forms of construction inherent in the contract to which they will be appointed.

  - It is essential that the standing neutral(s) be acceptable to both the contractual parties. (In practice with the NEC and the DRB, it is not encouraged to appoint a lawyer as standing neutral.)

  - The standing neutral(s) functions as an objective, impartial, and independent body at all times.

  - The fees of the standing neutral(s) are shared equally between the parties.

  - As stated in Chapter 2, which outlined the development and implementation of the NEC, the role of the Adjudicator under the NEC is "akin to that of a nuclear deterrent – to encourage people to sort of out their own disputes."

Analogously, the mere presence of the DRB has a preventative effect, inspiring the parties to avoid disputes or settle them without DRB intervention.

- The use of the standing neutral(s) provides the probability of a quick, on-site resolution of any dispute during the period of construction. If necessary, Arbitration (or Tribunal in the UK) is still available.

6.5.3.1 Differences

- Role of the contract --- Unlike the DRB, the NEC redefines the role of the contract, as depicted in Section 2.3.2. As has been discovered in this research, the NEC is not just a set of legal documents, but conditions that effectively and successfully manage and operate a project to the benefit of all parties involved. Despite the success of the DRB, it is still just a "patch" on a hole of deficiency of the present system.

- Adjudication ---
  - Under the NEC, the Adjudicator does not conduct periodic visits of the project. One of the Board's primary responsibility is to come to the job site and acts as a spur to promote dialogue and timely resolution. This mechanism to improve the resolution process is included in the DRB provisions. Whereas, the Adjudicator is only summoned when the dispute is inevitable. This procedure reduces its effectiveness in dealing with disputes. The Adjudicator has to be brought up to speed on the project. He/she does not have the benefits, as the DRB members, of having constant contact with the parties and an understanding of the project

dynamics. Thus, there is a "learning curve" embedding on the objective of "real time" resolution.

- Section 6.3.2 stated that the DRB consists of three persons and the NEC Adjudicator is one person. This organization yields dissimilarity in the adjudication process. With three people of various experiences, knowledge, and expertise, an issue causing dispute can be thoroughly evaluated from many angles. As a result, the best possible and most fair resolution is highly probable. On the other hand, the highly respected and expert Adjudicator does not have a "soundboard" in which to ponder his understanding and ideas for the best and fair resolution.

- It is not necessary for a standing neutral appointed for a NEC contract to be knowledgeable about the NEC system, whereas the DRB member must be familiar with the contract being used to effectively fulfill his role as a standing neutral.

6.6 Conclusion

The DRB and the NEC are the latest efforts to manage disputes in the construction industry. As shown in this chapter, their development processes, products of their development, implementation strategies, and impacts on the construction industry differ. Yet, both have similar extraordinary success stories to tell. Both set out to accomplish like goals, but did it in different ways. In conclusion, the climate in construction practices is improving and progressing towards an amicable, efficient, less litigious, and more cost savings enterprise.

Chapter 7. Conclusions

This chapter infers conclusions from this study. The information in Chapters 2 and 3 provides an understanding of what the NEC system of contracting is and its creative process and purpose. Chapters 4 and 5 provide an understanding of the background and industry perspectives on the DRB process. Subsequently, Chapter 6 compares the NEC and DRB concepts by reviewing the mechanisms, procedures, and the impacts of their implementation. This chapter consolidates the research results and findings.

7.1 Overview

The research described in this report was undertaken to achieve three specific objectives, which are set out in Chapter 1. This section covers an overview of those objectives.

First, this research commences with the objective of describing the processes used to develop and implement the NEC in the engineering and construction industry. In examining the development, the history and the philosophy behind the creation of the NEC are explained in Chapter 2. Chapter 2 also introduces the end products of the NEC development in terms of the available materials, organization, and procedures. Furthermore, the elements involved in the implementation of the NEC and a survey of how it is being used in practice is provided.

Second, the objective of presenting the results of studies done to measure the impact and use of the NEC in the construction process is attained in Chapter 3. To begin, the work done by scholars, Broome and Perry, from the University of Birmingham, England are presented. An identification and discussion of the structural changes, secondary changes, and improvements to contracting practices are outlined in Chapter 3. Furthermore, Chapter 3 provides a synopsis of two surveys, one conducted by Thomas Telford Limited and the other by Quigley, a researcher from the University of Salford, England. The information gained

from these surveys reveal industry perspectives from personnel who directly use and are effected by the NEC.

To compare the development and impact of the NEC system of contracting with the development and impact of the DRB process augmenting present contracting practices is the third objective. Chapters 2 and 3 on the NEC and Chapters 4 and 5 on the DRB establish the groundwork. The comparison of the NEC system and the DRB process manifests in Chapter 6.

7.2 Methodology Accomplished

To achieve the objectives of this research, certain methodologies were established. A comprehensive study of the inspiration and creative process abetting the development of the NEC and the DRB was performed. The most important method aimed at accomplishing the objectives was a journey to the UK to meet and interview the founding fathers of the NEC. At the same time, the trip afforded an opportunity to meet and interview with engineering and construction personnel who use and support the NEC in development and in practice. Lastly, the findings were assembled to resolve the objectives of this research.

7.3 Main Conclusions

The main conclusions ascertained in this thesis are:

- The US and the UK construction industries have similar working environments. Both construction environments are plagued with adversity, rising numbers of claims, and high litigation cost.

- Champions (e.g. Mathews and Barnes) for change emerged and influenced the industries in the US and the UK, respectively, to address the afflictions and improve practices.

- The US and the UK construction industry leaders embarked on different approaches to deal with the working environments, but both efforts (DRB and NEC) provided mechanisms to improve communication and relations, and manage disputes in a timely fashion at the job site level.

- The DRB and the NEC share common success stories. The results and impacts that they have had on the construction industry are similarly good and effective.

In summary, it really does not appear to matter what method is used to manage disputes or how it is implemented. Ultimately, people make the process work. As long as the method emphasizes good management strategies, communication, and timely resolution under the auspices of a standing neutral, improvements in the climate of the construction industry will surface.

7.4 Future Research

The subject of managing disputes during the construction process is continuously under study. At the same time, knowledge is being gained from experience and increased efforts. Future research described briefly in the following areas may also be beneficial to the industry:

- Spreading the news --- what things need to be done and what avenues need to be taken to "spread the news" when new and innovative ideas are available for use in various aspects of the engineering and construction process. How can the key people who would benefit from a particular new idea be reached and influenced.

- Obstacles and/or invitation to change --- what obstacles are there in the industry to change (i.e. attitudes, cultural differences, laws, etceteras), specifically when the change is in methods other than technology.

- Integration with other contracting procedures --- can the scheduling, payment, and cost estimating software packages available in the market be integrated with the NEC contract software.

In more depth, future research in the area of information transfer may also be beneficial to the industry. This research has identified the need to do a study parallel and similar to work done by Panagiotis Mitropoulous on expert systems technology transfer (specifically "An Expert Systems Technology Transfer Model for the Architecture-Engineering-Construction Industry") in the area of information technology. Future research could investigate the following questions:

- How are industry processes adapted for new policy, procedures, contracts, codes, and the like? For example, if a new code is established, how and when will change occur?
- In kind to work done by Bob Tatum, what are the roles of industry participants in adapting and implementing a new process?
- What are the characteristics and correlation of the people, organizations, and extent of the technology that lead to successful practices?
- Using the NEC and ADR mechanisms as case studies, how were they adopted in practice?
- How do you go about implementing a different contract?
- How do you go about implementing a different procurement concept like Design-Build?
- How are non- technical innovations disseminated in the industry?

The T^2 model developed in Mitropoulous' research focused on the transfer of expert system technology to the architectural, engineering and construction industry. "The model provides a framework that can be used by all engineering disciplines for analyzing the transfer of other innovative [information] technologies and the adoption of corporate policies requiring change in the status quo" (Mitropoulous 1991). Research in the area of information

technology transfer will contribute to the understanding of how procedures, policies, et cetra promulgate and work in the engineering and construction industry.

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APPENDICES

APPENDIX A: Matrix of the New Engineering Contract "family" of Documents

Table of Main Options

Contract	Activity Schedule	Bills of Quantity	Target	Cost Reimbursable	Management	Term	Time Based
Engineering and Construction Contract	YES	YES	YES	YES	YES	NO	NO
Professional Services Contract	YES	NO	YES	NO	NO	YES	YES
Plant Contract	YES	NO	YES	YES	NO	YES	NO
Short Contract	Price list covers payment by activity schedule, lump sums, bill of quantities, schedule of rates per hour or per day.						

APPENDIX A continued,

Table of Secondary Options

Secondary Options	Engineering and Construction Contract	Professional Services Contract	Plant Contract
Performance bond	Yes	No	Yes
Parent guarantee	Yes	Yes	Yes
Advanced payment	Yes	No	Yes
Multiple currencies	Yes	Yes	Yes
Sectional Completion	Yes	No	Yes
Limitation of liability for design	Yes	No	No
Price adjustment for inflation	Yes	Yes	Yes
Retention	Yes	No	Yes
Bonus for early completion	Yes	No	Yes
Delay damages	Yes	No	Yes
Low performance damages	Yes	No	Yes
Changes in the law	Yes	Yes	Yes
CDM Regulations 1994	Yes	No	Yes
Trust Fund	Yes	No	Yes
Additional conditions of contract	Yes	No	Yes
Extending the defects date	No	No	Yes
Spare parts	No	No	Yes
Transfer of copyright	No	Yes	No
Employer's Agent	No	Yes	No
Termination at will	No	Yes	No
Special Conditions of Contract	No	Yes	No
Country limitation of compensation event assessment	No	No	Yes

Source: Thomas Telford Electronic Publishing Services, 1997.

APPENDIX B: Engineering and Construction Contract Main and Secondary Options

Main Options

The Main Options differ in arrangements for payment to the *Contractor* and in the allocation of risk between the *Employer* and the *Contractor*.

Main options available:

A – Priced contract with activity schedule
B – Priced contract with bill of quantities
C – Target contract with activity schedule
D – Target contract with bill of quantities
E – Cost reimbursable contract
F – Management contract

Type of Contract	Main Option	Payment	Risk
Priced Contract	A and B	Paid for work at tendered (bid) Prices	Largely borne by *Contractor*
Target Contract	C and D	Cost shared between *Employer* and *Contractor*	Shared between *Employer* and *Contractor*
Cost Reimbursable Contract	E	Paid for properly expended costs	Largely borne by *Employer*
Management Contract	F	Paid for Actual Cost and Fee	Largely borne by *Employer*

The major reason for choosing the main options are as follows:

- If the *Employer* can define the scope of work and its is more easily expressed as activities, then **Option A**.
- If the *Employer* can define the scope of work and it is more easily expressed as bills of quantities, then **Option B**.
- If the scope of the work is not fully defined or where anticipated risks are greater, then **Option C** or **Option D**.
- If the definition of the work is inadequate, yet an early start is required then **Option E**.
- If the *Employer* does not wish to subcontract directly with the Subcontractors, then **Option F**.

Secondary Options

When to use the various Secondary Options:
It should always be borne in mind that some Secondary Options may no be used with some Main Options. The contract strategy should be carefully considered so that incompatible choices are not made.

Secondary options available:

G – Performance bond
H – Parent company guarantee
J – Advance payment to *Contractor*
K – Multiple currencies
L – Sectional completion
M – Limitation of *Contractor's* liability for his design to reasonable skill and care
N – Price adjustment for inflation (used only with Options A, B, C, and D)
P – Retention (used only with Options A, B, C, D and E)
Q – Bonus for early completion
R – Delay damages

G	Use when you require financial security for the performance of the *Contractor* in accordance with the contract.
H	Use when you require a guarantee that the work will be finished in accordance with the contract. This guarantee is normally appropriate where the *Contractor* has a parent company.
J	Use when the *Contractor* has to make a substantial investment at the beginning of the contract.
K	Use when payment to the *Contractor* should be made in more than one currency and the risk of exchange rate changes should be carried by the *Employer*.
L	Use when you require sections of the works to be completed before the whole of the works. If you include this option, you must define each section in the Works Information.
M	Option is frequently applied to design work. It reduces the *Contractor's* liability for his design to be in accordance with the Works Information. In the event of a defect, the *Contractor* has adequate defence if he can show that he used reasonable skill and care.

APPENDIX B continued,

More Secondary Options

N	Use when the *Employer* decides to accept the risk of inflation.
P	Use when additional financial security is required should the *Contractor* not complete any part of the works, and other *Contractors* need to be called upon to complete the works. It also provides additional motive to the *Contractor* to complete the works.
Q	Use when completion before the Completion Date in the Contract Data will benefit you and you can use this option to motivate the *Contractor*.
R	Use when delay in completion of the contract will have adverse financial implications. It is recommended that this option is included in most contracts.
S	Use when performance in terms of the Works Information is important and performance is difficult to quantify. This option eases administration, and it relieves the *Employer* of the burden to prove that the *Contractor's* work is substandard.
T	Use when the *Employer* decides to accept the risk of changes in the law occurring after the Contract Date.
U	Use where a delay to the work caused by application of The Construction (Design and Management) Regulations 1994 could not reasonably have been foreseen by an experienced *Contractor*.
V	Use to choose the ECC Trust Fund. This clause was designed to protect a firm, at any tier of the supply chain, against insolvency of its *Employer*. It is recognized that trust laws differ from country to country.
Z	Use for any special conditions of contract, which you may require.

Source: Thomas Telford Electronic Publishing Services, 1997.

APPENDIX C: Professional Services Contract Main and Secondary Options

When to use the various main options:
When using **Option A**, the *Consultant* is paid a lump sum for the services according to the activities in the Activity Schedule.

Option B is a cost reimbursable form of contract, which should be used when the services cannot be defined sufficiently accurately for a lump sum to be provided.

Option C is a target contract, which is sometimes used when the extent of the work to be done is not fully defined or where anticipated risks are greater. The financial risk is shared between the *Employer* and the *Consultant*.

When using **Option D**, the Term Contract provides for the appointment of a *Consultant* for an agreed period time. The *Consultant* prices a task schedule prepared in advance by the *Employer*, where each price on the task schedule is a lump sum for that particular activity.

When to use the secondary options:

G	Use if the *Employer* wishes to retain copyright of the documents provided by the *Consultant*.
H	Use if an *Employer's* Agent is nominated to act on behalf of the Employer.
J	Use if the *Employer* reserves the right to terminate for any reason.

Source: Thomas Telford Electronic Publishing Services, 1997.

APPENDIX D: Plant Contract Main and Secondary Options

Main options available:

A – Priced contract with activity schedule
B – Target contract with activity schedule
C – Cost reimbursable contract
D – Term contract with price list

Secondary options available:

G – Performance bond
H – Parent company guarantee
J – Advance payment to the Supplier
K – Multiple currencies
L – Sectional completion
M – Country limitation of compensation event assessment
N – Price adjustment for inflation
P – Retention
Q – Bonus for early completion
R – Delay damages
S – Low performance damages
T – Changes in the law
U – The Construction (Design and Management) Regulations 1994
V – Trust fund
W –Extending the defects date
X – Spare parts
Z – Additional conditions of contract

Note on main options:

Option D - Term contract with price list is a "call off" or framework contract.

Using the secondary options:

M	Use if the risk of choosing a source country for plant should rest with the Supplier choose a source in an earthquake zone, there would be no change to the Prices or the Completion Date if an earthquake occurred.
W	Use if the whole of the plant cannot be used due to a Defect after Completion but before the defects date, the defects date is increased pro rata.
X	Use to solve the problem of spares provision over the operating life of the plant.

Source: Thomas Telford Electronic Publishing Services, 1997.

APPENDIX E: New Engineering Contract Panel 1997-1998 Membership

Mr. Peter Higgins, BSc CEng FICE FCIArb [Panel Chairman]
Symonds Travers Morgan Consulting Company

Mr. P. Andrew Baird
Contract Management Consultant
ESKOM

Dr. Martin Barnes, BSc (Eng) FEng FICE [Founder of NEC]

Professor Phillip N. Capper, MA (Oxon) BA (Dunelm)
Masons Solicitors

Mr. Les T. Eames, BSc FRICS FCIOB
Commercial Manager
Costain Civil Engineering

Mr. Kelvin Hughes, FBEng FCIOB ACIArb
NEC Commercial Manager
Thomas Telford Limited

Mr. Tom H. Nicholson, BSc CEng FICE [Panel Secretary]
Lecturer and Retired Civil Engineer

Mr. Michael A. Noakes
General Manager Rail Projects
British Airport Authority

Mr. Terry J. Pasley, MSc CEng FICE FIHT
Private Consultant and Retired Civil Engineer

Professor John G. Perry, BEng MEng PhD CEng FICE [Co-founder of NEC]
Department of Civil Engineering
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Mr. Nigel Shaw
Member of the Chartered Institute of Purchasing and Supply
Independent Consultant

Mr. T. William Weddell, BSc DIC CEng FICE FIStructE
Lecturer and Retired Civil Engineer as Head of Contracts at Symonds Travers Morgan

Mr. Drick Vernon, Technical Advisor [Panel Secretary]
The Institution of Civil Engineers

APPENDIX F: New Engineering Contract Users' Group Membership **

Member	Contact person
Royal Hong Kong Jockey Club	Gary Yau, Construction Projects Controller
Union Railways Limited	Mike Attridge, Senior Contracts Manager
London Underground Limited	Richard Bliss, Supply Chain Manager of Construction
Mott MacDonald	M.R. Tulett, Division Director
Contracts Consultancy	David M. Giles, Director
Environment Agency	Gordon Heald, Engineering Manager
Railtrack	David Meek, Head of Commercial Services
BAA, plc	David H. Williams, Group Construction Director
Symonds Travers Morgan	Peter Higgins, Director of Civil Engineering
Yorkshire Water Services, Ltd.	John H.O. Williams
Scottish HydroElectric, plc.	Brian D. Johnston, Contracts Services Manager
ESKOM	Andrew Baird, Corporate Consultant Contract Management
ESKOM International	Charles Murray, Head of Generation and Technology Services
Ashcroft and Armstrong	Col Armstrong, Partner
Warings, Ltd.	Len E. Salter, Managing Director
Tarmac Construction Limited	Edward Barron, Director
National Power, plc	Andrew Wrightson
Balfour Beatty Civil Engineering Limited	Tim P. Gorman, Commercial Director
Shepherd Construction, Ltd.	Paul Craggs, Regional Quantity Surveyor
J. Sainsbury, plc.	Paul Fincham, Property Services
Mercury Communications, Ltd.	Cedric Hudson, Head of Design Group
Department for International Development	Mike McCarthy, Contract Adviser
London Underground Limited	Anil Singh
Wheeler Group Consultancy	Joe S. Greevey, Director

Anglian Water Services, Ltd.	Paul Glass, Senior Engineer
Needlemans, Ltd.	Barry Trebes, Director
AMEC Civil Engineering, Ltd.	Murray Roberts, Project Director
Suffolk Waste Disposal Co., Ltd.	Mr. C. Palmer, Managing Director
University of Hong Kong	Art McInnis, Associate Professor
Miller Civil Engineering, Ltd.	Martin Broome, Commercial Director
Walter Lawrence Civil & Mechanical Limited	Christopher Walker, Managing Director
Dean and Dyball Construction Limited	Howard Reeves, Commercial Director
Camas Associated Asphalt	Martin Hunt, Planning Engineer
British Gas TransCo	Dennis Turner/Steve Riley, Purchasing & Contracts Adviser
South African NEC Users Group Association	
City of Glasgow Council	Ian Telford, Senior Project Manager / Brian Swan, Consultancy Services Manager
Wessex International Water Services	Ken Foulger, Contracts Support Manager
SWALEC Network Services	Martin Kilroy, Mains Design Manager
GDG Management, Ltd.	Graham Clarkson, Director
Nigen Kilroot Power, Ltd.	Robin P. Davis, Project Engineer
Masons Solicitors	Frances E. Alderson, Partner
Ernest J. Bayton	Ernest J. Bayton, Chartered Quantity Surveyor
Rock DCM	Michael Kelly
UK Nirex, Ltd.	Graeme Carus, Head of Purchasing / David Lawrence, Project Manager
D H Simper & Associates	D. H. Simper, Partner
AEA Technology, plc.	Alan Brown
Morrison Construction, Ltd.	Jeff Tallant, Regional Commercial Manager
Staffordshire Engineering Consultants	Mr. D. A. Wilson, Head of Consultancy
Michael Felber	
Wiggins Gee Construction, Ltd.	Mandy Welten, Group Construction Marketing Manager
Mansell, plc.	Trevor Plummer, Managing Director, Special Projects
The Nottingham Trent University	Barrie Foster, Senior Technician, Department of Surveying

Gleeds	S. Zarka, Associate
British Waterways	Mr. C. D. Rainger, Senior Project Manager
Berkeley M.S., Ltd.	Steven Brown
Virginia Polytechnic Institute and State University	Professor Mike Vorster
Raymond Saudi Arabia, Ltd.	Brain George, Business Development Manager
O'Brien - Kreitzberg & Associates Limited	Anthony F. Caletka, Project Controls Manager
Bayfield Associates	R. W. Bayfield
Edmund Nuttall, Ltd.	B. E. Lloyd
UKAEA	Mr. Bob Soames, Procurement Development Manager
BNFL Engineering Limited	Mr. L.G. Wilson, Head of Construction Contracts

**Membership list as of 15 January, 1998.

Source: Thomas Telford Limited, 1998.

the new engineering contract

survey (total 364 returns)

As a purchaser of one or more of the NEC contract documents it would be very helpful if you could spend a few minutes completing the following questionnaire. All information will be treated in the strictest confidence and will not be distributed outside the ICE group.

1. Have you used or are you currently using documents from the NEC range on contracts?

41% ☐ Yes (151)

59% ☐ No (213)

If no, please go to question 28.

2. If yes, which contracts have you used or are you using?

27% ☐ Option A: Priced Contract with Activity Schedule (80)

16% ☐ Option B: Priced Contract with Bill of Quantities (48)

15% ☐ Option C: Target Contract with Activity Schedule (43)

3% ☐ Option D: Target Contract with Bill of Quantities (10)

3% ☐ Option E: Cost Reimbursable Contract (10)

4% ☐ Option F: Management Contract (11)

10% ☐ Sub-contract (31)

14% ☐ Professional Services Contract (41)

8% ☐ Adjudicator's Contract (22)

3. Are you using the contracts as printed or are you making modifications?

36% ☐ as printed (62)

54% ☐ with minor modifications (92)

10% ☐ with major modifications (16)

4. Do you consider the use of the NEC has benefited your projects?

72% ☐ Yes (107)

28% ☐ No (42)

5. If yes, where have the benefits arisen?

32% ☐ better management procedures (57)

31% ☐ easier handling of problems (54)

15% ☐ time savings (27)

12% ☐ cost savings (22)

10% ☐ other, please specify (17)

Faster resolution of Final Account (2)
Open, non adversarial relationships
Simplified language, open handed system
Heightened contractual awareness
Focused minds to resolve disputes timorously
Clearer allocation of risk, function and responsibility
Focus on effects of change
Spirit of co-operation
Common base for wide range of services
Less disputes, easier management
Simplified documentation
Built a team approach
Fits partnering well
More overt attention to costs and defining compensation events
Security of outturn cost (Employer)
Better relationship with Client and his advisers
NEC contracts provide an equitable base for contracting

6. Do you consider the use of the NEC has caused problems with your projects?

46% ☐ Yes (68)

54% ☐ No (79)

7. If yes, where have the problems arisen?

59% ☐ lack of familiarity with the contract caused management difficulties (55)

10% ☐ caused increased costs (9)

10% ☐ contract did not cater for particular problems (9)

1% ☐ extended the length of the contract (1)

20% ☐ other, please specify (20)

Notice and response obligations much too short
Unworkable procedures for compensation events
Option D - Poor definition of Actual Cost, % for Working Areas not practical
Non compliance by the Employer due to ignorance
Application of fee % and % for working area overheads does not always reflect true cost of compensation events
Compensation event methods and time restrictions caused management problems and created paperwork.
Meeting specified dates for compensation events
Internal and external training vital
Unwillingness of parties to co-operate
Complying with all the requirements
Increased competence required from contract admin staff should not be underestimated
Cumbersome and unwieldy procedures have added to management costs. Ambiguities compounded matters
The level of resources required to comply with the time scales in the contract is causing problems

8. What is the range of values of contracts on which you have used the NEC?

10% ☐ under £100K per contract (24)

22% ☐ £100K to 500K per contract (53)

2% ☐ £500K to £1million per contract (52)

25% ☐ £1 million to £5 million per contract (59)

11% ☐ £5 million to £10 million per contract (25)

10% ☐ more than £10 million per contract (25)

9. What is the average number of contracts on which you have been or expect to be using the NEC in a 12 month period?

79% ☐ 1 - 5 (116)

12% ☐ 6 - 10 (17)

4% ☐ 11- 20 (6)

3% ☐ 21- 50 (4)

2% ☐ 50 plus (3)

10. Have you used the Guidance Notes in conjunction with your use of the NEC?

93% ☐ Yes (137)

7% ☐ No (11)

11. If yes, did you find the Guidance Notes?

39% ☐ very useful (54)

59% ☐ useful (81)

2% ☐ not very useful (3)

12. Have you used the Flowcharts in conjunction with your use of the NEC?

42% ☐ Yes (62)

58% ☐ No (87)

13. If yes, did you find the Flowcharts?

23% ☐ very useful (14)

68% ☐ useful (42)

9% ☐ not very useful (6)

14. Do you see a need for more in-depth and comprehensive published guidance on the use of the NEC?

53% ☐ Yes (79)

47% ☐ No (69)

15. Did you use or are you using external consultants to advise you on your use of the NEC?

28% ☐ Yes (41)

72% ☐ No (108)

16. Would you use a register of approved NEC consultants?

45% ☐ Yes (68)

55% ☐ No (82)

17. Have you had staff trained in the use of the NEC?

69% ☐ Yes (104)

31% ☐ No (46)

18. If yes, how was this training provided?

27% ☐ internal resources (39)

32% ☐ external trainer brought into organisation (47)

35% ☐ staff sent on external courses (52)

5% ☐ internal use of externally produced NEC training material (7)

1% ☐ other please specify (2)

Precontract course/discussion with BAA
Experience with previous employer

19. If you used external training resources how useful was this training?

30% ☐ very useful (28)

53% ☐ useful (50)

17% ☐ not very useful (16)

20. Which of the following levels of training have you used or would be interested in using?

21% ☐ initial awareness (55)

32% ☐ general training (84)

16% ☐ in-depth training (43)

11% ☐ distance learning (28)

20% ☐ discussion on problem areas (54)

21. Are you a member of the NEC Users Group?

16% ☐ Yes (24)

84% ☐ No (124)

22. If no, would you like further information sent to you?

73% ☐ Yes (90)

27% ☐ No (34)

23. Which of the following ideas for NEC-based computer software could enhance your use of the NEC?

24% ☐ computerised preparation of Contract Data (70)

20% ☐ contract in electronic form (59)

8% ☐ computerised flowcharts (23)

17% ☐ interactive training packages (50)

17% ☐ project management and information management software linked to NEC (48)

13% ☐ electronic preparation and transmission of NEC communications (37)

1% ☐ other software uses, please specify (2)

Calculation of costs/assessments for compensation events
Details of calculation of cost components (Long and short methods)

24. If software were made available which of the following delivery systems would you be able to utilise?

40% ☐ disk-based for use on a stand-alone PC or lap-top (95)

33% ☐ networked via a server (78)

27% ☐ CD-ROM-based for use on a stand-alone PC (64)

25. Which of the following do you use?

40% ☐ Windows 95 (87)

7% ☐ Windows NT (16)

36% ☐ Windows 3.1 (80)

6% ☐ Lotus Notes (13)

11% ☐ Internet (24)

26. Do you use project management or information management software?

66% ☐ Yes (98)

34% ☐ No (50)

27. If yes, which project management or information management software package do you use?

27% ☐ Primavera (29)

6% ☐ Open Plan (7)

9% ☐ Artemis (10)

4% ☐ Plantrac (4)

4% ☐ Microplanner (4)

4% ☐ Hornet (4)

46% ☐ Other, please specify (51)

MS Project (32)
Power Project (12)
CS Project (2)
Pertmaster (2)
In house system (NatWest)
In house system (AMEC Tunnelling)
MAC Project
Project Commander
CA Superproject
Suretrack
JobMaster
Project Planner
Super Project
SAP
Custom Integrated Management System (Oracle Based)

Please go to question 30.

28. If you have not used the NEC do you envisage usage in the future?

71% ☐ Yes (155)

29% ☐ No (62)

29. If you are not using the NEC, why not?

14% ☐ it is inappropriate for your type of work (31)

56% ☐ you have not been asked to undertake a project using it (127)

4% ☐ you do not consider it to be a good contract (10)

5% ☐ your advisors or financiers are unhappy with the NEC (12)

21% ☐ other, please specify (46)

Considered by procurement but not by Architects and Project Managers
Opportunity not arisen
Happy with JCT
Too busy for learning curve to change from current contract system.
Unfamiliarity amongst design team and contractors (2)
Do not see the need to depart from ICE 6 or Design and Construct
Director of Engineering says not to use it
Clients have not specified it (2)
We haven't let a civil engineering contract for 15 years.
Clients not using it for water treatment
Insufficient knowledge and experience (3)
ICE contracts suit our needs (3)
Existing forms OK for type of work/risks (2)
Apparent lack of certainty
Solicitors who have not been instructed to deal with an NEC case (4)
Insurance Loss Adjusters who have not been instructed to deal with an NEC case
No disputes have arisen yet as very few of our clients use it
Company standard contracts apply
More knowledge required before using it (2)
Awaiting Head Office directive
Role of Adjudicator and ease with which he can be used by the Contractor
Tend to use Dept. of Transport Conditions (ICE 5)
Does not apply to ground investigation
Not yet incorporated into company standing orders
We have our own forms
Have not yet evaluated it - using ICE 6/IChemE
Time involved amending existing documentation
Intending to use
University Lecturer
Internationally unknown, clients prefer a "known" form (Solicitor)
Requires sophisticated users
Claimed benefits not proven
No precedent in litigation
Using NEC to obtain ideas for use in Australian contracts
Jordanian Government official order
Main Contractors prefer ICE 6
Accumulating information and advice for pilot NEC projects
It is new to Sri Lanka
Using FIDIC instead

30. The range of NEC contracts is being extended. The following contracts may be available shortly. Which of these might you consider using?

41% ☐ NEC Short Contract (151)

20% ☐ NEC Plant Contract (74)

39% ☐ NEC Term Contract (146)

31. Are there other contract areas you would like the NEC to cover, please specify

Contract for work which is designed and primarily fabricated off site, then installed on site.
Contractor - choice dictated by Employer
Project finance related version
Partnering agreements (2)
Process contract based on performance
Minor work (£25k to £100 k) (4)
Demolition
R&D for international contracts
Ground investigation (2)
A mixture of Prof. Services and data gathering e.g. settlement monitoring, defect surveys, etc.

Maintenance and repair of facilities (Building and M&E)
Construction management including proper set off, access not possession, etc.
Appointing people for short term assignments
Schedule of rates contracts
Process Plant
Civils associated M&E (2)
Concession Contracts /PF1
Subconsultancy
Plant overhaul and refurbishment
Repair and maintenance
Computer systems development
Project management
Any exchange of ideas on contracts is very desirable
TCC and EPC

32. Which other contracts do you use as well as or instead of the NEC? Please rank relevant contracts in order of usefulness in your activity.

12%	☐	NEC (120)
26%	☐	ICE (271)
8%	☐	FIDIC (83)
20%	☐	JCT (198)
11%	☐	IChemE (115)
14%	☐	GC/Works/1 (147)
9%	☐	other, please specify (88)

MF/1 (23)
Clients own bespoke forms (16)
Own in house forms (11)
BEAMA (9)
BPF/ACA (7)
G90 (6)
ACE (5)
NFDC (3)
JCT S/C Forms (3)
ICE D&C
ICE Minor Works
ICE Blue Form
World Bank
ICTAD (Sri Lanka)
Hong Kong Government Contracts
Australian Contracts
Jordanian Contracts (based on FIDIC)

Some respondents did not rank the contracts in order of usefulness as required, but of those who did, the following results have been calculated in order of usefulness.....

1st ICE (30% of votes)
2nd JCT (18% of votes)
3rd equal NEC & GC/Works/1 (14% of votes each)
5th IChemE (11% of votes)
6th Other (7% of votes)
7th FIDIC (6% of votes)

33. How would you classify your organisation?

18%	☐	client (68)
29%	☐	consultant (113)
29%	☐	contractor (112)
8%	☐	quantity surveyor (29)
1%	☐	designer (6)
15%	☐	other, please specify (56)

LA (13)
Subcontractor (11)
Solicitor (8)
Construction Managers (8)
University (6)
NHS Trust (4)
Electricity Generator
Port Authority
Facility Managers
Loss Adjusters
Municipal Engineer
Specialist Contractor

34. Are there are any other comments you would like to make on any aspect of the NEC?

Drafting style unclear and idiosyncratic
Would like a database of all NEC projects
HA are going to use it
Having difficulties with the different concept
As contractors we have no influence on choice of contract form
Less applicable to M&E works
Needs to apply to site investigation work
Can't wait to get hold of software!
Can we get disk versions of NEC?
Lack of understanding causes problems
Client amendments cause problems
Owned plant cost very difficult to price and use!
Additional staff required
Valuable for supply chain management and partnering
See Eggleston's book
Clients need more guidance
Need more training
Compensation events too complicated and time scales too short
Only using for research and study (academic)
Need index for Guidance Notes
People need to react to culture change
NEC not yet recognised by our clients
NEC administration difficult on fast projects
Need a book of examples of compensation events.
Early warning meetings can become excessive
Users Group extremely valuable
A first class document!
Simple language does not always give clear intent and meaning
Wording can be vague or misleading
Users Group should be free to all NEC purchasers
Excellent family of documents!
SCC is unworkable!

Insufficient attention to subcontract procedures
Partnering/co-operation approach excellent!
We are holding an NEC workshop in Jordan shortly
Too complicated for the average Project Manager
The Guidance Notes are used to cover the lack of wording, but do not form part of the contract
Change comes through incentives compulsory or in the form of benefits to those that change

APPENDIX H: Technical Committee on Contracting Practices of the Underground Technology Research Council 1991 Membership

P. E. (Joe) Sperry [Chairman]
Tunnel Construction Consultant

Frank Carr, Esquire
Chief Trial Attorney
U. S. Army Corps of Engineers

John D. Coffee
Area Engineer
Federal Highway Administration

John E. Reeves
Chief, Office of Highway Construction
California Department of Transportation

Robert A. Rubin, Esquire
Postner & Rubin

Robert J. Smith, Esquire
Wickwire Gavin, P.C.

Oliver T. Harding
Washington State Department of Transportation

Ronald E. Heuer
Geotechnical Consultant

Martin N. Kelley
Vice President, Engineering (Retired)
Kiewitt Construction Group, Inc.

Vladimir Khazak
Director, Technical Services
Municipality of Metro Seattle

John F. MacDonald
Project Manager
Guy F. Atkinson Company

Al Mathews
Al Mathews Corporation

Norman A. Nadel
Chairman
Nadel Associates, Inc.

Source: "Avoiding and Resolving Disputes During Construction", 1991.

CUMULATIVE SUMMARY

	TO JANUARY 1988			TO FEBRUARY 1991			TO JANUARY 1994				INCREASE 91 TO 94			INCREASE 91 TO 94		
	EACH	$ B	DISPUTES SETTLED	EACH	$ B	DISPUTES SETTLED	EACH	$ B	DISPUTES SETTLED	DISPUTES SETTLED PER CONTRACT	EACH	$ B	DISPUTES SETTLED	EACH	$ B	DISPUTES SETTLED
COMPLETED CONTRACTS																
TUNNELS & UNDERGROUND	4	0.2	6	11	0.3	10	29	1.0	36	1.2	18	1	26	164%	272%	260%
HEAVY - HIGHWAY	2	0.3	9	7	0.5	40	31	1.2	72	2.3	24	1	32	343%	141%	80%
BUILDING & PROCESS	1	0.5	0	3	0.3	13	8	0.5	15	1.9	5	0	2	167%	70%	15%
TOTALS	7	0.9	15	21	1.1	63	68	2.7	123	1.8	47	2	60	224%	153%	95%
CONTRACTS UNDER CONSTRUCTION																
TUNNELS & UNDERGROUND	9	0.3	1	20	1.3	7	34	2.9	24	0.7	14	2	17	70%	126%	243%
HEAVY - HIGHWAY	3	0.2	0	21	0.8	8	43	2.9	55	1.3	22	2	47	105%	281%	588%
BUILDING & PROCESS	0	0.0	0	1	0.1	0	21	1.2	9	0.4	20	1	9	2000%	INF	INF
TOTALS	12	0.4	1	42	2.1	15	98	7.0	88	0.9	56	5	73	133%	229%	487%
CONTRACTS COMPLETE & UNDER CONSTRUCTION																
TUNNELS & UNDERGROUND	13	0.5	7	31	1.5	17	63	3.8	60	1.0	32	2	43	103%	151%	253%
HEAVY - HIGHWAY	5	0.5	9	28	1.3	48	74	4.1	127	1.7	46	3	79	164%	225%	165%
BUILDING & PROCESS	1	0.5	0	4	0.4	13	29	1.7	24	0.8	25	1	11	625%	335%	85%
TOTALS	19	1.4	16	63	3.2	78	166	9.7	211	1.3	103	7	133	163%	204%	171%
CONTRACTS PLANNED																
TUNNELS & UNDERGROUND	7	0.4	—	42	2.5	---	63	4.7	—	---	21	2	---	50%	91%	---
HEAVY - HIGHWAY	7	0.3	—	3	0.8	---	76	3.6	—	---	73	3	---	2433%	366%	---
BUILDING & PROCESS	0	0.0	—	0	0.0	---	33	0.9	---	---	33	1	---	INF	INF	---
TOTALS	14	0.7	—	45	3.2	---	172	9.2	---	---	127	6	---	282%	183%	---
ALL CONTRACTS																
TUNNELS & UNDERGROUND	20	0.9	7	73	4.0	17	126	8.5	60	---	53	5	43	73%	114%	253%
HEAVY - HIGHWAY	12	0.8	9	31	2.1	48	150	7.8	127	---	119	6	79	384%	278%	165%
BUILDING & PROCESS	1	0.5	0	4	0.4	13	62	2.6	24	---	58	2	11	1450%	547%	85%
TOTALS	33	2.1	16	108	6.4	78	**338**	**18.9**	**211**	---	230	12	133	213%	193%	171%

Construction Dispute Review Board Manual, 1996
Author: Matyas, R and et al.
The McGraw-Hill Companies

COMPLETED CONTRACTS

TUNNELS & UNDERGROUND

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION	TUNNEL LENGTH feet	TUNNEL DIAMETER feet	COST $ million	KEY	DISPUTES HEARD	DISPUTES SETTLED	DISPUTES LITIGATED
Eisenhower Tunnel, 2nd Bore Loveland Pass, CO	1975 1979	Colorado DOT	Kiewit		8,900	34	106	A	4	4	0
Mount Baker Ridge Tunnel, I-90 Seattle	1982 1986	Washington DOT	Atkinson	31,968 x 9 (1 at 1,332 ft x 63 ft)			36	A	3	3	0
Chambers Creek Interceptor Tacoma, WA	1983 1984	Pierce County	Mole Construction		11,700	6	10	AC	0	0	0
Hanging Lake Explor. Tunnel Glenwood Springs, CO	1983 1984	Colorado DOT	Shank-Artukovich		3,950	13	2	A	1	1	0
Beavertail Tunnel DeBeque, CO	1985 1987	Colorado DOT	Morrison-Knudsen		two at 600	43	18	HC	0	0	0
Metro Bus Tunnel Seattle	1987 1988	Seattle Metro	Atkinson-Dillingham		two at 4,100	20	45	YC	0	0	0
Sewer Relief, Increment 2 Honolulu	1987 1989	Honolulu City & Co	Kumagai Hawaii		5,200	5	10	A	0	0	0
Sewer Relief, Increment 3 Honolulu	1987 1989	Honolulu City & Co	Kumagai Hawaii		3,800	5	6	A	3	3	0
Westlake & Convention Sta Seattle	1987 1989	Seattle Metro	SCI Contractors	Cut & Cover Transit Stations			87	A	0	0	0
Sewer Relief, Increment 4 Honolulu	1987 1990	Honolulu City & Co	Pan Pacific Tokyu		5,400	5	11	A	0	0	0
San Antonio Channel Tunnels San Antonio, TX	1987 1993	Corps of Engineers	Ohbayashi		22,000	23	71	SY	13	13	0
Reverse Curve Tunnel Glenwood Canyon, CO	1988 1989	Colorado DOT	Shea		600	42	7	A	1	1	0
Bradley Lake Power Tunnel and Dam, Homer, AK	1988 1992	Alaska Power Authority	Ensearch Alaska		17,600	14	85	DC	0	0	0
Stanley Canyon Hydro Tunnel Colorado Springs, CO	1988 1993	City of Colo Spr	National Projects		17,500	9	32	AC	2	2	0

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION	COST $	KEY	DISPUTES HEARD

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION		COST $ million	KEY	DISPUTES HEARD	SETTLED	LITIGATED
H-3 Exploratory Tunnel Honolulu	1989 1990	Hawaii DOT	Coluccio	7,000	13	13	A	1	1	0
Lehigh Tunnel No. 2 Allentown, PA	1989 1991	PA Turnpike Commission	Newberg Joint Venture	4,500	45	38	AC	0	0	0
State-Mount Hope System Rochester, NY	1989 1991	Monroe County	Grow & Conduit	8,000	14	29	A	0	0	0
Shot Tower Line, NE-01-01 Baltimore, MD	1989 1993	Baltimore Metro Trans	Kiewit/Shea	two at 5700	20	70	A	4	4	0
Hanging Lake Tunnel Glenwood Cyn, CO	1989 1994	Colorado DOT	Hanging Lake Joint Venture	two at 4,000	42	68	AC	0	0	0
Hemlock Tunnel Rehab Rochester, NY	1990 1991	City of Rochester	Hall Contracting	12,100	6	5	A	1	1	0
Trans-Missouri River Tunnel Kansas City, MO	1990 1992	City of Kansas City	Mole-Kassouf	14,600	8	21	A	0	0	0
Johns Hopkins, NE-02-02 Baltimore, MD	1990 1992	Baltimore Metro Trans	Kiewit/Shea	two at 700	20	13	A	1	1	0
H-3 Windward (Haiku) Tunnels Honolulu	1990 1993	Hawaii DOT	Frontier-Kemper, Traylor, Black	two at 3,500	45	108	A	1	1	0
Cowles Mountain Tunnel San Diego, CA	1991 1993	San Diego Co Water Auth	Traylor	6,800	8	11	A	1	0	0
Deer Is. North Systems Tunnels Boston, MA	1991 1993	MA Water Res Auth	Kiewit, Atkinson, Kenny	9,050	12	20	D	Negotiations in progress 1	1	0
SSC, N15-20 Ellis County, TX	1992 1993	DOE	Obayashi & Dillingham	14,300	14	18	A	One dispute to hear 0	0	0
SSC, N20-25 Ellis County, TX	1992 1993	DOE	Traylor Bros. Frontier-Kemper	12,700	14	14	A	0	0	0
SSC, N25-40 Ellis County, TX	1992 1993	DOE	Gilbert-Shea	43,700	14	16	A	0	0	0
SSC, N40-55 Ellis County, TX	1992 1993	DOE	Gilbert-Shea	44,900	14	12	A	0	0	0
TOTALS, COMPLETED TUNNELS & UNDERGROUND				29 EACH		$1.0 BILLION		37	36	0

HEAVY - HIGHWAY

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION	COST $ million	KEY	DISPUTES HEARD	SETTLED	LITIGATED
Eisenhower Tunnel, 2nd Bore Loveland Pass, Colorado	1979 1981	Colorado DOT	Weaver Construction	Finish work in Tunnel	15	A	12	12	0
El Cajon Hydro Project Honduras	1980 1986	ENEE	Impregilo	Dam	236	L	5	5	0
3rd Lake Washington Floating Bridge I-90, Seattle	1985 1987	Washington DOT	Atkinson	Bridge Approach	36	CFL	10	10	0
First Hill Lid Structure, I-90 Mercer Is, WA	1987 1989	Washington DOT	Paschen Constructors	Roadways & Lid	66	AC	11	11	0
Seattle Lid, I-90 Seattle	1987 1990	Washington DOT	Kiewit-Atkinson	Roadways & Lid	65	A	2	2	0
Mt. St. Helens Highway Replacement Hoff. Crk - Geo. Ridge, WA	1988 1990	Washington DOT	Ledcor/ Seacon	Replace SR 504	7	A	0	0	0
University Ave Reconstructed Sewer Honolulu	1988 1990	City & County of Honolulu	Coluccio	24" sewer	2	L	1	1	0
Seattle Transit Access Seattle	1988 1991	Washington DOT	Kiewit	I-5 to I-90 Interchange	54	A	0	0	0
Mt. St. Helens Highway Replacement Geo. Ridge to Elk Rock, WA	1989 1991	Washington DOT	West Co.	Replace SR 504	8	A	0	0	0
Mt. St. Helens Highway Replacement Hoffstadt section, WA	1989 1991	Washington DOT	Koney	Replace SR 504	13	A	0	0	0
Seattle Transit Access Seattle	1989 1991	Washington DOT	Kiewit	I-5 to I-90 Interchange	27	A	0	0	0
Mt. St. Helens Highway Replacement Hoffstadt Crk Bridge, WA	1989 1991	Washington DOT	Selby Br.	Replace SR 504	13	A	1	1	0
L. V. Morrow Bridge Renovation, I-90 Seattle, WA	1989 1992	Washington DOT	Traylor	Structure	36	A	1	1	0
74th to Island Crest Way, I-90 Mercer Island, WA	1989 1992	Washington DOT	DBM	Roadways	31	A	Issues Remain 1	1	0
First Hill Lid Eastbound, I-90 Mercer Island, WA	1989 1992	Washington DOT	Atkinson	Roadways and Lid	48	A	0	0	0

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION	COST $ million	KEY	DISPUTES HEARD	SETTLED	LITIGATED
Hanging Lake Viaduct Glenwood Springs, CO	1989 1993	Colorado DOT	Flatiron/Prescon JV	I-70	37	A	12	12	0
Harbor Freeway, I-110 Los Angeles	1989 1993	Cal Trans	C. C. Myers, Inc.	Diamond Lanes	81	LW	4	4	0
Century Freeway, I-105 @ I-91 Los Angeles	1989 1993	Cal Trans	C. C. Myers, Inc.	HOV Lanes	31	LW	2	2	0
1,500 Acre Subdivision Burlingame, CA	1990 1992	Shea Homes	Granite	Grading & Drainage	20	A	0	0	0
Boston Harbor Outfall Diffuser Shafts Boston, MA	1990 1992	MA Water Res Auth	Cashman, Interbeton	drilled shafts, 3 ft dia by 240 ft deep in Bay	77	D	Board never setup 0	0	0
Shoshone Dam I/C Bridge Glenwood Springs, CO	1990 1992	Colorado DOT	Centric-Jones	I-70	23	A	1	1	0
Seattle Lid Eastbound, I-90 Seattle	1990 1992	Washington DOT	Kiewit	Roadways and Lid	39	A	0	0	0
23rd Avenue, I-90 Seattle	1990 1992	Washington DOT	Mowat	Roadways	26	A	0	0	0
Mt. St. Helens Highway Replacement Elk Rock to Maratta Creek, WA	1990 1992	Washington DOT	Kiewit	Replace SR 504	25	A	Issues remain 1	1	0
Bellvue Transit Access, Ph 1 Seattle	1991 1992	Washington DOT	General Construction	I-90 Interchange	17	A	2	2	0
Mt. St. Helens Highway Replacement Maratta Creek to Coldwater, WA	1991 1993	Washington DOT	Kiewit	Replace SR 504	10	A	0	0	0
Kalanianaole Highway, Ph 1 Honolulu	1991 1993	Hawaii DOT	Hawaiian Dredging	Roadways	37	A	2	2	0
Luther Burbank to N. Mercer, I-90 Mercer Island, WA	1992 1993	Washington DOT	Kuney	Roadways	29	A	0	0	0
Renton 'S' Curves, Utility Tunnels I-405, Seattle	1992 1993	Washington DOT	Atkinson	Structure and short tunnels	34	A	3	3	0
Milner Hydro Electric Project Twin Falls, ID	1992 1993	Idaho Power Company	Mortenson	Structure	15	L	1	1	0

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION	COST $ million	KEY	DISPUTES HEARD	SETTLED	LITIGATED
L. V. Morrow Bridge Replacement I-90, Seattle, WA	1992 1993	Washington DOT	General, Rainier	Floating Bridge	74	A	0	0	0
TOTALS, COMPLETED HEAVY - HIGHWAY				31 EACH	$1.2	BILLION	72	72	0
BUILDING & PROCESS									
Eisenhower Tunnel, 2nd Bore Loveland Pass, Colorado	1975 1977	Colorado DOT	Howard Electric	Electrical in Vent Buildings	7	A	13	13	0
Newsprint Mill Granada, MS	1986 1989	News South, Inc.	Rust Intl. and Natl. Ind. Constrs	Newsprint Mill	250	LO	0	0	0
America West Arena Phoenix, AZ	1990 1992	City of Phoenix	Mardian Const.	Phoenix Suns Basketball Arena	47	H	0 Board never met	0	0
Inter-Island Terminal Honolulu, HI	1990 1993	Hawaii DOT	Kiewit Pacific	Airport Terminal	131	A	2	2	0
Office Complex Alpharetta, GA	1991 1992	AT & T	HCB	Office Buildings	19	A	0	0	0
Convert Mfg to Office Orlando, FL	1992 1993	AT & T	Huber, Hunt & Nichols	Office Buildings	8	A	0	0	0
Philadelphia Convention Ctr. Philadelphia, PA	? ?		2 contracts		50	?			
TOTALS, COMPLETED BUILDING & PROCESS				8 EACH	$0.5	BILLION	15	15	0
TOTALS, COMPLETED CONTRACTS				68 EACH	$2.7	BILLION	124	123	0
CONTRACTS UNDER CONSTRUCTION									
TUNNELS & UNDERGROUND				TUNNEL LENGTH feet	TUNNEL DIAMETER feet				
Cumberland Gap Tunnel Cumberland Gap, TN	1990 1993	FHWA for NPS	S. A. Healy, Lodigiani	two at 4,200	40	52 PT	95% complete 1	0	
Boston Harbor Outfall Tunnel Boston, MA	1990 1994	Mass Water Res Auth	Kiewit, Atkinson, Kenny	49,500	25	202 D	Diapute may be litigated 40% complete 6 More disputes to hear	6	0

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION		COST $ million	KEY	DISPUTES HEARD / SETTLED / LITIGATED
Crystal Springs Water Project Half Moon Bay, CA	1991 1994	Coastside Water Dist	J. H. Pomeroy	600 + 15,000 ft pipeline	7	6	A	95% complete 1 1 0
Metro Red Line, B221 Vermont-Western Line + Sta, LA	1991 1994	Los Angeles Transit Comm	Tutor-Saliba, Perini	two at 4,800	19	80	?	99% complete 0 0 0
H-3 Halawa Tunnels Honolulu	1991 1994	Hawaii DOT	Hawaiian Dredge & Ohbayashi	two at 1,800	45	89	A	95% complete 0 0 0
Metro Red Line, B231 Wilshire/Western Station, LA	1991 1994	Los Angeles Transit Comm	Tutor-Saliba & Perini	Cut & Cover Transit Station		54	?	90% complete 0 0 0
NC-1B Tunnels and Undg Station Dallas	1991 1994	Dallas Area Rapid Tran.	S. A. Healy	11,000	20	94	A	75% complete 0 0 0
Metro Red Line, B201 Alvarado to Vermont Line, LA	1991 1994	Los Angeles Transit Comm	Tutor-Saliba, Perini	two at 3,405	19	45	?	90% complete 0 0 0
Metro Red Line, B211 Wilshire/Vermont Station, LA	1991 1994	Los Angeles Transit Comm	Tutor-Saliba & Perini	Cut & Cover Transit Station		45	?	70% complete 0 0 0
Inter-Island Tunnel Boston, MA	1991 1994	MA Water Res Auth	S. A. Healy, Modern Cont.	25,000	11	73	D	50% complete 21 16 0
Lesotho Highlands Transfer Tunnel Lesotho, Africa	1991 1997	Leshoto High Dev. Auth	LHPC	145,000	16	460	L	More disputes to hear 50% complete 0 0 0
Immersed Tube, I-90, Central Artery Boston, MA	1992 1995	Mass DOT	M-K, Interbeton, J. F. White	4,000		227	DM	Disputes to hear 50% complete 1 1 0
Metro Red Line, B251 Vermont to Hollywood Line, LA	1993 1996	Los Angeles Co Transit Comm	Shea, Kiewit, Kenny	two at 31,600	19	172	D	20% complete 3 Disputes to hear
Ertan Project, Sichuan Prov. Peoples Republic of China	1992 1998	Ertan Hydro Development	Philip Holzman & JV Partners	3,300 Megawatt Undg Powerhouse		444	A	20% complete 0 0 0
Pleasant Hill Interceptor Martinez, CA	1993 1994	Cent Contra Costa Sanitary Dist.	Ranger Pipeline Company	2,000 + 17,000 ft pipeline	9	14	A	Board being organized
Soft ground tunnel Ft. Knox, KY	1993 1994	COE	W. L. Hailey			6	H	0 0 0 DRB never met
14th Avenue Interceptor, IA Kenosha, WI	1993 1995	City of Kenosha	Super Excavators	6,000	8	9	A	90% complete 0 0 0

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION		COST $ million	KEY	DISPUTES HEARD / SETTLED / LITIGATED
Lower 'K' Development San Manual, AZ	1993 1995	Magma Copper Co.	Frontier- Kemper	33,200	15	33	AP	5% complete Board never organized
14th Avenue Interceptor, IB Kenosha, WI	1993 1995	City of Kenosha	Michael's Pipeleine	7,000 jacked pipe	7	5	A	20% complete 0 0 0
St. Clair River Tunnel Port Huron, MI	1993 1996	CN North America	Traylor & Asso	6,050	27	53	AP	10% complete 0 0 0
West Hills Tunnel Portland, OR	1993 1996	Tri-Met	Frontier-Kemper + Traylor	two at 16,000	19	104	A	5% complete 0 0 0
Richmond Transport Fac. San Francisco, CA	1993 1996	City of San Francisco	Shank, Balfour Beatty	11,100	14	30	A	Board being organized
B-11A Washington, D.C.	1993 1996	WMATA	J. F. Shea	two at 5,400	17	50	LMN	Board being organized
Sewer Contract E San Francisco, CA	1993 1996	City of San Francisco	Kajima	1,150	10	20	A	Board being organized
San Francisco Muni-Turnaround San Francisco, CA	1993 1997	City of San Francisco	Tutor-Saliba- Perini	1,700	16	95	A	Board appointed
Metro Red Line, C331 Universal City to No Holly., LA	1993 1996	Los Angeles Co Transit Comm	Obayashi	two at 10,500	19	65	D	Board being organized
Metro Red Line, B241 Vermont/Beverly Station, LA	1993 1997	Los Angeles Co Transit Comm	Tutor-Saliba- Perini	Cut & Cover Transit Station		41	D	Board being organized
Metro Red Line, B252 Vermont/Santa Mon. Sta., LA	1993 1997	Los Angeles Co Transit Comm	Kiewit-Shea	Cut & Cover Transit Station		51	D	Board being organized
Metro Red Line, B261 Vermont/Sunset Station, LA	1993 1997	Los Angeles Co Transit Comm	Tutor-Saliba- Perini	Cut & Cover Transit Station		45	D	Awaiting award
Metro Red Line, B271 Hollywood/Western Sta, LA	1993 1997	Los Angeles Co Transit Comm	PCL	Cut & Cover Transit Station		37	D	Awarded
Metro Red Line, B281 Hollywood/Vine Station, LA	1993 1997	Los Angeles Co Transit Comm	Kajima-Wilson	Cut & Cover Transit Station		49	D	Awarded
Nathpa Jhakri Project Northwest India	1993 1998	Nathpa Jhakri Power Corp.	Impregilo + 3 other contractors	Dam, tunnels and Underground Powerhouse		100	A	Awarded
TOTALS, TUNNELS & UNDG UNDER CONSTRUCTION				34 EACH		$2.9	BILLION	30 24 0

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION	COST $ million	KEY	DISPUTES HEARD SETTLED LITIGATED
HEAVY - HIGHWAY							
Century Freeway Los Angeles	1989 1994	Cal Trans	Kasler	I-105 to I-405 Interchange	124	LW	95% complete 2 2 0
H-3 Windward Viaduct Honolulu	1990 1993	Hawaii DOT	SCI/Black	Long Span Segmental Viaduct	136	AF	99% complete 42 38 0
Century Freeway Los Angeles	1990 1993	Cal Trans	MCM Construction	I-105 to I-710 Interchange	80	LW	9 disputes to hear 90% complete 5 4 0
Century Freeway Los Angeles	1990 1993	Cal Trans	Ball, Ball & Brosamer	Roadways & Haz Waste Removal	53	LW	85% complete 4 3 0
Haliewa Bypass Honolulu, HI	1991 1993	Hawaii DOT	Fletcher-Pacific	Structures	23	A	98% complete 1 0 0
Mill Seat Landfill Monroe County, NY	1991 1993	Monroe County	H. E. Sargent	Sanitary Landfill	29	A	90% complete 0 0 0
Natchez Trace Pkwy Bridge Nashville, TN	1991 1994	FHWA	PCL Constrs	Precast Segmental Concrete Arch Br	14	T	1 dispute to hear 30% complete 0 0 0
Cowlitz Falls Project Morton, WA	1991 1995	Lewis Co. PUD District #1	Torno-America	Hydro Project	55	A	95% complete 3 3 0
Katse Dam, Lesotho Highlands Proj Lesotho, Africa	1991 1997	Leshoto High Dev. Auth	Impregilo JV	250 MCY dam	320	L	More disputes to hear 35% complete 0 0 0
Snohomish River Bridge, SR 2 Everett, WA	1992 1993	Washington DOT	Atkinson	Structure	19	A	99% complete 1 1 0
405/NE 8th St Interchange, SR 405 Bellevue, WA	1992 1993	Washington DOT	Kiewit	Structure	28	A	70% complete 2 2 0
Coal Creek to N.E. 8th, SR 405 Bellevue, WA	1992 1993	Washington DOT	Leadcore	Roadway	12	A	85% complete 0 0 0
Pittsburg-Antioch Extension Contra Costa Co, CA	1992 1994	Bay Area RTD San Francisco	Tutor-Saliba	Line Section, Concord-No Concord	48	D	40% complete 0 0 0
OC-2 Section Dallas, TX	1992 1994	Dallas Area Rapid Transit	Hensel-Phelps	5,000 foot bridge + 5,000 feet at grade	19	A	80% complete 0 0 0

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION	COST $ million	KEY	DISPUTES HEARD	SETTLED	LITIGATED
Twin S Curve Renton, WA	1992 1994	Washington DOT	Atkinson	Widen & Realign	35	A	70% complete 0	0	0
C & O Canal Bridge Wilmington, DE	1992 1995	Deleware DOT	Recchi America	Concrete Segmental Cable Stayed Bridge	74	A	25% complete 0	0	0
H-3 North Halava Valley Viaduct Honolulu	1992 1995	Hawaii DOT	Kiewit	Long Span Seg- mental Viaduct	141	A	50 % complete 0	0	0
Ertan Project, Sichuan Prov. Peoples Republic of China	1992 1998	Ertan Hydro Development	Impregilo & JV Partners	3,300 Megawatt Dam & Appurtances	625	A	33% complete 0	0	0
Twin Falls Project Twin Falls, ID	1993 1994	Idaho Power Company	TIC	Addition to Hydro Electric Plant	8	A	20% complete 0	0	0
Kalanianaole Highway, Ph 2 Honolulu	1993 1994	Hawaii DOT	Kiewit	Roadways	35	A	30% complete 0	0	0
NC-1A Transition - tunnel to surface Dallas	1993 1994	Dallas Area Rapid Transit	Rosiek Const.	Cut & cover	10	A	60% complete 2	2	0
Jones Rd to Maplewood Seattle	1993 1994	Washington DOT	Kiewit	Roadway	12	A	30% complete 0	0	0
Green River Interchange Seattle	1993 1994	Washington DOT	PCI	Roadway	7	A	35% complete 0	0	0
Snohomish River Bridge, P2 Everett	1993 1994	Washington DOT	General Const.	Structures	10	A	60% complete 0	0	0
Bellvue Transit Access, Ph 2 Seattle	1993 1995	Washington DOT	Max J. Kuney	I-90 Interchange	18	A	55% complete 0	0	0
H-3 Project Honolulu	1993 1995	Hawaii DOT	Kiewit Pacific	Mech-Elect & Tunnel Finish	31	A	30% complete 0	0	0
OC-1 Dallas	1993 1995	Dallas Area Rapid Transit	Neosho	9,500 feet at grade wit Amtrack interfaces	15	A	60% complete 0	0	0
Northrup to Bothel, SR 405 Bellevue, WA	1993 1995	Washington DOT	Max J. Kuney	Roadway	25	A	50% complete 0	0	0
No Halawa Valley Hwy, Unit 1, Ph 1A Honolulu	1993 1995	Hawaii DOT	Hawaiian Dredging	Roadway Reconstruction	25	A	5% complete 0	0	0
Mt. St. Helens Highway Repl. Coldwater to Johnson, WA	1993 1995	Washington DOT	Washington Constructors	Replace SR 504	25	A	60% complete 0	0	0

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION	COST $ million	KEY	DISPUTES HEARD	SETTLED	LITIGATED
Pittsburg-Antioch Extension Contra Costa Co, CA	1993 1995	Bay Area RTD San Francisco	Conco Cement Company	North Concord/ Martinez Sta	24	D	10% complete 0	0	0
Colma Station Extension, 12YC-110 San Mateo Co, CA	1993 1995	Bay Area RTD San Francisco	Dillingham	Station, Line & TRackwork	42	D	5% complete 0	0	0
Three Projects Bangladesh	1993 1995	World Bank		Bridges & River Bank Protection	100	?	10% complete 0	0	0
Colma Station Extension, 12YS-110 San Matro Co, CA	1993 1995	Bay Area RTD San Francisco	Morse Diesel/ Bomel	Parking Str & Bridges	25	D	0% complete 0	0	0
Dublin-Pleasanton Extn, 08ys-110 Alameda Co, CA	1993 1995	Bay Area RTD San Francisco	Walsh-Pacific	Castro Valley Sta & Parking	18	D	0% complete 0	0	0
195th to 164th SW HOV, Stage 2 Seattle	1993 1995	Washington DOT	Max J. Kuney	Roadway	30	A	5% complete 0	0	0
Central Business District, at-grade Dallas, TX	1993 1996	Dallas Area Rapid Transit	Gilbert-Texas	7,000 feet light rail and three stations	44	A	5% complete 0	0	0
New Haven to Boston Conn. and Mass.	1993 1997	Amtrack	MK-Comstock-Spie	Upgrade rail	350	?	Construction start 1994 0	0	0
Evergreen Point Bridge Seattle	1994 1995	Washington DOT	Atkinson	Structure Rehabilitation	17	A	0% complete 0	0	0
Snohomish - Ebey Bridge, Stage 2 Seattle	1994 1996	Washington DOT	General Const.	Structures	10	A	5% complete 0	0	0
Seven Oaks Dam San Bernadino, CA	1994 1997	COE	??? bid protest	38 million CY earthfill dam	180	AP	Awaiting award		
TOTALS, HEAVY - HIGHWAY UNDER CONSTRUCTION				43 EACH	$2.9	BILLION	62	55	0
BUILDING & PROCESS									
City Hall Phoenix, AZ	1991 1994	City of Phoenix	Huber, Hunt & Nichols	20 story, 450,000 SF	45	H	95% complete 0	0	0
Akron Convention Center Akron, Ohio	1992 1994	City of Akron, Ohio	CM = Ruhlin Co. 19 Genl Contrs	Convention Center	24	A	70% complete 1	1	0
Twin Towers Correctional Facility Los Angeles	1991 1994	Los Angeles County	Newberg/Dick	Jail, hospital & central plant	373	A	93% complete 3	2	0
Lynwood Regional Justice Center	1991	Los Angeles	Newberg	Jail, court	194	A	98% complete		

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION	COST $ million	KEY	DISPUTES HEARD	SETTLED	LITIGATED
Lynwood, CA	1994	County		& sheriff station			7	6	0
Health Science Building Seattle	1991 1994	Univ of Washington	SDL Corp	New Educational Building	33	A	90% complete 0	0	0
Physics & Astronomy Bldg Seattle	1991 1994	Univ of Washington	Mortenson Construction	New Educational Building	46	A	90 % complete 0	0	0
H-3 Project Honolulu	1991 1995	Hawaii DOT	TLT Babcock	Vent Fans & Acc	19	A	80% complete 0	0	0
Chemistry Science Building Seattle	1992 1994	Univ of Washington	Ellis-Don Construction	New Educational Building	27	A	90 % completee 0	0	0
Biomedical Science Building Seattle	1992 1994	Univ of Washington	Ellis-Don Construction	New Educational Building	40	A	90 % complete 0	0	0
H-3 Project Honolulu	1992 1995	Hawaii DOT	JPW Controls	Control Systems	20	A	30% complete 0	0	0
Comprehensive High School Everett, WA	1993 1994	Everett School Dist.	Mortenson Construction	New Educational Building	24	A	80 % complete 0	0	0
Wastewater Treatment Plant Martinez, CA	1993 1994	Cent Contra Costa Sanitary District	Humphry Construction	Headwork	18	A	60 % complete 0	0	0
Phoenix Central Library Phoenix, AZ	1993 1995	City of Phoenix	Sundt Corp	Library	27	H	30% complete 0	0	0
Secondary Treatment Plant Fresno, CA	1993 1996	City of Fresno	Western Summit Constructors	Upgrade Plant	82	A	Board being organized		
Makai Expansion, Inter-Island Airport Terminal, Honolulu	1994 1995	Hawaii DOT	Hawaiian Dredging	Add five gates to new terminal	19	AP	Awaiting award		
Prisons Texas	1994 1996	TX Dept of Criminal Justice	5 contracts		165	H			
Phase III Headquarter Expansion Washington, D.C.	1994 1996	International Monetary Fund	Heery/Donohoe	Commercial Office Bldg	80	?	Awarded, Await Notice to Proceed		
TOTALS, BUILDING & PROCESS UNDER CONSTRUCTION				21 EACH	$1.2	BILLION	11	9	0
TOTALS, CONTRACTS UNDER CONSTRUCTION				98 EACH	$7.0	BILLION	103	88	0
TOTALS, CONTRACTS COMPLETED & UNDER CONSTRUCTION				166 EACH	$9.7	BILLION	227	211	0

CONTRACTS PLANNED

TUNNELS & UNDERGROUND

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION	TUNNEL LENGTH feet	TUNNEL DIAMETER feet	COST $ million	KEY	DISPUTES HEARD SETTLED LITIGATED
Dwamish River/1st Ave. South Seattle	1994 1995	City of Seattle		500 Utility relocation		10	7	A	bids 1994
Metro Red Line, C411 Wil/West to Pico/SanVin., LA	1994 1996	Los Angeles Co Transit Comm		two at 10,000		19	120	D	bids 1994 ???
Lexington North Rochester, NY	1994 1996	Monroe County		4,700		10	7		Bids 1994 ???
Metro Red Line, C311 Sta 630 to Univ City, LA	1994 1997	Los Angeles Co Transit Comm		two at 13,370		19	180	D	bids 1994
Provo Canyon Tunnels Provo, UT	1994 1997	Utah DOT		three at 400		29	20		bids 1994
Metro Red Line, C301 Holly-Highland Station, LA	1994 1997	Los Angeles Co Transit Comm		Cut & Cover Transit Station			80	D	Bids 1994
Mt Hope - Rosedale Rochester, NY	1994 1997	Monroe County		8,100		12	14		Bids 1994 ???
Senaca-Norton, Phase 2 Rochester, NY	1994 1997	Monroe County		6,500		12	11		Bids 1994 ???
Glenmont Storage Yard Washington, DC	1994 1996	WMATA		Grading, drainage & trackwork			20	MN	Bids 1994
Glenmont Station Washington, DC	1994 1997	WMATA		Cut & cover			36	MN	Bids 1994
Mid-City Route, E-2C Washington, D.C.	1994 1997	WMATA		two at 3,100		18	45	MN	Bids 1994
Mid-City Route, E-4A Washington, D.C.	1994 1997	WMATA		Cut & Cover Transit Station			60	MN	Bids 1994
Mid-City Route, E-4B Washington, D.C.	1994 1997	WMATA		two at 6,700		18	85	MN	Bids 1994
Mid-City Route, E-3A Washington, D.C.	1994 1997	WMATA		Cut & Cover Transit Station			65	MN	Bids 1994

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION		COST $ million	KEY	DISPUTES HEARD SETTLED LITIGATED
Mid-City Route, E-3B Washington, D.C.	1994 1997	WMATA		two at 3,200	18	40	MN	Bids 1994
Metro Red Line, C351 North Hollywood Station, LA	1994 1998	Los Angeles Co Transit Comm		Cut & Cover Station & Crossover		70	D	Bids 1994
Effluent/Storage Tunnel Atlanta, GA	1994 1998	City of Atlanta		41,000	26	110		Bids 1994
Metro Red Line, C321 Universal City Station, LA	1994 1998	Los Angeles Co Transit Comm		Cut & Cover Station & Crossover		75	D	Bids 1994
West Seattle Tunnel Seattle	1994 1998	Seattle Metro		10,500	9	25	A	Bids 1994
Metro Red Line, C421 Pico/San Vincente Sta, LA	1994 1998	Los Angeles Co Transit Comm		Cut & Cover Transit Station		120	D	Bids 1994 ???
Central Artery Project Boston, MA	1994 1998	Mass DOT	6 contracts	Cut & Cover Freeway		1309	DJTZ	Bid 1994 - 1996
Transit Expansion Projects Toronto, Ontario	1994 1999	Toronto Transit Commission	32 contracts	Tunnels, C&C Stations, Surface & Other		1440	A	Bid 1994 - 1996
Metro Red Line, C401 Crenshaw/Olympic Station, LA	1995 1998	Los Angeles Co Transit Comm		Cut & Cover Transit Station		100	D	Bids 1995 ???
Point Loma Tunnel San Diego, CA	1995 1998	Clean Water Program Greater San Diego		55,000	12	160	A	Bids 1995
River Mountain Pumped Storage Proj. Arkansas	1995 2000	Consol Pumped Storage, Inc.		Underground Powerhouse & Tunnels		350	A	Bids 1995
Outer "F" Line, F-6 A Washington, DC	1996 1999	WMATA		2 @ 4,00 + Cut & Cover Station	18	100	D	Bids 1996
Elk Creek Tunnel Drain, OR	1997 1999	Oregon DOT		1,200	40	20	A	bids 1996
TOTALS, TUNNELS PLANNED				63 EACH		4.7	BILLION	
HEAVY - HIGHWAY								
Snohomish - Ebey Bridge, Stage 3 Seattle	1994 1995	Washington DOT		Structures		19	A	Bids 1994
No Halawa Valley Hwy, Unit 2	1994	Hawaii		Structures		47	A	Bids 1994

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION	COST $ million	KEY	DISPUTES HEARD SETTLED LITIGATED
Honolulu	1995	DOT					
Black Diamond - SE 312th, Stage 1 Seattle	1994 1995	Washington DOT		Raodway	29	A	Bids 1994
Duwamish River/First Ave Soutn Br. Seattle	1994 1996	Washington DOT		Bridge	80	A	Bids 1994
No Halawa Valley Hwy, Unit 1, Ph 1B Honolulu	1994 1995	Hawaii DOT		Structures	20	A	Bids 1994
Tukwila to Lucille St., Stage 1 Seattle	1994 1996	Washington DOT		Raodway & Structure Widening	29	A	Bids 1994
Various Highway Projects California	1994 1996	Cal Trans	40 contracts		1000	W	Bids 1994
SR 18, Issaquah - Hobart I/C+ Raging River Bridge, Seattle	1994 1996	Washington DOT		Interchange	22	A	Bids 1994
NC-2 Dallas	1994 1996	Dallas Area Rapid Transit		13,000 feet at grade + 3 stations	20	A	Bids May 1994
Issaquah-Hobart & Bridge Seattle	1994 1996	Washington DOT		Raodway & Structures	22	A	Bids 1994
Pierce to Tukwila HOV, Climbing Lane Seattle	1994 1996	Washington DOT		Raodway Widening	21	A	Bids 1994
Tukwila to Lucille St., Stage 2 Seattle	1994 1997	Washington DOT		Raodway & Structure Widening	35	A	Bids 1994
Central Artery Project Boston, MA	1994 1998	Mass DOT	8 contracts	Raodway & Structures	553	DJTZ	Bid 1994 - 1996
Portland Bridge Replacement Project Portland, ME	1994 1998	Maine Dept of Transportation	5 contracts	Bascule Bridge	150	A	Bid 1994
Tukwila to Lucille St., Stage 3 Seattle	1995 1997	Washington DOT		Raodway & Structure Widening	30	A	Bids 1995
SR-167, Auburn to Kent HOV Seattle	1995 1997	Washington DOT		Raodway	30	A	Bids 1995 ???
SR 405, Tukwila to Factoria Seattle	1995 1997	Washington DOT		Raodway	25	A	Bids 1995
Duwamsih - 1st Ave Bridge Rehab	1995	Washington		Rehab	42	A	Bids 1995

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION	COST $ million	KEY	DISPUTES HEARD SETTLED LITIGATED
Seattle	1998	DOT					
Metro Red Line, C401 Crenshaw/Olympic Station, LA	1995 1998	Los Angeles Co Transit Comm		Cut & Cover Station	60	D	Bids 1995
Offshore Riser & Outfall Connection San Diego, CA	1996 1997	Clean Water Program Greater San Diego			20		Bids 1996
SE 312th Way - SE 304th St Seattle	1996 1997	Washington DOT		Raodway Widening	29	A	Bids 1996
Longtan Project, Guanxi Prov. Peoples Republic of China	1995 2002	Longtan Hydro Development			1000		Bids 1995
Outer "F" Line, F-6 B Washington, DC	1996 1999	WMATA		Retained cut Station + line	100	MN	Bids 1996
Outer "F" Line, F-7 Washington, DC	1996 1999	WMATA		Aerial line + Station	90	MN	Bids 1996
Outer "F" Line, F-9 Washington, DC	1996 1999	WMATA		Station & Line at Grad	80	MN	Bids 1996
Outer "F" Line, F-10 Washington, DC	1996 1999	WMATA		Station & Line at Grad	80	MN	Bids 1996
TOTALS, HEAVY - HIGHWAY PLANNED				76 EACH	3.6	BILLION	

BUILDING & PROCESS

Art Museum Phoenix, AZ	1994 1996	City of Phoenix		Renovation & Restoration	18	H	bids too high may be rebid
Inter Island Terminal, Phase II Honolulu	1994 1996	Hawaii DOT		Airport Terminal	19	A	Bids 5-94
Parking Structure Akron, OH	1994 1995	City of Akron		7 story, 700 car deck Will use same DRB as Convention Center	9	U	Bids 3-94
Central Artery Project Boston, MA	1994 1998	Mass DOT	4 contracts	Process & Control Buildings	200	DJTZ	Bid 1994 - 1996
Prisons Texas	1994 1996	Texas Dept of Criminal Justice	25 contracts	Prisons	590	H	Bid 1994 & 1995
Pt Loma Water Treat Plant Tie-In	1995	Clean Water Program			15		Bids 1995

PROJECT NAME AND LOCATION	YEARS	OWNER	CONTRACTOR	DESCRIPTION	COST $ million	KEY	DISPUTES HEARD SETTLED LITIGATED
San Diego, CA	1998	Greater San Diego					
TOTALS, BUILDING & PROCESS PLANNED				33 EACH	0.9 BILLION		
TOTALS, CONTRACTS PLANNED				172 EACH	$9.2 BILLION		
TOTALS, ALL PROJECTS				338 EACH	$18.9 BILLION		

KEYS

A ASCE DRB specification, current at time of construction, used without variation, or conformed to all critical provisions of that ASCE specification.

The following keys show variations of the ASCE DRB specification and other features of contracts.

B Binding recommendations by Board, rather than non-binding as provided by ASCE specification.
C Major claims settled without referral to the Board.
D Delayed access to Board via General Conditions Disputes provision requiring submittal and review before DRB hearing.
F Problems in design resulted in many disputes.
H Board heard disputes only; Board did not attend progress meetings or receive progress reports.
J Jurisdiction of Board was limited to large disputes.
L Late. Board was established after disputes arose.
M Members selected by each Party nominating three members and then selecting one member from other Parties list. First two members selected Chair. Parties did not approve members.
N Owner and Contractor personnel observed Board deliberations.
O One person functioned as DRB.
P Partnering was included in contract.
R Recommendations were not admissible in subsequent settlement proceedings.
S Owner could refuse to take a dispute to the Board.
T Jurisdiction of Board was limited to technical issues.
U Included provisions for Board to hear Sub-contractor disputes.
V Low maximum limit was placed on billing rate of Board members.
W Some of the members were not neutral.
X Either party could require appointment of a new Board for future disputes.
Y Optional. Either party could request establishment of the Board.
Z Board members were required to indemnify Owner and Contractor.

APPENDIX J: DRB Methodology Checklist

Contract Requirements

1. The intention to establish a board is noted in the instructions to bidders.

2. The provisions for establishing the board are set out in the contract.

3. The provisions for establishing the board do not preclude either owner or contractor from resorting to other methods for the final settlement of disputes.

Member Qualifications

4. Board members are neutral, able to serve owner and contractor equally and have no conflict of interest.

5. Board members have acknowledged technical expertise in the type of work being undertaken.

6. Board members are respected by the owner and contractor for their impartiality and technical expertise.

Member Selection

7. Owner and contractor each nominate one board member. These two members select the third member to act as a chairperson of the board.

8. All parties agree on the selection and appointment of all board members.

Operating Procedures

9. Board members receive regular, written progress reports and remain informed on the status of the work.

10. Board meetings are held on the job site at regular intervals, not exceeding 4 months.

11. Presentations to the board are made by field project managers who are completely involved in the process.

APPENDIX J continued,

Conduct of Hearings

12. Either owner or contractor is able to appeal any decision, action, order, claim, or controversy to the board, at any time.

13. Both owner and contractor are adequately represented at all hearings; rebuttal and requests for clarification are permitted.

14. Board recommendations are in writing and are made directly to the project participants who are responsible for accepting, appealing or rejecting recommendations.

Timing and Sequence of Events

15. Board selection and appointment are made within eight weeks of notice to proceed with contract work.

16. Appeals are made to the board as soon as possible and the board handles issues current at the time of appeal.

17. Written recommendations of the board and the reasoning supporting the recommendations are made available to the project participants within two weeks of an appeal.

Limitations of Authority

18. Board members do not act as consultants and do not give advice on the conduct of the work.

19. The board does not usurp either the owners' or the contractors' authority to direct the work as provided in the contract.

Subsequent Proceedings

20. The recommendations of the board are not binding and may be rejected by either owner or contractor.

21. The written recommendations of the board and the reasoning supporting the recommendations are admissible as evidence in any subsequent dispute resolution procedure.

Costs

22. The cost of the board is borne equally by the owner and the contractor.

Source: Dispute Prevention and Resolution, 1993.

VITA

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Permanent Address
8543 Walden Glen Drive
Jacksonville, FL 32256
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EDUCATION

Doctorate of Philosophy, **Civil Engineering**, Expected May 2000
Virginia Polytechnic Institute and State University (Virginia Tech),
Blacksburg, VA
Advisor: Michael C. Vorster

Master of Science, **Civil Engineering**, May 1998
Virginia Tech
Blacksburg, VA
Thesis: Dispute Review Boards and the New Engineering Contract: Efforts to Manage Disputes in the Construction Industry
Advisor: Michael C. Vorster

Bachelor of Science, **Civil Engineering**, May 1992
University of California, Davis
Davis, California
Advisor: Melvin Ramey

HONORS/AFFILIATIONS

- Engineer-in-Training (CA#XE092579)
- Southern Regional Education Board Doctoral Fellowship
- American Society of Civil Engineers
- National Society of Black Engineers
- Alpha Kappa Mu, National Honor Society
- American Association of University Women
- Delta Sigma Theta Sorority, Inc.

RESEARCH INTERESTS

- Construction and Project Management
- Contract Specifications and Administration
- Alternative Dispute Resolution Mechanisms

PROFESSIONAL PRESENTATIONS

Virginia Tech Construction Affiliates, Fall 1997
Title: The New Engineering Contract's Potential Effects on the US Construction Industry
Minneapolis, Minnesota

WORK EXPERIENCE

ENGINEER-IN-TRAINING (CIVIL)
HDH Associates, P.C. - Salem, Virginia
(January 1996 - August 1996)

- Studied and prepared design plans and re-roofing reports of existing engineered structures for design alternatives based on moisture surveys and site investigations and making recommendations for remodeling, renovation, and/or replacement

- Prepared marketing packages for and attended bid interviews.

TRANSPORTATION DESIGN ENGINEER
URS Consultants, Incorporated - New Orleans, Louisiana
(May 1995 - January 1996)

- Responsible for preparing profiles, horizontal alignments and developing geometric details in regards to the criteria and constraints of the Louisiana Department of Transportation (LDOT).

- Design Engineer for the widening and improvements of Louisiana Highway 167/425 Project and Mandleville Highway 190 Project.

- Coordinated the preliminary and final design efforts of various design engineer consultants with the needs and constraints of the City of New Orleans and the LDOT. Project Coordinator for a project management team on five segments of the City of New Orleans Earhart Corridor Improvement Project.

TRANSPORTATION ENGINEER (CIVIL)
CALIFORNIA DEPARTMENT OF TRANSPORTATION
Office of Design Statewide - Sacramento, California
(July 1994 - May 1995)

- Utilized proven engineering skills to analyze and identify seismic retrofit requirements on California aqueduct bridges in Merced County, California.

- Operated computerized engineering software to model the dynamics of various types of bridges due to earthquake forces. Developed appropriate and economical retrofit strategies.

TRANSPORTATION ENGINEER (CIVIL)
CALIFORNIA DEPARTMENT OF TRANSPORTATION
Division of Design Statewide, Office of Central Design - Sacramento, California
(April 1994 - June 1994)

- Reported to the Senior Office Engineer and responsible for preparing Standard Special Provisions (SSP) for the San Francisco Highway 101 Seismic Retrofit Project and the Los Angeles Interstate5 Seismic Retrofit Project.

- Personally gathered and coordinated SSP data from support staff, the Division of Structures, and Caltrans District offices. Used civil engineering knowledge to compose and edit special provisions to correspond to specific portions of each project.

- Used financial analysis skills and knowledge of the bidding process to prepare project estimates; reviewed historical cost data to develop unit costs; and projected work requirements, field conditions, and design intent.

TRANSPORTATION ENGINEER (CIVIL)
CALIFORNIA DEPARTMENT OF TRANSPORTATION
Division of Structures, Preliminary Investigations North - Sacramento, California
(October 1993 - March 1994)

- Conducted preliminary engineering analysis on the Santa Clara County Blossom Hill Road Widening Project, the Santa Barbara County Maria Ygnacio Creek Bridge Replacement Project, and the Sacramento County Elk Grove Interchange Reconstruction Project. Surveyed terrain to establish elevations and alignments for the modification of existing bridges and construction of new bridges.

- Reviewed hydrological and hydraulic reports to identify and calculate stream flow characteristics, design flows, and water surface elevations.

- Operated WSPRO and HYDRAIN engineering software to prepare hydraulic reports and develop bridge foundation plans. Compiled survey data and hydrological and hydraulic analysis reports to develop recommendations on bridge design requirements including pier and column dimensions, minimum clearance requirements, and scour potential.

TRANSPORTATION ENGINEER (CIVIL)
CALIFORNIA DEPARTMENT OF TRANSPORTATION
Office of Construction, Highways - San Jose, California
(October 1992 - September 1993)

- Gained the respect of contractors and commended by superiors for outstanding engineering skills and project support on the San Jose Highway 85 new construction project. Observed material testing and inspected completed work to ensure compliance with project plans for the construction of drainage systems, sanitary sewer systems, soundwalls, sidewalks, curbs and gutters, and monitored traffic controls.

- Used engineering knowledge to interpret contract plans and specifications. Also, conducted construction surveys and construction staking to adjust plans. Created progress pay listings and computed pay quantities for a wide range of contract items.

TRANSPORTATION ENGINEER (CIVIL)
CALIFORNIA DEPARTMENT OF TRANSPORTATION
Office of Project Development Alternatives - Sacramento, California
(April 1992 - September 1992)

- Assigned to the Sacramento Design Office preparing plans, specifications and estimates on the San Francisco Highway 280 Seismic Retrofit Project and San Bernardino County Rehabilitation Highway Projects; assisted in preparing plans, specifications, estimates, and quantity summaries and calculations.

- Developed alternative proposal to improve transportation infrastructures and coordinated consultants' reports, plan specifications, and estimates with city, state and federal agencies.

QUALIFICATIONS

- Used Generally Accepted Civil Engineering Techniques on Transportation Projects, Working Closely with Senior Engineers, Preliminary Investigators and Private Contractors

- Demonstrated Experience in Seismic Analysis and Retrofit Design of Bridge Structures

- Proven Ability to Gather Data and Prepare Plans, Specifications, and Estimate Packages

- Ensured Compliance with Plans and Specifications on All Aspects of Each Project

- Maintained Cost Controls and Coordinating Highway Construction Project Schedules

- Made Critical Decisions on Material Submittals and Monitoring Material Testing

- Skilled Problem Solver Using Excellent Written and Verbal Communications Abilities

- Used IBM Compatible and Macintosh Computers with Computerized Engineering Programs. Also, Experienced Using BASIC, FORTRAN, WSPRO, HYDRAIN, WordPerfect, Excel and Microsoft Word Software