Unit 4: Structures and Forces

Content Area: **Technology**
Course(s): **Engineering Design 1**
Time Period: **December**
Length: **6 blocks**
Status: **Published**

Enduring Understandings

1. Structures are always under stress from forces whether it is from gravity, the environment, or people.

2. Dead loads are easy to plan for because they do not change while live loads are difficult to plan for because they are variable.

3. A material's properties will determine how it reacts to particular forces.

4. A certain material may perform well under one type of force and/or stress but poor under another type.

Essential Questions

1. How do different forces affect the design of a structure?

2. How can materials be combined together to create stronger structures?

3. How are forces distributed around a structure?

4. How does materials science influence the design of a structure?

5. What is the difference between designing structures effectively vs efficiently?

Content

Vocabulary:

Dead load, Live load, Compression, Tension, Bending, Torsion, Shear, Stress, Strain, Elastic deformation, Modulus of elasticity, Plastic deformation, Cantilever, Force, Static load, Dynamic load, Beam, Arch, Girder, Truss, Gusset, Bending moment, Newton, Tensile strength, Hooke's law, Structure, Load factor, Materials science, Natural structure, Man-made structure, Deflection, Material failure, Composite material

Skills

1. Evaluate a scenario to determine which forces are affecting a structure.

2. Calculate the amount of stress on a structure caused by a force.

3. Calculate the amount of strain on a structure caused by a force.

4. Calculate forces acting on a simply supported beam.

5. Calculate forces acting on a moment arm.

6. Manipulate a structural engineering computer program to design a bridge as efficient as possible.

Resources

Desktop computers

Structural testing software

Structural prototyping tools

Structural prototyping equipment

Structure testing device

Standards

TECH.8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
TECH.8.2.12.C.7	Use a design process to devise a technological product or system that addresses a global problem, provide research, identify trade-offs and constraints, and document the process through drawings that include data and materials.
TECH.8.2.12.D.1	Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.
TECH.8.2.12.D.3	Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.
TECH.8.2.12.D.4	Assess the impacts of emerging technologies on developing countries.
TECH.8.2.12.D.5	Explain how material processing impacts the quality of engineered and fabricated products.
TECH.8.2.12.D.CS1	Apply the design process.
TECH.8.2.12.E.1	Demonstrate an understanding of the problem-solving capacity of computers in our world.