

Overview
Civil Engineering: Designing Bridges
Target Grade Levels: Primary (K-2)
<p>Big Ideas: A force is a push or a pull. When all forces acting on a structure are balanced, the structure is in a state of static equilibrium.</p>
<p>Unit Summary: This unit guides students to discover and discuss the connections between the science topics of force, balance and stability; the design of bridges; and the field of civil engineering.</p>
<p>Essential Questions: How do civil engineers build stable structures? How can the Engineering Design Process help us solve problems?</p>
Standards Addressed
<p>Next Generation Science: 4-PS3-1. – Use evidence to construct an explanation relating the speed of an object to the energy of that object. 4-PS3-3. – Ask questions and predict outcomes about the changes in energy that occur when objects collide.</p> <p>Technology/21st Century Skills: Creativity and Innovation, Critical Thinking, Problem Solving and Decision Making</p> <p>Engineering: 3-5-ETS1-1. – Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2. – Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 3-5-ETS1-3. – Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.</p> <p>Arts: AH-I-SA-U-2 – Understand the principles of design and the elements of visual arts. AH-I-SA-U-4 – Understand that existing and emerging technologies can inspire new applications of structural components.</p> <p>Math: CCSS.Math.Practice.MP2 – Reason abstractly and quantitatively. CCSS.Math.Practice.MP4 – Model with mathematics. CCSS.Math.Practice.MP5 – Use appropriate tools strategically. 3-5.OA – Operations and Algebraic Thinking</p>

*Lesson plans subject to change.

**Accommodations/Modifications – for student specific accommodations, see *Confidential Folder* in wall tray.

Learning Targets	Learning Activities/Instructional Strategies	Evaluation/Assessment
<p>I CAN... ...identify engineers as the people who design objects. ...describe the role of civil engineers in identifying and addressing forces acting on a structure. ...design, build and tests a bridge.</p>	<p>Daily Structure: STEAM Townhall (5 minutes, whole group, direct instruction) Center Work (40 minutes, independent, small group practice) Reflection (5 minutes, whole group, independent reflection)</p> <p>Contact Hour 1 – Preparatory Lesson:</p> <ul style="list-style-type: none"> Examine everyday examples of technology <p>Contact Hour 2 – Javier Builds a Bridge:</p> <ul style="list-style-type: none"> Read the story Javier Builds a Bridge Learn about various types of bridges Talk about what civil engineers do for their jobs Become familiar with the Engineering Design Process <p>Contact Hour 3 – Pushes and Pulls:</p> <ul style="list-style-type: none"> Examine several different structures and observe how each is affected by a force Brainstorm and implement some engineering solutions to prevent forces from causing a structure to fail Discuss how civil engineers work to counteract the forces (pushes and pulls) on a structure in order to make it stronger and more stable <p>Contact Hour 4 & 5 – Bridging Understanding:</p> <ul style="list-style-type: none"> Create three different types of bridges (beam, arch, and deep beam) out of index cards Test each type of bridge to see how much weight it can support and how adding weight affects the structure of the bridge Examine the materials available for designing bridges and brainstorm how the materials might be used <p>Contact Hour 6 & 7 – Designing a Bridge: Use the Engineering Design Process to design a bridge made from paper and other materials Test and improve bridges using the evaluation criteria of strength and stability</p>	<ul style="list-style-type: none"> Anecdotal notes Teacher observation Discovery Journal Daily Student Reflections Self-Assessment Day 2-5 DIY Projects DIY Products
<p>Critical Vocabulary</p> <p>Force Push Pull Static Equilibrium/Balance Arch Beam Abutment Failure</p>		<p>Questioning Examples</p> <p>How have today's experiences inspired me? What was my biggest success today? What was my biggest failure today? How would I reteach what I learned?</p>
<p>Accommodations/Modifications**</p> <p>Technology Visual Timer Redirection Corrective Feedback Preferential Seating Model targeted skills/direction Structured transition w/advanced warning Frequent and positive feedback</p>		<p>How is what I created... ...beautiful? ...thoughtful? ...personally meaningful? ...sophisticated? ...shareable? ...moving? ...enduring?</p> <p>How could you create a bridge to withstand the forces of an earthquake?</p>

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		<p>NO HOMEWORK – students may continue to explore www.diy.org at home, but are discouraged from creating a personal account as it will not count towards STEAM credit.</p>				
Teacher Reflection/Notes						
Higher Order Thinking	Scaffolding	21 st C. Skills	Learning Styles	Student Reflection	Project-based	
Student Choice	Global Perspective	Interdisciplinary	Student-Centered	Critical Thinking	Differentiation	
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