Unit 3: Bridge Engineering and Design

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 1**
Length: **14 Days**
Status: **Published**

Summary

Students will design and build a balsa wood bridge. They will learn about the history of bridges and the many different types of bridges. Students will use basic engineering principles and design methods in designing and constructing their bridge.

Revision Date: June 2021

LA.W.6.4	Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)
LA.W.6.8	Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.
LA.SL.6.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.
LA.SL.6.4	Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate speaking behaviors (e.g., eye contact, adequate volume, and clear pronunciation).
SCI.MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
SCI.MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
CS.6-8.8.2.8.ED.1	Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
CS.6-8.8.2.8.ED.2	Identify the steps in the design process that could be used to solve a problem.
CS.6-8.8.2.8.ED.3	Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
CS.6-8.8.2.8.ED.5	Explain the need for optimization in a design process.
CS.6-8.8.2.8.ED.7	Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches).
CS.6-8.8.2.8.ITH.1	Explain how the development and use of technology influences economic, political, social, and cultural issues.
CS.6-8.8.2.8.ITH.2	Compare how technologies have influenced society over time.
WRK.9.2.8.CAP.1	Identify offerings such as high school and county career and technical school courses, apprenticeships, military programs, and dual enrollment courses that support career or occupational areas of interest.

WRK.9.2.8.CAP.3	Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.
TECH.9.4.8.CI.3	Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2).
TECH.9.4.8.CI.4	Explore the role of creativity and innovation in career pathways and industries.
TECH.9.4.8.CT.1	Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).
TECH.9.4.8.CT.3	Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.

Essential Questions/Enduring Understandings

Essential Questions:

How have bridges affected society throughout time?

What types of bridges are there?

Why are there so many types of bridges?

How are bridges designed, made, and tested?

How do bridges work?

What opportunities to bridges bridge to communities?

Enduring Understandings:

Bridges are one of the earliest technologies that served to make the world "smaller" and more interconnected.

Bridges have made it possible for people to quickly go to places that they would previously have to travel long distances by land or sea to get to.

From the earliest civilizations to modern day, bridges allowed for the easier transfer of language, information, culture, technologies, and goods.

Objectives

Students will know a variety of different types of bridges from the past and those used today.

Students will know the history of bridge design and engineering.

Students will know the roles that tension, torsions, compression, and shear forces play in bridge engineering and design.

Students will know how and why different types of bridges work in different situations and environments.

Students will know how to design a bridge based on bridge engineering and design concepts.

Students will know the vocabulary of bridge engineering and design.

Students will be skilled at using a ruler and grid paper to create the 2D drawing of their bridge design.

Students will be skilled at accurately measuring and cutting their balsa wood sticks as they construct their bridge.

Students will be skilled at identifying a technological problem and the use of the design process to create an appropriate solution.

Learning Plan

Introduction to Bridges: Students will participate in an interactive Nearpod slide lesson as they are introduced to bridges. In Nearpod they will answer this question: Why are there so many different types of bridges? The Nearpod activity will be the Bridges Overview slides, history of bridges, types of bridges, give students to see videos of failed bridges, let students go on virtual reality trips to the Golden Gate Bridge and to Roman aqueducts, along with a bridge and bridge stresses vocabulary matching activity.

Bridge Design: Students will explore the strongest shapes in nature through interactive demonstrations and YouTube videos. Students will also review bridge designs from around the world. The remainder of this activity will involve students using rulers and grid paper to draw out a 2D representation of the side view of their bridge. Students will follow precise requirements while being mindful of height and width constraints. Finally, students will also draw their top and bottom view of their bridges. Students will keep a digital portfolio of their work through the use of Google Slides where all steps of the Engineering Design Process are addressed and documented.

Bridge Construction and Testing: To complete this unit, students will use balsawood and construction glue to build their bridges. Students will place wax paper over their grid paper drawing and build the first side of their bridge, paying attention to precise measurements and using construction specific cutting tools. Students will then remove the wax paper and repeat the process to have two completed sides to their bridge. The top and bottom of the bridge will be constructed next. Students will connect all their pieces of their bridge together by using mini binder clips. Finally, students will test their designs using the bridge table to attach a bucket and block, and slowly add bags of sand to see how much weight it can hold as they test for efficiency. Students will complete their digital portfolio for this unit, including adding images of their designing, building, and testing stages. They will also review and analyze the data collected during building and testing.

Assessment

Formative:

Do Nows

Class Discussions

Nearpod assignment

Summative:

Bridge portfolio and reflection

Benchmark:

Google Forms

Exit tickets

Completion of 2D design for side, top and bottom drawings

Alternative:

Checklists

Verbal Discussions

Bridge design using CAD program

Materials

Chromebooks

Projector

Document camera

YouTube

Google Forms, Docs, Slides

Pencils

Grid paper

Wax paper

Ruler

Balsawood

Cardboard

Construction glue

Scissors

Masking tape

Mini binder clips

Bridge testing table (including chain, bucket, and sand bags)

Safety goggles

Paper towels

Integrated Accommodation and Modifications, Special Ed, ELLs, At-Risk, G & T, Career Education, 504s

See attached document:

https://docs.google.com/spreadsheets/d/1pzkODxxGOSxESwthnE0jQW8hVfMaZ9ygEBg5QsKBcDA/edit?usp=sharing