Description
During this lesson, students will apply knowledge of homes from the past to design and construct a home that can withstand a windstorm. They will focus on shapes and materials that ensure the strength of the home. Each home design will include five required elements: a sleeping area, a cooking area, a bathroom, an entry door and a roof.

Grade Levels	Objectives	Grade Levels in adaptations (Appendix A)
1-2	Students will: • Sketch the interior model of the home. • Create an exterior model of the home. • Explain how the design (e.g., shape) of the structure helps with the stability and function of the home. • Compare and contrast their structure to a historical picture of a home.	• K, 4, 9-12, after school

Duration	Tech Tips
Three to five 50-minute sessions	Our Tech Tips and their accompanying videos can be found here. • Assessment • Framing the Challenge • Innovation Design Process • Prototyping • Sharing Solutions • The Language of Engineering • What is Engineering?

Standards Connections

Note: Bolded parts of the standards are fully met by this lesson.

- ***NGSS*** PE K-2-ETS1-2. Engineering Design: **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.**
- **NGSS Disciplinary Core Ideas (DCI)**
  Developing Possible Solutions (ETS1.B)
  Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solution.
- **NGSS Science and Engineering Practices (SEP)**
  2. Developing and Using Models:
    - **Develop a simple model based on evidence to represent a proposed object or tool.**
- **NGSS Crosscutting Concepts (CCC)**
  6. Structure and **Function**:
    - **The shape and stability of structures of natural and designed objects are related to their function.**

Content Standards

This lesson is written with a connection to the 1st grade **CA Social Studies standard 1.4 (Students compare and contrast everyday life in different times and places around the world and recognize that some aspects of people, places, and things change over time while others stay the same.)** This challenge can be adapted for a variety of social studies content standards over various grade levels:

- CA History-Social Science K.6.3: Students understand that history relates to events, people, and places of other times. Understand how people lived in earlier times and how their lives would be different today (e.g., getting water from a well, growing food, making clothing, having fun, forming organizations, living by rules and laws).
- CA History-Social Science 4.2.5: Students describe the social, political, cultural, and economic life and interactions among people of California from the pre-Columbian societies to the Spanish mission and Mexican rancho periods. Describe the daily lives of the people, native and nonnative, who occupied the presidios, missions, ranchos, and pueblos.
- CA History-Social Science 9-12 Chronological and Spatial Thinking #2: Students analyze how change happens at different rates at different times; understand that some aspects can change while others remain the same; and understand that change is complicated and affects not only technology and politics but also values and beliefs.
- Skill Building: Participants work in groups where they practice skills such as team building, collaboration, and use of effective communication.

For more information on those connections and applications, see section C and Appendix A.

Set up and Prep for Classroom	Set Up and Prep for Student Work Area

• Arrange building materials around the room from which students will choose to build their structure.
• Place on worktables the sample pictures of **historical** buildings connected to your grade level content area. See Appendix A.
• Copies of Desired **Features** Checklist. See Appendix D. (One per student or team.)
• Set up a Test Area that includes:
  • Building site on a sturdy platform.
  • Lego® or another similar figurine.
  • Fan, lid, or blow dryer to simulate a windstorm.
  • Whiteboard and dry erase marker for **interior** sketches..
	• Individual white board to do interior sketches. If unavailable, use a sheet of paper in a clear plastic sheet protector and a dry erase marker. Students can also use a sheet of paper, grid, or graph paper on a clipboard.
	• Sturdy platform such as a piece of cardboard on which to build the structure. (One per student.)

Materials (per class of 32 students)*

Structural pieces (~150 total)
- Stiff paper (e.g. index cards, construction paper)
- Paper plates
- Tin foil
- Wood stick-like pieces of varying lengths and diameters (e.g. dowels, pencils, chopsticks, etc.)
- Rocks of various sizes and shapes
- Plastic pieces of various sizes and shapes (e.g. beads, buttons)
- Fabric - pre-cut pieces ranging from 3 in to 1.5 ft squares and rectangles.
- Pre-cut string, twine, or rope in lengths of 1 to 2 ft.

Connectors (~150 total)
- Glue stick (one per student)
- Masking tape (one roll per student)
- Modeling compounds (clay, play dough)
- Binder clips
- Brads
- Rubber bands

Other materials
- 1 base per student. Options include:
  - 1 8.5" x 11" whiteboard
  - 1 8.5" x 11" sheet of cardboard with 1 sheet of white copier paper in a plastic sleeve
  - 1 8.5" x 11" grid or graph paper on a clipboard
- Lego® or figurine
- Fan or large plastic container lid to simulate a windstorm
- White board (or other blueprint drawing)
- Pencils (1 per student)
- Erasers (1 per student)
- Scissors (1 per student)
- Rulers (1 per student)

Make materials accessible to students so they can see what is available and organize by type. Send teams to the table one at a time or have one member from each team access the materials. See Tech Tip: Materials Strategies for Engineering Design for more materials management suggestions.
*Many of these materials are suggestions based on what students have found useful. It is not necessary to have all building materials. Feel free to use materials you have on hand that may be useful for your learners. Think creatively!

A. Introduction

This lesson is designed to be used as either an inquiry-based learning experience, with the content standard introduced and taught after the initial design challenge, or as an application of previously covered content material. Part C gives guidance on connections to the content standard. Appendix A provides suggestions on modifications for connections to other grade level content standards.

1. Lead a discussion to introduce the concept of engineering. Tech Tip: What is Engineering? provides information on discussing engineering, problem solving and creative thinking with youth.
2. Explain to students that they are going to solve a problem as historic engineers. Discuss students' prior knowledge of housing and migrations. Reference pictures of Sample Historic Homes (see Appendix D).
   - *Throughout history, some people have lived in one place while others have **migrated** or moved from place to place. However, all people have used different structures for homes. Some people decide to live in cities, while some live in the country.*
   - *Why do some people live in one place while others move around?* Possible answers include: People may be fleeing from danger, following food sources, avoiding weather, or looking for new jobs.
   - *What makes a person decide to live in a certain place?* (Possible answers include: People may want to be close to work, away from traffic, away from crowded areas, or close to family.
   - *Look at the pictures around the room. How are they the same?* Possible answers include: They all have a place to sleep. They all have a place to make food.
   - *What makes a home useful and safe?* Possible answers include: It has enough space for everyone. It protects people from rain, cold and other weather.
   - *How might the **past** inspire our designs?* Possible answers include: We use the same **shapes**.
3. Discuss what students know already about how people design homes and build them.
   - *Who has seen a new building being built?*
   - *What happens before making a new building?* Possible answers include: The building is drawn so that the construction workers know exactly how to build it.
   - Explain that **architects** are people who design buildings and makes **models** and plans to give to a builder**.** Students will be architects in the following challenge.
4. Introduce the engineering challenge scenario that students will be working to solve. For modifications for grades K, 4, and 9-12 Social Studies Standards, see Appendix A.
   - *The Paradise fires in Northern California destroyed a whole town quickly and displaced many families, many of whom had to move to new cities or rebuild.* How can we be prepared for future situations where housing is needed quickly?
     - Show students the following video or have before and after pictures of the Paradise fire available to show the real-life problem. Video link: https://youtu.be/K9cvNO92Jek.

B. Design Challenge

1. Discuss necessary background information with students.
   - Review and discuss shapes and desired features in images of historical homes like those found in the Sample Historical Homes hand-out in Appendix D.
   - Tell students that as architects, they will be using the engineering design process and will be making and testing models or prototypes just like architects and engineers do. Tech Tip: Innovation Design Process and Tech Tip: Prototyping provide additional facilitation strategies for this discussion.

2. Introduce the engineering design challenge

Design Problem Working as an architect, sketch an **interior** model of a new home for a resident of Paradise, California. Then construct a physical model.
1-2: Desired Features • Sketch the interior on the base. • Build a model of the **exterior** that stands on its own (making this a 3-dimensional model). • The home must include five components: a sleeping area, a cooking area, a bathroom, an entry door and a roof. • Other elements of a home may be added if desired and if materials are available. • The entry door must be of sufficient height that a person represented by a Lego® figurine can get through easily. • The house must stand up by itself and may not be taped or tied to the base. • Budget: Use only the materials provided. • Schedule: 30 minutes.
Testing • Compare and contrast model to pictures of historic buildings. • Lego® person can gain access to interior of the building. • Let go of the model to test if it can stand on its own.

Desired features should be part of your discussion, so students can help identify the features which may affect their solution. See Tech Tip: Framing the Challenge.

3. Explain the two components of this challenge: base and **structure**.
   - On the base, learners should draw the inner walls of their home. They may also draw furniture to show the purpose of each room. Using dry/wet erase pens or a pencil will allow for easier iteration on their designs.
   - Teams should use additional materials to build the outside walls, roof and functioning door of their structure.
4. Give students 30 minutes to collect materials and build. As students design ask questions. Suggested questions:
   - *Which materials are easiest to work with? Why?* Possible answers include: Foil and stiff paper can be bent but still hold their shape and stand on their own. *(DCI;SEP)*
   - *Which materials are hard to work with? Why?* Possible answers include: You can't change the shape of rocks, fabric does not stand on its own.
   - *What is the best way to connect the materials together so the house can stand on its own?* Possible answers include: Connect each part to the base. Connect each part to one or more other parts. *(DCI;SEP)*
   - *How can the shape of a structure help it stand on its own?* Possible answers include: Balanced shapes that have at least two sides touching the ground tend to stand on their own. *(CCC)*
   - *How can the shape of a structure make it fall down easily?* Possible answers include: Unbalanced shapes or shapes with just one side touching the ground tend to fall over easily. *(CCC)*
5. Share solutions

When build time is over, lead the class in final testing and demonstration of their designs. For ideas on a possible facilitation protocol see Tech Tip: Sharing Solutions. Suggested share-out questions:

- **Comparing solutions**
  - *In which models would it be easy and comfortable to live? Why? (CCC)*
  - *Which models stand on their own? How are they able to do this? (CCC)*

- **Iteration**
  - *Are our houses missing anything? What would make the houses more comfortable places to live?* (CCC)
  - *What materials or shapes would allow the houses to be sturdier so that they keep their shape and stand on their own?* (CCC)
- **Optimal Design**
  - *Were any materials used that weren't really needed? Which ones?*

6. Have students reflect on the materials used to develop their design solution and the properties and functions of those materials.
   - *Which shapes did you use when building your home?* (CCC)
   - *Which shapes seem sturdiest? How can you tell?* Possible answers include: Triangles and arches tend to stand easily on their own and hold their shape even when you push on them. (CCC)
   - *Which materials work best when building a sturdy structure that can stand on its own? Why?* Possible answers include: Wood pieces keep their shape. They can hold up the building. (CCC)

C. Content Learning

1. Circle back to the original scenario and design problem. Ensure students make connections about dwellings from the past in urban, suburban, and rural areas, and the need for new homes now and in the future.
   - If this activity is being used as an inquiry-based approach, introduce new content material and learning about the content standard.
   - If this activity is being used as an application of previously covered material, review and expand on students' knowledge and understanding.
   - After introduction or review of content, spend time connecting the engineering challenge to the iteration that learners will do next with the appropriate content standard.
2. To help students apply their knowledge of historical people and their homes, review the solutions that students came up with during build time. One way to strengthen connections between the engineering challenge and content is to use questions such as:
   - *What determines where you might put a front door in a house?* Possible answers include: A front door would allow people to enter from the street or front of the house and would go into a public part of the house. (CCC)
   - *What materials would you include in your design that are like a home from the past?* Possible answers include: We might use sturdy materials that can stand on their own or materials found close to where the home will be built. (CCC)
   - *What shapes do we see in the homes of the past?* Possible answers include: Homes of the past used different shapes like triangles, rectangles, circles and half-circles or arches. Learners can point these out in the Sample Historical Homes hand-out in Appendix D. (CCC)
   - *Why do you think those shapes were used?* Possible answers include: Rectangles and circles provide a lot of space inside. Triangles and arches stand on their own, keep their shape and are hard to push over. (CCC)
3. Prepare students to iterate on their design by incorporating what they know about historic homes. Tell them that in the next challenge, they will need to make sure their models can stand in the wind.
   - *When you look at the homes of the past, which of these homes do you think would withstand the wind the best? Why do you think so?*
   - *What is one new shape or material you would like to use in your next design? Why?* (CCC)

D. Iterate Design Solutions

1. After share out and discussion about the models, have students return to their work area to iterate on their device. Introduce changes to the scenario/design problem.

- Changes to challenge: Models will be tested against a natural element—wind.
- Lead a discussion on how weather might affect a building design.
  - *How would you design a building that would need to shelter from a lot of rain or snow?* Possible answers may include: The building should be water-proof and have a steep roof and gutters that help the rain to move off of the house. (CCC)
  - *How would you design a desert building to protect people from very hot temperatures during the day and very cold temperatures at night?* Possible answers may include: The building should be made of materials that keep the heat in and the cold out.
- Real-world problem connection/reasoning for change
  - Explain that wind speeds in Paradise, CA average 6 miles per hour and can get up to 12 mph. In the next challenge, learners will construct a model that can withstand a windstorm, simulated by a fan.

2. Remind students of the design problem they are working to solve and desired features they are working within.

Design Problem
Sketch and build a model structure that is stable and functional with inspiration from historical photos.
1-2 Desired Features • Sketch the interior on the base. • Build a model of the exterior that stands on its own. • The home must include five components: a sleeping area, a cooking area, a bathroom, an entry door and a roof. • Other elements of a home may be added if desired and if materials are available. • The entry door must be of sufficient height that a person represented by a Lego® figurine can get through easily. • The house must stand up by itself and may not be taped or tied to the base. • The house must withstand 30 seconds of wind without falling over. • Budget: Use only materials provided. • Schedule: 20 minutes to sketch and build.
Testing • Compare and contrast model to pictures of buildings. • Lego® person can gain access to the interior of the building. • Use a fan to simulate wind directed towards the student's structure. Wind can be simulated in many ways depending on what is available and the desired level of difficulty. A structure placed approximately 1 ft from a box fan on high speed will simulate winds of 6 mph. A lighter wind can be simulated using a lower speed, increasing the distance or creating a "hand fan" using a plastic lid or paper plate. Be consistent in distance and strength of wind to ensure fair testing.

3. Have teams reflect on changes they would like to make to their design.
   - *What are you planning to change? How will this make your design better?*
   - *What is a part of another team's design that worked well that you might try in your design?*
   - *What design features in past homes would you like to include in your design? Why?*
   - *Which home from the past do you think would be able to stand up in windy weather? Why do you think that?* Refrain from giving students an answer so they can test their ideas. (CCC)
4. As students work, circulate throughout teams to ensure that learners are keeping in mind shapes and materials that will withstand wind, as well as the ways in which they plan to incorporate an idea from a historic home into their own.
5. Lead a second class share-out and discussion. Be sure to have students explain the improvements they made, why they made them, and what historical home helped inspire their changes. For ideas on a possible

facilitation protocol, see Tech Tip: Sharing Solutions.

- *How does the shape of your structure allow it to withstand wind?* (CCC)
- *What is one change you made in your model to help it withstand wind or to make it more stable? How did you know to do this?* (SEP)
- *What shapes do you notice stand up best in the wind?*
    - Guide learners to notice shapes that allow the wind to flow around them such as round buildings or buildings with many different surfaces, while flat surfaces allow the wind to push over or move a structure. Learners can observe this phenomenon by placing different shapes in the wind to see how each behaves.

6. After teams have tested and shared their design iterations, discuss the connections between homes the class designed and homes of the past.
    - *How was the home you built different from the homes of the past?* (DCI)
    - *How is the home you built similar to the homes of the past?* (DCI)

E. Evaluation

Formative assessment and evaluation of student learning is integrated throughout this lesson. This section summarizes suggestions for implementing summative evaluation and creating authentic experiences for students around design challenges and learning by sharing their work. For additional guidance on assessment, see Tech Tip: Assessment.

Having students participate in an authentic presentation or discussion of their work is a great way to reinforce that they, too, are engineers and that their work should be shared with community and the public in similar ways. Finding some way to bring students' work to a larger audience also helps to build on the idea that engineers help people in creative ways and are part of something larger than themselves.

1. What are we assessing?
    - Remember, students are not being graded on whether their design was successful or not in meeting all the desired features of the challenge. The most important part of design challenge learning is the process, helping students develop their skills to work through difficult problems and persevere through failure.
2. The rubric in this lesson is designed to evaluate student mastery of the "met" standards using the following categories: Below Standard, Approaching Standard, Meeting Standard, and Above Standard. This allows you to give individual feedback, particularly for students who are Below Standards or Above Standards in specific areas. For examples of rubrics and information on assessing learning with rubrics, see Tech Tip: Assessment.
    - In the Below Standards and Above Standards sections of the rubric, the goal is that no student receives these ratings without individualized support from the educator – either as remediation or as an extension to reach students where they are.
    - The descriptions and observations in these two sections are examples of what you might see for students performing at that level. Comments and notes in these sections should be tailored to individual students and accompanied by individualized support and conversations.
3. Review the Student Rubric and Performance Assessment Checklist: Educator and Student Versions. See Appendix D to become familiar with the criteria used in evaluating student success. The student version of the Performance Assessment Checklist is included to help explain expectations in simple terms for students.
4. Review the final assessment project with students and explain the connections between the design challenge and assessment.
    - Explain that for the final showcase, learners will be taking on the role of an architect for a **city** (a place with a large population, size or importance) with a rapidly growing population. The city needs well-

designed, functional, and stable structures that meet the needs of families. The city will be testing each design for stability.
- Have students present three things: a sketch, model, and verbal description of the similarities and differences between their design and historical evidence. Assessment will focus on:
  - Inclusion of all five components of a home.
  - Student explanation of how the shapes of their design affect its function.
  - Learner explanation of at least one similarity and difference to historical homes.
  - Description of at least one change made to the design.
- Make copies of the Performance Assessment Checklist so students can keep track of their progress and presentation points.

5. Invite adults or an older class of students to act as city representatives. Provide the following list of questions to ask as they display their models:
   - *What are the parts of your home in your model?* (DCI)
   - *How does your structure remind you of a historical building of the past? How is it different?*
   - *Describe which shapes you used. Why did you use these shapes?* (CCC)
   - *What is one change you made to your model? Why did you make this change?* (SEP)

Appendix A – Grade Level Modifications

While written to address a first grade standard focused on comparing and contrasting everyday life in different places around the world, this unit is applicable to other grade level standards. Below are some ways to modify the scenario and design problem to address different grade level standards.

General modifications for different grade bands:

- Grades K-2: Engineering challenges in this grade band ask students to design for "desired features" rather than specific criteria and constraints.
- Grades 3-5: In this grade band, criteria and constraints are introduced and, during share-outs, students are guided to focus on failure points, as well as changes they want to make during iterations.
- Grades 6-8: In this grade band, students should participate in generating and agreeing upon the criteria and constraints for engineering challenges.

Specific modifications for individual grade levels:

Kindergarten CA History-Social Science K.6: Students understand that history relates to events, people, and places of other times. 3. Understand how people lived in earlier times and how their lives would be different today (e.g., getting water from a well, growing food, making clothing, having fun, forming groups, living by rules and laws).
A – Intro and Scenario • Wampanoag life and Pilgrim life are different from today's life. Their houses were also different.
B – Design Problem • Build a Wampanoag house, or • Build a Pilgrim house.
C – Content Connections and Adaptations • Primary source evidence: Let's Find Out magazine and video, or • Books about the Wampanoag and Pilgrim life.
D – Iterating Design Solutions • Lego® or figurine must fit through the door.
E – Assessment • Display models at the library during Thanksgiving week.

4th Grade

CA History-Social Science 4.2: Students describe the social, political, cultural, and economic life and interactions among people of California from the pre-Columbian societies to the Spanish mission and Mexican rancho periods.

5. Describe the daily lives of the people, native and nonnative, who occupied the presidios, missions, ranchos, and pueblos.

A – Intro and Scenario

- Study the different California regions and analyze the homes of Native Americans in each region.
- Explain that Native Americans could not deep plow their land and had to move their villages often to find new fertile land. As a result, their houses were often made of few lightweight materials.

B – Design Problem

- Build a model from a group in one of the regions and compare it with a different group to determine the similarities and differences.

Criteria:

- Sketch of the interior must include each room in the structure: sleeping area, cooking area, bathroom, entry door, and roof using historical evidence to represent these as realistically as possible.
- Build a model of the exterior that stands on its own and has a roof using materials available to the selected group.
- Identify similarities and differences to historical pictures.
- Entry must be able to open repeatedly to allow entry but also close to block out the weather.

Constraints:

- Model must fit on the workspace provided.
- Use only materials provided.
- Limit of 10 structural pieces.
- Set time limit to construct model.

C – Content Connections and Adaptations

- Primary source evidence: Use photos of historic homes.
- Visit historic buildings when possible.

D – Iterating Design Solutions

- Test your model for stability.
- Dwelling must stand in high winds (produced by a box fan) and the inside of the home must stay dry in a rainstorm (produced by 3 sprays of water from a spray bottle).

E – Assessment

- Explain attributes that make the model functional for the region for which it was constructed.
- Explain evidence that supports how people lived and the materials they had available to them.

9th-12th Grade

CA History-Social Science 9-12 Chronological and Spatial Thinking:

2. Students analyze how change happens at different rates at different times; understand that some aspects can change while others remain the same; and understand that change is complicated and affects not only technology and politics but also values and beliefs.

A – Intro and Scenario

- Analyze how homes changed in California throughout its history due to the advancement of technology.

B – Design Problem

- Californians face many unique problems such as earthquakes and wildfires. How can homes be built using modern technology that address these specific concerns?

Criteria:

- Sketch of the interior must include each room in the structure: sleeping area, cooking area, bathroom, entry door, and roof to a given scale (e.g., 1 in = 1 ft).
- Build a model of the exterior that stands on its own and includes a roof. Model should be built to a stated scale.
- Identify similarities and differences to homes built over 100 years ago.

Constraints:

- Model must fit on workspace provided.
- Stay within a budget. Educator will assign prices to each material. Your house must cost no more than $100,000 to build.
- Set time limit to construct model.
- House must be a reasonable height for the scale given.

C – Content Connections and Adaptations

- Primary source evidence: Use pictures of homes built in California throughout its history.
- Students research new materials and building techniques that prevent earthquake and fire damage.

D – Iterating Design Solutions

- Test initial structure on shake table.
- Iterate model to withstand earthquakes using researched building innovations.

E – Assessment

- Create a model town with each student contributing a different home.
- Students pitch their home design and why specific technologies used should be incorporated into new building codes.

After School

9. Skill Building: Participants work in groups where they practice skills such as team building, collaboration, and use of effective communication.

A – Intro and Scenario

- Design and create a model playhouse for the students to use as part of a new playground.

B – Design Problem

- Design a house for all ages to use during play. Create rules, procedures, and expectations for the home.

Criteria:

- Sketch of the interior must include each room in the structure: sleeping area, cooking area, bathroom, entry door, and roof.
- Build a model of the exterior that stands on its own and has a roof.
- Lego® figurine must fit through the door.

Constraints:

- Model must fit on provided workspace.
- Use only the materials provided.
- Set time limit to construct model.

C – Content Connections and Adaptations

- Primary source evidence: Explore different actual homes or fantasy homes.

D – Iterating Design Solutions

- Have students modify their homes to allow youth in wheel chairs to easily access the home.

E – Assessment

- Present your home to another class in the afterschool program.

Appendix B – Vocabulary

The following is a suggested list of words to discuss as you progress through this lesson with students. For more in-depth information about vocabulary, see Tech Tip: The Language of Engineering.

Term	Student-friendly definition
architect	A person who designs buildings and makes models and plans to give to a builder.
city	A place where many people live close together.
exterior	Outside of something.
feature	An important part of something.
function	The action or purpose of something.
historical	From the past.
interior	Inside of something.
migration	Movement of people or animals from one place to another.
model	An example or miniature version of something.
neighbor	A person who lives near another.
past	The time that happened before now.
present	The time that is now.
shape	The form or outline of an object.
solution	An answer to or explanation of a problem.
structure	A building.
urban	Within a city.

Appendix C – Resources and References

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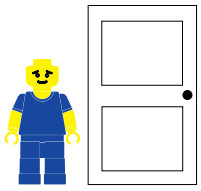
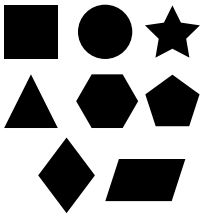
Appendix D – Lesson Handouts

Looking to the Past to Build the Future: Worksheet

Name:_____

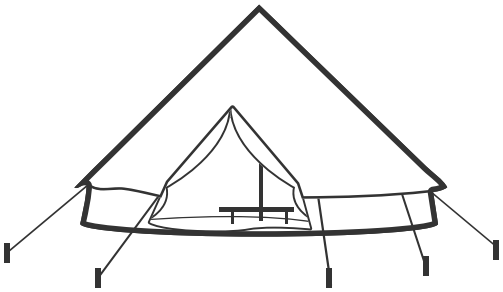
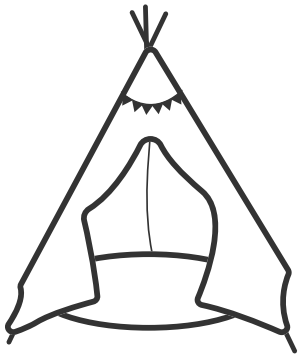
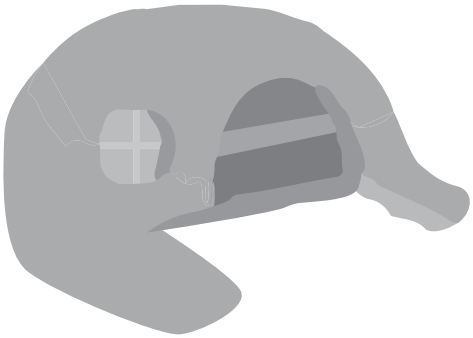
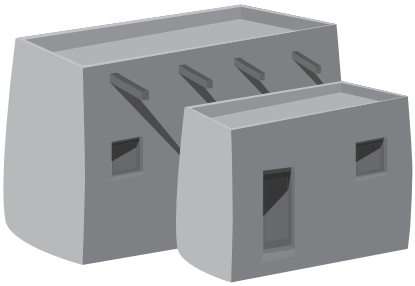
Date:_____

Desired Features Checklist

Features		**#1**	**#2**
	A place to cook and eat		
	A sleeping area		
	A bathroom		
	A door for Lego® person to pass through		
	A roof		
	Inspiration from historical evidence		
	Shapes in my design		

Sample Historical Homes

The following are images for inspiration to use to connect to the content area for grades K, 1, and 2. Educators should select from their own grade level the appropriate primary source evidence to use in this design challenge. See grade level modifications.

Pioneer Log Home 	**Yurt** 
Wigwam 	**Tepee** 
Earth Shelter 	**Mud Home** 

Performance Assessment Checklist: Educator Version

Student:_____

Date:_____ Historical Home Inspiration:_____

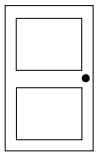
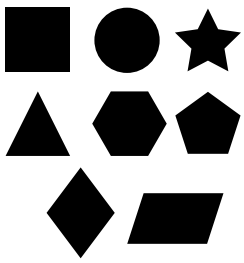
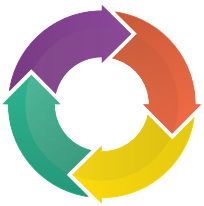
As students do their mock presentations as architects to city planners on their design, use the following checklist to assess student learning. These items align directly to the rubric.

First Design	Second Design
❑ Sketches interior structure of home. ❑ Models exterior of structure with materials provided. ❑ Designs door so symbolic person can enter/exit. ❑ Explains the components of their home (sleeping area, cooking area, bathroom, entry door, and roof). ❑ Explains one similarity to homes of the past (historical evidence): *"What is the same about your design and the pictures of past homes?"* ❑ Explains one difference between model and historical home of the past: *"What is different from past homes?"* ❑ Explains how shape helps design: *How does the shape of your structure allow someone to live there?"* ❑ Explains how shape affects stability: *"How does the shape of your structure help it to stand on its own?"*	❑ Sketches interior structure of home and meets the five required components of home. ❑ Models exterior of structure with materials provided. ❑ Explains the five components of their home. ❑ Designs door so symbolic person can enter/exit. ❑ Explains one similar shape used to a home of past (historical evidence). *"What is one shape in your design that is similar to a home from the past?"* ❑ Explains one difference between the shapes used in the model from a historical home of the past: *"What is one shape in your design that is different from a home from the past?"* ❑ Explains how the design will withstand wind: *"How does the shape of your structure allow it to withstand wind?"* ❑ Iteration: Explains at least one change made to the model based on wind or another test result. *"What is one change you made in your model to make it withstand wind or to make it more stable? How did you know to do this?"*

Performance Assessment Checklist: Student Version

Name:_____

Date:_____

Desired Features		**✓ Done**
	Model the exterior	
	Sketch the interior	
	A door for Lego® person to pass through	
	Show and tell about all the desired features on the checklist	
	Show shapes that are the same and different from a home from the past Tell how the shape of your home protects it from the wind	
	Tell one thing you changed to your home and why	

Student Rubric

NGSS PE: K-2-ETS1-2. **Engineering Design: 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.**

	Below Standard	Approaching Standard	Meeting Standard	Above Standard
(NGSS DCI) ETS1.B Developing Possible Solutions **Designs can be conveyed through sketches, drawings or physical models. These representations are useful in communicating ideas for a problem's solution to other people.**	*Areas that individual students may need one-on-one support with:* • Sketching the interior of home. • Selecting materials to build exterior of home.	• Only interior of home sketched or only exterior of home built. • Sketch and/or model does not include all desired features (bedroom, cooking area, bathroom, entry door, and roof).	• Sketch and model include an entry door, a bedroom, a place to cook, a bathroom, and a roof. • Student can describe and locate the entry door, bedroom, kitchen, bathroom, and roof in sketch and model.	*Areas where students may exceed:* • Model of structure is detailed and realistic (e.g., working door). • Sketch is thorough and detailed with more items than those assigned. *Ideas for next steps for growth:* • Have students demonstrate how to apply skills to a new model of interest to them (e.g., playground equipment).
(NGSS SEP) Developing and Using Models **(K-2) Develop a simple model based on evidence to represent a proposed object or tool.**	*Areas that individual students may need one-on-one support with:* • Noticing different characteristics of historical homes to inspire their own design. • Understanding the desired features checklist.	• One solution tried and documented. No modifications made. • Explanation does not include comparison to a historical home.	• Explains a similarity and a difference to homes of the past. • Explains at least one change made to the model based on test data.	*Areas where students may exceed:* • Compares and contrasts two or more features of their model with historical evidence. *Ideas for next steps for growth:* • Interior of structure is inspired by historical evidence.
(NGSS CCC) Structure and Function **(K-2) The shape and stability of structures of natural and designed objects are related to their function.**	*Areas that individual students may need one-on-one support with:* • Identifying common shapes. • Noticing attributes of stable structures and shapes.	• Explains at least one way that the shape of their structure helps their design function; however, their explanation may not be completely accurate. • Identifies similar shapes between their model and historical homes but may struggle with identifying a different shape.	• Explains at least two ways that the shape of their structure helps their design function as a home (standing on its own and during a windstorm). • Accurately identifies at least one similar and one different shape in their model compared to historical homes.	*Areas where students may exceed:* • Identifies multiple shapes in their sketch and model. *Ideas for next steps for growth:* • Student can identify the purpose of the shapes used in their sketch and model. • Student can observe and test different shapes for stability under different conditions to notice how different shapes behave.