Chapter 1

Introduction

The struggle of the foreigner to get the words right results in the right words.—PBS news commentator, December 12, 2005

Modern telecommunication systems link the world together in an irrevocable manner, creating a global working environment, but cultural differences are still prevalent because the world is a long way from being a homogeneous society. Engineering and construction (E&C) professionals are required to work within societal and cultural constraints when they are performing work for global clients in foreign countries or working with foreign nationals within their own nations. Global variations also account for the vast differences seen in the construction techniques and processes used to construct projects throughout the world.

The twenty-first century is being shaped by global political, social, and economic events that are no longer concentrated in Western nations because Eastern nations now are moving to the forefront of global visibility. Forty percent of the working-age population is concentrated in India and China, and projections are that by 2032, three of the four largest economies in the world will be Japan, China, and India (Zakaria, 2005). Throughout the world, investors have been acquiring foreign firms, and it is becoming harder to determine which firms are domestic and which are foreign.

The definition of global competitiveness includes *firms competing for work in foreign countries,* but it also requires an analysis of the effects of global competition on domestic engineering and construction (E&C) markets. Diverting personnel and resources onto foreign projects creates more opportunities in domestic markets for native firms. Monitoring the trends and events that transpire in the global E&C arena is essential because members of domestic E&C firms are affected by price fluctuations in the cost of construction materials, the increasing cost of transporting materials, emerging innovative designs, the availability of technical personnel, foreign ownership of domestic E&C firms, and changing global economic and political climates.

In order for E&C firms to remain competitive in the global marketplace, their personnel have to be able to adapt quickly to working with people from other cultures, and they have to develop a global perspective that is incorporated into their designs, the techniques and processes used to construct a facility, and the way they manage construction projects.

The price of structural-steel members doubled during 2005, along with similar price increases for timber products. The main producers of steel now are located in Pacific Rim countries. Virgin forests in North America and other countries have

been denuded, and compressed wood chips (glue lams or plystrand) are replacing wood as structural materials. The quality of construction materials is declining steadily, owing to relaxed safety requirements in the nations where construction materials are being produced or fabricated, and designs have to be adjusted to accommodate lower-quality materials.

Since firms are forced to compete for scarce resources that are produced by firms throughout the world they are influenced by global competitiveness issues, even if they are only domestic E&C firms. When domestic firms no longer produce or process the raw materials and components used in construction projects, domestic E&C firms have to compete for scarce materials in the global marketplace, which requires an understanding of the issues and challenges that surface when working with global suppliers, fabricators, and foreign E&C firms.

The competitiveness of domestic E&C firms also is affected when firms can no longer locate qualified personnel in their native countries to hire for technical positions. Increasing competition for highly qualified E&C professionals has led to firms hiring foreign nationals to fill positions because the country of origin of a worker is not as important as a firm's ability to perform the work required for the fulfillment of an engineering or construction contract.

1.1 Global Engineers and Constructors

Civil unrest, wars, terrorist activities, severe natural disasters, escalating terrorism, and the increaseing number of worldwide natural disasters affects E&C professionals as they are called on to design, build, or manage the reconstruction efforts following these destructive events. E&C professionals are required to move rapidly to disaster sites to perform damage assessments and to create reconstruction plans. Figure 1.1 contains a photo of an oil tank, located in St. Croix, U.S. Virgin Islands, that was damaged by a hurricane. This photo demonstrates the power of natural disasters, given that the oil tank was constructed of heavy-gauge steel, but it was completely crushed by hurricane-force winds. Figure 1.2 shows one stage in the slow and arduous process of repairing the oil tank.

Figure 1.3 shows a retaining-wall construction operation in Hong Kong, where the reinforcement is being lifted into place with a small crane beneath a precariously perched shantytown in the shadow of modern high-rise apartments. Figure 1.4 shows the delicate task of repairing and strengthening the Acropolis in Athens, Greece. Both these construction operations are being performed with technology that has been used on construction projects for thousands of years (except for motorization of the crane), yet there are high-technology apparatuses, such as the three-story-high universal testing machine shown in Figure 1.5, that are available to help analyze structural members used in construction projects if clients can afford them.

Much of the infrastructure in developed countries was built in the decade following World War II, the 1950s, and as it continues to deteriorate, structural fail-

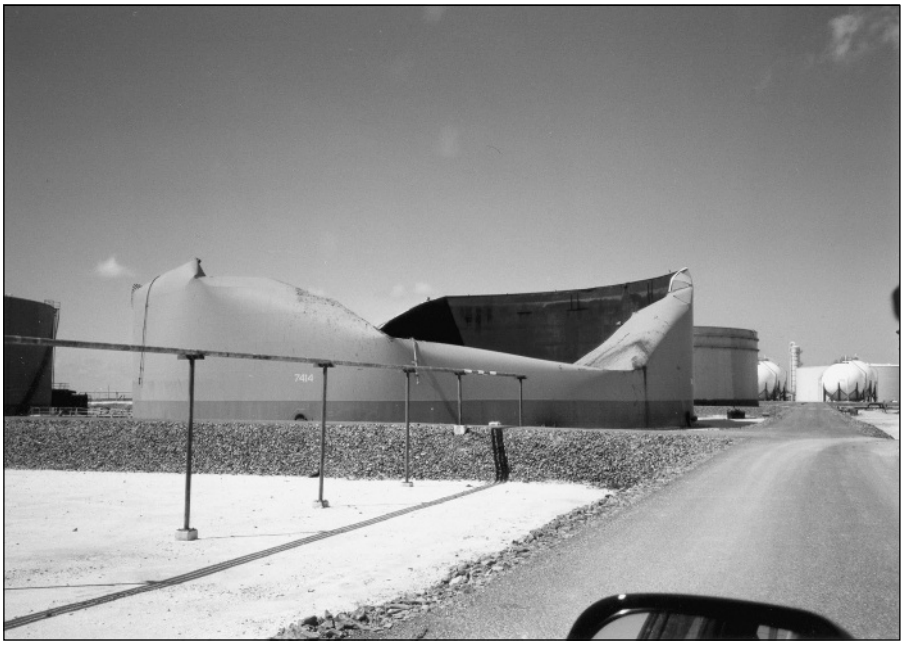

Figure 1.1 Oil tank destroyed by a hurricane, St. Croix, U.S. Virgin Islands.

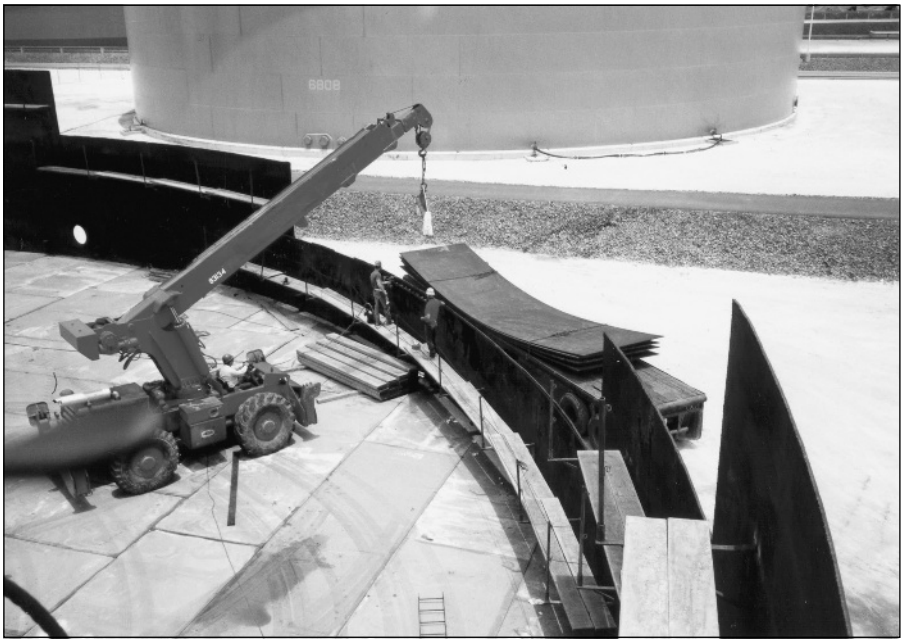

Figure 1.2 Oil tank repair, St Croix, U.S. Virgin Islands.

Figure 1.3 Construction of a retaining wall, Hong Kong.

Figure 1.4 Reconstruction of the Acropolis, Athens, Greece.

Figure 1.5 Three-story universal-testing machine, Seattle, Washington.

ures will become more commonplace. Major infrastructure reconstruction projects will require E&C professionals from every region of the world because no one country could possibly provide enough technical expertise to design and build all the upcoming reconstruction projects. Figures 1.6 and 1.7 show two extremes in bridge reconstruction and highway construction—when they have to be repaired or retrofitted to meet new building codes. The retrofitting process on the Golden Gate bridge in San Francisco, California, shown in Figure 1.6, was accomplished with small cranes, whereas in Figure 1.7 the roadway sections for the Eisenhower Freeway in Colorado were lifted with a massive gantry.

Social entrepreneurs provide funds to affect social change in developing countries, but even they realize that their efforts will be unsuccessful without a solid

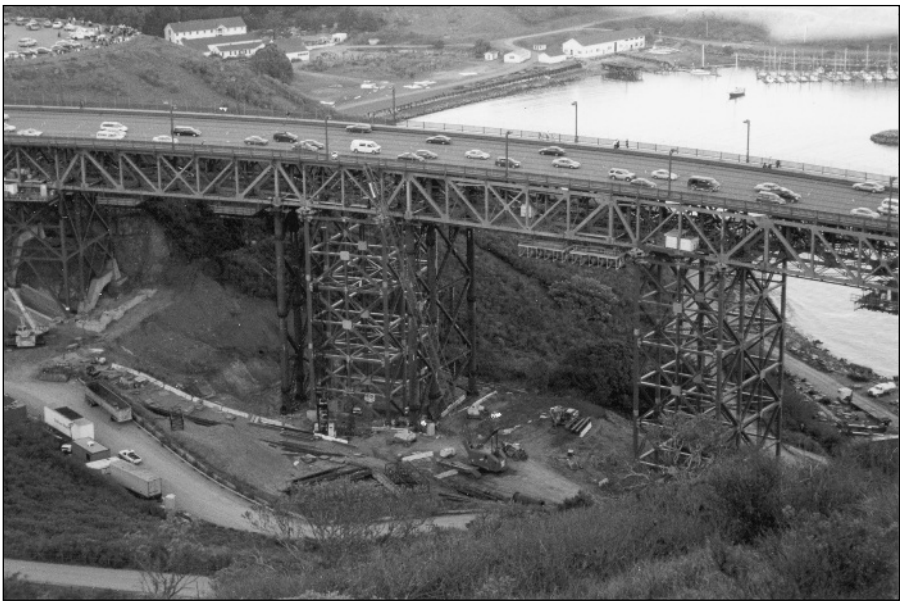

Figure 1.6 Golden Gate Bridge retrofit project, San Francisco, California.

Figure 1.7 Gantry lifting a roadway section, Bear Creek, Colorado.

infrastructure, including transportation and sanitation systems (Hsu, 2005). A solid infrastructure is the backbone of any country, and throughout the world governments are emphasizing how important basic services are to maintaining their national stability.

When engineers are developing global designs, they need to be cognizant of the fact that suppliers, fabricators, engineers, and constructors from foreign cultures will be the ones interpreting the contracts, plans, and specifications for projects. Anyone who works for an E&C firm is now part of the global marketplace, even if they never leave their native country. *Global* is defined as "involving the earth as a whole," and *foreign* is defined as "situated outside one's own country; characteristic of, or dealing with, another country or countries" (*Webster's Dictionary,* 2005, p. 261 and p. 542). Therefore, if E&C personnel specify or order materials from foreign countries, they are involved in the global environment.

When engineers design projects that will be built in foreign countries, they make assumptions about the culture that will surround the project that could result in lengthy construction delays, increased costs, or high turnover rates in personnel. In the global environment, engineers and constructors can no longer only rely on their technical expertise to design and build projects, because now they need insight into how to solve additional nontechnical challenges related to cultural differences, language barriers, import and export restrictions, religious requirements, major economic and exchange-rate fluctuations, environmental restrictions, differing productivity rates, and contrary legal systems.

1.2 Engineering and Construction Global Ambassadors

Engineers and constructors are a unique element of society, and the influence they have globally has been evident throughout recorded history. Providing designs and construction expertise are not the only results achieved by members of the E&C industry as they are also global ambassadors. In their 1957 book, *The Earth Changers,* Neil C. Wilson and Frank J. Taylor describe "the role of America's many 'unsung' ambassadors with power shovels who are doing a great job of friendship-building for the U.S.A" (Wilson and Taylor, 1957, p. 125). Wilson and Taylor dedicated their book to "the rugged construction stiff in his hard hat and muddy boots, doing his best, and doing it well, from the Artic Circle to the Antarctic and from Suez to right around to Suez. Teaching what he knows to distant peoples, and learning from them considerably more than he teaches" (Wilson and Taylor, 1957, p. 5).

Fifty years later, as E&C professionals continue traveling around the world, to work on projects far from their homes, often risking their lives, they are still learning more from the "distant peoples" than they teach. Engineers and constructors may be the first foreigners from a certain country that the residents of the job

site ever encounter, and the impression they leave behind could determine how the locals will view the citizens of these countries until their next encounter with them.

1.3 Global Risks to Engineers and Constructors

Being global ambassadors increases the visibility of E&C personnel, which exposes them to additional risks related to terrorism, kidnapping, theft, and political upheaval. Unfortunately, publicity surrounding these types of events prevents some E&C personnel from accepting overseas work assignments. Multinational firms are working to reduce the risk exposure of their employees, but individuals are also responsible for learning about how to protect themselves in foreign environments. Several of the chapters in this book address the risks associated with working overseas and provide information on precautions that could be implemented by individuals to help reduce risks.

1.4 Organization of This Book

The purpose of this book is to provide information on the issues and challenges that engineers and constructors face when working in the global marketplace. The book is organized to provide both general and specific information about the global E&C environment. General information on global issues of concern to E&C professionals is provided in the first half of the book, along with examples from different regions of the world, and the second half of the book provides details on global engineering and construction practices and information on specific regions of the world.

Chapter 2 discusses where to find information and assistance when planning to work in a foreign country. Chapter 2 also includes information on technical issues E&C personnel face when designing projects that will be built in foreign countries, such as language and translation considerations, design criteria for different cultures, technology considerations, and cultural issues that affect engineers and constructors.

Chapter 3 provides information on managing global E&C projects and the differences between managing projects in industrialized nations and managing them in developing countries. This chapter also discusses the desired characteristics of global E&C managers and personnel, how to effectively manage projects overseas, global calendar and time considerations, scheduling, safety issues, construction failures, and construction-failure investigation techniques. Appendix B contains a case study about a project that was built in Indonesia that demonstrates the concepts presented in Chapter 3.

Chapter 4 provides an analysis of global competitiveness in the E&C industry during the later part of the twentieth century and an analysis of the competitive issues that are influencing the E&C industry at the beginning of the twenty-first century. A historical analysis of competitiveness is provided in this chapter because competitiveness issues during a particular decade are the result of events that transpired in previous decades.

Chapter 5 discusses global E&C alliances because in many parts of the world foreign E&C firms cannot design and build domestic projects unless they are aligned with a domestic firm. The formation of global alliances is required for entering previously closed construction markets and for increasing the volume of work for a company. Chapter 5 focuses on multinational contractors, global contracting, the global dimension and global influences, global strategies, risks in global investments, project financing, privatization, build-own-transfer projects (BOT), and global joint ventures and partnerships.

Chapter 6 explains global financing techniques, including countertrade, cofinancing, swap financing, and other financing options to help E&C personnel understand some of the financial constraints that restrict funds for global construction projects. This chapter also includes a discussion about global payment methods that provides information on addressing global exchange rate fluctuations and government restrictions on exporting currency.

Chapter 7 guides readers through some of the legal issues and contract clauses that affect global construction contracts, and Chapter 8 provides information on international technical standards, environmental standards, the ISO 9000 series of quality standards, the ISO 14000 series of environmental standards, and how international standards are developed and implemented in the E&C industry.

Chapter 9 explains global environmental issues that affect engineering and construction projects and provides information on global treaties and protocols that are designed to reduce environmental pollution and hazardous waste generation (the global construction industry generates the largest proportion of hazardous waste of any industry).

Chapter 10 addresses global productivity issues and includes international comparisons of labor productivity rates, along with providing a discussion about management, labor, and materials in the context of how they affect productivity rates in different countries.

Chapter 11 provides insight into the types of delays that occur during both the planning and execution stages of global construction projects and provides examples of mitigation strategies that are used in the E&C industry to help prevent delays and that can be implemented to guide projects back on schedule.

Chapter 12 addresses terrorism and kidnapping issues and discusses design considerations related to acts of terrorism, as well providing information on how E&C personnel can protect themselves while working overseas. Preparing to work globally is discussed in Chapter 13, and the last chapter, Chapter 14, provides summaries of global regional differences and country-specific information on culture and customs, business methods, whether business agents are required, materials available locally, social standards, languages spoken, and holidays. Appendix A is a glossary that provides definitions of the terms used throughout this book.

1.5 Summary

Engineering and construction professionals now face additional challenges due to the interconnection of the world that they did not have to address in previous centuries, such as increasing competition for materials and technical professionals. If they are able to adjust to working in a global environment, they will maintain their competitive position; but if they cannot adapt to working with foreign engineering and construction professionals, other firms will dominate the global marketplace.

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