



4th Grade – Science and Engineering

“Exploring and Building Bridges: How do we know what makes a structure effective?”

<p><u>Standard(s)</u></p>	<p><u>NGSS: ETS 1-1:</u> Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. <u>NGSS: ETS 1-2:</u> 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><u>Objective(s)</u></p>	<ul style="list-style-type: none"> Students can work together collaboratively to plan, carry out, and share investigations that test and answer the question: “How do we know what makes a structure effective?” (NGSS: ETS 1-3)
<p><u>4 Cs</u> <i>Just a few examples of how this activity connects to the 4Cs</i></p>	<p><u>Communication/Collaboration:</u> At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs (NGSS:3-5-ETS1-2). <u>Critical Thinking/Collaboration:</u> Students will plan and conduct an investigation collaboratively to answer questions or test solutions to problems (NGSS:3-5-ETS1-3). <u>Creativity:</u> I can use an idea to create an original and useful product that responds to the challenge, investigation, or problem (NVUSD.CREATIVITY3/4.RUBRIC).</p>
<p><u>Materials</u></p>	<ul style="list-style-type: none"> Recommended literature to introduce concept: <u>Monsters Under Bridges</u> by Rachel Roellke Coddington, <u>Twenty One Elephants and Still Standing</u> by April Jones Prince <u>Images of the following bridges:</u> Golden Gate Bridge and Bay Bridge in San Francisco, CA (suspension bridges), new Maxwell Bridge in Napa, CA (beam bridge), Old Carquinez Bridge between Crockett and Vallejo, CA (truss bridge) vs. new Carquinez Bridge: Alfred Zampa Memorial Bridge (suspension bridge), Benicia-Martinez Bridge between Benicia and Martinez, CA (beam bridge), First Street Bridge in Napa, CA (arch bridge) Supplies for small group Bridge Building Activity (depends on the activity that you choose) Digital Cameras/Smart Phones/Tablets (to take pictures of bridges during exploration of the River Trail) Clipboards/Pencils/Paper (to record and draw pictures of bridges during exploration of the River Trail)
<p><u>Prerequisite</u></p>	<ul style="list-style-type: none"> arch bridge



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<p><u>Knowledge (Vocab.)</u></p>	<ul style="list-style-type: none">● suspension bridge● truss bridge● beam bridge● structure● function● (Chosen vocabulary from recommended literature used for the “Opener.”)
<p><u>Lesson Summary</u></p>	<p><u>Prior to Visiting the Vine Trail:</u></p> <ol style="list-style-type: none">1. Opener: Using your chosen Language Arts classroom practices, explore one of the recommended books from the materials list with your class.2. To connect the literature to Science and Engineering Concepts, view the Bill Nye the Science Guy, Season 1, Episode 14 on “Structures,” with your students. https://www.youtube.com/watch?v=WNSDjV_nnQ03. Create an anchor chart/pictorial of the 4 main different types of bridges: arch, suspension, beam, and truss. Discussion or venn diagram graphic organizers can be used to determine as well as compare and contrast how each of those bridge designs function and are effective.4. Check-In: Students play a matching game around the 4 main different types of bridges using images of each of the bridges indicated in the “Materials” section. <p><u>Vine Trail Field Trip:</u></p> <ol style="list-style-type: none">5. Students visit one or more of the bridges along the Vine Trail (indicated in “Part of the Trail” section). Use the following questions to guide a VTS group discussion while observing the bridge: “What is going on in this structure?” “What do you see that makes you say that?” “What more can you find?”6. Students draw pictures, record observations, and take pictures of the bridge(s). <p><u>Field Trip Follow- Up Classroom Activity:</u></p> <ol style="list-style-type: none">7. Students work in small groups to complete Bridge Challenge. Students will need to collaborate to decide which type of the four bridges they would like to construct. (There are several different resources that have different bridge building activities that each have different materials lists. I have provided a couple of those resources below in the “Additional Resources” section so that you can pick the activity that best fits your classroom and student needs.)8. Students present their bridges to the class, using details to describe how and why their structures will be effective as well as reasoning behind why they chose that specific structure.9. Students test their bridges by adding weight in small increments.10. Optional Extension: Students can make adjustments to their bridge designs and try the weight portion of the experiment again.



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	<p><u>Visual Arts Extension:</u> “Monet Water Lily Bridges” The following are some websites that have ideas for this project: http://elementary-art-rocks.blogspot.com.au/2013/04/grade-1-monet-bridge.html http://tippytoecrafts.blogspot.com/2012/08/monets-water-lilies.html http://www.dreamdrawcreate.com/2010/04/monet-inspired-art-work-by-grade-2.html http://elementaryartfun.blogspot.com/2015/04/claude-monets-garden-1st-grade.html</p> <p>Have an arts question or looking for different ideas? E-mail Shannon Hattyar at shattyar@nvusd.org</p>
<p><u>Part of Trail</u></p>	<ul style="list-style-type: none"> ● South Napa near Maxwell/Imola Bridge ● North Napa (new Vine Trail bridge between Trancas and Wine Country) ● Central Napa (First Street and Second Street Bridges)
<p><u>Additional Resources</u></p>	<ul style="list-style-type: none"> ● https://www.teacherspayteachers.com/Product/STEM-Engineering-Challenge-Picture-Book-Pack-Monsters-Under-Bridges-1104694 (Contains three different bridge building activities that each utilize different materials) ● http://www.scholastic.com/browse/lessonplan.jsp?id=1509 (Bridge building activity that utilizes popsicle sticks) ● http://historicbridges.org/b_a_county.php?county=Napa%20County,%20California (Historic bridges of Napa County)