Construction

PROFILE The construction sector[4] comprises general and specialty contractors in the fields of building construction, residential construction, highway construction, heavy industrial construction, and municipal utility construction, as well as special trades such as plumbing, heating, and demolition. Construction is a large, trillion-dollar industry dominated by very small businesses. Of the more than 700,000 construction firms nationwide, the vast majority (85%) employ 10 or fewer people.[5]

Sector At-a-Glance

Number of Companies:	732,000[1]
Value of Construction:	$1 trillion[2]
Number of Employees:	6.4 million[3]

TRENDS In recent years, domestic construction has continued its steady growth, fueled by new residential starts, home improvement projects, and other housing-related activities, as well as growth in non-residential sectors such as health care and eduction.[6] Residential construction accounted for 55% of total construction in 2004.[7] Between 2003 and 2004:

- The value of total construction put in place increased by 11% to more than $1 trillion.
- The annual value of residential construction increased by 18% to $570 billion.
- The annual value of non-residential construction grew by a more modest 3% to $458 billion. Educational, commercial, and highway/street construction represented the largest shares of non-residential activity.[8]

The National Association of Home Builders forecasted just over 2 million residential construction starts in 2005, an increase of 6% over 2004.[9] Non-residential construction also was expected to experience modest growth in 2005.[10]

KEY ENVIRONMENTAL OPPORTUNITIES

For the growing construction sector, there are opportunities for environmental improvements through managing and minimizing waste, encouraging green construction, improving water quality, and reducing air emissions.

The Associated General Contractors of America (AGC) has recognized the need for performance data and is considering ways to better assess the sector's environmental performance. Some industry surveys have been conducted, and EPA and AGC are learning from them how to obtain more comprehensive and higher quality information. However, the following factors pose challenges to measuring and improving environmental performance across the sector: the large number of construction firms (and the even larger number of construction sites), the prevalence of small businesses, and the lack of centralized data (federal or state) regarding compliance with environmental requirements.

Managing and Minimizing Waste

Construction provides various opportunities for recycling construction and demolition (C&D) debris. Additionally, the sector generates some hazardous waste.

Construction and Demolition Debris

C&D debris refers to waste materials generated during the process of construction, renovation, or demolition of buildings, roads, and bridges. C&D debris often contains bulky, heavy materials such as the following: concrete, wood, asphalt, gypsum (the main component of drywall), metals, bricks, glass, plastics, salvaged building components (e.g., doors, windows, and plumbing fixtures), and trees, earth, and rocks from clearing sites.

Comprehensive data on the amount of C&D debris being recycled nationally is difficult to obtain. As noted in the case study below, many states currently have programs that deal with C&D debris, and some have even established model contract specifications regarding C&D reuse and recycling in renovations or new construction. However, states that have been collecting data on this topic use different methodologies and terminologies, so summation of this data is difficult.

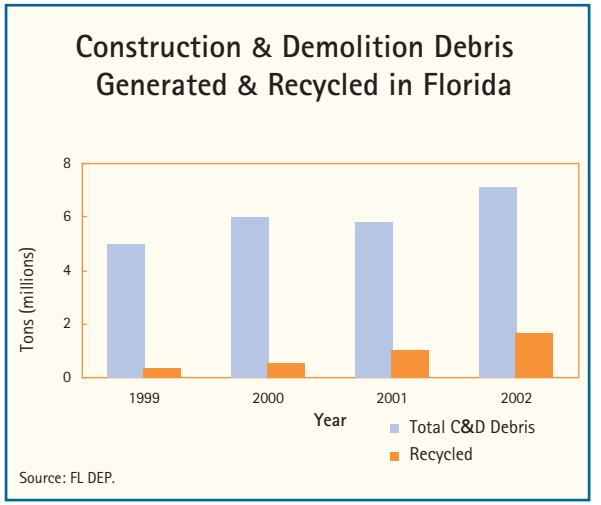
EPA is currently updating its 1998 report, *Characterization of Building-Related Construction and Demolition Debris in the United States*, which analyzed the quantity and composition of building-related C&D debris generated nationally.[11] According to the original report, in 1996 the construction, renovation, and demolition of buildings generated more than 136 million tons of C&D debris. Although 20-30% of the C&D debris was recycled, the majority (70-80%) ended up in municipal solid waste landfills or in special C&D landfills.

In 2004, AGC surveyed its members regarding their C&D debris generation and recycling practices. Of the 328 members who completed the survey, 58% indicated that they recycled some C&D debris. Steel and asphalt were the most commonly recycled materials, reflecting the inherent value of these materials.[12]

The construction sector and EPA are working collaboratively on C&D debris issues through numerous programs, including the Sector Strategies Program, Resource Conservation Challenge, WasteWise Building Challenge, GreenScapes, Green Buildings Program, and the Building Deconstruction Consortium.[13]

Case Study: Construction and Demolition Debris in Florida *As part of its mandate to evaluate municipal solid waste under Florida's Solid Waste Management Act, Florida's Department of Environmental Protection (DEP) tracks the quantity of C&D debris produced annually and the amount being recycled. Although some states count road and bridge debris, commercial structures, or land clearing debris, Florida tracks only C&D debris that is considered municipal solid waste, such as debris from residential construction or demolition. Waste data from landfills is sent to the counties, who add or subtract from these data based on their knowledge of solid waste in the county and then send annual solid waste reports to the DEP. Beginning in 1999, reporting procedures were improved to ensure that road and bridge debris was not included.*

As shown in the ***Construction & Demolition Debris Generated & Recycled in Florida*** *bar chart, while the total quantity of debris produced increased between 1999 and 2002, the proportion recycled also increased from 6% to 23% over that period.*[14] *Along with improved reporting, a number of factors may have contributed to this increase in C&D recycling, including: (1) increased tipping fees at state landfills, (2) the closure of a number of C&D landfills, and (3) the availability of state-sponsored continuing education for construction contractors on green construction. One such course, Build Green and Profit, was attended by about 5,000 contractors in the state.*[15]



Hazardous Waste EPA hazardous waste data on large quantity generators, as reported in the *National Biennial RCRA Hazardous Waste Report*, indicate that the construction sector accounted for less than 1% of the hazardous waste generated nationally in 2003.

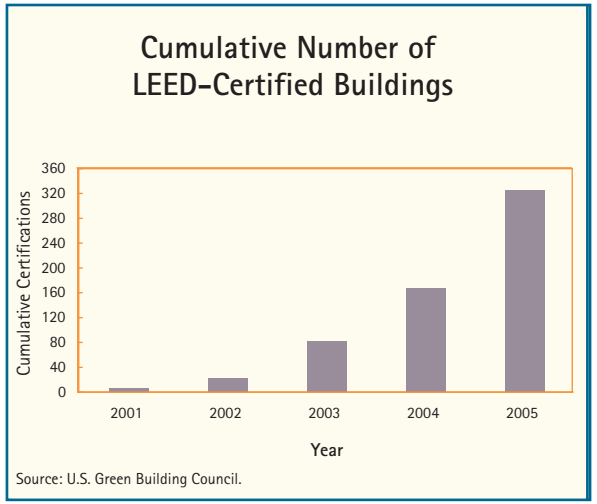
In 2003, 76 construction sites reported 13,000 tons of hazardous waste generated. When reporting hazardous wastes to EPA, quantities can be reported as a single waste code (e.g., lead) or as a commingled waste composed of multiple types of wastes. Quantities of a specific waste within the commingled waste are not reported. The construction sector reported 49% of its wastes as individual waste codes. Of the individually reported wastes, the predominant hazardous waste types reported by the 76 facilities in 2003 were lead, benzene, and wastewater treatment sludge.[16]

Encouraging Green Construction

AGC and other stakeholders in the construction sector have increasingly promoted methods to reduce the environmental impact of construction activities. These methods are known collectively as "green construction." Tracking the sector's activities in the area of green construction provides some indication of movement toward more sustainable construction practices. Progress can be measured in part by the number of green buildings constructed and by the number of construction professionals with training in green construction techniques.

The Leadership in Energy and Environmental Design® (LEED) Green Building Rating System is a voluntary standard for evaluating high-performance, sustainable buildings. This rating system was developed by members of the U.S. Green Building Council (USGBC), which counts 680 contractor or builder firms among its 6,000 member companies and organizations. In order to attain LEED certification, a new building project must demonstrate performance in five areas: sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality.[17]

As shown in the *Cumulative Number of LEED-Certified Buildings* bar chart below, the number of LEED-certified buildings in the U.S. is increasing at an accelerating rate. By the end of 2005, there were 325 LEED-certified buildings.[18]



Construction professionals can demonstrate their understanding of green building practices and principles and their familiarity with LEED requirements, resources, and processes by becoming LEED-accredited. Contractors currently account for 1,387 (nearly 7%) of the 20,663 LEED-accredited professionals in the U.S.[19]

The Green Globes™ design and assessment system is another commercial building rating system gaining attention among both construction and design professionals. In 2005, more than 500 professionals received training on the Green Globes system, of which 20% were construction professionals.

The following case study highlights how one construction firm has met LEED certification requirements at its new corporate headquarters.

Case Study: Alberici's LEED-Certified Corporate Headquarters *Alberici Constructors, a construction firm based in St. Louis, MO, recently converted a 50-year-old manufacturing facility into the new headquarters for its parent company, Alberici Corporation. Because of the building's siting, design, materials, landscaping, construction methods, and other features, it received LEED Platinum certification, the highest level awarded by the USGBC. In fact, the building scored the highest point total for any LEED-certified building in the world.*

To create the new headquarters, Alberici deconstructed and reused parts of a 60,000-square-foot warehouse on the property, diverting more than 90% of the material from landfills. Fifty-seven percent of all material used was manufactured within 500 miles of the site, and 52% of all the raw materials used were extracted locally. Recycled and rapidly renewable materials were used extensively.

To reduce lighting and energy costs, the building was designed to maximize sun exposure. Virtually all employees have a direct view to the outdoors from their workstations. The raised floor system used throughout the building allows individual air flow and temperature control through floor vents. Ventilation and low-emitting adhesives, sealants, paints, carpets, and composite wood ensure indoor air quality.

A 65-kilowatt wind turbine will generate 20% of the building's total energy needs, and a passive solar preheat system heats the water. The building is 60% more energy efficient than a conventional building of similar size.

Two retention ponds and native plants on the property virtually eliminate stormwater runoff and the need for a permanent irrigation system. A rainwater catchment system is used for sewage conveyance, which saves an estimated 146,000 gallons of potable water annually. Six acres of restored prairie and reconstructed wetlands provide wildlife habitat.[20]

Improving Water Quality Stormwater runoff from construction and other land-disturbing activities can significantly impact water quality. Operators of regulated construction sites are required to develop and implement stormwater pollution prevention plans and obtain National Pollution Discharge Elimination System (NPDES) permits from an authorized state or from EPA. Stormwater permits require construction firms to implement certain management practices, but they do not require any water-quality monitoring, so no national data are available to track water quality improvements from the changes in stormwater management practices of the construction sector.

Comprehensive, national data on the construction sector's compliance with stormwater permit requirements also are not available. This data gap is due in part to the large number of construction sites nationwide compared with the small number of sites that EPA and state governments inspect each year.

At this time, the best proxy available is to track the sector's awareness of stormwater permit requirements. An indicator of awareness is the number of stormwater permits applied for and issued to construction site operators in the states for which EPA is the NPDES permitting authority. EPA issues Construction General Permits for five states – Alaska, Idaho, Massachusetts, New Hampshire, and New Mexico. Permits applied for and issued in those states totaled more than 5,300 in 2004. This number will be tracked in future reports to detect trends in permit applications.[21]

Reducing Air Emissions Most air emissions from the construction sector come from non-road mobile sources (e.g., construction equipment such as excavators, off-highway trucks, and portable generators) and construction processes (e.g., grading and asphalt paving).

Diesel engines power many construction vehicles and equipment, such as earth-moving equipment, generators, and compressors. Currently there are 1.8 million pieces of diesel-powered construction equipment in operation in the U.S.[22] These engines are a major source of air pollution, particularly emissions of nitrogen oxides (NO_X) and particulate matter (PM). Diesel exhaust also contains sulfur, which contributes to sulfur oxide (SO_X) emissions.

Current EPA data combine construction-related emissions with other sources, and the portion of these emissions due to construction activities alone cannot be determined. According to EPA's National Emissions Inventory, as a group, non-road diesel engines (e.g., construction and agricultural equipment) contributed 17% of NO_X emissions nationally (3.5 million tons per year) and 31% of NO_X emissions from mobile sources in 2002. These percentages can be considerably higher in some urban areas.[23]

On a national basis, the strategy for controlling air pollution from diesel engines involves stricter pollution requirements for new diesel engines and rules covering the fuel used by these engines. Diesel engines on existing equipment will not be subject to the new regulations, yet they may remain in operation for another 25 to 30 years. Therefore, EPA and its partners are encouraging firms to retrofit existing diesel vehicles with pollution controls.

AGC is working actively with EPA to ensure the success of a new federal diesel emissions reduction program for the construction sector called Clean Construction USA. This is part of EPA's National Clean Diesel Campaign to reduce the pollution emitted from diesel engines through the implementation of varied control strategies. In 2005, EPA awarded 9 grants totaling $945,000 for reducing diesel emissions from off-road construction equipment.[24] As illustrated in the case study below, several states have instituted retrofitting programs of their own.

Case Study: Voluntary Diesel Retrofit Programs in California and Texas *Across the nation, construction companies are participating in voluntary programs to reduce air emissions from their equipment fleets. California's Carl Moyer Memorial Air Quality Standards Program (Carl Moyer Program) and the Texas Emissions Reduction Plan (TERP) are two programs in which construction companies are participating.*

For the past seven years, California's Carl Moyer Program has been providing incentive-based funds for the reduction of NO_X and PM emissions from various sources, including construction equipment. In the first four years of the program, 106 construction off-road engines were retrofitted with pollution control equipment or repowered with newer engines. Combined, these projects have reduced NO_X emissions from construction equipment by 190 tons per year, at an average cost of $4,400 per ton of NO_X reduced. This compares favorably with California Air Resources Board estimates for the 2003 State Implementation Plan, which averaged about $8,300 per ton of NO_X reduced. PM emissions from construction equipment have been reduced by nearly 16 tons per year.[25]

In 2001, TERP was established to improve air quality by providing voluntary financial incentives to companies to offset the incremental cost of reducing NO_X emissions. Construction contractors participating in the program have improved their fleets by purchasing cleaner equipment, replacing old diesel engines, retrofitting engines with emissions reduction technology, and/or using cleaner burning fuel. As of the December 2004 grant cycle, 45 AGC member companies in Texas have conducted 64 retrofit projects. These projects are projected to remove a total of almost 6,000 tons of ozone-producing NO_X from the air over the life of the projects.[26]