KEY CONCEPTS (BOULDER BUILDERS)

- Tents are among the earliest structures invented and built by humans. They are still used today.
- Important factors to consider in tent construction include structure, function and tension.
- Since tents provide temporary shelter, they should be easy to assemble and disassemble.
- Tents must be designed to adapt to the environment and provide protection from natural elements.
- The purpose of a bridge is to provide passage from one landmass to another when the distance between the two is impassable.
- Most bridges fit into one of three categories: beam, arch or suspension.
- Deciding what type of bridge to build depends primarily on the length between two landmasses.
- Bridges are strong when their forces of tension are balanced.
- Builders must determine what characteristics make a structure strong, yet attractive.
- Builders must incorporate techniques that will prevent a structure from crumbling under natural influences, such as earthquakes.
- Builders must ensure that the earth beneath a future structure will be able to support it.
- Builders must be able to destroy a weak structure without damaging adjacent structures.
- The job of a good builder combines a variety of skills with imagination to create a worthwhile structure.
- Architects consider both function and aesthetics when designing a building.
- Spiders build elaborate living spaces with strong materials that also function as food traps.
- Burrowing animals fashion tunnels that incorporate techniques used by humans. These include ventilation, protection from weather/ intruders and different living spaces within a structure to accommodate various needs.
- Most birds fashion structures capable of bearing weight greater than the weight of the nest itself and that can withstand all types of weather.

OBJECTIVES

- Explore form and structure by creating an original two- or three-dimensional tent design.
- See how blueprints provide a guide for building through the transferal of original ideas on paper to a final three-dimensional model.
- Discover how various concepts, such as tension, structure, function, skeleton and skin, are essential for tent construction by arranging poles, guide ropes and coverings on a tent.
- Discover ways to make tents waterproof, windproof and durable by testing a completed model.
- Determine the strength of beam and arch bridges by devising and testing prototypes using chairs and sheets of paper.
- Explore how a suspension bridge works by building a prototype using two chairs and cables.
- Discover basic building strategies by constructing a model structure.
- Explore strength principles by building a model that can withstand outside forces.
- Test the strength of a building by applying movement similar to an earthquake.
- Learn techniques for destroying a building (through implosion) without damaging adjacent structures.
- Go on a scavenger hunt to search for different shapes/forms found within architectural structures.
- Create buildings that are both functional and aesthetically appealing.
- Create a structure with a balance of tension by designing a spider web that will catch and hold a plastic insect.
- Consider what principles must be used to create an unobstructed path in a shelter by creating an animal burrow/tunnel.
- Explore weight-bearing principles by building a nest that is capable of supporting a live load.

COMMON CORE STATE STANDARDS FOR MATHEMATICS ALIGNED TO BOLDER BUILDERS (TM) K-5

COUNTING AND CARDINALITY

- K.CC1 Count to 100 by ones and by tens.
- K.CC2 Count forward beginning from a given number within the known sequence (instead of having to begin at 1).
- K.CC6 Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.

OPERATIONS AND ALGEBRAIC THINKING

- 1.OA1 Use addition and subtraction within 20 to solve word problems involving situation of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, eg., by using objects, drawings, and equations with symbol for the unknown number to represent the problem.
- 1.OA6 Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on: making ten (e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 + 14): decomposing a number leading to a ten (e.g., 13 - 4 = 13 - 3 - 1 = 10 - 1 = 9): using the relationship between addition and subtraction (e.g., knowing that 8 + 4 = 12, one knows 12 - 8 = 4): and creating equivalent but easier or known sums (e.g., adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 13).
- 2.OA1 Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.
- 2.OA2 Fluently add and subtract within 20 using mental strategies.

NUMBER & OPERATIONS IN BASE TEN

- K.NBT1 Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by drawing or equation (e.g., 18 + 10 + 8): understand that these numbers are composed of ten ones and one two, three, four, five, six, seven, eight, ore nine ones.
- 1.NBT4 Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones: and sometimes it is necessary to compose a ten.
- 2.NBT5 Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

NUMBER & OPERATIONS-FRACTIONS

- 5.NF3 Interpret a fraction as division of the numerator by the denominator (a/b = a ÷ b). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem.

MEASUREMENT & DATA

- K.MD1 1. Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
- 1.MD4 Organize, represent, and interpret data with up to three categories: ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.
- 4.MD5 Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:

  a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a “one -degree angle,” and can be used to measure angles.

GEOMETRY

- K.G1 Describe objects in the environment using names of shapes, and describe the relative positions of these objects

using terms such as above, below, beside, in front of, behind, and next to.

- K.G2 Correctly name shapes regardless of their orientations or overall size.
- K.G4 4. Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts.
- 1.G2.2 Compose two-dimensional shapes or three-dimensional shapes to create a composite shape, and compose new shapes from the composite shape.
- 3.G2 Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole.
- 6.G4 Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY IN HISTORY/SOCIAL STUDIES, SCIENCE, AND TECHNICAL SUBJECTS ALIGNED TO BOLDER BUILDERS (TM) K-5

WRITING STANDARDS

- Range of Writing

1. Write routinely over extended time frames (time for research, reflections, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

SPEAKING AND LISTENING

- Comprehension and Collaboration

1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

- Presentation of Knowledge and Ideas

4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

5. Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

6. Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

LANGUAGE

- Conventions of Standard English

1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

- Knowledge of Language

3. Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

NEXT GENERATION SCIENCE STANDARDS ALIGNED TO BOLDER BUILDERS (TM) K-5

PHYSICAL SCIENCE

K-PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

- K-PS2-1. Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.

1-PS4 WAVES AND THEIR APPLICATIONS IN TECHNOLOGIES FOR INFORMATION TRANSFER

- Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.

2-PS1 MATTER AND ITS INTERACTIONS

- 2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- 2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.*
- 2-PS1-3. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.

3-PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

- 3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
- 3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

4-PS3 ENERGY

- 4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- 4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.

4-PS4 WAVES AND THEIR APPLICATIONS IN TECHNOLOGIES FOR INFORMATION TRANSFER

- 4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

5-PS1 MATTER AND ITS INTERACTIONS

- 5-PS1-3. Make observations and measurements to identify materials based on their properties.

5-PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

- 5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.

LIFE SCIENCE

K-LS1 FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES

- K.LS.1 Use observations to describe patterns of what plants and animals (including humans) need to survive.

1-LS1 FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES

- 1.LS.1 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

4-LS1 FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES

- 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

EARTH AND SPACE SCIENCES

K-ESS2 EARTH'S SYSTEMS

- K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.

K-ESS3 EARTH AND HUMAN ACTIVITY

- K-ESS3-3. Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.

2-ESS1 EARTH'S PLACE IN THE UNIVERSE

- 2-ESS1-1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly.

3-ESS3 EARTH AND HUMAN ACTIVITY

- 3-ESS3-1. Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

4-ESS2 EARTH'S SYSTEMS

- 4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

4-ESS3 EARTH AND HUMAN ACTIVITY

- 4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

5-ESS3 EARTH AND HUMAN ACTIVITY

- 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

ENGINEERING DESIGN

K-2-ETS1 ENGINEERING DESIGN

- K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

3-5 ETS1 ENGINEERING DESIGN

- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3. 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.