Fairfax Collegiate
2026 Summer Program
Buildings and Bridges Course Syllabus
Rising Grades 4-6

Course Description

Build models of large structures.

Construct towers, bridges, domes, dams, and disaster-ready buildings.

Test materials, evaluate shapes and floorplans, create budgets, and refine blueprints.

Build load-bearing models, experiment with hydraulic mechanisms and waterproofing techniques, and simulate earthquakes.

Students gain experience in building, experimenting, and solving design challenges. This course introduces young engineers to the core ideas behind how structures stand, balance, and stay safe, while giving plenty of room for creativity. Students brainstorm, test, and improve their designs as they learn how engineers think and work. Many projects encourage teamwork as students build in pairs or small groups.

At the end of the course, families receive photos and videos of student work. Students leave with a stronger understanding of structural engineering and the confidence to take on bigger building design or STEM challenges.

Learning Objectives

Course Goals	**Structural Design:** Students explore the research, planning, and budgeting that goes into building a home, school, or other structure. **Components of Structures:** Students discover the different types of materials used in structures such as buildings and garages. Through various hands on projects, they will understand the benefits and drawbacks of using different materials **Safety Testing:** Students learn the importance of safety testing. They will experiment with developing structures that resist harm from natural disasters such as earthquakes, hurricanes, and tornadoes. **Blueprints:** Students learn about blueprints for various categories of structures. They will apply

	their knowledge to create and refine blueprints for the structures they build. **Teamwork:** Students collaborate on creating more complex structures that combine the introductory principles that they have learned.
Course Topics	**Building on a Budget:** Students are tasked with building common public structures with budget and resource constraints **Construction Materials & Technology:** Students explore the evolution of technology and material science that shapes the modern structural engineering. **Optimization:** Students assess existing structures and propose modifications to make them more water resistant, energy efficient, and/or sustainable. **Resisting Disaster:** Students build and test the safety of a hydraulic bridge, simulate the effects of natural disasters on the structures they build, and learn to plan ahead for natural disasters **Geometric Exploration:** Students experiment with incorporating various geometric shapes in their structures to improve strength and durability.

Course Schedule

Class Meeting 1	**Pre-Test: Building a House:** Students are given a certain amount of materials to build a house using the knowledge that they already have. **Introduction to Structural Engineering:** Students participate in an icebreaker and be introduced to the activities, concepts, and applications of this course. **Engineering Design Process:** Students learn about the flow of the engineering design process.
Class Meeting 2	**Properties of Materials in Structures:** Students learn about the purposes for various materials in structures. **Model Parking Garage:** Students learn about how parking garages are engineered and will construct a model parking garage.
Class Meeting 3	**Model Parking Garage:** Students learn about how parking garages are engineered and will construct a model parking garage. **Introduction to Bridges:** Students are introduced to the fundamentals of bridge engineering and building. **Basic Bridges:** Students choose one bridge configuration previously introduced to them and build it in groups.
Class Meeting 4	**Hydraulic Bridges:** Students understand how hydraulic bridges are engineered as they build their own.

	Flimsy Bridges: Students manipulate flimsy materials to create load-bearing bridges
Class Meeting 5	**Tower Building:** Students explore how strong towers are engineered to be load-bearing and weather-resistant. **Tower Building:** Students explore how strong towers are engineered to be load-bearing and weather-resistant.
Class Meeting 6	**Earthquake Simulator:** Students learn how engineers design and construct buildings to withstand earthquake damage by building their own model structures using toothpicks and marshmallows. They experiment to see how earthquake-proof their buildings are by testing them in an earthquake simulated in a pan of Jell-O®. **Waterproofing:** Students investigate the properties of various flimsy materials to determine which one is best for waterproofing a roof
Class Meeting 7	**Design A Dam:** Students learn how dams are designed and created and then have the opportunity to engineer their own. **Design A Dam:** Students learn how dams are designed and created and then have the opportunity to engineer their own.
Class Meeting 8	**Design A Dome:** Students explore and investigate the role of geometry in designing a geodesic dome. **Design A Dome:** Students explore and investigate the role of geometry in designing a geodesic dome.
Class Meeting 9	**Solar Panels:** Students learn about how solar panels work and observe how they can harness solar energy to provide heat and electricity. **Solar Panels:** Students learn about how solar panels work and observe how they can harness solar energy to provide heat and electricity. **The Super Structure:** Students synthesize the knowledge of structural engineering from this session to design, create, and test the durability of a structure given a specified budget.
Class Meeting 10	**The Super Structure:** Students synthesize the knowledge of structural engineering from this session to design, create, and test the durability of a structure given a specified budget. **The Super Structure:** Students synthesize the knowledge of structural engineering from this session to design, create, and test the durability of a structure given a specified budget.