# Bridges

Content Area: **Science**
Course(s): **CP Introduction to Engineering**
Time Period: **Marking Period 2**
Length: **3 weeks**
Status: **Published**

## Course Pacing Guide

| Unit | MP/Trimester | Weeks |
|---|---|---|
| Bridges | 2 | 4 |

## Unit Overview

In this unit, students begin by researching bridges; different types of bridges, how bridges redistribute the load to the foot of the bridge, how to optimize the mass to load ratio of their bridge. After this initial research students work in groups choosing three different truss designs for testing and construct the truss out of 1/4" x 1/4" balsawood pieces, making each truss section 30 cm long. once constructed, they are put into a frame and a load is applied to the truss until it breaks. Based on the results of this testing the group then desides on the type of truss for their full bridge design. Students then construct a three dimentional bridge and again a load is applied to the bridge untill it fails and then the bridge is scored on a ratio of the mass the bridge held vs the mass of the bridge. Once groups get their results, they write a reflection piece about the challanges they encountered, how they overcame these challanges, what they would do differently, and what they took away from the project.

## Enduring Understandings

How truss design allows a structure to hold a greater load by redirecting the force.

Teamwork

## Essential Questions

How does truss design allows a structure to hold a greater load?

## New Jersey Student Learning Standards (No CCS)

| | |
|---|---|
| 9-12.HS-ETS1 | Engineering Design |
| 9-12.HS-ETS1-2 | Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. |
| 9-12.HS-ETS1-1.1 | Asking Questions and Defining Problems |
| 9-12.HS-ETS1-2.6.1 | Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. |
| 9-12.HS-ETS1-1.ETS1.A | Defining and Delimiting Engineering Problems |

## Amistad Integration

The Amistad Bill (A1301), which became law in 2002, calls on New Jersey schools to incorporate African-American history into their social studies curriculum.

This course does not fall in this category.

## Holocaust/Genocide Education

**a.** Every board of education shall include instruction on the Holocaust and genocides in an appropriate place in the curriculum of all elementary and secondary school pupils.

**This is not an approprate place in the curriculum**

## Interdisciplinary Connections

| | |
|---|---|
| CAEP.9.2.12.C.3 | Identify transferable career skills and design alternate career plans. |
| CAEP.9.2.12.C.4 | Analyze how economic conditions and societal changes influence employment trends and |

| | |
|---|---|
| | future education. |

## Technology Standards

| | |
|---|---|
| TECH.8.1.12.A.CS2 | Select and use applications effectively and productively. |
| TECH.8.1.12.B.CS2 | Create original works as a means of personal or group expression. |
| TECH.8.2.12.C.CS1 | The attributes of design. |
| TECH.8.2.12.C.CS2 | The application of engineering design. |
| TECH.8.2.12.D.CS1 | Apply the design process. |

## 21st Century Themes/Careers

| | |
|---|---|
| CAEP.9.2.12.C.3 | Identify transferable career skills and design alternate career plans. |
| CAEP.9.2.12.C.4 | Analyze how economic conditions and societal changes influence employment trends and future education. |

## Financial Literacy Integration

1. The State Board of Education shall require that a school district incorporate in each of the **grades [1][kindergarten] six[1] through eight** financial literacy instruction to pupils enrolled in those grades. The purpose of the instruction shall be to provide [1][elementary and][1]middle school students with the basic financial literacy necessary for sound financial decision-making.

This course does not fall in this range.

## Instructional Strategies & Learning Activities

In this unit, students begin by researching bridges; different types of bridges, how bridges redistribute the load to the foot of the bridge, how to optimize the mass to load ratio of their bridge. After this initial research students work in groups choosing three different truss designs for testing and construct the truss out of 1/4" x 1/4" balsawood pieces, making each truss section 30 cm long. once constructed, they are put into a frame and a load is applied to the truss until it breaks. Based on the results of this testing the group then desides on the type of truss for their full bridge design. Students then construct a three dimentional bridge and again a load is applied to the bridge untill it fails and then the bridge is scored on a ratio of the mass the bridge held vs the mass of the bridge. Once groups get their results, they write a reflection piece about the challanges they encountered, how they overcame these challanges, what they would do differently, and what they took away from the project.

## Differentiated Instruction

- Curriculum Map
- Inquiry/Problem-Based Learning
- Learning preferences integration (visual, auditory, kinesthetic)
- Tiered Learning Targets
- Learning through play
- Relationship-Building & Team-Building
- Self-Directed Learning
- Debate
- Student Data Inventories
- Mastery Learning (feedback toward goal)
- Goal-Setting & Learning Contracts
- Grouping
- Rubrics
- Flipped Classroom
- Mentoring
- Assessment Design & Backwards Planning

## Formative Assessments

Testing three different truss elements to determine the best one to use going forward.

## Summative Assessment

The final testing of the bridge by placing a load on the bridge until it breaks.

## Benchmark Assessments

N/A

## Alternate Assessments

The final testing of the bridge by placing a load on the bridge until it breaks is an alternative to the traditional

test given at the end of a unit.

## Resources & Technology

The research students do at the beginning of the assignment. Also the supplies used in the bridge building process.

## BOE Approved Texts

There is no text for this class

## Closure

Once groups get their results, they write a reflection piece about the challanges they encountered, how they overcame these challanges, what they would do differently, and what they took away from the project.

## ELL

- Teacher Modeling
- Group work
- Simplified Written and Verbal Instructions
- Google Translate

## Special Education

- Specify and list exactly what the student will need to learn to pass.
- Evaluate the classroom structure against the student's needs (flexible structure, firm limits, etc.).
- Keep workspaces clear of unrelated materials.
- Reduce visual distractions in the classroom (mobiles, etc.).
- Provide a computer for written work.
- Seat the student close to the teacher or a positive role model.
- Provide an unobstructed view of the chalkboard, teacher, movie screen, etc.
- Keep extra supplies of classroom materials (pencils, books) on hand.

- Maintain adequate space between desks.
- Give directions in small steps and in as few words as possible.
- Number and sequence the steps in a task.
- Have student repeat the directions for a task.
- Provide visual aids.
- Go over directions orally.
- Allow the student to complete an independent project as an alternative test.
- Grade spelling separately from content.
- Show a model of the end product of directions (e.g., a completed math problem or finished quiz).
- Stand near the student when giving directions or presenting a lesson.

## 504

Examples of accommodations in 504 plans include but are not limited to:

- preferential seating
- extended time on tests and assignments
- reduced homework or classwork
- verbal, visual, or technology aids
- modified textbooks or audio-video materials
- behavior management support
- adjusted class schedules or grading
- verbal testing
- excused lateness, absence, or missed classwork
- pre-approved nurse's office visits and accompaniment to visits
- occupational or physical therapy

*Add to or remove any of these as you see fit.

## At Risk

- Have student restate information
- Provision of notes or outlines
- Concrete examples
- Assistance in maintaining uncluttered space
- No penalty for spelling errors or sloppy handwriting
- Follow a routine/schedule
- Teach time management skills
- Verbal and visual cues regarding directions and staying on task
- Visual daily schedule
- Immediate feedback
- Work-in-progress check
- Pace long-term projects

- Cue/model expected behavior
- Use de-escalating strategies
- Use peer supports and mentoring
- Chart progress and maintain data

## Gifted and Talented

Focus on effort and practice

Offer the Most Difficult First

Offer choice

Speak to Student Interests

Allow G/T students to work together

Encourage risk taking