

# **CAREER GUIDE FOR CIVIL ENGINEERS**

SOC Code: 17-2051

Pay Band(s): 5 and 6 ([Salary Structure](#))

**Standard Occupational Description:** Perform engineering duties in planning, designing, and overseeing construction and maintenance of building structures, and facilities, such as roads, railroads, airports, bridges, harbors, channels, dams, irrigation projects, pipelines, power plants, water and sewage systems, and waste disposal units. Includes architectural, structural, traffic, ocean, and geo-technical engineers.

**Civil Engineer positions in the Commonwealth are assigned to the following Roles in the [Architecture and Engineering Career Group](#):**

[Engineer I](#)

[Engineer II](#)

While Civil Engineers within the Commonwealth are all located within the Architecture and Engineering Career Group, individuals may want to pursue other managerial opportunities within the Commonwealth depending upon individual training, education, knowledge, skills, abilities, and interests.

Other Career Group(s) that may be of interest are:

[General Administration](#)

[Program Administration](#)

[Engineering Technology](#)

[Environmental Services](#)

[Life and Physical Science](#)

[Building and Grounds](#)

## **SKILLS, KNOWLEDGE, ABILITIES AND TASKS**

(Technical and Functional Expertise)

### **Skills**

**Note:** *The technical and functional skills listed below are based on general occupational qualifications for Civil Engineers commonly recognized by most employers. Typically, you will not be required to have all of the skills listed to be a successful performer. Recruitment and selection standards for an individual state job must be based on the specific knowledge, skills, and abilities for that job as indicated in the job announcement and job description in the Employee Work Profile.*

1. Using mathematics to solve problems.
2. Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
3. Using scientific rules and methods to solve problems.
4. Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
5. Understanding written sentences and paragraphs in work related documents.
6. Understanding the implications of new information for both current and future problem-solving and decision-making.

7. Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
8. Monitoring/Assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.
9. Considering the relative costs and benefits of potential actions to choose the most appropriate one.
10. Bringing others together and trying to reconcile differences.

## **Knowledge**

**Note:** *The technical and functional knowledge statements listed below are based on general occupational qualifications for Civil Engineers commonly recognized by most employers. Typically, you will not be required to have all of the knowledge listed to be a successful performer. Recruitment and selection standards for an individual state job must be based on the specific knowledge, skills, and abilities for that job as indicated in the job announcement and job description in the Employee Work Profile.*

### **The Knowledge of:**

1. Practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
2. Design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
3. Arithmetic, algebra, geometry, calculus, statistics, and their applications.
4. Materials, methods, and the tools involved in the construction or repair of houses, buildings, or other structures such as highways and roads.
5. Structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.
6. Principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.
7. Business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.
8. Principles and methods for moving people or goods by air, rail, sea, or road, including the relative costs and benefits.
9. Relevant equipment, policies, procedures, and strategies to promote effective local, state, or national security operations for the protection of people, data, property, and institutions.
10. Circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.

## **Abilities**

**Note:** *The technical and functional abilities listed below are based on general occupational qualifications for Civil Engineers commonly recognized by most employers. Typically, you will not be required to have all of the abilities listed to be a successful performer. Recruitment and selection standards for an individual state job must be based on the specific knowledge, skills, and abilities for that job as indicated in the job announcement and job description in the Employee Work Profile.*

### **The Ability to:**

1. Apply general rules to specific problems to produce answers that make sense.
2. Communicate information and ideas in speaking so others will understand.
3. Tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
4. See details at close range (within a few feet of the observer).

5. Listen to and understand information and ideas presented through spoken words and sentences.
6. Read and understand information and ideas presented in writing.
7. Arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
8. Speak clearly so others can understand you.
9. Imagine how something will look after it is moved around or when its parts are moved or rearranged.
10. Combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).

### **Tasks**

**Note:** *The following is a list of sample tasks typically performed by Civil Engineers. Employees in this occupation will not necessarily perform all of the tasks listed.*

1. Analyzes survey reports, maps, drawings, blueprints, aerial photography, and other topographical or geologic data to plan projects.
2. Plans and designs transportation or hydraulic systems and structures, following construction and government standards, using design software and drawing tools.
3. Estimates quantities and cost of materials, equipment, or labor to determine project feasibility.
4. Directs construction, operations, and maintenance activities at project site.
5. Computes load and grade requirements, water flow rates, and material stress factors to determine design specifications.
6. Directs or participates in surveying to lay out installations and establish reference points, grades, and elevations to guide construction.
7. Inspects project sites to monitor progress and ensure conformance to design specifications and safety or sanitation standards.
8. Conducts studies of traffic patterns or environmental conditions to identify engineering problems and assess the potential impact of projects.
9. Tests soils and materials to determine the adequacy and strength of foundations, concrete, asphalt, or steel.
10. Provides technical advice regarding design, construction, or program modifications and structural repairs to industrial and managerial personnel.

### **INTERESTED?**

Like people, occupations have traits or characteristics. These characteristics give important clues about the nature of the work and work environment, and give you an opportunity to match your own personal interests to a specific occupation. When you choose a job in an occupation that matches your own interests you have taken an important step in planning a successful and rewarding career.

The civil engineer occupation has the following characteristics:

**Realistic** — Realistic occupations frequently involve work activities that include practical, hands-on problems and solutions. They often deal with plants, animals, and real-world materials like wood, tools, and machinery. Many of the occupations require working outside, and do not involve a lot of paperwork or working closely with others.

**Investigative** — Investigative occupations frequently involve working with ideas, and require an extensive amount of thinking. These occupations can involve searching for facts and figuring out problems mentally.

**Conventional** — Conventional occupations frequently involve following set procedures and routines. These occupations can include working with data and details more than with ideas. Usually there is a clear line of authority.

## **LICENSURE, REGISTRATION, OR CERTIFICATION REQUIREMENTS**

Generally licensure is required for engineers or a licensed professional engineer must supervise unlicensed civil engineer positions in state government.

Licensing information for professional engineers can be found on the Department of Professional & Occupational Regulations' web site at <http://www.dpor.virginia.gov/>

All 50 States and the District of Columbia require licensure for engineers who offer their services directly to the public. Engineers who are licensed are called Professional Engineers (PE). Recent graduates can start the licensing process by taking the examination in two stages. The initial Fundamentals of Engineering (FE) examination can be taken upon graduation. Engineers who pass this examination commonly are called Engineers in Training (EIT) or Engineer Interns (EI). After acquiring suitable work experience, EITs can take the second examination, the Principles and Practice of Engineering exam. Several States have imposed mandatory continuing education requirements for licensure.

Licensure and certification enhances professional development and career progression.

## **EDUCATIONAL, TRAINING, AND LEARNING OPPORTUNITIES**

The Department of Labor provides the following information:

Civil engineers design things. These might be roads, buildings, airports, tunnels, dams, bridges, or water supply and sewage systems. This is one of the oldest types of engineering.

Many civil engineers manage people and projects. A civil engineer may oversee a construction site or be a city engineer. Others may work in design, construction, research, and teaching. Civil engineers usually work in areas that are industry and business centers. Often they work at construction sites. Some times they work in places that are far away from cities.

Many civil engineers hold supervisory or administrative positions, from supervisor of a construction site to city engineer. Others may work in design, construction, research, and teaching.

A bachelor's in engineering is needed for almost all entry-level engineering jobs. College grads with a degree in a science or mathematics may get some jobs.

Getting into engineering school requires a strong report card in math and science, and courses in English, social studies, and computers.

In a typical college, the first 2 years are for studying math, science, engineering basics, the arts, and social sciences. In the last 2 years, most courses are in engineering, mostly in a single branch.

Engineers should be creative, curious, analytical, and detail-oriented. They should be able to work as part of a team. People skills are important. This is because engineers often work with people in a wide range of fields.

The State Council of Higher Education (SCHEV) lists many Virginia educational institutions offering programs in engineering on their web site:  
<http://research.schev.edu/degreeinventory/inventory>

## **COMMONWEALTH COMPETENCIES**

Competencies are a set of identified behaviors, knowledge, skills, and abilities that directly and positively impact the success of employees and the organization. Competencies can be observed and measured. When consistently demonstrated, competencies make employees particularly effective in their work. Competencies help lay out a road map to career success. You can use the Commonwealth Competencies to help improve your individual performance by adopting behaviors that make high performing employees successful in their jobs. In this way, you can use the Commonwealth Competencies for your further professional development.

### **The Commonwealth Competencies are:**

1. Technical and Functional Expertise
2. Understanding the Business
3. Achieving Results
4. Serving the Customer
5. Teamwork
6. Interpersonal and Communication Skills
7. Leadership and Personal Effectiveness

The above competencies may be applied to employees throughout the Commonwealth of Virginia. They can be rank-ordered by agencies and hiring managers to represent the needs of a specific job. The rank ordering will change depending upon the occupation, an organization's priorities, the actual job requirements, and the supervisor's preferences.

Career success is both about what you do (applying your technical knowledge, skills, and ability) and how you do it (the consistent behaviors you demonstrate and choose to use) while interacting and communicating with others. Hopefully, by studying the Commonwealth competencies, identifying your developmental opportunities, and working to refine your own competence, you can take charge of your career!

For additional information about the **Commonwealth Competencies** go to:  
[http://jobs.state.va.us/cc\\_planningctr.htm](http://jobs.state.va.us/cc_planningctr.htm). For the competencies, we first list the competencies and then define each. Finally, we list competency indicators; to describe what successful performance looks like.

## **COMMONWEALTH CAREER PATH**

Career opportunities in the Commonwealth are not limited to moving “up” to the next highest role and pay band, changing positions, or to becoming a supervisor. That’s because most roles describe a broad group of occupationally related positions that perform a range of work that requires increased knowledge and skills. For that reason, Commonwealth roles describe the career paths within the same or higher-level role for the same or different Career Group. The broad salary range and the Commonwealth’s pay practices provide flexibility in recognizing career development and advancement. (Salary Structure)

For example:

Pay Band	Practitioner Role
5	Engineer I
6	Engineer II

Pay Band	Manager Role
5	Architect/Engineer Manager I
6	Architect/Engineer Manager II
7	Architect/Engineer Manager III
8	Architect/Engineer Manager IV

### Sample Career Path

#### Engineer I

The Engineer I role provides career tracks for civil engineers whose expertise levels range from trainee to advanced level. Responsibilities include applying engineering principles and practices to projects of varying complexity in specialty areas.

#### Engineer II

The Engineer II role provides career tracks for civil engineers that serve as an expert or first line supervisor. Duties include evaluating the plans and specifications for capital outlay projects prepared by other architects and engineers; or for applying related engineering principles and practices to complex, extensive and diversified engineering projects in specialty areas.

#### Engineering Manager I

The Engineering Manager I role provides career tracks for managers who manage various administrative, budgetary, planning, scheduling and technical activities related to multiple complex engineering projects or programs and the staff performing related functions. These functions draw upon knowledge of specialty engineering; capital outlay or other construction projects, transportation, water and wastewater projects or programs and health and safety related operations.

#### Engineering Manager II

The Engineering Manager II role provides career tracks for managers who manage, coordinate, and direct the activities of one or more specialized transportation or environmental engineering or health and safety related program operations in their assigned geographic or divisional area. This role also provides career tracks for managers who manage staff and resources related to the procurement, design, construction or renovation of capital projects or non-capital outlay for an entire agency’s construction and maintenance reserve programs. This includes budgetary, planning, scheduling, public relations, human resource functions, and technical activities related to a broad range of engineering, administrative and other projects or programs.

### **Engineering Manager III**

The Engineering Manager III role provides career tracks for managers who direct the transportation engineering, construction, maintenance, administrative and other operations and programs of a defined geographic transportation district. This role provides career tracks for managers who serve as an assistant to the Commissioner for Transportation and direct the operations of divisions and/or districts in areas such as administration, planning and operations. In addition, this role provides career tracks for executive level of Engineering and Buildings, and Facilities Management managers for the Commonwealth and for managers of an agency's design and construction projects that involve multiple facilities with special requirements, such as security provisions and long-term development and evaluation of programs.

### **Engineering Manager IV**

The Engineering Manager IV role provides a career track for the executive manager who serves as the agency's chief engineer responsible for planning and directing large-scale, multi-division preliminary engineering and construction programs for operations with statewide scope. Directs areas such as location and design, structure and bridge, right of way and utilities, materials and transportation construction. Interfaces with state and federal officials and executives on agency issues and with the Commonwealth Transportation Board.

## **ADDITIONAL OCCUPATIONAL INFORMATION CAN BE FOUND AT:**

O\*NET (Occupational Information Network)

<http://online.onetcenter.org/>

Virginia Employment Commission

<http://www.alex.vec.state.va.us/>

Department of Professional & Occupation Regulation

<http://www.dpor.virginia.gov>

Career One Stop

<http://www.careeronestop.org/>

Virginia Career Resource Network

<http://www.vacrn.net/>

American Society of Civil Engineers

<http://www.asce.org>

[Accreditation Board for Engineering and Technology, Inc.](http://www.abet.org/)

[/help/exit?u=http%3A/www.abet.org/&t=Accreditation%20Board%20for%20Engineering%20and%20Technology%2C%20Inc.external site](http://www.abet.org/)

[American Society for Engineering Education](http://www.asee.org/)

[/help/exit?u=http%3A/www.asee.org/&t=American%20Society%20for%20Engineering%20Educationexternal site](http://www.asee.org/)

[National Council of Examiners for Engineers and Surveying](http://www.ncees.org/)

[/help/exit?u=http%3A/www.ncees.org/&t=National%20Council%20of%20Examiners%20for%20Engineers%20and%20Surveyingexternal site.](http://www.ncees.org/)

[National Society of Professional Engineers](http://www.nspe.org)  
[/help/exit?u=http%3A%2F%2Fwww.nspe.org%2F&t=National%20Society%20of%20Professional%20Engineers](http://www.nspe.org/help/exit?u=http%3A%2F%2Fwww.nspe.org%2F&t=National%20Society%20of%20Professional%20Engineers) external site.