CONSTRUCTION

ABSTRACT

Studies of the construction industry reveal several trends, such as deterioration of the national infrastructure, changes in the way that construction projects are funded and executed, the loss of skilled workers, and the impact of technology. Counterterrorism and outsourcing by the Department of Defense (DOD) are also key construction industry issues that have national security implications. There are likely to be regular and repeated construction demand surges in the international marketplace, and the U.S. government should take a more proactive role in helping the construction industry take advantage of international construction opportunities.

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Domestic
Associated General Contractors of America, Washington, DC
Bechtel Corporation, San Francisco, CA
Boston Harbor/Central Artery Tunnel, Mass. Transit Auth., Boston, MA
Hamilton Army Airfield Base Realignment and Closure Office, CA
Huber, Hunt, Nichols/Kajima, Inc., San Francisco, CA
IFC Kaiser Engineering, Boston, MA
Massachusetts Water Resources Authority Boston Harbor Project, MA
National Association of Home Builders, Washington, DC
National Institute of Standards and Technology, Gaithersburg, MD
Odebrecht Contractors, Inc., Seven Oaks Dam, Los Angeles, CA
Parsons Brinkerhoff, New York, NY
Parsons Corporation, Pasadena, CA
Port Authority of New York, World Trade Center, New York, NY
Ray Wilson Co./Tokyu Construction, General Contractors, Pasadena, CA
Raytheon, Boston, MA
Ronald Reagan Federal Triangle Building, Washington, DC
San Francisco International Airport/Port Authority, CA
Sheet Metal Workers' Union - Local #100, Suitland, MD
Stromberg Sheet Metal Works, Beltsville, MD
U.S. Army Corps of Engineers, L.A. and San Francisco Districts, CA

International
Airport City Link Railway Tunnel Construction Site, Sydney, Australia
Australian Defence College, Canberra, Australia
Australian Defence Estate/Dept. of Ind. Relations, Canberra, Australia
Australian Industry Group Office, Canberra, Australia
Department of Defence, Sydney, Australia
Holmes Construction, Ltd., Christchurch, New Zealand
Housing New Zealand—Regional Office, Christchurch, New Zealand
New South Wales Dept. of Public Works/Services, Sydney, Australia
New South Wales Government on Infrastructure Dev., Sydney, Australia
New Zealand Ministry of Defence, Wellington, New Zealand
Olympic Authority Construction Project, New South Wales, Australia
Opus International Consultants, Ltd., Wellington, New Zealand
Sodexho Marriott Corp., New South Wales, Australia
U.S. Embassy, Canberra, Australia
Victoria Barracks, Sydney, Australia
Westin Corp. Sydney Hotel Construction Project, Sydney, Australia
Westpac Trust Center Project, Christchurch, New Zealand

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INTRODUCTION

Developing from an industry of artisans and journeymen, the construction industry is a very large, competitive, market-driven sector of the U.S. economy. Industry activities include consulting, design, engineering, construction management, construction, maintenance, repair, renovation, demolition, removal, and disposal.

The infrastructure of the United States is a critical element of national security. The construction industry provides and maintains the infrastructure necessary to ensure U.S. economic, political, military, and diplomatic strength. The condition of the infrastructure is not only an important factor in U.S. productivity and international competitiveness, but also a quality-of-life factor. For example, the vast highway and rail network in the United States helps the nation's industrial productivity by allowing faster and cheaper transportation of products.

THE CONSTRUCTION INDUSTRY DEFINED

The U.S. construction industry employs about 7 million people and accounts for about 8 percent of the nation's gross domestic product (GDP). Construction activity, on average, grows at a rate that approximates the rate of GDP growth. The total value of domestic construction put in place during 1998 was $657 billion. (The construction industry accounts for 15.2 percent of Japan's GDP, 14.6 percent in Germany, 21 percent in China, and 7.9 percent in the United Kingdom.) Total global spending on construction in 1998 was $3.22 trillion. The United States is the largest single-country construction market.

Construction work includes private residential, private nonresidential (telecommunications, industrial facilities), public construction, and utilities. Small firms make up the bulk of the industry. According to U.S. Census Bureau reports, there were 649,601 construction establishments in 1997. Construction may be categorized as general construction, which involves private residential building and private nonresidential building (198,124 firms); heavy construction, which involves public industrial construction such as roads, highways, bridges, dams, sewage treatment plants, public hospitals, schools, prisons, tunnels, and utilities (42,010 firms); and special trade construction, which involves steel erection and the placement of concrete, mechanical, electrical, sheet metal, masonry, and other construction components (409,467 firms). It is estimated that as much as 90 percent of the industry consists of special trade contractors who perform under
subcontract to general contractors. Total payroll for 1997 was $175 billion, a 49 percent increase over the 1992 total payroll.\textsuperscript{8}

The U.S. construction industry has experienced an average annual growth rate of 1.9 percent over the last 20 years with only a slight downturn in the early 1990s. The domestic construction market seems to have reached maturity, providing steady work and modest overall growth.

About 80 percent of worldwide construction activity takes place outside the United States. The nation's construction and engineering firms are successfully competing internationally through foreign affiliates using local labor. Despite the economic downturn caused by the Asian financial crisis, U.S. construction equipment and parts producers managed to increase exports during the first half of 1998. During the first 6 months of 1998, these producers shipped $3.6 billion in equipment and parts overseas, 5.5 percent more than in the same period of 1997. The increase was due to strong demand from Canadian users, which offset falling demand in Asia and Africa. Exports to Canada increased 25.3 percent to $1.4 billion.\textsuperscript{9}

The construction industry is highly competitive. Increasingly, the competition is expanding from the domestic to the international arena, as world economic and social conditions improve. At the same time, globalization and advances in the use of technology are creating growth potential worldwide for the industry.

**CURRENT CONDITION**

The construction industry can be divided into four major sectors according to spending: private residential, private nonresidential, public (less highway), and highway. In 1998 dollars, the value of construction in these sectors was $297.1 billion, $213.7 billion, $101.2 billion, and $45 billion, respectively, for a total of $657 billion. (See Figure 1.)

New private residential housing construction has experienced steady growth since 1990, except for 1995 when sales dropped 5 percent. Construction of residential housing accounts for 45 percent of the total value of construction put in place for 1998. Private nonresidential construction spending for 1998 was about the same level as that in 1997. Within this category, construction of hotels, motels, and offices, as well as religious, railroad, and educational facilities, has had strong growth over the last 3 years. Construction for manufacturing, commercial, hospitals, and institutional buildings experienced a decrease in spending from 1997 levels. This probably reflects a market adjustment to offset strong growth since 1993.
States own most public facilities (88 percent) and spend more money on public construction than the federal government. While aggregate spending in public construction fell slightly in 1998 from the 1997 level, spending in 1997 and 1998 for education-related construction was more than 10 percent higher than the 1996 level. Public spending in 1997 and 1998 for housing, federal (industrial), and military construction projects dropped significantly below 1995 levels. Table 1 shows annual changes in the value of U.S construction for the last 7 years.

Labor. In 1995, only 17.7 percent of construction employees were members of a union. The membership rate was 40.1 percent in 1973 and 87.1 percent in 1947. Union contractors face difficulties competing for construction work with open-shop contractors because of the unionized firm's higher labor costs—about $13 per hour more on average than the non-union rate in 1996. Recently, this differential has narrowed as open-shop contractors have boosted wages in an effort to keep workers from leaving and to attract new workers.

An extreme shortage of competent construction workers, union or non-union, presents a serious problem. In 1995, Engineering News-Record (ENR) surveyed the top 400 U.S. construction firms and learned from the 217 union and non-union firms responding that more than half of the 18 crafts examined suffered from shortages. Of these 217 firms, 26 percent reported moderate labor shortages while 12 percent described
Table 1: Value Of Construction Put in Place (Billions of 1992 dollars)

<table>
<thead>
<tr>
<th>TYPE CONSTRUCTION</th>
<th>Constant 1992 Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1990(^1) 1993(^1) 1994(^1) 1995(^1) 1996(^1) 1997(^1) 1998(^1)</td>
</tr>
<tr>
<td>TOTAL NEW</td>
<td>479.0 465.0 487.6 486.7 496.3 520.1 539.8</td>
</tr>
<tr>
<td>PRIVATE</td>
<td>370.1 347.8 367.9 363.1 378.2 395.3 418.4</td>
</tr>
<tr>
<td>Resdnt'l Bldgs. Total</td>
<td>188.0 206.5 218.0 207.4 212.1 221.5 242.9</td>
</tr>
<tr>
<td>New Housing</td>
<td>131.6 137.2 153.2 142.8 154.0 156.0 173.1</td>
</tr>
<tr>
<td>Single family</td>
<td>111.8 127.0 140.4 127.1 135.5 137.2 153.1</td>
</tr>
<tr>
<td>Multiply family</td>
<td>19.8 10.2 12.8 15.9 17.4 18.9 20.0</td>
</tr>
<tr>
<td>Improvements</td>
<td>56.4 63.2 64.7 64.6 58.1 60.5 62.9</td>
</tr>
<tr>
<td>Non-Residential Total</td>
<td>146.7 106.7 111.4 119.8 130.4 139.1 139.4</td>
</tr>
<tr>
<td>Office</td>
<td>35.8 20.2 20.6 22.6 24.1 27.6 31.2</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>34.4 25.6 26.8 28.9 28.0 26.4 24.7</td>
</tr>
<tr>
<td>Hotels and Motels</td>
<td>10.9 4.4 4.3 16.4 10.3 10.7 11.7</td>
</tr>
<tr>
<td>Other Commercial</td>
<td>40.9 31.3 34.8 37.8 41.3 42.7 40.8</td>
</tr>
<tr>
<td>Religious</td>
<td>3.6 3.7 3.5 3.9 4.0 4.0 5.2</td>
</tr>
<tr>
<td>Education</td>
<td>4.7 4.5 4.5 4.9 5.8 7.1 7.5</td>
</tr>
<tr>
<td>Hospital &amp; Instut.</td>
<td>11.1 12.0 10.0 10.0 10.5 11.8 11.0</td>
</tr>
<tr>
<td>Misc. Buildings</td>
<td>5.2 5.0 5.6 5.3 6.5 7.9 7.3</td>
</tr>
<tr>
<td>Farm Structures</td>
<td>2.9 3.2 3.0 3.1 2.7 NA NA</td>
</tr>
<tr>
<td>Public Utilities</td>
<td>29.5 34.1 32.7 30.2 30.8</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>9.9 9.5 9.8 9.8 10.4 9.9 10.3</td>
</tr>
<tr>
<td>Railroads</td>
<td>2.6 3.1 3.2 3.0 4.0 4.2 4.6</td>
</tr>
<tr>
<td>Electric Utilities</td>
<td>11.6 15.1 13.9 11.8 11.2 12.0 12.4</td>
</tr>
<tr>
<td>Gas Utilities</td>
<td>5.0 5.5 4.9 4.7 4.3 4.5 4.6</td>
</tr>
<tr>
<td>Petroleum Pipeline's</td>
<td>0.4 1.0 0.9 0.8 0.9 0.9 0.9</td>
</tr>
<tr>
<td>Misc. Structures</td>
<td>3.0 3.2 2.8 2.6 2.1 2.1 2.1</td>
</tr>
<tr>
<td>Public Building Total</td>
<td>108.9 117.2 119.8 123.6 115.4 124.8 121.4</td>
</tr>
<tr>
<td>Buildings</td>
<td>44.6 50.2 49.9 53.4 49.4</td>
</tr>
<tr>
<td>Housing &amp; Redevelopment</td>
<td>3.9 4.6 4.9 5.4 3.9 4.0 3.7</td>
</tr>
<tr>
<td>Federal Indst'l</td>
<td>1.5 1.6 1.4 1.4 1.2 0.8 0.8</td>
</tr>
<tr>
<td>Education</td>
<td>16.4 21.3 21.7 22.9 20.1 22.8 22.4</td>
</tr>
<tr>
<td>Other Hospitals</td>
<td>2.9 3.5 3.6 3.9 4.6 4.2 3.2</td>
</tr>
<tr>
<td>Highways</td>
<td>31.8 34.2 36.5 34.9 33.3 38.6 37.8</td>
</tr>
<tr>
<td>Military Facilities</td>
<td>2.7 2.4 2.3 2.7 2.2 2.2 2.2</td>
</tr>
<tr>
<td>Conservation &amp; Devel.</td>
<td>4.9 5.7 6.0 5.8 5.2 4.8 4.7</td>
</tr>
<tr>
<td>Sewer Systems</td>
<td>10.7 9.1 9.5 9.8 9.1 9.0 8.9</td>
</tr>
<tr>
<td>Water Supply</td>
<td>5.0 5.1 4.9 5.4 5.1 5.4 5.6</td>
</tr>
<tr>
<td>Misc. Public Str.</td>
<td>9.3 10.4 10.8 11.5 11.1 11.3 10.1</td>
</tr>
</tbody>
</table>
severe shortages. The crafts experiencing the largest shortages included electricians (13.7 percent shortage), carpenters (10.6 percent), sheet metal workers (8.8 percent), and pipe fitters (7.9 percent). The shortages continue today with no sign of abating. Like the U.S. military, the construction industry is currently having difficulty attracting sufficient numbers of young people. Although recent wage hikes, expected to continue for the next few years, are helping to draw new workers into the industry, there remains a real question whether the United States will have a sufficient number of trained craftsmen to provide the labor pool necessary to meet industry needs in the future.

Infrastructure. The Federal Highway Administration reports that approximately 60 percent of U.S. primary highways are in poor to fair condition. Highway usage by private automobile and commercial trucking has increased substantially over the last 40 years, causing major congestion, intensifying safety concerns, and accelerating road deterioration. Highway spending was at an all time low during 1980–1990, but the Intermodal Surface Transportation Efficiency Act of 1992 (ISTEA) authorized increased levels of funding for U.S. highways. The recently signed Transportation Equity Act for the 21st Century (TEA-21) is the largest federal public works legislation in U.S. history. Along with the Airport and Airway Trust Fund and the Highway Trust Fund, the TEA-21 provides appropriations in excess of $200 billion over 5 years for highway capital improvement, research, mass transit support, and new highway construction across the United States. Transportation spending significantly increased during 1997–1999 and is expected to remain high through 2003 with the passage of the TEA-21.

Construction Services. Exports of construction services from the United States were about $3.0 billion in 1996. Most U.S. exports of construction services are construction management services, engineering, design, and specialized technology. In 1997, the Asia-Pacific region imported 45.6 percent of exported U.S. construction services. Europe imported 14.2 percent; the Middle East, 8.9 percent; Africa, 6.2 percent; and other Western Hemisphere countries (i.e., Canada, the countries of Central and South America), 25.1 percent. Imports of these services amounted to only about $500 million—an industry trade surplus of $2.5 billion.
Technology. Computers have had a positive impact on the construction industry. Computer-assisted design/drawing programs let architectural and engineering firms produce drawings and plans in a matter of hours, rather than days or months. Design or construction changes that used to be costly and time-consuming can now be incorporated at the stroke of a key, saving both time and money. The Internet provides an avenue for the high-speed exchange of information and for immediate document delivery. Architectural and engineering firms and contractors can also have design and drafting work done overseas (overnight) with enormous savings. Increasingly, computers are serving in design, engineering, and management of construction projects. Computers, robotics, and global positioning systems can be used to operate "uninhabited" equipment (e.g., graders, trenching equipment, earth-moving equipment) in large grading and excavation projects or in remote locations.

Project Delivery. The process by which owners, architects, engineers, and construction companies initiate and complete construction projects is changing. The design–bid–build (DBB) process has been used for some time and is considered traditional in the United States. The design and construction functions are completely separate in the DBB process, a sequential one. An owner hires an architect to design a project and deliver construction documents, and general contractors then bid on the project. Design–build (DB) is a "one-stop shopping" project delivery process in which an owner purchases design and construction services from a single entity. The advantages of DB include cost savings of 10–15 percent and time savings of 15–25 percent. The company in charge of design is continuously re-estimating construction costs and can project final costs at a much earlier stage than a company using the DBB process. Owners have more early information and, therefore, more choices about the project. The potential for change orders is reduced. Performance factors are clearly defined prior to starting construction. The DB process requires extensive planning and oversight, however. Many bonding and insurance companies are unfamiliar with the DB process.17

It is generally agreed that DBB is more suitable for very large, complex projects; DBB provides a high degree of comfort to both the owner and the contractor. There is an extensive body of DBB case law. There are, however, several disadvantages of the DBB process. It encourages litigation, as firms often submit "low" bids in the hope of making up the difference later through change orders and/or litigation. In addition, DBB projects tend to exceed initial cost estimates, run behind schedule, involve costly delays, and discourage innovation.

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because DBB is a rigid process that restricts the construction contractor to the confines of the engineering drawings.

In 1985, DB commanded only 5 percent of the overall construction market. In 1995, the percentages were 25 percent for DB and 65 percent for DBB; the balance, 10 percent, was accounted for by construction management. In Europe, more than 50 percent of nonresidential construction projects are delivered using DB. In Japan, DB project delivery exceeds 70 percent. Railways in Naples, Genoa, Athens, Paris, London, Istanbul, Ankara, and Hong Kong were all completed using the DB process.

Codes, Standards, and Regulations. Much of the workmanship and material in construction projects is ultimately hidden, but the codes, standards, and regulations that govern the construction industry address the safety and quality of each project and protect the interests of business, the community, and individuals. Currently, there are three regional sets of codes and standards. The biggest problem with the building codes lies in the fact that they are not uniform among states and regions. Often, local standards vary between adjoining counties within the same state. The National Association of Home Builders recognizes the strains that multiple codes place on contractors. Therefore, they are seeking to establish one national building code through the International Code Council (ICC), a nonprofit organization dedicated to developing a comprehensive and coordinated national code. International standards in this area are coordinated through the American National Standards Institute (ANSI), the sole U.S. representative of the two major non-treaty international standards organizations, the International Standards Organization (ISO), and the International Electrotechnical Commission (IEC). Many laws and regulations apply to the construction industry, including appropriation laws, procurement laws, labor laws, occupational safety laws, environmental laws, base realignment, and closure laws.

Construction Research and Development (R&D)—Public/Private Sector. The fragmented nature of the construction industry makes R&D funding and accomplishment extremely difficult. In the public sector, the National Science Foundation, the National Institute of Standards and Technology (NIST), and the U.S. Army Corps of Engineers sponsor construction research and development organizations. The National Science Foundation is responsible for promoting science and engineering through programs that invest nearly $3.5 billion per year. It conducts more than 20,000 research and education projects annually. The purpose of NIST is to assist industry in R&D to improve product quality, ensure product liability, and facilitate rapid commercialization of new products.
It provides expert research for performance prediction, measurement, and testing of building materials, components, and systems. The DOD conducts construction-related R&D because it has extensive military-related infrastructure to operate and maintain. Research and development provides new technologies that ensure the efficient and cost-effective construction, operation, and maintenance of DOD facilities. Among DOD agencies, the U.S. Army Corps of Engineers has the largest involvement with construction-related R&D. Technology transfer to the private sector is an important function for the Army Corps of Engineers.

The American Society of Civil Engineers (ASCE) supports the research and education needs of the civil engineering profession. Particularly concerned with infrastructure research and innovation, the ASCE established the Civil Engineering Research Foundation (CERF) to foster a unified research effort and to coordinate R&D programs that address construction industry needs.

**CHALLENGES**

*Global Public Sector Challenges.* Nations, including the United States, must construct, maintain, and expand critical infrastructure (e.g., highways, roads, bridges, ports, waterways, water/sewer systems). Traditional methods of financing needed public works are not sufficient to keep up with construction requirements in most nations. National, state, regional, and local governments—once the world’s sole source of investment in infrastructure development—are looking to leverage their limited resources against private sector investment capital as a means to obtain infrastructure projects. Privatization of new and existing infrastructure is rapidly becoming a frequently used method to stretch limited public resources. Integrated privatization programs allow governments and private firms to choose among several acquisition and operation schemes. Choices for new construction include build-operate-transfer (BOT), build-own-operate (BOO), build-transfer (BT), build-transfer-operate (BTO), or build-lease-transfer (BLT). For existing infrastructure, choices are rehabilitate-operate-transfer (ROT), rehabilitate-own-operate (ROO), develop-operate-transfer (DOT), and contract-add-operate (CAO). Each of these options provides a different level of involvement for the private sector in owning and operating infrastructure systems, as well as asset control options for the government. Each one requires private sector financing of infrastructure projects.
Global Market Challenges. The worldwide construction market represents 10 percent (approximately $3 trillion) of the world's economy. It is a relatively stable market, and data indicate that it will remain so for the foreseeable future.\textsuperscript{19} Approximately 30 percent of the top 225 international construction contractors are U.S. companies.\textsuperscript{20}

Although the United States is a highly competitive nation, U.S. construction firms are reluctant to compete for international construction business. The U.S. economy is now at an all-time high, and ample construction opportunities exist domestically. The healthy economy produces a very low unemployment rate that translates into a labor shortage for the construction industry. In addition, U.S. firms do not compete for international infrastructure construction projects because foreign infrastructure investment opportunities have been too risky. Financing projects in overseas locations is also an obstacle for U.S. contractors, who see foreign cash flows for billing purposes as too uncertain—requiring too much up-front capital. Finally, U.S. construction firms are not as competitive in overseas markets because of the concessionary finance practices of some competitor governments, discriminatory government procurement policies, nontransparency of financial transactions, corruption and bribery, and trade barriers.\textsuperscript{21} For many U.S. construction firms, the risks, complexities, and barriers of international markets outweigh the benefits.

Despite the obstacles, several large U.S. construction companies have been very successful internationally. To date, smaller companies have been more hesitant to incur either the risks or the costs of operating in a global environment. Yet it is a potential market with ample opportunities for all types and sizes of companies.

The motivation to engage internationally resides at two levels. For individual contractors, the motive to undertake projects outside the United States derives from the profit incentive and the desire to neutralize the effect of the cyclical downturns that routinely occur in the domestic construction market. For the nation, the strategic interest in promoting greater U.S. contractor involvement in international projects originates in global defense responsibilities and the likelihood of perpetual involvement in peacekeeping activities and hostility containment. Invariably, the U.S. defense presence requires concomitant construction activity in order to provide the necessary infrastructure for troop support. The strategic interests of the United States would be better served by the existence of a cadre of U.S. contractors broadly experienced in managing construction projects in foreign countries. This contractor resource would facilitate adjustments to a different culture, unfamiliar labor and work conditions, and the management challenges
ing in doing business in a foreign country. Preexisting business partnerships and alliances with local area contractors overseas translate into added leverage, advantage, and military effectiveness.

**Domestic Challenges.** The condition of the U.S. infrastructure has deteriorated significantly. The ASCE estimates that it will take $1.3 trillion to bring the nation’s roads bridges, schools, and drinking water and wastewater treatment facilities to an adequate level. Rating the condition of infrastructure systems, the ASCE gave mass transit, aviation, bridges, and solid waste facilities a grade of “C”; roads, drinking water and wastewater treatment facilities, dams, and hazardous waste facilities received a “D”; and public schools received an “F” because more than 60 percent of public school facilities need major repairs.\(^{22}\) Unfortunately, most public sector corrective action is reactive rather than proactive.

**DOD Construction Challenges.** Two factors, threat and budget, drive nearly every decision made within the DOD. At issue is whether the DOD can meet its national security obligations over the long run in an environment of declining budgets, when a significant percentage of those budgets is consumed by support functions rather than direct war-fighting requirements. How can the DOD maintain its force modernization goals and at the same time provide an adequate quality of life for personnel and families? One method for resolving these issues is to shift support activities to the private sector.

Privatization is a subset of outsourcing and involves the complete transfer or sale of government assets. It is DOD policy that activities can be outsourced if in-house performance of that activity is not required to meet mission requirements; a competitive commercial market exists for the activity; and outsourcing results in the best value for the government.\(^{23}\) The Logistics Civil Augmentation Program (LOGCAP) plans worldwide use of civilian contractors in support of DOD missions. It resolves combat support and combat service support shortfalls; provides contract augmentation in the United States during mobilization; and assists contractors in planning for logistics, construction, and engineering services for base or logistics camp construction, operations, and field services.\(^{24}\) Similarly, the Navy’s Construction Capability (CONCAP) Atlantic Briefing document identifies construction and engineering services to support natural disaster recovery, military-supported humanitarian assistance, and military conflict support for Navy forces deployed worldwide.\(^{25}\) Currently, CONCAP is supporting Navy forces in Bosnia for base construction and management. The Air Force Contract Augmentation Program (AFCAP) provides base operating support and temporary construction capabilities to relieve or
augment military support forces and resources involved in military operations other than war. 26

**Military Family Housing Privatization.** The DOD's 300,000 military family housing units (average age of 33 years) need management attention, repair, and improvement in order to remain at an adequate level of quality. The 1996 Defense Authorization Act allows the DOD, in some cases, to work with the private sector to build or renovate military housing. A key advantage of the law is that it permits developers to build to local standards rather than to federal standards and military specifications. The law allows the DOD to provide civilian firms with a variety of contractual and/or financial instruments that privatize military family housing: 27 loan or rental guarantees; mortgage payment guarantees and insurance; limited guarantees against base realignment and closure, force reduction, or major deployment; leasing opportunities (DOD to lease units that have been acquired or newly constructed); investment opportunities (DOD to provide funding limited to 33 percent of the total capital investment to private firms to acquire or construct units); and direct loans (title, land, and improvements to remain with owner). Congress, however, has become concerned about unpredictable program outcomes, unexplained costs, impacts on Congressionally approved military construction (MILCON) family housing improvement and repair work, potential loss of installation commander control, and potential financial impacts of housing privatization on military members and families. The jury is still out regarding this privatization, pending the outcome of several test cases.

**The Antiterrorism Construction Challenge.** The United States is rebuilding ("hardening") State Department facilities and a limited number of military facilities to better protect building occupants against a terrorist attack. Recent State Department studies suggest that as a matter of national culture, U.S. embassies have been far more concerned with being "open" as opposed to being "secure." Admiral William J. Crowe (former Chairman of the Joint Chiefs of Staff), head of two State Department investigations, was blunt in his assessment that there was a collective (institutional) failure by several Administrations and Congress over the past decade to reduce the vulnerability of U.S. diplomatic missions adequately. According to Admiral Crowe, the United States must change its way of looking at the world. Overall costs are large. The Administration provided $2 billion for counterterrorism, including monies for hardening embassies, after the recent embassy bombings in Africa. Of that money, $1.4 billion went to rebuild the embassies in Nairobi and Dar es Salaam, to relocate eight other vulnerable embassies, to upgrade security equipment, and to harden portions of 250 other
embassies and consulates. To date, military facilities are not receiving the same attention. Local commanders must request funds for hardening facilities through the facility management process. The Combating Terrorism Readiness Initiative Fund is provided to the DOD to address emerging or concurrent antiterrorism and force protection problems. In 1998, $15 million was available for the Chairman of the Joint Chiefs of Staff to harden military facilities, an amount that does not allow extensive rebuilding.

OUTLOOK

Domestically, the outlook for the construction industry is strong in homebuilding. The largest increases in public construction activity are expected in highways, public safety buildings, housing redevelopment, prisons, water supply systems, and waste management systems. The biggest declines will be in military facilities, conservation, sewerage, and federal industrial facilities.

The main impacts of the Year 2000 (Y2K) problem on the construction industry would be in the design systems, automated processes, machinery, and liability areas. Large firms are taking the necessary actions to prepare for Y2K. Small firms are not as automated as the larger firms, do not have the assets to address the issue as easily, and therefore are not as proactive as the large firms. Construction firms could be sued for not providing Y2K-compliant systems or services (e.g., heating, ventilating and air conditioning systems, elevators, security systems) for the facilities that they have built. Some firms recognize this potential liability and are contacting customers and testing to ensure compliance. Overall, Y2K impacts on the construction industry should be minimal. Secondary impacts resulting from Y2K problems among construction material and equipment manufacturers could not be accurately measured.

Global Outlook. Demand for basic infrastructure is on the rise, with a significant portion of the growth in the emerging markets. The World Bank estimates that annual infrastructure investment needs total $200 billion. Developing nations know that without investment in a solid, modern infrastructure, they will not be able to create modern, competitive economies. Despite the economic and financial crisis that began in the Asian markets in 1997 and spread to the rest of the world, many countries continue to invest sizable amounts in their infrastructure programs. In 1998, the world's 200 largest design firms reported a 10.9 percent increase in billings for design projects worldwide.
Many foreign governments are turning to joint ventures with the private sector for their public infrastructure and maintenance needs. For example, European nations are permitting private firms to build, own, and operate major portions of their highway systems. There are more than 5,000 miles of toll roads operated by private firms in Italy, France, and Spain alone, far more than in the United States. Developing nations are relying increasingly on build–operate–transfer (BOT) projects as conventional funding becomes harder to obtain, development aid becomes tighter, and spending caps force changes in the ways that nations obtain and maintain infrastructure.

As the financial crisis in Asia begins to turn around, the opportunities for infrastructure privatization projects will increase; Asian governments will work to restart projects that had been put on hold for several years. As interest rates and currencies stabilize, many countries in this region will once again invest in their infrastructure programs to fuel their economies. The Asian Development Bank estimates that Asia’s power generation sector needs investments of $75 billion per year and that the telecommunications sector is likely to need $40–$70 billion per year. Raytheon has been selected to complete a $700-million design–build dam in the Philippines and, along with other U.S. firms, is involved in a $2-billion private development project for the design, construction, and operation of power, water, rail, and port facilities in Australia.

The biggest market potential lies in China. The World Bank estimates that China will spend more than $700 billion on infrastructure needs through the year 2005. In the past, China’s construction industry has suffered from poor regulation and corrupt practices. The Chinese are now adopting new laws and policies to open their country to more foreign trade and investment. Government officials are seeking private sector involvement to develop BOT projects to meet their tremendous demands for power, water, wastewater treatment, and other infrastructure requirements.

Latin America withstood the recent financial crisis and continues to privatize infrastructure systems in an effort to improve efficiency. The Inter-American Development Bank reports that more than $22 billion in infrastructure assets have been sold, leased, or contracted out to private firms, and Latin American countries need $50 billion in infrastructure investments annually. Since local and federal governments lack the available resources, private investments will have to meet the demands. Latin America has become more attractive to U.S. firms because of improved laws to promote and protect international investors. Mexico is privatizing its transportation infrastructure by pursuing joint ventures.
between Mexican and European or U.S. firms to modernize and operate seaports, airports, and railroads. Argentina is planning to spend $10 billion over the next 6 years to privatize its highway network.36

One of the leaders in privatizing infrastructure in Latin America is Chile. The Chilean government first launched privatization initiatives in the early 1980s when it opened its energy and telecommunications industries. Underinvestment in its infrastructure over the last two decades has led to deterioration of its roads, water treatment facilities, and wastewater treatment systems, however. The government is now moving from owner to regulator in the water and wastewater treatment business and expects to fund $9 billion per year for transportation and environmental infrastructure work over the next 5 years.37 The Ministry of Public Works will parcel out highway, airport, and seaport concessions in order to reach the necessary investment levels for Chile’s infrastructure systems.

Europe lags behind Latin America in adopting new legislation and policies that protect private investors. Recent reports indicate that private sector and international organizations will have to participate in the infrastructure development in Eastern Europe, because government resources will not be adequate. Hungary is planning to spend $13 billion over the next 10 years for roads and railways. The remaining Eastern European nations need to invest an additional $100 billion.38 Many of these projects are expected to follow the European concession system of private sector development.

Opportunities in Africa will be limited, as this region continues to lag in economic development. South Africa is the one exception, as it has numerous infrastructure projects in the planning stages. Tourism, which is growing 16 percent annually, is driving the need for improved infrastructure. The U.S. Trade and Development Agency estimates that South Africa will spend $8.2 billion on 45 planned projects in the coming years, with many projects to be public–private partnerships.39

Participating in public–private ventures in foreign countries is not easy business for U.S. firms. They have to overcome many barriers to be competitive. Some barriers are local in nature, such as the culture, language, regulations, and building standards, while other factors, such as project financing stipulations and political issues, make investing risky. Corruption, bribery, and lack of transparency in financial institutions contribute to the high risks of operating in some nations. Many U.S. construction firms choose not to participate in these markets, because the risks are so great.

Financing challenges are significant for U.S. firms in overseas markets, but there are capital sources available to reduce the investment
risk for companies involved in infrastructure development. Groups such as the World Bank, the International Finance Corporation, the Inter-American Development Bank, the Inter-American Investment Cooperation, the Asian Development Bank, the African Development Bank, and the European Bank for Reconstruction and Development provide financing for large international infrastructure projects. Other groups, such as the Export–Import Bank of the United States, the Overseas Private Investment Corporation, and the Multilateral Investment Guarantee Agency, provide insurance against political unrest, currency devaluation, and commercial risk.  

Construction Materials. Many factors influence the international and domestic demand for construction materials. Industry experts report that the internationalization of the building materials industry has grown through exporting and investing. Building material companies in the United States have a strong production presence abroad, particularly in Canada, Mexico, and Europe. Major export items for U.S. producers include flat glass, builders' hardware, fabricated structural metals, plastic pipefitting, insulation, and prefabricated metal buildings. These items are exported mainly to Canada, Mexico, and Japan.  

Exports of U.S. construction materials have risen over the last several years, but imports have risen at a faster pace. In 1996, the United States exported about $4.9 billion of nonlumber construction materials, up 9 percent from 1995. The United States imported $6.7 billion, however, a 14 percent increase from 1995. This resulted in a U.S. trade deficit of about $1.8 billion. The U.S. market will continue to be a large and strong market for foreign suppliers, while rising levels of construction activity worldwide should help U.S. exports. Foreign companies own construction materials–producing facilities in the United States, especially cement, clay brick, and flat glass plants. Imports of ceramic tiles, cement, and builders' hardware come mostly from Canada, Mexico, Italy, and Spain. Among the construction materials that U.S. firms produce overseas are flat glass, insulation, flooring, and gypsum board. Generally, U.S. construction materials are well accepted overseas for quality and price, but face some trade barriers involving standards, building codes, product certification, and testing. Closed distribution systems in some countries are also a problem. Industry observers expect U.S. imports to increase by about 10 percent per year, exports by 5 percent. Growth in foreign construction markets is expected to drive the U.S. building materials export market. Current and anticipated improvements in trade agreements, regional agreements (e.g., the European Community and the North American Free Trade Agreement
Construction Machinery—Earth-Moving Equipment. The international construction machinery industry manufactures such machinery as earth-moving equipment, power cranes, mixers, bulldozers, as well as components and parts. Major players include the United States, Japan, Germany, and South Korea. Caterpillar (United States) and Komatsu (Japan) are world leaders—they participate in every major market and offer full product lines. Industry observers report that these companies are involved in a perpetual battle to increase their market share. The competition has led to the formation of strategic alliances with other major construction machinery producers. In addition, there are many collaborative agreements in the industry for reasons of production and technology sharing, cost containment, and market access, and U.S. construction machinery manufacturers are striving to develop close relations with construction and engineering firms to guarantee an outlet for their equipment.

The United States exports about 30 percent of its construction equipment production to foreign markets. In 1996, the major U.S. export markets included Canada, Australia, Chile, Belgium, and Mexico. Due to the growing internationalism of the industry and the competitiveness of the U.S. industry, major U.S. manufacturers produce many models of equipment solely for overseas markets. All of the major U.S. producers are seeking to establish a solid position in the emerging markets of developing countries through joint ventures. In 1999, a subsidiary of Fiat (Italy) acquired a controlling interest in the third largest U.S. equipment manufacturer, the Case Corporation.

GOVERNMENT GOALS AND ROLE

The important issues facing the U.S. government today in regard to the construction industry center on competitiveness, privatization, deregulation of markets, establishment of effective national-level programs that facilitate flexible labor markets, establishment of strategic alliances through multilateral trade agreements and treaties, and provision of incentives for continued investment in new technology by the private sector.

The U.S. government can take action to increase U.S. competitiveness in foreign construction markets. It can reduce the financial risk to U.S. firms in foreign markets by providing tax incentives for investing in foreign infrastructure development. It can increase the amount of financial protection. Government agencies such as the Export—
Import Bank, the Overseas Private Investment Corporation, and the U.S. Trade Development Agency have programs that assist U.S. construction companies by providing insurance against political unrest, devaluation, and commercial risk. Officials of the U.S. government can work with those of foreign governments to minimize the risk to private investors and U.S. construction firms from unfair business practices. The U.S. government can also create more opportunities for U.S. firms by supporting reforms to increase financial transparency and oversight, reduce corruption and graft, and reduce organized and other crime.

Government promotion of the U.S. construction industry abroad has tremendous potential advantages for U.S. national interests. Globalization of the world's economies and infrastructure systems, including telecommunications, transportation, and power generation, is the trend of the future. The United States must not squander the opportunities available in the international infrastructure market. Billions of dollars will be spent on infrastructure systems in the near future, and U.S. firms must participate and be competitive in this global market. To the extent that rising living standards contribute to political stability, infrastructure development can influence other nations and serve as a deterrent for conflict.

To enhance competitiveness in global markets, the U.S. conversion to the metric system must become a priority. Because conversion will be costly for U.S. businesses, the U.S. government should consider offering incentives for speedy conversion.

CONCLUSION

Global demand for basic infrastructure is on the rise with a significant portion of the growth in the emerging markets. In addition, globalization of world markets will present tremendous opportunities for the U.S. construction industry. In the past, U.S. construction firms have concentrated mainly, due to real or perceived risks, on work in the Middle East. In the future, they should pursue global construction opportunities—with emphasis on work in Asia and South America. The U.S. construction industry (especially small firms) should position itself to better capitalize on global construction opportunities. The industry should seek active U.S. government support toward this objective.

For individual contractors, the motivation to undertake projects outside the United States should derive from the profit incentive and from the desire to neutralize the effect of the cyclical downturns that routinely affect the domestic construction market. The strategic level of interest is related to U.S. global defense responsibilities for peacekeeping.
and hostility containment. National strategic interests would be better served by a cadre of U.S. contractors broadly experienced in managing construction projects in foreign countries. This contractor resource would be of significant importance during adjustments to a different culture, unfamiliar labor and work conditions, and the management challenges inherent in doing business in a foreign country. Preexisting business partnerships and alliances with local area contractors overseas translate into added leverage, advantage, and military effectiveness.

Foreign countries spend a much larger amount on construction-related research and development than the United States does. More coordinated public–private R&D within the construction industry is recommended. In the United States, the need for infrastructure investment has grown rapidly in the last decade. The nation’s roads, bridges, wastewater treatment plants, and other infrastructure need substantial work. Significant fiscal constraints at the federal, state, and local levels are making it more difficult to fund these much needed infrastructure projects. Some privatization will be necessary. The U.S. construction industry, like the U.S. military, must take action to attract and retain workers, especially young workers and skilled workers. In general, the construction industry is capable and willing to meet the national security needs of the United States.

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19 Tulacz, “World Market.”
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