

# Engineering

## Can A Civil Engineering Project Save America?

Subject Area: US History

Grade Levels:11<sup>th</sup> Grade

Date: August 2013

### Lesson Overview

In this lesson students in groups are given the task of creating a formal project consisting of an argumentative essay, project board/power point and 3-D model in support of sparing an engineering marvel (from both a historical and engineering perspective) from destruction by alien invaders.

### Materials Included in this Lesson

- What is Civil Engineering WS
- Vocabulary Activity WS
- Civil Engineering Quiz
- Assessment WS
- Reflection WS

### Other Materials for this Lesson

- Computers (for research)
- Poster board
- Objects to create a 3-D model (varies depending on the group)

### Skills the Student will Learn

- Predicting
- Active Reading
- Collaboration
- Time Management
- Evaluation
- Research
- Reflection

### Student Deliverables

- What is Civil Engineering? Worksheet
- Vocabulary Activity
- Civil Engineering Quiz
- Argumentative Essay
- Poster board or PPT
- 3-D Model
- Assessment Worksheet
- Reflection Worksheet
- Peer Presentation Rubric

## Length of Lesson: 6-10 Class Periods

### Activity Part One - Introduction (One class period)

Objective: Students will become familiar with the field of civil engineering through a reading and vocabulary activity.

Teacher will distribute "What is Civil Engineering?" and have students answer pre-reading questions. Read the passage about civil engineering as a class. Instruct students to re-read the passage by themselves and answer the questions that follow. Show a video clip about Civil Engineers to give students a greater understanding of what civil engineering is and what civil engineers do. Here is a link to one <http://www.youtube.com/watch?v=pyqdU5MpaPg>, but you may use a different video if you have access.

Distribute vocabulary worksheet and place students in to groups of four. Distribute the vocabulary key terms and definitions to each group. In groups students should match the key terms to the correct definition. This can become a competition, the first group finished with all the correct answers can earn extra credit for their efforts. When a group is finished, review the matches for accuracy. If the vocabulary is accurate have students copy the vocabulary and definitions on to their worksheet. Students should review the What is Civil Engineering Worksheet? and vocabulary for homework.

### Activity Part Two – Research and Project Preparation (1-2 weeks)\*

Objective: Assess student understanding of Civil Engineering and complete research preparation.

Distribute quiz to assess student learning from the previous day's activity. Go over the quiz with the class to ensure that everyone has a basic understanding of civil engineering. Introduce students to the project and organize them in to groups of at least four. Students need to establish a project manager and begin researching their project. Halfway through the project the teacher should meet with the project managers to make sure that the project is on target.

\*Note: The time it takes to complete the project will vary depending on the school schedule and whether or not you allow the students to work on their project in class or outside of class.

### Activity Part Three – Presentation (1-2 days – depending on class size)

Objective: Groups will present their projects to class, assess each other's project and reflect on their participation in the project.

Students will present their projects and assess the presentations based on a rubric. The class will vote on the project that represents the best hope for saving the continental United States from destruction. Students will complete a reflection of their participation in the project and the participation of other members of their group.

### Enrichment Suggestions

Take students on a field trip or encourage them to go to a local site that reflects civil engineering (Folsom Dam, San Francisco Golden Gate Bridge or the California Aqueducts).

Have an engineer come in to the classroom as a guest speaker or have students interview an engineer and report their findings to the class.

### Student Resources

Video that reflects engineering marvels all over the country.

<http://www.youtube.com/watch?v=KMEt-HYuDCo>

### Foundation Academic Standards

Social Science Curriculum Standards – US History

11.5: The students will analyze the major political, social, economic, technological and cultural developments of the 1920's.

11.6: The students will analyze different explanations for the Great Depression and how the New Deal fundamentally changed the role of the federal government.

Common Core Standards

Language Standard 11-12.1: Demonstrate command of the conventions of the standards of English grammar and usage when writing and speaking.

Language Standard 11-12.2: Demonstrate command of the conventions of standard English capitalization, punctuation and spelling when writing.

Reading History in Social Science Standard 11-12.7: Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g. visually, quantitatively as well as in words) in order to address an issue or solve a problem.

Writing Standards for History and Social Science 11-12.6: Conduct short as well as more sustained research project to answer a question or to solve a problem, synthesize multiple sources on the subject demonstrating an understanding of the subject under investigation.

### CTE Pathway Standards

Engineering and Architecture/Engineering Technology Pathway B 1.0: Communicate and interpret information clearly in industry standard visual and written formats.

Engineering and Architecture/Engineering and Design Pathway C 1.0: Understand historical and current events related to engineering design and their effect on society.

### Lesson Plan Relevance To Externship

I completed my externship at RICK Engineering of Sacramento and during my time I gained a greater understanding for civil engineering. The goal of this lesson is to introduce engineering to my students in a way that is connected to the study of US History making them more aware of the importance of engineering to the rise of the US during the 1920's and 1930's.

## Project Rubric Can an Engineering Project Save America?

Student Deliverables	(4) Exceeds Expectations	(3) Meets Expectations	(2) Approaches Expectations	(1) Fails to Meet Expectations
What is Civil Engineering? Worksheet	All boxes filled out and complete	Nearly all boxes filled out and complete	More than half of the boxes are filled out and complete	Less than half complete
Vocabulary Worksheet	All boxes filled out and complete	Nearly all boxes filled out and complete	More than half of the boxes are filled out and complete	Less than half complete
Argumentative Essay	Essay is clear, coherent and grammatically correct and includes an introduction, thesis, counter-argument and three claims with cited evidence and a conclusion.	Essay is clear, coherent may include some grammatically errors but a key area is missing or incomplete in the introduction, thesis, counter-argument and three claims with cited evidence and a conclusion.	Essay is structurally correct but may not be complete or includes major spelling or grammar errors.	Essay is missing key elements of essay and includes significant grammatical or spelling errors.
Presentation	Multi-media presentation or tri-fold presentation board is clear, neatly done and reflects an understanding of engineering and US History. At least five minutes in length.	Multi-media presentation or tri-fold is clear but lacking an area – either does not reflect an understanding of engineering or US History or board is not neatly done or complete.	Presentation fails to meet length requirement and project contains minor errors.	Project fails to meet length requirements and project contains major errors.
3-D Model	Model is an accurate scale representation of the engineering project.	Model is a representation of the project but may not be to scale or lack accuracy.	Model is not an accurate reflection of the selected project.	No model was presented.
Project Reflection	Written reflection meets length and content requirements and is shared in class.	Written reflection meets length and content requirements is not shared in class.	Written reflection has minor grammar, spelling or content errors.	Written reflection has significant grammar, spelling or content errors.

## What is Civil Engineering?

## Pre-Reading Questions

1. On the lines below write a definition of civil engineering.

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2. List at least two projects that a civil engineer might work on.

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3. On a scale of 1 (lowest) to 5 (highest) rate your interest in civil engineering. \_\_\_\_\_

Directions: As you read the excerpt below from the American Society of Civil Engineers Website below, underline or highlight any passages that reflect the importance of civil engineers to society.

The design and maintenance of public works such as roads, bridges, water and energy systems as well as public facilities like ports, railways and airports. Civil engineers touch many aspects of our everyday lives. From the water you use to brush your teeth in the morning to the road you drive on to work and the school that you attend to the power that charges your cell phone. Civil engineers design and build the systems that bring us water and power. They build the infrastructure with our national parks. Civil engineers build mass transit.

Civil engineers use creativity and a strong foundation in math and science to design and maintain infrastructure it helps to think of them as problem solvers. They assess problems, envision solutions and apply practical knowledge to make their ideas a reality. There are several disciplines within the field of civil engineering including transportation, geotechnical, structural, environmental, water resources and construction. Professionals in the different disciplines work together to complete a project.

Transportation engineers deal with analysis and planning highways, railways and traffic control systems while geotechnical engineers determine the suitability of rock and soil to safely support building activities. Structural engineers are most closely associated with bridges, tunnels, buildings and dams. With a thorough understanding of calculus, physics and chemistry, they arrange structural elements to manage the pushing and pulling forces that act on suspension bridges and skyscrapers alike. They also know which building materials are best for the job from both a safety and a cost-management perspective.

Advanced computer programs assist structural engineers in design procedures, but they still rely on their experience, expertise and judgment when difficult decisions need to be made. Through trial and error has provided the engineering field with numerous lessons throughout the years, education and training are what best prepare civil engineers to do their job. That and a willingness to abide by a strict code of ethics that emphasizes safety and human welfare before all else.

## Student Worksheet

## Post-Reading Questions

Re-visit your answer to the pre-reading questions one and two. Answer them again below using evidence from the reading to make sure they are accurate.

1. On the lines below write a definition of civil engineering.

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2. List at least two projects that a civil engineer might work on.

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3. Provide at least two examples from the reading that reflect the importance of civil engineers to society.

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4. List at least four disciplines included in the umbrella of civil engineering.

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5. After reading about civil engineers and watching the video clip rate your interest in civil engineering 1 (lowest) – 5 (highest) \_\_\_\_\_

Did your opinion change from the pre-reading questions? Explain why using specific examples on the lines below:

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## Vocabulary Matching Activity

Directions: Below are key terms to help you understand civil engineering more completely. First in groups of four match the key terms to the correct definition. The first group done will receive extra credit. After your matches have been checked for accuracy copy the definitions next to the correct key term.

Key Term	Definition
CIVIL ENGINEERING	
CIVIL ENGINEER	
ELEVATION	
SURVEYING	
GIS	
REDEVELOPMENT	

AUTOCAD	
ENVIRONMENTAL IMPACT ASSESSMENT (EIA)	
TOPOGRAPHIC MAP	
SUBDIVISION	
EASEMENT	
GPS	
RENDERINGS	
GRADING	

## Activity Cards

Directions: Photocopy enough sheets for groups of four. Cut out the key terms and definitions, mix them up and distribute the stacks to the student groups.

Key Term	Definition
<b>CIVIL ENGINEERING</b>	A discipline that deals with the design, construction, and maintenance of the physical and naturally built environment, including works like roads, bridges, canals, dams, and buildings. It is traditionally broken into several sub-disciplines takes place on all levels: in the public sector from municipal through to national governments, and in the private sector from individual homeowners through to international companies.
<b>CIVIL ENGINEER</b>	An engineer trained in the design and construction of public works, such as bridges and dams
<b>ELEVATION</b>	Orthographic drawings that show one side of a building, building's interior, or exterior
<b>SURVEYING</b>	A means of making relatively large-scale, accurate measurements of the Earth's surfaces. (1) the determination of existing relative horizontal and vertical position, such as that used for the process of mapping, and (2) the establishment of marks to control construction or to indicate land boundaries.
<b>GIS</b>	Geographic information system, a system for storing and manipulating geographical information on a computer.
<b>REDEVELOPMENT</b>	To restore (buildings or neighborhoods, for example) to a better condition
<b>AUTOCAD</b>	A software application for 2D and 3D design and drafting. One of the first computer aided programs to run on personal computers, notably the IBM PC.

<p style="text-align: center;"><b>ENVIRONMENTAL IMPACT ASSESSMENT (EIA)</b></p>	<p>A report of the possible positive or negative impact that a proposed project may have on the environment, together consisting of the natural, social and economic aspects</p>
<p style="text-align: center;"><b>TOPOGRAPHIC MAP</b></p>	<p>Shows the elevation (or height) of the land using contour lines. Contour lines connect points around a given area (think of a mountain) that are at the same elevation. Each contour line represents a specific elevation, and on a given map, there is a fixed elevation difference between contour lines. You can use peaks and valleys on this map as landmarks to help identify where you are.</p>
<p style="text-align: center;"><b>SUBDIVISION</b></p>	<p>The act of dividing land into pieces that are easier to sell or otherwise develop, usually via a plat. If it is used for housing it is typically known as <i>housing development</i>, although some developers tend to call these areas communities. May also be for the purpose of commercial or industrial development, and the results vary from retail shopping malls with independently owned <i>out parcels</i>, to industrial parks.</p>
<p style="text-align: center;"><b>EASEMENT</b></p>	<p>A right of use over the property of another. Traditionally the permitted kinds of uses were limited, the most important being rights of way and rights concerning flowing waters. It was normally for the benefit of adjoining lands, no matter who the owner was, rather than for the benefit of a specific individual.</p>
<p style="text-align: center;"><b>GPS</b></p>	<p>A space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more satellites. The system provides critical capabilities to military, civil and commercial users around the world. It is maintained by the United States government and is freely accessible to anyone with a receiver.</p>
<p style="text-align: center;"><b>RENDERINGS</b></p>	<p>Pictorial drawings that illustrate a design's details, sketches, a collection of free hand drawings that communicate an idea; three types: program, design, and thumbnail.</p>
<p style="text-align: center;"><b>GRADING</b></p>	<p>In civil engineering and construction is the work of ensuring a level base, or one with a specified slope, for a construction work such as a foundation, the base course for a road or a railway, or landscape and garden improvements, or surface drainage. The earthworks created for such a purpose are often called finished contouring.</p>

### Can A Civil Engineering Project Save America?

An alien spaceship has landed in the United States. The lead representative B-Fred, explains in clear English that he is from a planet called C Engineera. The aliens of C Engineera are interested in building and design. They are master engineers as evidenced by their ability to create a space ship that can reach the United States. B-Fred explains they have seen several examples of structural engineering on all of the other continents and these continents will be spared from destruction, however, they are unfamiliar with any engineering marvels in the continental United States, so they plan to level the continent and make it their home base on the planet.

#### **TASK**

In groups no larger than four, write an argumentative essay and create a presentation detailing the engineering and historical significance of a landmark in the United States.

Step I: Form a group and select a project leader. The project leader is responsible for dividing and monitoring work progress and will also be the speaker for the presentation.

Step II: Select a monument/site in the United States.

Step III. Research the historical significance of the site (why was it built in that location? Why was it built? What was the impact? What is the historical significance?) and the engineering (technology used, dimensions, manpower, materials used, problems, costs) aspects that make the site unique and worthy to be spared.

Step IV: Write a one-page argumentative essay (minimum five paragraphs) using the evidence you compiled from your research to make a case that the chosen site/monument represents an engineering marvel that is better than one of the sites from another continent in order to save the United States. Essay must include an introduction, thesis statement, and counter-argument, at least three claims supported by evidence, a conclusion and a bibliography that includes at least three sources (at least one print source must be used).

Step V: Create a 4-6 minute presentation to B-Fred using the evidence you gathered for your paper (the presentation is not just reading your paper) that details the historical and engineering significance of your landmark. Your presentation must include a visual aid – either a large tri-board presentation board or a Power Point presentation (with a minimum of six slides). These should be visual aids and writing should be limited to captions.

Step VI: In addition you must create an accurate 3-D scale model of your landmark/site for B-Fred to take back to his home planet. You may use whatever materials you would like to replicate your site. The 3-D model may be used as an exhibit during your presentation.

Step VII: Using a rubric, the class will grade each group on their presentation and select the project that best represents a landmark of historical/engineering significance to save the continent.

Project Reflection Worksheet

Write your name here:

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Landmark/Site:

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List below what you contributed to the project:

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In the boxes below list the names of the members of your group and place a check in the box that identifies how much credit you think they deserve on this project. You must provide an explanation for the box that you checked.

Name	Full Credit	Partial Credit	No Credit	Explanation

Please use the lines below to reflect on this project (what did you learn/gain from the project – what did you like or not like about the project – did you learn more about civil engineering). You must write at least 5-8 sentences.

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## Student Worksheet

## Can an Engineering Project Save America? Peer Rubric

Name of Project:

	Exceeds Expectation	Meets Expectations	Approaches Expectations	Fails to Meet Expectations
Eye Contact	Holds attention of entire audience with eye contact.	Consistent use of direct eye contact.	Displayed minimal eye contact.	No eye contact with audience.
Elocution	Student uses a clear voice and correct precise pronunciation.	Student's voice is clear and pronounces most terms correctly.	Student's voice is low, and incorrectly pronounces terms.	Student mumbles, incorrectly pronounces terms
Persuasiveness	Student provides three claims with convincing evidence to support the claim.	Provides three claims (at least one historical and one engineering claim).	Student provides limited persuasive claims.	Shows no interest in topic presented.
Subject Knowledge	Student demonstrates full knowledge by answering all class questions with explanations and elaboration.	Student is at ease with the subject matter and can answer questions without elaboration.	Student is uncomfortable with information and is able to answer simple questions.	Student does not have grasp of information; student cannot answer questions.
Visual Aid	PPT or Tri-fold board is clear, neatly done and reflects and understanding of engineering and US History.	PPT or Tri-Fold is clear but contains error – lacking understanding of US History or Engineering.	PPT or Tri-Fold contains major errors (pictures too small/too many words); incomplete or not neatly put together.	No visual aid (PPT or tri-fold is presented)
3-D Model	Model is an accurate, completed to scale and represents the engineering project.	Model is a representation of the project but may not be to scale or lacks accuracy.	Model is not an accurate reflection of the selected project.	No model presented.

List one historical fact you learned from the project.

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List one engineering fact you learned from the project.

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Overall rating of project (1-lowest 5-highest) \_\_\_\_\_

## Civil Engineering Quiz

1. Define civil engineering.
2. List two disciplines within civil engineering.
3. Although engineers rely on technology – what do they also rely on (list at least one).
4. List one way that civil engineering has an effect on you personally in your daily life.
5. \_\_\_\_\_ is a software application for 2D and 3D design and drafting. One of the first computer aided programs to run on personal computers, notably the IBM PC.  
A. GPS                      B. GIS                      C. AutoCad                      D. HVAC
6. A system for storing and manipulating geographical information on a computer is \_\_\_\_  
A. GPS                      B. GIS                      C. AutoCad                      D. HVAC
7. A space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more satellites. The system provides critical capabilities to military, civil and commercial users around the world. It is maintained by the United States government and is freely accessible to anyone with a receiver.  
A. GPS                      B. GIS                      C. AutoCad                      D. HVAC
8. In civil engineering and construction is the work of ensuring a level base, or one with a specified slope, for a construction work such as a foundation, the base course for a road or a railway, or landscape and garden improvements, or surface drainage. The earthworks created for such a purpose are often called finished contouring.  
A. Redevelopment                      B. Grading                      C. Surveying                      D. AutoCad
9. List a structural engineering monument in the United States.
10. List a structural engineering monument in Europe.

