

Mapping Your Future

Engineering

What is the Engineering Industry?

Engineers use science and math to solve real-life problems. We see examples of engineering in just about all of our daily activities. Engineering makes digital devices like smartphones and tablets possible. Did you know that we have engineers to thank for heat in the winter and air conditioning in the summer? With a turn of a faucet and a flick of a switch, engineers give us clean, running water, and electricity. Transportation engineers designed the subway system that gets us to work and school. Aerospace engineers designed the jets that take us across the globe.

New York City is one of the most celebrated cities in the world thanks in large part to engineers. They are behind a lot of great entertainment here: Citifield, the Barclays Center and not one, but two Yankee Stadiums. They helped design the Brooklyn Bridge, the Empire State Building, and the Coney Island Cyclone. They decided what materials should be used and how they should be built.

- **Construction and civil engineers** oversaw their general design and construction.
- **Geotechnical engineers** made sure they were built upon a solid foundation by testing the soil and bedrock at the construction site.
- **Structural engineers** did stress tests to make sure that these structures would withstand heavy use and weather conditions.

Engineers also help improve the quality of life for all New Yorkers. For example, water resource engineers designed distribution systems that bring to New Yorkers some of the world's safest drinking water, and sewer systems that reduce the impact of flooding.

What Types of Work Can I Find in New York City?

New York City has many engineering career opportunities. With a population of 8 million residents and millions more visitors, the City requires many buildings, roadways, railways, subways and airports to house and transport all of its people as well as electrical grids and water systems that serve 24/7 without fail. Each one of these structures or systems requires engineers to calculate how to safely build them, to determine what materials have the strength, flexibility or the capacity to handle the level of use.



After these structures are built, they must be constantly monitored to ensure they remain safe and structurally sound. The City's many businesses need other types of engineers, such as electrical engineers and technicians, to manage their software and hardware systems. New York City's pioneering tech startups depend on computer hardware engineers for new ideas.

The three major types of engineering occupations in New York City are:

- **Civil engineers**, who work on large construction projects and systems, including roads, buildings, airports, tunnels, dams, bridges and systems for water supply and sewage treatment.
- **Electrical/Electronics engineers**, who work on electrical and electronic devices such as high definition television, embedded computer systems, solar power generators, microprocessor chips, electronic amplifiers, laser sources, robots and intelligent systems.
- **Mechanical engineers**, who work on mechanical and thermal devices (like heating, ventilation and air conditioning equipment) including tools, engines and machines.

Engineers mainly work in engineering firms. They might also work for the government, and firms in IT, TV broadcasting, and high-tech manufacturing, to name a few. They can specialize in a number of subfields, and these are profiled in this brochure.

continued from front cover

What Skills Do I Need to Be an Engineer?

- **Math and science.** You must have a firm grasp of and interest in science and math to become an engineer. Science—chemistry, physics and biology—and math—algebra, geometry, and calculus—give engineers the tools to understand the nature of a problem and ways to create solutions.
- **Soft skills.** Engineers must communicate and collaborate well. Much of the work is team-based and involves important business partners and clients worldwide. Leadership and creativity will set you apart from the competition in any job you pursue.
- **Computer-Assisted Design (CAD).** In any engineering field, it's important to be able to use CAD programs like AutoCAD,[®] Revit[®] and Inventor.[®]
- **Project management.** Because most work in this field is project-based, project management skills come in handy.
- **Safety skills** are necessary for anyone entering into civil, structural, or construction engineering.

MAP KEY



Expected to grow faster than average between now and 2020.

Pay Range

The pay range reflects typical pay from entry level to experienced. The higher pay takes many years to reach and development of significantly greater skills and knowledge.

Jobs that are primarily part-time are expressed as hourly pay; jobs that are primarily full-time are shown with annual pay. Those that could be either are shown both ways.

Education Minimum education and experience requirements. This may vary from employer to employer.

This flyer highlights jobs in the sector projected to have the same or more openings between now and 2020.

How Can I Get My Foot in the Door in Engineering?

It takes a lot to break into engineering, but it's worth the time and effort. Where you start depends on how much education you have.

If you are interested in installing, connecting and inspecting things like structures, computer systems or mechanical devices, you might want to be a **technician**. If you are artistic and comfortable drawing with CAD software, a **draftsman** might be a natural fit for you. To work in these jobs, you'll likely need to complete a 2-year degree program in your discipline.

You must complete a 4-year engineering degree to be able to practice as an entry-level engineer. In this capacity, you can help senior-level engineers to generate ideas, research solutions, create designs, and test the results.

As an entry-level engineer, you'll get the work hours needed to qualify for the Professional Engineering (PE) licensing exam. PEs also take continuing education to stay licensed. They take on more responsibility and authority, can advance further, and are paid more. Only licensed engineers can prepare, sign, seal and submit engineering plans and drawings.

Who Likes to Work in This Field?

People who like to work in engineering welcome a good challenge. They are naturally curious people. They may look at an object like a cell phone and be more interested in learning how it was built and what else it could do than in what it does now.

Put Yourself on the Map: How to Use This Brochure

Like any map, this Career Map helps you find your way to new places – in this case, a bunch of careers within one specific industry. (An industry is a loosely defined area of businesses engaged in similar work.) As you read, ask yourself: what different kinds of jobs are there? How does one job lead to the next? Which ones will I like? How much money can I earn, and how long will it take me to get there? What kind of training do I need?

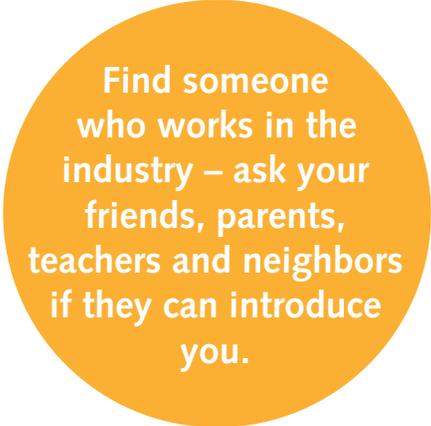
One of the best ways to find a satisfying career is to get clear about your personal interests and strengths. What do you most enjoy doing? What do your friends, teachers, parents say you do best? Do you prefer to work with people, ideas or things? Do you want to be in charge, or work alongside your peers? Which of these jobs will let you be your best?

Once you've found a path that sounds like a good fit, it's time to test it out. Find someone who works in the industry – ask your friends, parents, teachers and neighbors if they can introduce you. Ask if they are willing to talk with you for a few minutes. This is called an “informational interview.” You're not asking them to find you a job; you're only asking to listen and learn about their experience. If you ask in a professional manner, many people are happy to speak with you. (If you're nervous about this, ask a teacher, guidance counselor or parent to help.)

Before you meet with the person, reread the brochure and write down any questions you have, for example:

- What do you spend your day doing in this job?
- How did you get started in this field?
- How much reading, writing or math do you do in your job?
- How do people dress at the work place?
- Do you have a routine set of tasks you do every day or do you do something different every day?
- Do you work the same schedule every week, or does it change?
- What courses would I take in high school or college to prepare for this job?
- What is my next step after high school if I am interested in this field?
- Where can I find people who can help me learn more about this field?

Make sure to send a thank you note, and in no time you'll be on your way. For more information about this industry and many others, you can visit www.careerzone.ny.gov



**Find someone
who works in the
industry – ask your
friends, parents,
teachers and neighbors
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you.**

INCREASING LEVELS OF EDUCATION/TRAINING REQUIRED

Associate Degree	Bachelor's Degree <i>continued</i>
<p>Architectural or Civil Drafter</p> <p>DUTIES: Prepares drawings of site maps, as well as architectural and structural building features for highways, bridges, and public works. Applies knowledge of building materials, engineering practice, and math to create drawings that will result in a safe and sound structure.</p> <p>PAY RANGE: \$27,000 to \$67,000 per year</p> <p>Environmental Engineering Technician</p> <p>DUTIES: Under the direction of senior engineering staff, modifies, tests, and operates equipment for pollution prevention, control, and cleanup.</p> <p>PAY RANGE: \$29,000 to \$77,000 per year</p> <p>Civil Engineering Technician ⚡</p> <p>DUTIES: Plans, designs, and oversees construction and maintenance of structures and facilities under the direction of senior engineering staff.</p> <p>PAY RANGE: \$32,000 to \$70,000 per year</p>	<p>Construction or Project Engineer</p> <p>DUTIES: Manages construction projects. Inspects all stages of construction to ensure design plans are implemented correctly and in compliance with government codes and regulations. Reviews construction plans, monitors costs and project progress. May help prepare cost estimates and construction schedules.</p> <p>PAY RANGE: \$44,000 to \$88,000 per year</p> <p>Water Resources or Wastewater Engineer ⚡</p> <p>DUTIES: Designs systems that distribute freshwater and wastewater, safely dispose of sewage, and prevent flood damage. Manages and analyzes data, does fieldwork, and ensures that projects comply with laws and regulations.</p> <p>PAY RANGE: \$46,000 to \$118,500 per year</p> <p>Structural Engineer</p> <p>DUTIES: Evaluates and designs load-bearing structures such as buildings, bridges or dams to ensure their strength and durability. Performs analysis of building materials for use in construction. Develops blueprints or specifications for use during construction that comply with codes and regulations. Investigates sites to determine the cause of structural failures, damages, and defects.</p> <p>PAY RANGE: \$47,000 to \$83,000 per year</p>
<p>Bachelor's Degree</p> <p>Environmental Engineer ⚡</p> <p>DUTIES: Tests for hazardous waste and other environmental pollutants. Uses engineering, soil science, biology, and chemistry to develop solutions to environmental problems. Seeks to improve recycling, waste disposal, public health, and water and air quality.</p> <p>PAY RANGE: \$39,000 to \$118,500 per year</p> <p>Civil Engineer ⚡</p> <p>DUTIES: Designs buildings and other load-bearing structures. Analyzes surveys, maps and other data to plan projects. Designs structurally sound buildings and foundations that stay true to an architect's design. Structural designs must support the weight of the building and people who will use it, and absorb the impact of local weather. Applies for permits in compliance with government codes and regulations.</p> <p>PAY RANGE: \$43,000 to \$107,000 per year</p>	<p>Transportation Engineer</p> <p>DUTIES: Plans and designs streets and highways, as well as larger infrastructure projects, such as rail, airports, ports, mass transit systems and harbors. Proposes changes to transportation infrastructure to improve traffic flow. Ensures compliance with government codes and regulations.</p> <p>PAY RANGE: \$47,000 to \$107,000 per year</p> <p>Geotechnical Engineer</p> <p>DUTIES: Ensures that foundations are solid. Focuses on how structures built by civil engineers, such as buildings and tunnels, interact with soil and bedrock. Designs and plans for slopes, retaining walls, and tunnels. May inspect areas for unsafe geological conditions, equipment, and working conditions.</p> <p>PAY RANGE: \$48,000 to \$75,000 per year</p>

Types of Employment

	HOURS/WEEK	SCHEDULE	WAGE/SALARY	PAYMENT	COMMON BENEFITS
Full-Time	Usually 35+	Steady	Annual	Weekly or bi-weekly	Paid sick leave, vacation time, health insurance, retirement savings
Part-Time	Usually <35	May vary	Hourly	Weekly or bi-weekly	Usually none
Temp	As needed by employer	May vary	Hourly	Weekly or bi-weekly	Usually none
Per Diem	As needed by employer	Daily or Per Shift	Hourly	Weekly or bi-weekly	Usually none
Self-employed aka Freelance	Varies	Varies	Negotiate rate of pay with client	Upon completion of work or on a schedule of deliverables	None: must pay own taxes and health insurance
Union			Typically higher than comparable non-union positions		As negotiated by the union with the employer on behalf of members

For more information on careers in this industry:

Bureau of Labor Statistics – Occupational Outlook Handbook

Civil Engineers:

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

Electrical and Electronic Engineers:

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

Mechanical Engineers:

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

State and National Associations

New York Society of Professional Engineers: <http://nysspe.org/>

American Society of Civil Engineers: <http://www.asce.org/>

American Society of Mechanical Engineers: <http://www.discovere.org/discover-engineering>

Institute of Electrical and Electronic Engineers: <http://www.ieee.org/index.html>

DiscoverE

<http://www.discovere.org/discover-engineering>

For information about the DOE CTE Programs:

<http://schools.nyc.gov/ChoicesEnrollment/SpecialPrograms/CTE/default.htm>

<http://CTECouncil.org>

Where can I get additional general information on careers?

For careers in New York State: www.careerzone.ny.gov

For general career information, including videos of nearly 550 careers: www.acinet.org

For general career information: www.bls.gov/k12

INCREASING LEVELS OF EDUCATION/TRAINING REQUIRED

Associate Degree	Bachelor's Degree <i>continued</i>	Associate Degree
<p>Electrical or Electronics Engineering Technician</p> <p>DUTIES: Builds, tests and maintains complex electrical and electronic equipment such as computers, control systems, communication networks, power systems and medical devices. PAY RANGE: \$31,000 to \$79,000 per year</p> <p>Electrical or Electronics Drafter</p> <p>DUTIES: Prepares wiring diagrams, assembly diagrams, and layout drawings used to manufacture, install, or repair electrical equipment. Supports and connects electronic components of circuit boards. PAY RANGE: \$33,000 to \$76,000 per year</p>	<p>Power or Energy Engineer</p> <p>DUTIES: Designs, develops, and tests energy-related projects to reduce energy costs and improve energy efficiency during the designing, building or re-modeling stages of construction. May specialize in electrical systems; heating, ventilation and air-conditioning (HVAC) systems; green buildings; lighting; air quality; or energy procurement. PAY RANGE: \$47,000 to \$123,000 per year</p> <p>Electrical Engineer</p> <p>DUTIES: Researches, designs, develops, tests, and supervises the manufacturing and installation of electrical equipment, such as electric motors, radar and navigation systems, communications systems, and power generation equipment. PAY RANGE: \$48,000 to \$112,000 per year</p>	<p>Mechanical Drafter</p> <p>DUTIES: Prepares detailed working diagrams of machinery and mechanical devices, including dimensions, fastening methods and other engineering information. PAY RANGE: \$32,000 to \$62,000 per year</p> <p>Mechanical Engineering Technician</p> <p>DUTIES: Modifies, develops, tests or calibrates machinery and equipment under direction of engineering staff or physical scientists. PAY RANGE: \$34,000 to \$68,000 per year</p>
Bachelor's Degree	Post-secondary Non-Degree Award	Bachelor's Degree
<p>Computer Hardware Engineer ⚡</p> <p>DUTIES: Researches, designs, develops, and tests computer and related equipment. Supervises the assembly and installation of computer or computer-related equipment and components like circuit boards, processors and wiring. PAY RANGE: \$40,000 to \$126,000 per year</p> <p>Electronics Engineer</p> <p>DUTIES: Researches, designs, develops, and tests electronic components and systems using knowledge of electronic theory and materials properties. Designs electronic equipment, such as broadcast and communications systems—like wireless and digital devices. PAY RANGE: \$40,000 to \$99,000 per year</p> <p>Photonics Engineer</p> <p>DUTIES: Designs technologies specializing in light information or light energy that power medical lasers used in eye surgery, industrial optics used in welding, drilling and cutting, and fiber optic used for high-speed cable. PAY RANGE: \$46,000 to \$123,000 per year</p>	<p>Sound Engineering Technician</p> <p>DUTIES: Operates machines and equipment to record, synchronize, mix or reproduce music, voices or sound effects in sporting arenas, theater productions, recording studios or movie and video productions. PAY RANGE: \$22,000 to \$81,000 per year</p>	<p>Thermal Engineer</p> <p>DUTIES: Designs technologies that convert heat energy into mechanical and electric energy sources that power machines like cars, conveyors and electric generators. May work in a number of different industries including the design of heating/cooling equipment, power management, and on the development of renewable energies. PAY RANGE: \$47,000 to \$94,000 per year</p> <p>Mechanical Engineer ⚡</p> <p>DUTIES: Designs tools, engines, machines, and other mechanical equipment, including electric generators, internal combustion engines, steam and gas turbines, refrigeration and air-conditioning systems, elevators, escalators and conveyor belts, to name a few. Analyzes problems to see how mechanical and thermal devices might help solve the problem. PAY RANGE: \$61,000 to \$105,000 per year</p> <p>Acoustical Engineer</p> <p>DUTIES: Consults with construction engineers and architects on the design and sound quality of facilities like performance spaces and recording studios. Ensures that buildings comply with local noise ordinances and standards, and minimizes noise caused by highway or air traffic. Some acoustic engineers design sound systems. Others also work in bioengineering to develop hearing aids. PAY RANGE: \$75,000 to \$92,000 per year</p>