

# Civil Engineer

## At a Glance

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*Civil engineers plan, design, and oversee the construction of buildings and other structures. These include bridges, dams, roads, railways, and sewers.*

### 16 Career Clusters

Architecture & Construction

Agriculture, Food & Natural Resources

Science, Technology, Engineering & Math

Transportation, Distribution & Logistics

### Earnings

**Earnings Range:** 51K - 119K

### Level of Education

- 4-Year College or University

### Core Tasks

- Use math and science to calculate if structure designs are possible and safe
- Study existing conditions at project sites
- Estimate quantities and cost of materials, equipment, and labor needed for projects
- Supervise construction workers and building progress at project sites
- Prepare reports on project issues

### Attributes & Abilities

- Problem-solving skills
- Communication skills
- An interest in construction and building
- Math and computer skills
- An understanding of business

### Workplace

- Work for engineering firms, manufacturing and construction companies, and government agencies
- Spend a lot of time working in offices on computers, making phone calls, or reading blueprints
- Work outdoors doing on-site inspections and supervising the construction process
- Most work 8 to 10 hours a day, 40 to 50 hours a week

## Job Description

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Civil engineers help design and build the structures that we use every day. Skyscrapers, hospitals, bridges, power plants—engineers work on them all. They also work on roads, railways, pipelines, and underground systems like sewers.

Civil engineers use their knowledge of math and science in practical ways. They ensure that buildings and transportation systems are safe and efficient. They might calculate the force of water currents on the piers that

support bridges. It would be a disaster to have a bridge buckle because it couldn't withstand a rush of water. Or, they may select the best materials to use to build a light rail system.

Civil engineering is a broad field. Specific duties depend on the type of work engineers focus on. For example, some may study a city's sewage system to make sure it can handle heavy rain. But all engineers oversee the progress of the projects they work on.

Engineers may survey sites to decide how best to approach the project. They write reports and draw up designs for approval. They supervise site workers and contractors. They inspect the site to make sure that construction meets building and safety codes. They also ensure projects run on time and on budget.

Engineers usually specialize in one area of civil engineering. One example is structural engineering. Those in this field are experts on structures that can support heavy loads. That includes apartment buildings, factories, and even oil rigs. Transportation engineers focus on roads, railways, and airports.

Geotechnical engineers help build tunnels, dams, and foundations. They know a lot about soil, rocks, and groundwater. Other specialists include hydrotechnical, construction, and environmental engineers.

## Working Conditions

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Civil engineers work for:

- construction companies
- engineering firms
- manufacturing companies
- governments
- utility companies
- railroad companies

Engineers spend a lot of time at their desks in offices. They do a lot of work on the computer. They also spend time writing reports, reading blueprints, and making phone calls.

However, they spend a lot of time outside as well. They do on-site inspections and supervise construction. This requires some local travel.

Civil engineers work 8 to 10 hours a day, 40 to 50 hours a week. They sometimes have to work nights and weekends. They can get called at any time to check out an urgent problem. They also work longer hours when they have a tight deadline.

Engineers often have many projects on the go at the same time. Each project may have a different deadline. Staying on top of things can be stressful. There can be a lot of pressure to keep a project on budget.

## Earnings

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Most civil engineers work full time. They receive a regular salary from their employer. Others work on a contract basis for consulting firms. This means they only get paid for projects that they are hired to work on.

Earnings for civil engineers range from about \$53,000 to \$130,000 a year. The median is around \$82,000 a year. Senior engineers and managers earn the most.

Engineers' salaries depend on their expertise and level of education. More education typically means more money. Those who have a master's degree or PhD earn more than those who don't. Some engineers earn a degree in business on top of their engineering degree. They also tend to earn more money.

Income can also depend on the economy. During a recession, fewer projects are undertaken. This can result in pay cuts or job losses for civil engineers. Due to this uncertainty, many consulting firms hire engineers on a contract basis.

Full-time engineers generally receive benefits on top of their salary. These may include health coverage, paid vacation time, and pension plans. Those who are self-employed or work contract jobs do not get benefits. Some engineers also receive bonuses based on performance.

## Massachusetts Wages

Occupation: Civil Engineers

Level of Experience	Hourly	Annual
Entry Wage	\$31.03	\$64,540
Median Wage	\$40.4	\$84,030
Experienced Wage	\$49.35	\$102,650

Source: U.S. Department of Labor, Bureau of Labor Statistics <http://www.bls.gov>

## Massachusetts Outlook

Occupation: Civil Engineers

### Employment

2014	6,440
2024	6,730

### Change

Number	290
Percentage	4.5

### Annual Average Openings

Total	Growth	Replacement
220	--	--

Source: Projections Central <http://www.projectionscentral.com>

## Education

While in high school, take as many courses in math and physics as you can. Courses in chemistry and other sciences, computers, and English are also helpful.

You need at least a bachelor's degree to enter this field. Civil engineering programs are available at most 4-year colleges. During the program, you will study subjects such as:

- math
- science

- soil mechanics
- fluid mechanics
- structural design
- civil engineering drawing
- mechanics of materials

It takes about 4 years to earn a bachelor's degree. However, most engineers don't stop there. A master's degree can improve your chances of advancing in the field. A PhD is required to teach at a college. It takes 2 years to earn a master's degree. A PhD requires another 4 years of study.

Many civil engineers focus their studies on a specific area. For instance, you may want to make roads, railways, and airports. In this case, you can get a master's degree with a focus in transportation engineering.

It's a good idea to get as much related experience as you can while you are in school. Look into internships and summer jobs in your area. Some schools offer co-op programs. These let you get work experience while you study.

It doesn't just take a degree to become a professional engineer. You need to be licensed in your state as a Professional Engineer (PE). First, you must complete an accredited program. You must work for several years under licensed engineers. Then, you must pass two exams.

You can also earn a Master of Business Administration (MBA) degree. Engineers often deal with budgets and other financial issues. An MBA can help you handle the business aspects of project planning.

### Related College Programs

- Civil Engineering, General
- Structural Engineering
- Transportation and Highway Engineering
- Civil Engineering Technology/Technician
- Pre-Engineering

### Other Suggested Qualifications

If you want to work as a civil engineer, you must have strong problem-solving and communication skills. You should be interested in construction and building, and have an aptitude for math and business. Computers play a big role in this job, so you should like keeping up with changing technology. There are many ongoing education programs offered by trade groups and equipment vendors which engineers take to keep abreast of developments in their field. A Master of Business Administration (MBA) degree or any other business-related qualification is an asset, since civil engineers must deal not only with technical and physical considerations, but also with budgetary and financial ones.

### Sample High School Program of Study

This Program of Study can serve as a guide, along with other career planning materials, as learners continue on a career path. Courses listed within this plan are only recommended coursework and should be individualized to meet each learner's educational and career goals.

### Engineering and Technology Science, Technology, Engineering & Math

Grade 9	Grade 10	Grade 11	Grade 12
<b>English/Language Arts</b>			
English/Language Arts I	English/Language Arts II	English/Language Arts III	English/Language Arts IV
<b>Math</b>			
	Geometry or Algebra II	Algebra II or Trigonometry	Trigonometry or Pre-Calculus/Calculus or AP

Grade 9	Grade 10	Grade 11	Grade 12
Algebra I or Geometry		Pre-Calculus or Statistics	Calculus or Math Analysis
<b>Science</b>			
Biology	Chemistry	Physics	AP Science or Structured Computer Program Language
<b>Social Studies/Sciences</b>			
State History  Civics	U.S. History	World History  World Geography	Economics  Entrepreneurship
<b>Career &amp; Technical Courses</b>			
Introduction to Engineering Design	Principles of Engineering or Information Technology Applications	Product Engineering and Development  Digital Electronics	Civil Engineering and Architecture  Engineering Innovation

States' Career Clusters Initiative, 2008, [www.careerclusters.org](http://www.careerclusters.org).

### Important

- Check with your advisor to make sure that your course selections satisfy your graduation requirements.
- Courses available may vary from school to school.

## Sample Career Path

People take different pathways through their careers, but no one starts at the top. This is an example of how the earnings, education and experience requirements, and responsibilities might progress for someone in this occupation.

### Level 1

<b>Sample Title</b>	Engineer-In-Training (EIT)
<b>Earnings</b>	\$50,000 to \$60,000 a year
<b>Requirements</b>	• Bachelor's degree in civil engineering or a related field
<b>Responsibilities</b>	Analyzing and designing basic projects under the guidance and supervision of a licensed engineer.

## Level 2

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<b>Sample Title</b>	Professional Engineer (PE)
<b>Earnings</b>	\$60,000 to \$80,000 a year
<b>Requirements</b>	<ul style="list-style-type: none"><li>• Several years of on-the-job experience</li><li>• Successful completion of the professional licensing exams</li></ul>
<b>Responsibilities</b>	Designing basic structures and individual components of larger designs; supervising on-site construction.

## Level 3

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<b>Sample Title</b>	Intermediate Engineer
<b>Earnings</b>	\$80,000 to \$100,000 a year
<b>Requirements</b>	<ul style="list-style-type: none"><li>• Several years of experience as a licensed PE</li><li>• Possibly a master's degree in a specific area of civil engineering</li></ul>
<b>Responsibilities</b>	Designing more complex structures; supervising junior engineers.

## Level 4

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<b>Sample Title</b>	Senior Engineer
<b>Earnings</b>	\$85,000 to \$120,000 a year
<b>Requirements</b>	<ul style="list-style-type: none"><li>• Many years of experience as a licensed PE</li></ul>
<b>Responsibilities</b>	Overseeing the analysis and design of several projects; supervising trainees and junior engineers; acting as a liaison between clients and government officials; performing administrative and managerial duties.

## Level 5

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<b>Sample Title</b>	Manager / Senior Partner
<b>Earnings</b>	\$90,000 to \$150,000 a year or more
<b>Requirements</b>	<ul style="list-style-type: none"><li>• Master of Business Administration (MBA) degree or some other business-related qualification</li></ul>
<b>Responsibilities</b>	Managing a large number of employees; pursuing new clients; ensuring that the organization is meeting its financial objectives; performing many administrative duties.

## Related Careers

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Here are some other occupations that you might be interested in. Click on an occupation name to learn more.

- Aerospace Engineer
- Agricultural Engineer
- Architect
- Building Inspector
- Chemical Engineer
- Civil Engineering Tech
- Electrical Engineer
- Electronics Engineer
- Environmental Consultant
- Environmental Engineer
- Hydrologist / Hydrogeologist
- Land Surveyor
- Landscape Architect
- Materials / Metallurgical Engineer
- Mechanical Engineer
- Naval Architect
- Nuclear Engineer
- Petroleum Engineer
- Planner

### Related Military Careers

- Civil Engineer

### Career Clusters

Career Clusters are groups or families of occupations that share common characteristics such as knowledge requirements, skill sets, and/or goals.

Architecture & Construction

Agriculture, Food & Natural Resources

Science, Technology, Engineering & Math

Transportation, Distribution & Logistics

### National Employment by Industry

Industry	% Employed
Professional, Scientific, and Technical Services	51
Government	29

Source: O\*Net Online, Browse by Industry, US Department of Labor  
<http://online.onetcenter.org/find/industry>

## Other Resources

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### American Society of Civil Engineers (ASCE)

A national trade association representing those who work in the civil engineering field. Scroll down and click on About Civil Engineering to learn more about this industry.

<http://www.asce.org>

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**Science Buddies – Civil Engineers**

This career profile offers some great basic information about the career, key requirements, job duties, and more.

<http://www.sciencebuddies.org/science-engineering-careers/engineering/civil-engineers>

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**TryEngineering.Org**

Find helpful career and educational resources here. Be sure to explore the Become An Engineer section to learn about engineering and engineering technology careers.

<http://www.tryengineering.org>

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**ABET – Explore Technical Careers**

ABET accredits post-secondary programs in engineering and technology and promotes a high quality in education. Here you can discover different career options.

<http://www.ecei.org/explore-technical-careers>

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**eGFI – Dream Up the Future**

The American Society for Engineering Education (ASEE) created this website for students interested in learning more about engineering and engineering careers.

<http://www.egfi-k12.org>

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**Discover Engineering**

A website designed for students to introduce them to the world of engineering.

<http://www.discoverengineering.org>

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**Engineer Your Life**

This website is designed to provide a guide to engineering for high school girls. Click on Find Your Dream Job to read about the different engineering disciplines.

<http://www.engineeryourlife.org>

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**Engineering Schools – Top 10 Qualities of a Great Engineer**

Find out what qualities are needed to be a successful engineer!

<http://www.engineeringschools.com/resources/top-10-qualities-of-a-great-engineer>

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**Occupational Outlook Handbook – Civil Engineers**

Career information from the US Department of Labor.

<http://www.bls.gov/ooh/architecture-and-engineering/civil-engineers.htm>