

Sloan Career Cornerstone Center

Civil Engineering Overview

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The Field

From the pyramids of Egypt to the space station Freedom, civil engineers have always faced the challenges of the future - advancing civilization and building our quality of life.

Today, the world is undergoing vast changes--the technological revolution, population growth, environmental concerns, and more. All create unique challenges for civil engineers of every specialty. The next decades will be the most creative, demanding, and rewarding of times for civil engineers, and now is the best time to find the right career for you.

Today, civil engineers are in the forefront of technology. They are the leading users of sophisticated high-tech products - applying the very latest concepts in computer-aided design (CAD) during design, construction, project scheduling, and cost control.

Civil engineering is about community service, development, and improvement -- the planning, design, construction, and operation of facilities essential to modern life, ranging from transit systems to offshore structures to space satellites. Civil engineers are problem solvers, meeting the challenges of pollution, traffic congestion, drinking water and energy needs, urban redevelopment, and community planning.

Our future as a nation will be closely tied to space, energy, the environment, and our ability to interact with and compete in the global economy. You, as a civil engineer, will perform a vital role in linking these themes and improving quality of life for the 21st century. As the technological revolution expands, as the world's population increases, and as environmental concerns mount, your skills will be needed. There is no limit to the personal satisfaction you will feel from helping to make our world a better place to live. Whatever area you choose, be it design, construction, research, teaching, or management, civil engineering offers you a wide range of career choices for your future.

Civil Engineering is grouped into seven major divisions of engineering: Structural; Environmental; Geotechnical; Water Resources; Transportation; Construction; and Urban Planning. In practice, these are not always hard and fixed categories, but they offer a helpful way to review a very diverse and dynamic field.

Preparation

A civil engineer's training should continue throughout his or her entire career. An effective engineer realizes that continuing education is the key to success. In college an engineer gains an ability to learn that will last throughout life, while at the same time absorbing the basic knowledge and skills that every engineer must master. On-the-job experience, gained through co-op assignments, internships, or summer jobs, is a vital factor in making a young engineer credible to potential employers. Gaining professional licensing is often important to career advancement. Becoming marketable means having the skills and experiences beyond the basics, perhaps through leadership in student or community organizations, plus having the ability to communicate one's unique qualifications clearly.



Undergraduate

Engineering students usually select their field in the first or second year of college. At the same time that you are coming to grips with the fundamentals of engineering, you should also pay attention to the broader issue of learning to learn a skill you will need to master if you are to continue to develop as an engineer – communication. It is important to develop your writing and speaking skills. It is a good idea to get involved in campus activities that let you develop as a person as you learn to be an engineer.

Co-ops and Internships

Civil Engineers will tell you that co-ops, internships, summer jobs, or any other way to gain experience in the field of your choice, will help you land a first job. More importantly, it will give you a chance to find out what you like to do and are good at doing.

Marketability

Anyone looking for a job has to get comfortable with the idea of selling one's strengths. Whether it is a deep specialization or a broad background, you will need to demonstrate how you will help an employer. Marketing includes both a profound knowledge of the product (yourself) and the buyer (the employer). When you find a match between your interests and their needs, the chances of success are high.



Licensing

Every U.S. state, the District of Columbia, and the U.S. territories have laws regulating the practice of professions including law, medicine, and engineering. These laws protect the public health, safety, and welfare by insuring that those receiving licenses to practice have at least met certain requirements of competence, ability, experience, and character. Licensure laws vary from state to state and are exclusively under the control of the individual state legislatures. But generally, the licensure laws for professional engineers require graduation from an accredited engineering curriculum followed by approximately four years of responsible engineering experience, and finally the successful completion of a written exam. Some states may waive the written exam on the basis of education and experience, but the trend is toward an examination requirement.

Graduate School

While not the only way to get ahead, graduate training can provide the critical depth of training some specialties require. The best sources of information about grad school are your professors and other practicing engineers.

Accredited Programs

Those interested in a career in civil engineering should consider reviewing engineering programs that are accredited by the Accreditation Board for Engineering and Technology, Inc. (ABET). ABET accreditation is based on an evaluation of an engineering program's student achievement, program improvement, faculty, curricular content, facilities, and institutional commitment. The following is a partial list of universities offering accredited degree programs in civil engineering.

<ul style="list-style-type: none">• The University of Akron• Alabama A&M University• University of Alabama at Birmingham• The University of Alabama in Huntsville• The University of Alabama• University of Alaska Anchorage• University of Alaska Fairbanks• Arizona State University• University of Arizona• University of Arkansas• Auburn University• Boise State University• Bradley University• Brigham Young University• Brown University• Bucknell University• California Polytechnic State University, San Luis Obispo• California State Polytechnic University, Pomona• California State University, Chico• California State University, Fresno• California State University, Fullerton• California State University, Long Beach• California State University, Los Angeles• California State University, Northridge• California State University, Sacramento• University of California, Berkeley• University of California, Davis• University of California, Irvine• University of California, Los Angeles• Carnegie Mellon University• Carroll College• Case Western Reserve University• The Catholic University of America• University of Central Florida• Christian Brothers University• University of Cincinnati• The Citadel• Clarkson University	<ul style="list-style-type: none">• Montana State University - Bozeman• Morgan State University• University of Nebraska-Lincoln• University of Nevada-Las Vegas• University of Nevada-Reno• University of New Hampshire• University of New Haven• New Jersey Institute of Technology• New Mexico State University• University of New Mexico• University of New Orleans• State University of New York at Buffalo• City University of New York, City College• North Carolina Agricultural and Technical State University• University of North Carolina at Charlotte• North Carolina State University at Raleigh• North Dakota State University• University of North Dakota• University of North Florida• Northeastern University• Northern Arizona University• Northwestern University• Norwich University• University of Notre Dame• Ohio Northern University• The Ohio State University• Ohio University• Oklahoma State University• The University of Oklahoma• Old Dominion University• Oregon Institute of Technology• Oregon State University• University of the Pacific• Pennsylvania State University• University of Pennsylvania• University of Pittsburgh• Polytechnic University• Polytechnic University of Puerto Rico• Portland State University
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- Clemson University
- Cleveland State University
- University of Colorado at Boulder
- University of Colorado at Denver and Health Sciences Center
- Colorado State University
- Columbia University
- University of Connecticut
- The Cooper Union
- Cornell University
- University of Dayton
- University of Delaware
- University of Detroit Mercy
- University of the District of Columbia-Van Ness Campus
- Drexel University
- Duke University
- Embry-Riddle Aeronautical University - Daytona Beach
- University of Evansville
- Florida A & M University/Florida State University (FAMU-FSU)
- Florida Atlantic University
- Florida Institute of Technology
- Florida International University (University Park)
- University of Florida
- George Mason University
- The George Washington University
- Georgia Institute of Technology
- Gonzaga University
- University of Hartford
- University of Hawaii at Manoa
- University of Houston
- Howard University
- Idaho State University
- University of Idaho
- University of Illinois at Chicago
- University of Illinois at Urbana-Champaign
- Illinois Institute of Technology
- Iowa State University
- University of Iowa
- The Johns Hopkins University
- Kansas State University
- The University of Kansas
- University of Kentucky
- Lafayette College
- Lamar University
- Lawrence Technological University
- Lehigh University
- University of Louisiana at Lafayette
- Louisiana State University and A&M College
- Louisiana Tech University
- University of Louisville
- Loyola Marymount University
- University of Maine

- University of Portland
- Prairie View A & M University
- Princeton University
- University of Puerto Rico, Mayaguez Campus
- Purdue University at West Lafayette
- Rensselaer Polytechnic Institute
- University of Rhode Island
- Rice University
- Rose-Hulman Institute of Technology
- Rowan University
- Rutgers, The State University of New Jersey
- San Diego State University
- San Francisco State University
- San Jose State University
- Santa Clara University
- Seattle University
- University of South Alabama
- University of South Carolina
- South Dakota School of Mines and Technology
- South Dakota State University
- University of South Florida
- University of Southern California
- Southern Illinois University at Carbondale
- Southern Illinois University-Edwardsville
- Southern University and Agricultural & Mechanical College
- St. Martin's College
- Stanford University
- Stevens Institute of Technology
- Syracuse University
- Temple University
- University of Tennessee at Knoxville
- Tennessee State University
- Tennessee Technological University
- Texas A & M University
- Texas A & M University - Kingsville
- University of Texas at Arlington
- University of Texas at Austin
- University of Texas at El Paso
- The University of Texas at San Antonio
- Texas Tech University
- The University of Toledo
- Tri-State University
- Tufts University
- Tulane University
- Union College
- United States Air Force Academy
- United States Coast Guard Academy
- United States Military Academy
- Utah State University
- University of Utah
- Valparaiso University
- Vanderbilt University
- University of Vermont

- **Manhattan College**
- **Marquette University**
- **University of Maryland College Park**
- **University of Massachusetts Amherst**
- **University of Massachusetts Dartmouth**
- **Massachusetts Institute of Technology**
- **University of Massachusetts Lowell**
- **The University of Memphis**
- **Merrimack College**
- **University of Miami**
- **Michigan State University**
- **Michigan Technological University**
- **University of Michigan**
- **Minnesota State University, Mankato**
- **University of Minnesota-Twin Cities**
- **Mississippi State University**
- **University of Mississippi**
- **University of Missouri-Columbia**
- **University of Missouri-Kansas City**
- **University of Missouri-Rolla**
- **University of Missouri-St. Louis**

- **Villanova University**
- **Virginia Military Institute**
- **Virginia Polytechnic Institute and State University**
- **University of Virginia**
- **Washington State University**
- **Washington University**
- **University of Washington**
- **Wayne State University**
- **West Virginia University**
- **West Virginia University Institute of Technology**
- **Western Kentucky University**
- **Widener University**
- **University of Wisconsin-Madison**
- **University of Wisconsin-Milwaukee**
- **University of Wisconsin-Platteville**
- **Worcester Polytechnic Institute**
- **University of Wyoming**
- **Youngstown State University**

Day in the Life

The only constant in the professional lives of civil engineers is that they never have typical days. Every day is different, bringing new challenges and unique demands, and the nature of these demands varies according to the specialization and seniority of the engineer. On the other hand, most report they work in teams, they spend time on things not necessarily well described in their titles, they concern themselves with continuing education and their networking part of the time, and women and minorities report a better environment than may once have been the norm in engineering. Virtually all engineers spend some part of every day doing some routine administrative tasks, and newly-graduated engineers may be surprised to find they will most likely file, type, send e-mail, make phone calls, take notes in meetings, and many other ordinary chores.

Teams and Coworkers

Almost all jobs in civil engineering require some sort of interaction with coworkers. Whether they are working in a team situation, or just asking for advice, most engineers have to have the ability to communicate and work with other people.

Tasks and Titles

Civil engineers have a wide array of specialty areas to choose from. The titles civil engineers hold are far more broad than most people know and their duties are even more diverse.

Work Experience

Civil Engineers tend to experience their work as part of an extremely significant contribution. In addition, civil engineers are committed to their profession and to performing well as part of a team.

Women and Minorities

Once engineering was predominantly a field belonging to white males, as were most professionals in the western world. This is arguably no longer the case, although there is still progress to be made. In the case of women, the percentage of engineering Bachelor's degrees awarded went from 0.8% in 1970 to 15.4% in 1990. (Engineering Manpower Commission cited in *Women in Engineering: An Untapped Resource*, published by Catalyst, 1992.)

Specialization

There are seven major disciplines within civil engineering that are closely interrelated:

Structural

As a structural engineer, you will face the challenge of designing structures that support their own weight and the loads they carry, and that resist wind, temperature, earthquake, and many other forces. Bridges, buildings, offshore structures, space platforms, amusement park rides, and many other kinds of projects are included within this exciting discipline. You will develop the appropriate combination of steel, concrete, timber, plastic, and new exotic materials. You will do the planning and design, as well as visit the project site to make sure the work is done properly.



Environmental

The skills of environmental engineers are becoming increasingly important as we attempt to protect the fragile resources of our planet. Environmental engineers translate physical, chemical, and biological processes into systems to destroy toxic substances, remove pollutants from water, reduce non-hazardous solid waste volumes, eliminate contaminants from the air, and develop groundwater supplies. In this field, you may be called upon to resolve issues of providing safe drinking water, cleaning up sites contaminated with hazardous materials, disposing of wastewater, and managing solid wastes.

Geotechnical

Geotechnical engineering is required in all aspects of civil engineering, because most projects are supported by the ground. As a geotechnical engineer, you might develop projects below ground, such as tunnels, foundations, and offshore platforms. You will analyze the properties of soil and rock that support and affect the behavior of these structures. You may evaluate the potential settlements of buildings, the stability of slopes and fills, the seepage of ground water and the effects of earthquakes. You will investigate the rocks and soils at



a project site and determine the best way to support a structure in the ground. You may also take part in the design and construction of dams, embankments, and retaining walls.

Water Resources

Water is essential to our lives, and as a water resources engineer, you will deal with issues concerning the quality and quantity of water. You will work to prevent floods, to supply water for cities, industry, and irrigation, to treat wastewater, to protect beaches, or to manage and redirect rivers. You might be involved in the design, construction, or maintenance of hydroelectric power facilities, canals, dams, pipelines, pumping stations, locks, or seaport facilities.



Transportation

Because the quality of a community is directly related to the quality of its transportation system, your function as a transportation engineer will be to move people, goods, and materials safely and efficiently. Your challenge will be to find ways to meet our ever-increasing travel needs on land, air, and sea. You will design, construct, and maintain all types of transportation facilities, including highways, railroads, airfields, and ports. An important part of transportation engineering is to upgrade our transportation capability by improving traffic control and mass transit systems, and by introducing high-speed trains, people movers, and other new transportation methods.

Construction

As a construction engineer, you are the builder of our future. The construction phase of a project represents the first tangible result of design. Using your technical and management skills will allow you to turn designs into reality – on time and within budget. You will apply your knowledge of construction methods and equipment, along with the principles of financing, planning, and managing, to turn the designs of other engineers into successful projects.



Urban Planning

As a professional in this area, you will be concerned with the entire development of a community. Analyzing a variety of information will help you coordinate projects, such as projecting street patterns, identifying park and recreation areas, and determining areas for industrial and residential growth. To ensure ready access to your community, coordination with other authorities may be required to integrate freeways, airports, and other related facilities. Successful coordination of a project will require you to be people-oriented as well as technically knowledgeable.



Earnings

Money issues are always relative. It is not just how big a paycheck, but what you have to do to get it, whether you enjoy the work and the environment, how much you get to keep after your living expenses, and what intangible rewards you might also value. Choosing to work in the public versus private sector may also influence salary ranges. As in any profession, civil engineering salaries bear some relationship to the level of responsibility the employee takes on.



Starting Salary

Entry-level salaries vary based on your areas of expertise, experience, education, supervisory responsibility, accountability for projects, and the geographic location, size, and industry of the employer. According to a 2005 salary survey by the National Association of Colleges and Employers, bachelor's degree candidates in civil engineering received starting salary offers averaging \$43,679 a year, master's degree candidates were offered \$48,050, and Ph.D. candidates were offered \$59,625.

Variation in median earnings and in the earnings distributions for engineers in the various branches of engineering also is significant. For civil engineers, earnings distributions by percentile in May 2004 are shown in the following tabulation.

Specialty	10%	25%	50%	75%	90%
Civil	\$42,610	\$51,430	\$64,230	\$79,920	\$94,660

Employer Size

The size of a company has considerable influence on the salary range for a given function. Larger firms tend to offer higher starting wages and more benefits, but upward mobility may be highly competitive. A smaller company may pay less but offer a more direct path to greater responsibility and a bigger check. It is your preference, and up to you to seek out the facts regarding each individual company you might consider working for. (Corptech database of 45,000 technical companies, Hoovers company info, equal opportunity publications, engineering news record, US Army Corps of Engineers, Best companies for working mothers)

Location

Pay in rural areas tends to be below salaries in big cities, but this is often offset by differences in cost of living.

Type of Employer

Rewards are very different in public and private sectors. The salaries may be higher in the private sector but when you consider the total compensation package, the difference may not be as significant.



Other Compensation Factors

Beyond the intrinsic reward of feeling good about your work, there are many varieties of compensation packages. Flexible hours and a family-friendly environment may be worth more than money to you. Everything from profit sharing to retirement benefits, health coverage, and vacation time should be part of your thinking in evaluating a potential employer. The opportunity for promotion and continuing education is particularly important for first-job seekers.

Globalization

Employment opportunities for civil engineers exist all over the world. Civil engineers are needed everywhere to plan, design, construct, operate, improve, and renovate the projects essential to modern comfort and growth. Where you work makes a big difference to your career. The key to making a success of a foreign assignment is being prepared, considering all the issues, and having a clear picture of the benefits.



Preparing Yourself

While there are abundant opportunities to work internationally as a civil engineer, it takes some special preparation to do well abroad. Speaking more than one language is a major factor. Being able to adapt to new conditions rapidly is another. Although the international workforce is becoming more mobile every day, traditionally big engineering firms tend to send experienced senior level staff on international assignments.

Things to Consider

Studying abroad is one way to investigate how interested you are in working internationally. Before you book a flight, here are some questions you should think through:

- What do I hope to gain?
- Am I willing and able to adapt to new situations and environments?
- Will the program delay completing my degree?
- Will I be able to transfer credits earned abroad?
- Do I need a visa or other paperwork?
- What are the financial implications?
- Is this program well-recognized in the industry and academia?
- What happens if I want to come home early?



If you are thinking of working abroad, the considerations are similar, plus you should get an agreement from the employer covering any concerns you may have.

The Benefits

Some form of international work or study experience is a strong credential for a young civil engineer. Even if you do not want to work in other countries on a regular basis, understanding engineering from a global perspective will enhance your ability to complete domestically in what is, increasingly, a world market.

Career Path Forecast

According to the U.S. Department of Labor, Bureau of Labor Statistics, civil engineers are expected to see average employment growth through 2014. Spurred by general population growth and an increased emphasis on infrastructure security, more civil engineers will be needed to design and construct safe and higher capacity transportation, water supply, and pollution control systems, as well as large buildings and building complexes. They also will be needed to repair or replace existing roads, bridges, and other public structures. Because construction and related industries -- including those providing design services -- employ many civil engineers, employment opportunities will vary by geographic area and may decrease during economic slowdowns, when construction often is curtailed.



Professional Organizations

Professional organizations and associations provide a wide range of resources for planning and navigating a career in Civil Engineering. These groups can play a key role in your development and keep you abreast of what is happening in your industry. Associations promote the interests of their members and provide a network of contacts that can help you find jobs and move your career forward. They can offer a variety of services including job referral services, continuing education courses, insurance, travel benefits, periodicals, and meeting and conference opportunities. The following is a partial list of professional associations serving civil engineers and employers. A broader list of professional associations is also available by clicking [here](#).



► **American Society of Civil Engineers (www.asce.org)**

Founded in 1852, the American Society of Civil Engineers (ASCE) represents more than 133,000 members of the civil engineering profession worldwide, and is America's oldest national engineering society. ASCE's vision is to position engineers as global leaders building a better quality of life.

► **Canadian Society for Civil Engineers (www.csce.ca)**

Founded in 1887 by prominent Civil Engineers in Canada, the Canadian Society for Civil Engineering (CSCE) is a learned society intended to develop and maintain high standards of civil engineering practice in Canada and to enhance the public image of the civil engineering profession.

► **The Institution of Civil Engineers (www.ice.org.uk)**

The Institution of Civil Engineers was founded in 1818, and today, ICE has nearly 80,000 members across the world.