

# Civil Engineering

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## Lesson Summary:

Civil engineering is a broad field containing many engineering sub-fields, such as transportation engineering, environmental engineering, geotechnical engineering, and construction engineering. Civil engineers design and supervise the construction of roads, buildings, airports, tunnels, dams, bridges, as well as water supply and sewage systems. They must consider many factors in the design process, from the construction costs and expected lifetime of a project, to government regulations and potential environmental hazards such as earthquakes.

This two-day lesson introduces the broad applications of civil engineering as well as this profession as a career choice. Students will explore the ancient and modern history of civil engineering –one of the oldest engineering disciplines, as well as the “Seven Wonders of the Modern World,” which are all feats of civil engineering. On Day One, students will take a pre-assessment of their knowledge about civil engineering. They will log their observations as they view an eleven-minute video interview with a construction engineer from Dayton, Ohio. Day One ends with a research homework assignment. Day Two will involve group work researching the “seven wonders of the modern world” culminating in a group presentation.

**Estimated Duration:** Three class periods, 55 minutes each for instruction and group presentations

## Ohio Academic Content Standards

### Grade



**Content Area/Discipline:**

Technology

**Standard:**

Design

**Benchmark: B**

Recognize the role of engineering design and of testing the design process.

**Indicator: 3**

Describe what an engineer does (e.g., analyze information found on engineering society Web sites).

**Content Area/Discipline:**

Science

**Standard:**

Science and Society

**Benchmark: C**

Give examples of how thinking scientifically is helpful in everyday life.

**Indicator: 4**

Describe how the pursuit of scientific knowledge is beneficial for every career and in everyday life.

## Grade

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7



**Content Area/Discipline:**  
**Standard:**  
**Benchmark: B**

Technology

Design

Recognize the role of engineering design and of testing the design process.

**Indicator: 2**

Describe the relationship between engineering, science, and mathematics.

**Content Area/Discipline:**  
**Standard:**  
**Benchmark: C**

Science

Scientific Ways of Knowing

Give examples of how thinking scientifically is helpful in daily life.

**Indicator: 3**

Describe how the work of science requires a variety of human abilities and qualities that are helpful in daily life (e.g., reasoning, creativity, skepticism, and openness.)

## Grade

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8



**Content Area/Discipline:**  
**Standard:**  
**Benchmark: B**

Technology

Design

Recognize the role of engineering design and of testing in the design process.

**Indicator: 1**

Summarize the role of engineering design.

**Indicator: 2**

Describe the relationship between engineering, science, and mathematics.

**Content Area/Discipline:**  
**Standard:**  
**Benchmark: A**

Science

Science and Technology

Find examples of how technological advances, influenced by scientific knowledge, affect the quality of life.

**Indicator: 1**

Examine how science and technology have advanced through the contributions of many different people, cultures, and times in history.

## Grade

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9



**Content Area/Discipline:**  
**Standard:**  
**Benchmark: B**

Technology

Design

Recognize the role of teamwork in engineering design and prototyping in the design process.

**Indicator: 5**

Describe how engineering design is influenced by personal characteristics such as creativity, resourcefulness, and the ability to visualize and think abstractly.

**Content Area/Discipline:**  
**Standard:**  
**Benchmark: D**

Science

Scientific Ways of Knowing

Recognize that scientific literacy is part of being a knowledgeable citizen.

**Indicator: 8**

Investigate how the knowledge, skills and interests learned in science classes apply to careers students plan to pursue.

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# Vocabulary



<b>Aqueducts:</b>	a system of bridges and canals, used to redirect and supply cities with safe water
<b>Construction Engineering:</b>	directs building of bridges, tunnels, dams, and super structures
<b>Water Resources:</b>	refers to rivers, irrigation, water supply, and sewage disposal
<b>Environmental Engineer:</b>	directs preservation and cleanup of water and the natural landscape
<b>Transportation Engineer:</b>	directs highway and railroad building and repair, and traffic control projects
<b>Geotechnical Engineer:</b>	directs earthwork, soil mechanics, and foundation projects
<b>BS:</b>	bachelors degree in science
<b>BEng:</b>	bachelors degree in civil engineering (a four-year college degree)
<b>Structural design:</b>	A process of applying engineering mechanics to create a functional, economic, and safe structure for the public
<b>Retaining wall:</b>	a structure that holds back earth materials
<b>Structural analysis:</b>	set of physical laws and mathematics required to study and predict the behavior of structures
<b>Hydraulic Engineering:</b>	the field of engineering concerned with the flow and conveyance of fluids, principally water.
<b>Structural Engineering:</b>	a subfield of civil engineering that deals with the design of any structural systems whose purpose is to support and resist various loads

# Procedure

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## Day One

- 1) Welcome students to Engineering Your Future: An Introduction to the World of Engineering.
- 2) Distribute the pre-assessment **Student Survey**, have students complete and hand in when finished.
- 3) Distribute copies of the Viewing Log. Have students complete the **Assumptions** column based on their knowledge of civil engineering.
- 4) Introduce the field of Civil Engineering and advise students that they will be viewing an eleven-minute interview with a civil engineer who worked on the construction of the Schuster Center for the Arts in Dayton, Ohio. As they watch a video, students should complete the **Viewing Log**. While students are watching the video, look over the student surveys to help guide the discussion following the video.
- 5) Allow students to complete their viewing log.
- 6) Hold a short discussion of the video interview. What are some challenges of a career in civil engineering as described by the engineer? What were some things you learned about civil engineering that you did not know? What types of projects do civil engineers work on? How have your previous assumptions about the field of civil engineering changed?
- 7) Next, with the remaining class period, students should begin exploring the history of civil engineering by visiting the Engineering Your Future Web site "What is Engineering?" page at <http://www.futuresinengineering.org>. **NOTE: You may need to reserve a computer lab for this part of the lesson.**

On a piece of paper, students should write down and answer the following questions using complete sentences. Students who do not finish the research during class should complete the homework either at the library or at a home computer.

1. The Ancient Romans were some of the earliest civil engineers. What were two of their innovations? (**Roads, aqueducts**)
2. During the Industrial Revolution, there were two types of engineers. What were they? (**military and civil engineers**)
3. When was the first professional society of engineers formed? (**1818**)

# Procedure

## Day Two



- 1) Begin by discussing the homework assignment with students and go over the answers as a class. Were students surprised by how old the discipline of civil engineering is?
- 2) Now, ask students to try and name some of the “Seven Wonders of the Ancient World” (the Pyramids at Giza in Egypt are an example that students will likely know.) Explain that all of the seven wonders were amazing civil engineering feats. Now ask students to name any other ancient civil engineering projects they can think of. (the Parthenon, Roman Coliseum, and the Apian Way, e.g.)
- 3) Next ask students if they can name any of the “Seven Wonders of the *Modern* World.”
- 4) Explain that students will use this class period to research the Seven Wonders of the Modern World as designated by the American Society of Civil Engineers at the following Web site:  
[http://www.asce.org/history/seven\\_wonders.cfm#chunnel](http://www.asce.org/history/seven_wonders.cfm#chunnel) .
- 5) Assign seven groups of 2-5 students to research the seven modern wonders, each group will work on researching one of the following:

1. The Channel Tunnel
2. The CN Tower
3. The Empire State Building
4. The Golden Gate Bridge
5. Itaipu Dam
6. Netherlands North Sea Protection Works
7. The Panama Canal

Students will use the Civil Engineering **Research Road Map** to guide their research. Every presentation should include an image of their topic either in handout or overhead format. Groups should also conduct internet searches to look for additional information from other reliable Web sources. Each group will present their research topic to the class the following class period.

# Student Survey

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Name \_\_\_\_\_

Date \_\_\_\_\_

Class \_\_\_\_\_

Period \_\_\_\_\_

**Directions: Answer the following questions. Make a complete statement for each question.**

- 1) What is a civil engineer?
  
- 2) What would you study to become a civil engineer ?
  
- 3) What types of projects do civil engineers work on?
  
- 4) Do civil engineers work primarily alone or in teams with other specialists?
  
- 5) What courses in high school will be important for a future in civil engineering?
  
- 6) Can you name any projects in your community that would have been developed by a civil engineer?
  
- 7) What math and science disciplines do engineers rely on?
  
- 8) Is college necessary for a career in civil engineering?

# Student Viewing Log \_\_\_\_\_



Name \_\_\_\_\_

Date \_\_\_\_\_

Class \_\_\_\_\_

Period \_\_\_\_\_

**Directions:** Record your assumptions about the field of Civil Engineering. While viewing the video list the new information you learned in the appropriate column.

**civil engineering**

**assumptions**

**what i learned**

What is a civil engineer?

What types of projects do civil engineers work on?

Is college necessary to pursue a career in civil engineering?

What high school math and science courses do civil engineers frequently use?

Are civil engineering projects generally collaborative, or does one person usually do the planning and execution of the project?

What are some examples of civil engineering projects found in most communities?

[Empty column for assumptions]

[Empty column for what i learned]

# Research Road Map

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## Civil Engineering



Group Members:

Research Topic:

Date:

Class:

Period:

**Directions:** Answer the following questions to help research the modern wonder of the world your group was assigned. You should begin your research at the American Society of Civil Engineers Web site at: [http://www.asce.org/history/seven\\_wonders.cfm#chunnel](http://www.asce.org/history/seven_wonders.cfm#chunnel)

- 1) What kind of structure is it?
- 2) When was it built?
- 3) Where is it located?
- 4) What is the purpose of the structure?
- 5) How is the structure innovative?
- 6) What makes the structure a “wonder” of the modern world?
- 7) There are several specialties within the field of civil engineering, for example:
  - Construction and structural
  - Water resources
  - Transportation engineering
  - Environmental engineering
  - Geotechnical engineering

Which specialists were likely required to collaborate on the design and construction of the structure your group researched? Explain your conclusions.

# Group Observation Form

## Civil Engineering



Group Members:

Research Topic:

Date:

Class:

Period:

Directions: Please check the appropriate responses for each group's level of understanding about Civil Engineering.

Observed Questions	Clearly Understands	Understands	Does Not Understand
1. What is the structure?			
2. When was the structure built?			
3. What is the purpose of the structure?			
4. Where is it located?			
5. What makes the structure a modern wonder of the world?			
6. Which civil engineering specialists collaborated on planning and construction?			