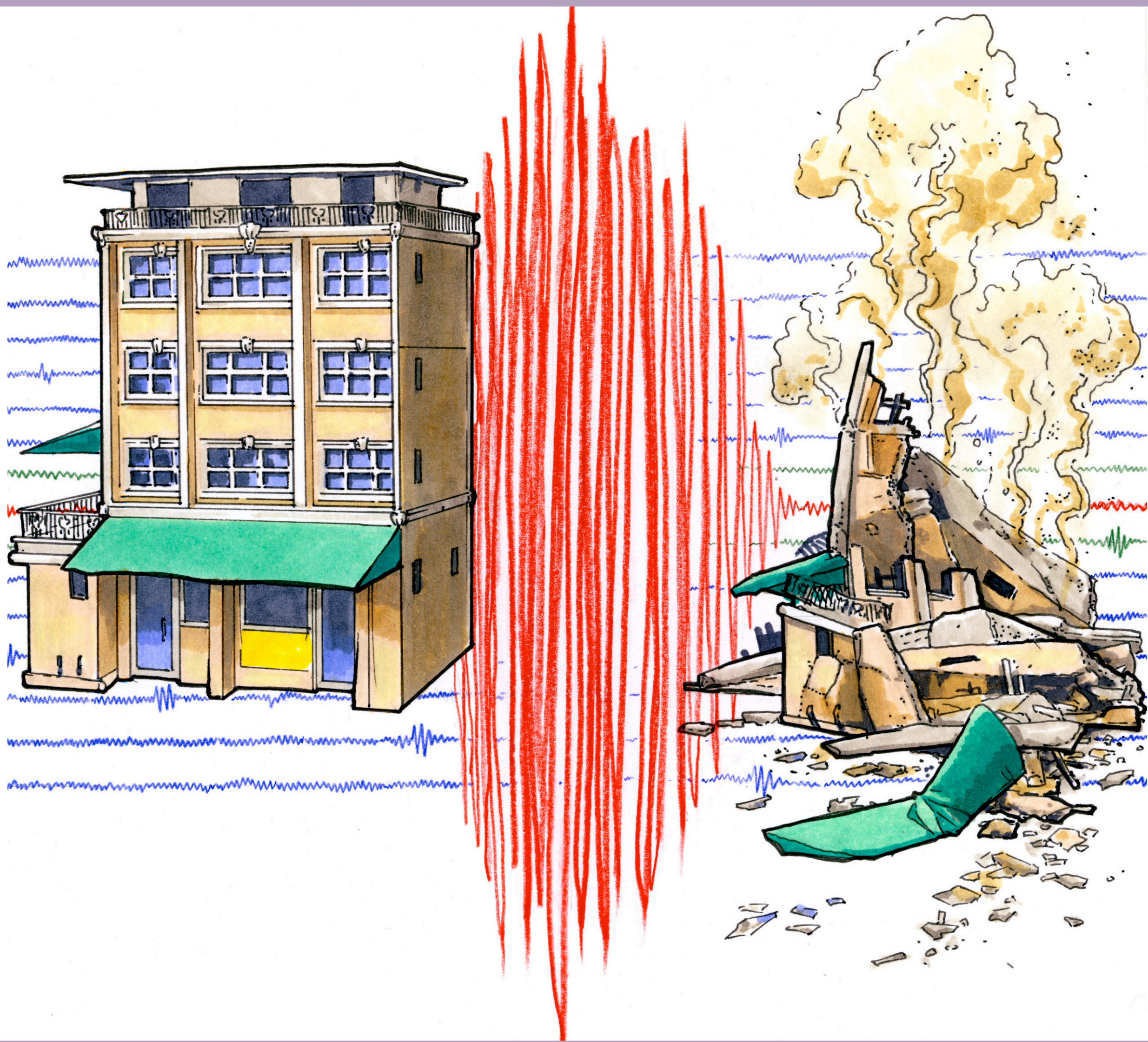
Engineering Adventures℠

Shake Things Up: Engineering Earthquake-Resistant Buildings

Earthquake Engineering for Out-of-School Time • Grades 3-5



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Engineering is Elementary® | Engineering Adventures
Developed by the Museum of Science, Boston

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Pilot Sites for Shake Things Up

This unit would not be possible without the valuable feedback from our pilot sites!

- Boys and Girls Club of Greater Sacramento, Sacramento, CA
- Boys and Girls Club of La Habra, La Habra, CA
- Boys and Girls Club of the South Coast Area, San Clemente, CA
- Bridgepoint Academy, Miami, FL
- Brown School Explorers, Somerville, MA
- Carolina Friends School, Durham, NC
- Charlestown Boys and Girls Club, Boston, MA
- City Gate, Washington, DC
- Columbus Afterschool, Medford, MA
- Comal ISD, New Braunfels, TX
- Cummings 21st Century Afterschool, Winthrop, MA
- Dazzling Discoveries, New York, NY
- Eagleview Elementary, Thornton, CO
- Education Connection, Westport, CT
- Ellis Memorial, Boston, MA
- For Kids Only Afterschool, Revere, MA
- For Kids Only Afterschool, Salem, MA
- High Rocks Educational Corporation, Hillsboro, WV
- Jefferson Village School, Jefferson, ME
- Jordan Boys and Girls Club, Chelsea, MA
- Latchkey Afterschool and the Frost School, Lawrence, MA
- Latchkey Afterschool and the Wetherbee School, Lawrence, MA
- Malden YMCA, Malden, MA
- Meadowvale Elementary School, Havre de Grace, MD
- Mustard Seed School, Hoboken, NJ
- Neah Bay Elementary COAST Program, Neah Bay, WA
- New Hingham Regional Elementary School, Chesterfield, MA
- Pittston Consolidated School, Gardiner, ME
- Roberts Elementary Afterschool, Medford, MA
- Russell Youth Center, Cambridge, MA
- Sacramento START / Winn Elementary School, Sacramento, CA
- Saint Paul’s Resource Center, Mattapan, MA
- Samuel Kennedy Elementary, Sacramento, CA
- Seashore Family Literacy Center, Waldport, OR
- Silvia Elementary, Fall River, MA
- South Boston Boys and Girls Club, Boston, MA
- Swampscott Middle School, Swampscott, MA
- Swift Waters After School, Boston, MA
- The Community Group, Lawrence, MA
- UCLA, Los Angeles, CA
- United South End Settlements, Boston, MA
- West Hills S.T.E.M. Academy, Bremerton, WA
- Woodlake Elementary, Sacramento, CA
- Yawkee Boys and Girls Club, Roxbury, MA
- YMCA Greater Boston, Boston, MA
- YMCA San Luis Obispo County - Shandon After School, Shandon, CA
- YWCA Southeastern MA, New Bedford, MA

Unit Map

Here is an overview of the adventures in this unit and how they all fit together.

Prep Adventure 1: What is Engineering?
Kids engineer a tower and are introduced to the Engineering Design Process as a problem-solving tool.

Prep Adventure 2: What is Technology?
Kids explore the idea that they, as engineers, can design and *improve* technology.

Adventure 1: A Shaky Situation
Kids are introduced to the problem: how can we stop buildings from being damaged during an earthquake?

Adventure 2: Building Skeletons
Kids explore how earthquakes impact buildings of different heights and shapes.

Adventure 3: Stop the Slide
Kids engineer ways to stop their buildings from sliding off the shake table.

Adventure 4: Getting Braces
Kids engineer ways to stop their buildings from changing shape during a test on the shake table.

Adventure 5: Creating an Earthquake-Resistant Building
Groups *plan, create*, and test their buildings on the shake table.

Adventure 6: Improving an Earthquake-Resistant Building
Groups *improve* their initial designs, test them, and finalize their building codes.

Adventure 7: Engineering Showcase
Groups present their final designs and share their knowledge of the Engineering Design Process.

Table of Contents

Introduction

Adventures

About Engineering is Elementary

Engineering is Elementary® (EiE) fosters engineering and technological literacy among children. Most humans spend over 95% of their time interacting with technology. Pencils, chairs, water filters, toothbrushes, cell phones, and buildings are all technologies—solutions designed by engineers to fulfill human needs or wants. To understand the world we live in, it is vital that we foster engineering and technological literacy among all people, even young children! Fortunately, children are born engineers. They are fascinated with building, taking things apart, and how things work. Engineering is Elementary harnesses children's natural curiosity to promote the learning of engineering and technology concepts.

The EiE program has four primary goals:
Goal 1: Increase children's technological literacy.
Goal 2: Increase educators' abilities to teach engineering and technology.
Goal 3: Increase the number of schools and out-of-school time (OST) programs in the U.S. that include engineering.
Goal 4: Conduct research and assessment to further the first three goals and contribute knowledge about engineering teaching and learning.

The first product developed by the EiE program was the Engineering is Elementary curriculum series. Designed for use in elementary school classrooms, this curriculum is hands-on, research-based, standards-driven, and classroom-tested. For more information about EiE, visit: www.eie.org.

In 2011, EiE began development of Engineering Adventures (EA), a curriculum created for 3rd-5th grade children in OST environments. EA is designed to provide engaging and thought-provoking challenges appropriate for the OST setting. More information about EA can be found online at: www.engineeringadventures.org.

In 2012 the Engineering Everywhere (EE) curriculum was created. EE is designed to empower middle school-aged children in OST settings to become engineers and solve problems that are personally meaningful and globally relevant. For more information, visit: www.engineeringeverywhere.org.

EiE is a part of The National Center for Technological Literacy (NCTL) at the Museum of Science, Boston. The NCTL aims to enhance knowledge of technology and inspire the next generation of engineers, inventors, and innovators. Unique in recognizing that a 21st century curriculum must include today's human-made world, the NCTL's goal is to introduce engineering as early as elementary school and continue through high school, college, and beyond. For more information, visit: www.nctl.org.

About Engineering Adventures

The mission of Engineering Adventures (EA) is to create exciting out-of-school time activities and experiences that allow *all* 3rd-5th grade learners to act as engineers and engage in the engineering design process. Our goal is to positively impact children's attitudes about their abilities to engineer by providing materials uniquely appropriate for the varied landscapes of out-of-school time settings.

The main ideas that guide the developers of EA are listed below.

We believe kids will best learn engineering when they:

- engage in activities that are fun, exciting, and connect to the world in which they live.
- choose their path through open-ended challenges that have multiple solutions.
- have the opportunity to succeed in engineering challenges.
- communicate and collaborate in innovative, active, problem solving.

Through EA units, kids will learn that:

- they can use the Engineering Design Process to help solve problems.
- engineers design technologies to help people and solve problems.
- they have talent and potential for designing and improving technologies.
- they, too, are engineers.

As kids work through their engineering design challenges, they will have the opportunity to build problem solving, teamwork, communication, and creative thinking skills. Most importantly, this curriculum is designed to provide a fun learning opportunity for kids!

For more information on Engineering Adventures, please visit:
www.engineeringadventures.org.

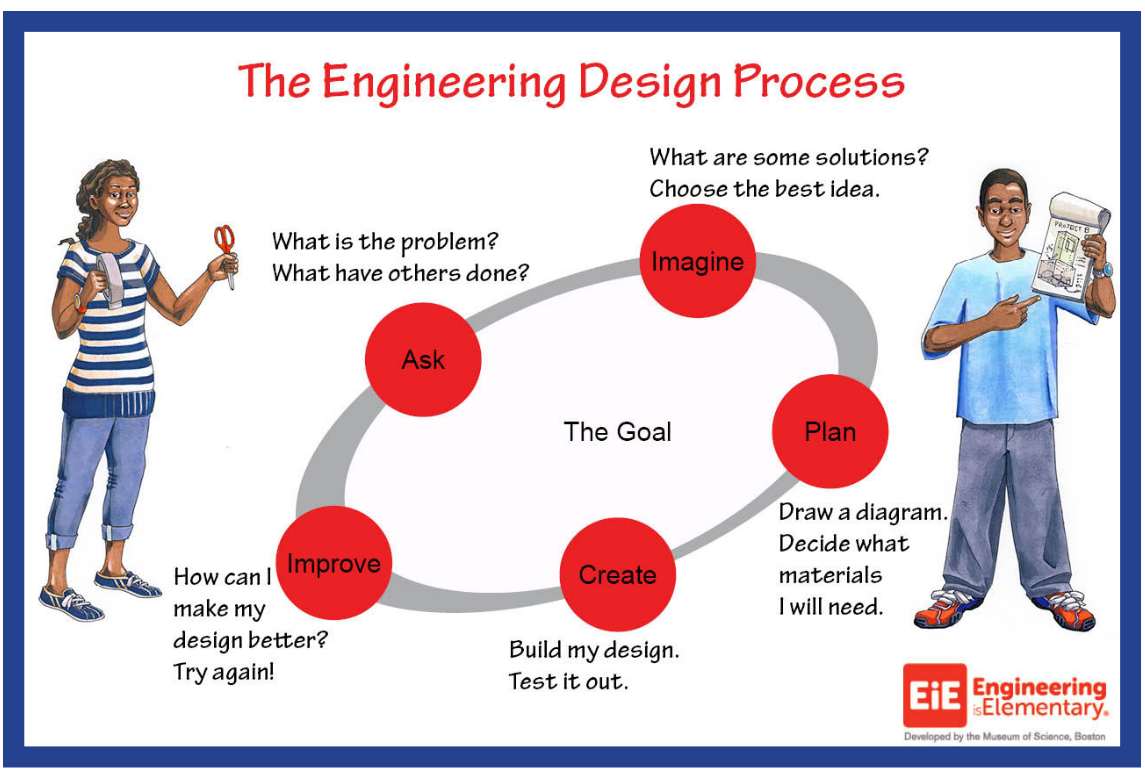
The Engineering Design Process

The Engineering Design Process (EDP) is the backbone of each Engineering Adventures (EA) unit. It is a five step process that guides kids in solving engineering challenges. Our goal for each EA unit is for kids to understand the EDP can not only help them solve problems in engineering but also in other areas of their lives.

While there are many other versions of the EDP that are used in academic and professional settings, the EiE team developed a five step process that is accessible for elementary school kids. India and Jacob, a fictional world-traveling brother and sister duo, introduce and guide kids through the Engineering Design Process in each unit. There are also questions for the educator to ask and sections in the Engineering Journal to provide an opportunity for kids to reflect on and discuss the process.

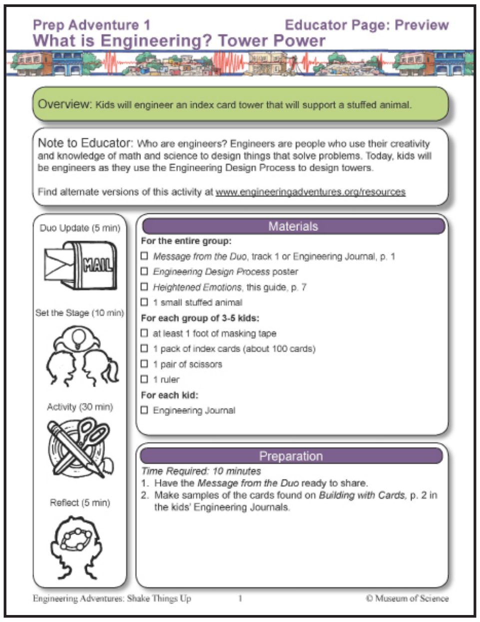
The EDP begins with the goal; the engineering challenge kids are asked to solve. The process is cyclical and flexible, kids can start a challenge at any step and may jump around to steps as they are engineering. For example, it is very common for kids to be creating their technology, but then ask questions about materials and imagine new ways to improve their design. In EA units, kids generally start with the *ask* step, then have time to *imagine* and *plan* their designs, then *create* and *improve* their technologies.

To further highlight the EDP throughout the unit, the steps are italicized in the guide. Below is the Engineering Design Process used in the Engineering Adventures units.



Each Engineering Adventure Includes

Preview pages with relevant background information, materials list, preparatory instructions, and a preview of the journal pages needed.



Prep Adventure 1 Educator Page: Preview
What is Engineering? Tower Power

Overview: Kids will engineer an index card tower that will support a stuffed animal.

Note to Educator: Who are engineers? Engineers are people who use their creativity and knowledge of math and science to design things that solve problems. Today, kids will be engineers as they use the Engineering Design Process to design towers.

Find alternate versions of this activity at www.engineeringadventures.org/resources

Duo Update (5 min)

Set the Stage (10 min)

Activity (30 min)

Reflect (5 min)

Materials

For the entire group:
- ☐ *Message from the Duo*, track 1 or Engineering Journal, p. 1
- ☐ *Engineering Design Process* poster
- ☐ *Heightened Emotions*, this guide, p. 7
- ☐ 1 small stuffed animal

For each group of 3-5 kids:
- ☐ at least 1 foot of masking tape
- ☐ 1 pack of index cards (about 100 cards)
- ☐ 1 pair of scissors
- ☐ 1 ruler

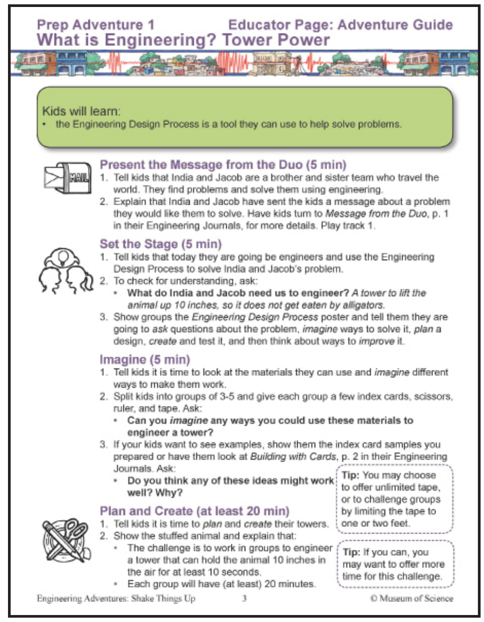
For each kid:
- ☐ Engineering Journal

Preparation

Time Required: 10 minutes
1. Have the *Message from the Duo* ready to share.
2. Make samples of the cards found on *Building with Cards*, p. 2 in the kids' Engineering Journals.

Engineering Adventures: Shake Things Up 1 © Museum of Science

An **Adventure Guide** with step-by-step instructions, including discussion questions, extension ideas, and tips.



Prep Adventure 1 Educator Page: Adventure Guide
What is Engineering? Tower Power

Kids will learn:
- the Engineering Design Process is a tool they can use to help solve problems.

Present the Message from the Duo (5 min)
1. Tell kids that India and Jacob are a brother and sister team who travel the world. They find problems and solve them using engineering.
2. Explain that India and Jacob have sent the kids a message about a problem they would like them to solve. Have kids turn to *Message from the Duo*, p. 1 in their Engineering Journals, for more details. Play track 1.

Set the Stage (5 min)
1. Tell kids that today they are going be engineers and use the Engineering Design Process to solve India and Jacob's problem.
2. To check for understanding, ask:
   - **What do India and Jacob need us to engineer?** *A tower to lift the animal up 10 inches, so it does not get eaten by alligators.*
3. Show groups the *Engineering Design Process* poster and tell them they are going to *ask* questions about the problem, *imagine* ways to solve it, *plan* a design, *create* and test it, and then think about ways to *improve* it.

Imagine (5 min)
1. Tell kids it is time to look at the materials they can use and *imagine* different ways to make them work.
2. Split kids into groups of 3-5 and give each group a few index cards, scissors, ruler, and tape. Ask:
   - **Can you *imagine* any ways you could use these materials to engineer a tower?**
3. If your kids want to see examples, show them the index card samples you prepared or have them look at *Building with Cards*, p. 2 in their Engineering Journals. Ask:
   - **Do you think any of these ideas might work well? Why?**

Tip: You may choose to offer unlimited tape, or to challenge groups by limiting the tape to one or two feet.

Plan and Create (at least 20 min)
1. Tell kids it is time to *plan* and *create* their towers.
2. Show the stuffed animal and explain that:
   - The challenge is to work in groups to engineer a tower that can hold the animal 10 inches in the air for at least 10 seconds.
   - Each group will have (at least) 20 minutes.

Tip: If you can, you may want to offer more time for this challenge.

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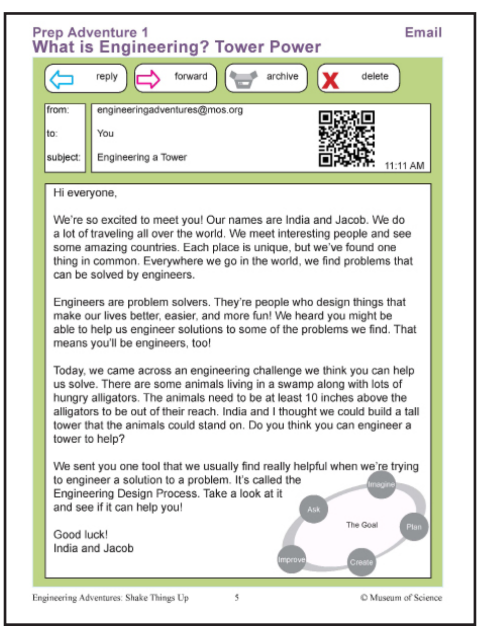
A **Message from the Duo**, India and Jacob, with information about the day's adventure.



Prep Adventure 1 Email
What is Engineering? Tower Power

reply forward archive delete

from: engineeringadventures@mos.org
to: You
subject: Engineering a Tower
11:11 AM

Hi everyone,

We're so excited to meet you! Our names are India and Jacob. We do a lot of traveling all over the world. We meet interesting people and see some amazing countries. Each place is unique, but we've found one thing in common. Everywhere we go in the world, we find problems that can be solved by engineers.

Engineers are problem solvers. They're people who design things that make our lives better, easier, and more fun! We heard you might be able to help us engineer solutions to some of the problems we find. That means you'll be engineers, too!

Today, we came across an engineering challenge we think you can help us solve. There are some animals living in a swamp along with lots of hungry alligators. The animals need to be at least 10 inches above the alligators to be out of their reach. India and I thought we could build a tall tower that the animals could stand on. Do you think you can engineer a tower to help?

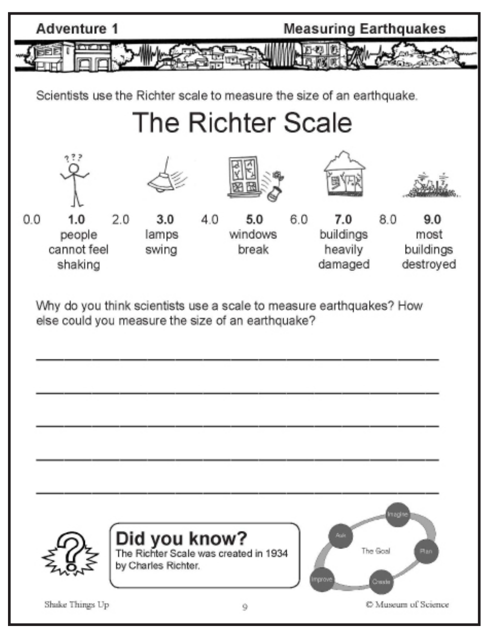
We sent you one tool that we usually find really helpful when we're trying to engineer a solution to a problem. It's called the Engineering Design Process. Take a look at it and see if it can help you!

Good luck!
India and Jacob

Imagine Plan Create Improve Ask The Goal

Engineering Adventures: Shake Things Up 5 © Museum of Science

Engineering Journal pages that allow kids to record findings and reflect on their learning.



Adventure 1 Measuring Earthquakes

Scientists use the Richter scale to measure the size of an earthquake.

The Richter Scale

0.0 | **1.0** people cannot feel shaking | 2.0 | **3.0** lamps swing | 4.0 | **5.0** windows break | 6.0 | **7.0** buildings heavily damaged | 8.0 | **9.0** most buildings destroyed

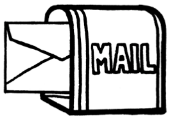
Why do you think scientists use a scale to measure earthquakes? How else could you measure the size of an earthquake?

Did you know?
The Richter Scale was created in 1934 by Charles Richter.

Imagine Plan Create Improve Ask The Goal

Shake Things Up 9 © Museum of Science

The Sections of the Adventures



Messages from the Duo

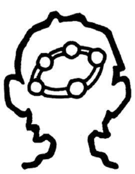
Messages from India and Jacob, a fictional world-traveling brother and sister duo, are provided as a quick, exciting way to present the real-world context for the unit's engineering challenge. Providing a context helps kids to understand the challenge and motivates them to find solutions. If you have access to a CD, MP3 player, or iOS device, we strongly suggest using the audio recordings, although reading the emails aloud will convey the same information.

Set the Stage (Ask)

The Set the Stage, or Ask, part of each adventure provides important information and questions that prepare kids for the main activity. During this section, you might ask questions prompting kids to share their prior knowledge, have them predict what they will find, or remind them of criteria that will help them as they engineer. This sets your kids up to succeed and feel confident in their ability to engineer.

Activities

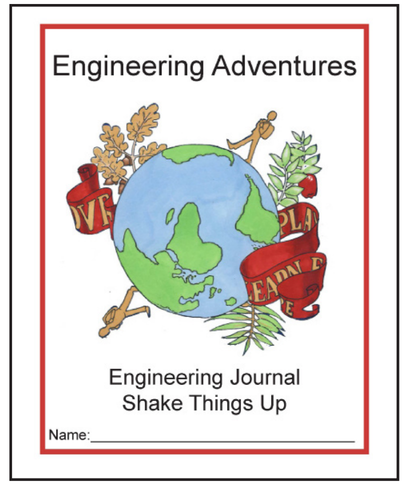
The activities are designed to get kids thinking and working together to solve the unit's engineering design challenge. As the educator, it is your role to guide kids through these activities by encouraging them to pursue and communicate their own ideas, even if you think they may not work. In engineering, there are no right or wrong answers! Every problem has many possible solutions and multiple ways to reach them.



Reflect

Each adventure includes 5-10 minutes at the end for kids to communicate with their peers by sharing their work. This gives kids the chance to discuss new ideas, think about their own work and the work of others, and reflect on what was learned. Group reflection can help reduce competition by encouraging kids to support each other as they move through the Engineering Design Process. For more individual reflection, each adventure also includes time for kids to record thoughts and ideas in their Engineering Journal.

Engineering Journals



Make a copy of the Engineering Journal for each kid as you begin working on this EA unit. The Engineering Journal is a central location for kids to record their thoughts and ideas as they move through the unit. It includes recording pages that will guide kids through the Engineering Design Process, poses questions, and prompts kids to reflect on their learning. The 5-10 minutes kids spend with their journals during each adventure will allow them to create a personalized record of their engineering learning.

There are a few ways you can use the Engineering Journal. You may want to have groups share one Engineering Journal as a central recording spot for all group data and findings. This allows group members who enjoy writing and recording to do so. You may also encourage groups to share the responsibility by having group members rotate who records for each adventure.

The back page of each Engineering Journal is a passport page from the country or state in which the unit takes place. Kids are encouraged to stamp the passport page when they finish a unit and collect the pages from all of the units they have completed.

Alternate Prep Adventures

The two prep adventures, "*What is Engineering?*" and "*What is Technology?",* introduce kids to engineering and technology. "*What is Engineering?*" gives kids the chance to collaborate, experience a mini hands-on engineering challenge, share out their designs, and learn about the Engineering Design Process. This adventure sets the stage for what kids can expect in the rest of the unit.

"What is Technology?" has kids interact with technologies, working with the definition that a technology is any thing designed by humans to help solve a problem. Most kids think of technology as things that can be plugged into the wall. They do not realize that the items that they interact with everyday, including pencils, paper, and water bottles, are also technologies. This adventure introduces the definition of technology that the kids will refer to as they engineer their own technologies to solve the problem presented in the unit.

There are alternate activities for both of these adventures available online in the Resources section at www.engineeringadventures.org. If kids complete multiple units, you may want to use an alternate activity to refresh the concepts in these activities. There may also be an activity that is more active or would be a better fit for the kids in your program. If you have questions about these activities, please email engineeringadventures@mos.org.

What You Need to Know **Before** Teaching an EA Unit

Engineering is fun.

The EA team hears this from many OST educators and kids. Engineering is really a way of problem solving—a way of thinking about the world—that is often very fun and creative. Any time you need to solve a problem in order to reach a goal, you are engineering.

There are no right or wrong answers.

There are often many great ways to solve the same problem. Not only is this a good engineering lesson for the kids in your program, it is a good life lesson.

It is okay to try it out!

It can be very helpful to try out the engineering challenge yourself—either beforehand or right alongside the kids in your program as they work through the adventures. This can help you understand the challenges the kids might face.

Scheduling the Adventures

Each adventure requires 45-60 minutes of teaching time. We recommend that you budget at least 9-14 hours in order to complete this unit, as some adventures may occasionally go longer than expected.

You can schedule this unit in several ways: once a week, several times a week, or daily. It is also possible to group certain adventures together. The chart below shows which adventures are easily taught together. Use this chart to help you plan your schedule.

Prep Adventure 1: What is Engineering? Tower Power Prep Adventure 2: What is Technology? Technology Detectives	2-3 hours
Adventure 1: A Shaky Situation Adventure 2: Building Skeletons	2-3 hours
Adventure 3: Stop the Slide Adventure 4: Getting Braces	2-3 hours
Adventure 5: Creating an Earthquake Resistant Building Adventure 6: Improving an Earthquake Resistant Building	2-3.5 hours
Adventure 7: Engineering Showcase: Shake Things Up	1-1.5 hours

Tips and Tricks for Teaching the Unit

Post a Daily Agenda

Giving kids a sense of the day's adventure will help them to plan ahead and manage their time during the activity.

Facilitate Teamwork

Being able to work well in teams is an important skill for any engineer. You may want to assign team roles to help kids if they struggle with teamwork. Possible roles include: the recorder, the materials gatherer, the tester, and the presenter.

Timing

As groups are working, call out regular time intervals, so kids know how much time they have left to complete their task. This is especially helpful if kids have more than 20 minutes to work on a task. Letting them know when five minutes increments have passed will allow them to budget their time and reassess where they are in their design.

Invite Others to the Engineering Showcase

The showcase, always the last adventure in the unit, is a big deal! This is a chance for kids to highlight the engineering they have done and share their accomplishments with others. Consider inviting families, program staff, and other kids to come to the showcase.

Mobile Apps

Mobile apps can be a fun way to engage kids in out-of-school time environments. The Engineering Adventures team has created iOS apps (compatible with most iPhones, iPod Touches, and iPads) that are designed to supplement the hands-on engineering experiences that your program provides.

You can download Engineering Adventures apps onto your personal device or devices that belong to your site. You may also choose to encourage kids to download the apps onto their devices, so they may continue to practice their engineering skills on their own time. Encourage them to receive permission from parents before doing so.

Technology Flashcards

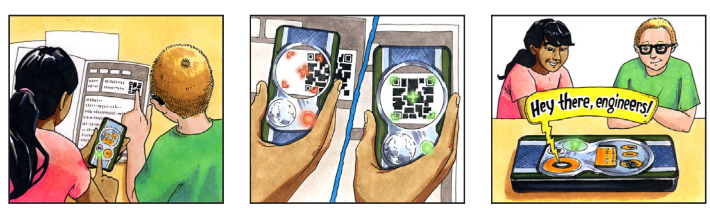
The Technology Flashcards app is designed to be used in conjunction with Prep Adventure 2. The app features a flashcards game that reinforces the idea that a technology is any thing designed by a human to help solve a problem. The game allows kids to learn from their misconceptions in real time by providing them with instant feedback on why selected items are classified as technologies or not.

Search for "Technology Flashcards" in the App Store or visit: www.tinyurl.com/flashcardsapp.

Messages from the Duo

The Messages from the Duo app is a new way for kids to listen to the audio communications from India and Jacob at the beginning of each adventure. Kids can use the scanner function in the app to scan the QR code at the top of each Message from the Duo page in the Engineering Journal. The audio of the message will play automatically as if India and Jacob are communicating directly to the kids over walkie-talkie! The app gives kids an opportunity to listen to the messages on their own for enhanced comprehension or to share with others. Educators may also choose to use the app as an alternative to a CD player or reading the messages aloud.

Search for "Messages from the Duo" in the App Store or visit: www.tinyurl.com/MFTDapp.



Background

Earthquake Engineering

Earthquake engineering is the design, development, and production of earthquake-resistant structures. In many parts of the world, the designs of most buildings do not need to consider the stresses of the ground shaking. However, buildings in areas prone to earthquakes need to be designed so that their structures can withstand this unique kind of stress. Earthquake engineers have developed a number of design strategies that help minimize the effects of the earth shaking. These strategies include strong and light building skeletons, solid bases, and bracing.

Engineers often use models to test designs on a small and manageable scale. In the field of earthquake engineering, engineers use a shake table in order to model how their earthquake resistant designs respond to vigorous shaking. In this unit, kids construct shake tables to test their own structures. To see how shake tables are used in the field, check out the Discovery News video *Earthquake Shake Table Rocks Buildings* (0:00-2:50) http://tinyurl.com/qze8z7f.

The ground can shake in many different ways during an earthquake. This unit focuses primarily on lateral movement, when the earth shakes from side to side. Scientists measure the intensity of an earthquake by using a device called a seismometer and a system of measurement called the Richter scale. In this unit, kids will use a special earthquake magnitude meter to standardize the degree of shaking that they test on their shake tables.

2010 Earthquake in Haiti

On January 24, 2010, a 7.0 magnitude earthquake struck the Caribbean nation of Haiti. The epicenter of the quake was located just 16 miles west of the capital city of Port-au-Prince. Because there are no building codes in Haiti, many structures were poorly reinforced. The earthquake resulted in massive destruction and loss of life. Rebuilding is still underway.

Online Resources

For more information about this unit, and other Engineering Adventures, visit: www.engineeringadventures.org.

Vocabulary

Bonjou**:** Haitian Creole word for “Hello.”

Building code: A law or standard that mandates requirements for the construction of buildings.

Creole: Along with French, the official language of Haiti.

Earthquake engineer: An engineer who designs earthquake-resistant structures.

Earthquake-resistant building: A building that is designed specifically to resist the stresses caused by the ground shaking.

Engineer: Someone who uses his or her creativity and knowledge of math and science to design things that solve problems.

Engineering Design Process: The steps that engineers use to design something to solve a problem.

Orevwa**:** Haitian Creole word for “Goodbye.”

Port-au-Prince: The capital city of Haiti.

Shear: A force that affects many structures during an earthquake. Shear occurs when the ground moves and the upper floors of buildings cannot keep up with the lower floors.

Richter scale: A tool earthquake engineers use to represent the strength and intensity of an earthquake.

Technology: Any thing designed by humans to help solve a problem.

Materials List

This kit is prepared for 8 groups of 3 kids.

Quantity	Item
	Non-Consumable Items
1	Duo Audio CD or access to a computer
1	Engineering Design Process Poster
1	stuffed animal toy
8	ruler, 12”
8	scissors
16	foam core board, 8.5” x 11”
16	tubes, plastic, 1.5” diameter, 10” long
128	hex nuts, 1/2”
	Consumable Items
1 roll	string, cotton
8 rolls	tape, masking
16	rubber bands, 7”
28	medium binder clips
32 blocks	self-adhesive foam, 1”
100	craft sticks
100	toothpicks
150	straws, drinking, no bend
200	coffee stirrers, 7”, plastic
200	pipe cleaners
300	brass fasteners, 1”
700	paper clip, #1 size
900	index cards, 3” x 5”
	NOT INCLUDED IN KIT
1	CD player or MP3 player
1	chart paper
1	clock/timepiece for scheduling
1	cloth or bag large enough to cover technologies, see p. 9
1	rock or leaf
8	technologies, see p. 9
30	markers/crayons

National Education Standards

Engineering Adventures units are written with the goal of teaching engineering skills and critical thinking practices. Many Engineering Adventures units also touch upon a variety of science topics and principles. The engineering standards taught in this unit and the science topic links in this unit are noted below.

		Prep Adventure 1: What is Engineering? Tower Power	Prep Adventure 2: What is Technology? Technology Detectives	Adventure 1: A Shaky Situation	Adventure 2: Building Skeletons	Adventure 3: Stop the Slide	Adventure 4: Getting Braces	Adventure 5: Creating an Earthquake Resistant-Building	Adventure 6: Improving an Earthquake Resistant-Building	Adventure 7: Engineering Showcase: Shake Things Up
National Science Education Standards	Science as Inquiry	✓			✓	✓	✓			
	Physical Science				✓	✓	✓			
	Life Science									
	Earth and Space Science			✓						
	Science and Technology	✓			✓	✓	✓	✓	✓	✓
	Science in Personal and Social Perspectives			✓	✓	✓	✓	✓	✓	✓
	History and Nature of Science									
ITEEA	The Nature of Technology		✓		✓	✓	✓	✓	✓	
	Technology and Society			✓						✓
	Design	✓			✓	✓	✓	✓	✓	
	Abilities for a Technological World	✓				✓	✓	✓	✓	✓
	The Designed World				✓	✓	✓	✓	✓	✓

		Prep Adventure 1: What is Engineering? Tower Power	Prep Adventure 2: What is Technology? Technology Detectives	Adventure 1: A Shaky Situation	Adventure 2: Building Skeletons	Adventure 3: Stop the Slide	Adventure 4: Getting Braces	Adventure 5: Creating an Earthquake Resistant-Building	Adventure 6: Improving an Earthquake Resistant-Building	Adventure 7: Engineering Showcase: Shake Things Up
Next Generation Science Standards (Gr. 3-5)	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.			✓	✓	✓	✓	✓	✓	✓
	4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.				✓	✓	✓	✓	✓	✓
	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.	✓		✓	✓	✓	✓	✓	✓	✓

How to Recognize Success Rubric Template

How do you know if you are leading an Engineering Adventures activity successfully? This tool will help you keep track of your kids' successful moments and will ask you to identify how your own actions enabled your kids to succeed.

Date: Adventure:

Elements of success	What does this look like?	How does the guide help me facilitate this?
Kids were engaged and challenged by the activity. They persisted through difficulties.	• Kids are on-task. • Kids are trying out their ideas. • Kids identify what is working well in their designs. • Kids troubleshoot their own work. • Kids *improve* their designs.	• Use the Message from the Duo to **set a real-world context** that will engage kids in the activity. • Use the bold prompts to **ask open-ended questions** to help kids troubleshoot their work. • Use the bold prompts to **ask kids about what they think is working well** in their designs and what they would like to *improve*. This will help kids feel more confident about their problem-solving abilities.
Kids did most of the talking, sharing their ideas with each other during the entire activity.	• Kids bring their own ideas to the activity and are comfortable sharing them. • Kids brainstorm and debate within their groups. • Kids share their designs with others. • Kids talk about how their ideas are changing over time.	• Use the bold prompts in the guide to **encourage kids to share and explain their thinking**. • Have kids **work in groups** so they can brainstorm and *create* a design together. • Use the bold prompts in the Reflect section to **help kids share their new ideas about designs.**
Kids value their engineering work as a process, not just as the end result.	• Kids go beyond talking about their design to talking about how they thought of it and why they designed it. • Kids use the Engineering Design Process to describe their actions.	• Use the bold prompts in the guide to **ask kids how they use the Engineering Design Process.** Spending time talking and thinking about their process will help kids see the value in it. • Use the bold prompts to **ask all kids about *Improving*** their designs, even if their designs are working well. • **Encourage kids to reflect individually** in their Engineering Journals to give them time for their experiences to sink in and be remembered.

How to Recognize Success Rubric

How do you know if you are leading an Engineering Adventures activity successfully? This tool identifies three elements of success and highlights how the Adventure Guide supports you in setting this up with your kids.

Date: Adventure:

Elements of success	Evidence: Did I see this during the activity?	What was my role in making this happen?
Kids were engaged and challenged by the activity. They persisted through difficulties.		
Kids did most of the talking, sharing their ideas with each other during the entire activity.		
Kids value their engineering work as a process, not just as the end result.		

Dear Family, Date: ________________

We are beginning an engineering unit called Shake Things Up: Engineering Earthquake-Resistant Buildings, which is part of the Engineering Adventures curriculum developed by the Museum of Science, Boston. Engineering Adventures is a curricular program that introduces children to the engineering design process and various fields of engineering. Throughout this unit, children will learn about earthquake engineering and work to solve an earthquake engineering design challenge. The unit is set in a real-world context: children will learn about the 2010 earthquake in Haiti, design a model earthquake-resistant building, and write their own building codes.

There are many reasons to introduce children to engineering:

- **Engineering projects reinforce topics children are learning in school.** Engaging students in hands-on, real-world engineering experiences can enliven math, science, and other content areas.
- **Engineering fosters problem-solving skills**, including problem formulation, creativity, planning, and testing of alternative solutions.
- **Children are fascinated with building and with taking things apart to see how they work.** By encouraging these explorations, we can keep these interests alive. Describing their activities as “engineering” when children are engaged in the natural design process can help them develop positive associations with engineering, and increase their desire to pursue such activities in the future.
- **Engineering and technological literacy are necessary for the 21st century.** As our society increasingly depends on engineering and technology, our citizens need to understand these fields.

Because engineering projects are hands-on, materials are often required. Several materials necessary to this unit are listed below. If you have any of these materials available, please consider donating them to us.

If you have expertise about earthquake engineering or Haiti, or have any general questions or comments about the engineering and design unit we are about to begin, please let me know.

Sincerely,

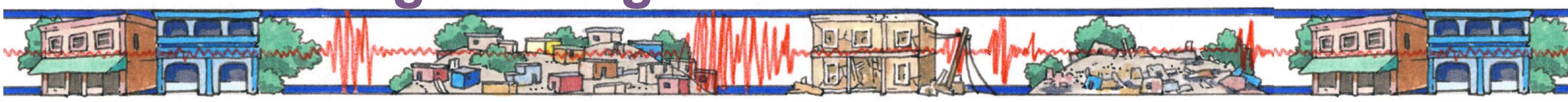
If you have any of the following materials available and would like to donate them, I would greatly appreciate having them by the following date: ______________________ . Thank you!

____________________________ ____________________________

____________________________ ____________________________

____________________________ ____________________________

What is Engineering? Tower Power

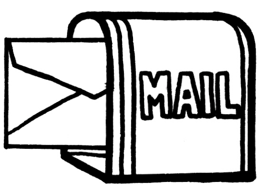


Overview: Kids will engineer an index card tower that will support a stuffed animal.

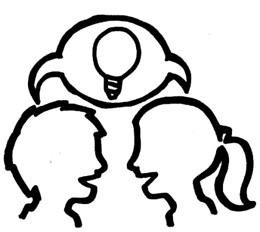
Note to Educator: Who are engineers? Engineers are people who use their creativity and knowledge of math and science to design things that solve problems. Today, kids will be engineers as they use the Engineering Design Process to design towers.

Find alternate versions of this activity at www.engineeringadventures.org/resources

Duo Update (5 min)

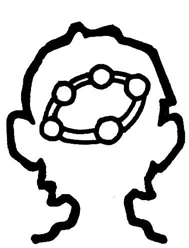


Set the Stage (10 min)



Activity (30 min)

Reflect (5 min)



Materials

For the entire group:

- ☐ *Message from the Duo*, track 1 or Engineering Journal, p. 1
- ☐ *Engineering Design Process* poster
- ☐ *Heightened Emotions*, this guide, p. 7
- ☐ 1 small stuffed animal

For each group of 3-5 kids:

- ☐ at least 1 foot of masking tape
- ☐ 1 pack of index cards (about 100 cards)
- ☐ 1 pair of scissors
- ☐ 1 ruler

For each kid:

- ☐ Engineering Journal

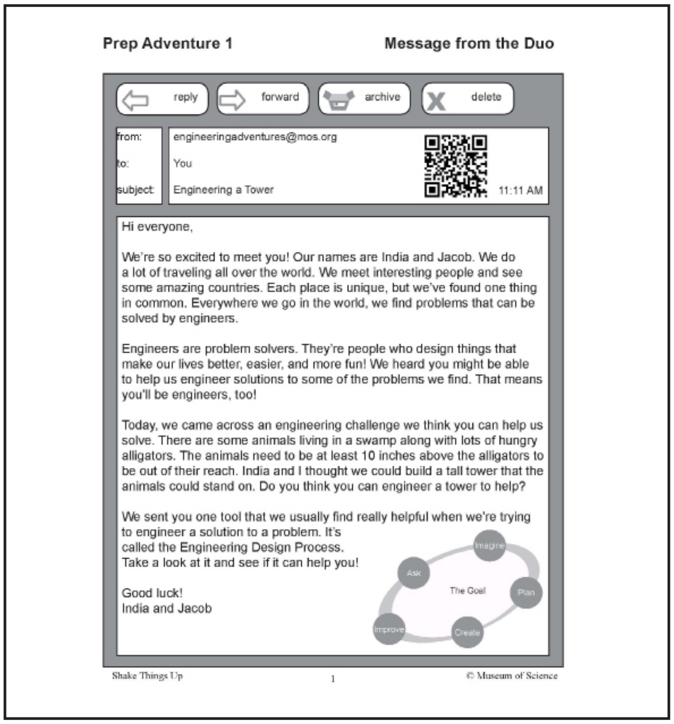
Preparation

Time Required: 10 minutes

1. Have the *Message from the Duo* ready to share.
2. Make samples of the cards found on *Building with Cards,* p. 2 in the kids' Engineering Journals.

Journal Pages for Prep Adventure 1

Message from the Duo, p. 1


Prep Adventure 1 Message from the Duo

reply forward archive delete

from: engineeringadventures@mos.org
to: You
subject: Engineering a Tower
11:11 AM

Hi everyone,

We're so excited to meet you! Our names are India and Jacob. We do a lot of traveling all over the world. We meet interesting people and see some amazing countries. Each place is unique, but we've found one thing in common. Everywhere we go in the world, we find problems that can be solved by engineers.

Engineers are problem solvers. They're people who design things that make our lives better, easier, and more fun! We heard you might be able to help us engineer solutions to some of the problems we find. That means you'll be engineers, too!

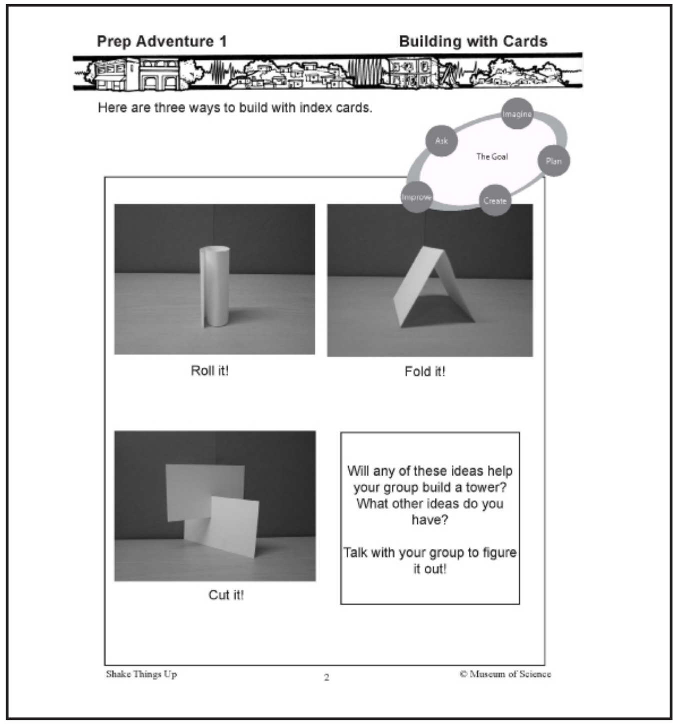
Today, we came across an engineering challenge we think you can help us solve. There are some animals living in a swamp along with lots of hungry alligators. The animals need to be at least 10 inches above the alligators to be out of their reach. India and I thought we could build a tall tower that the animals could stand on. Do you think you can engineer a tower to help?

We sent you one tool that we usually find really helpful when we're trying to engineer a solution to a problem. It's called the Engineering Design Process. Take a look at it and see if it can help you!

Good luck!
India and Jacob

Shake Things Up 1 © Museum of Science

Building with Cards, p. 2


Prep Adventure 1 Building with Cards

Here are three ways to build with index cards.

Roll it!

Fold it!

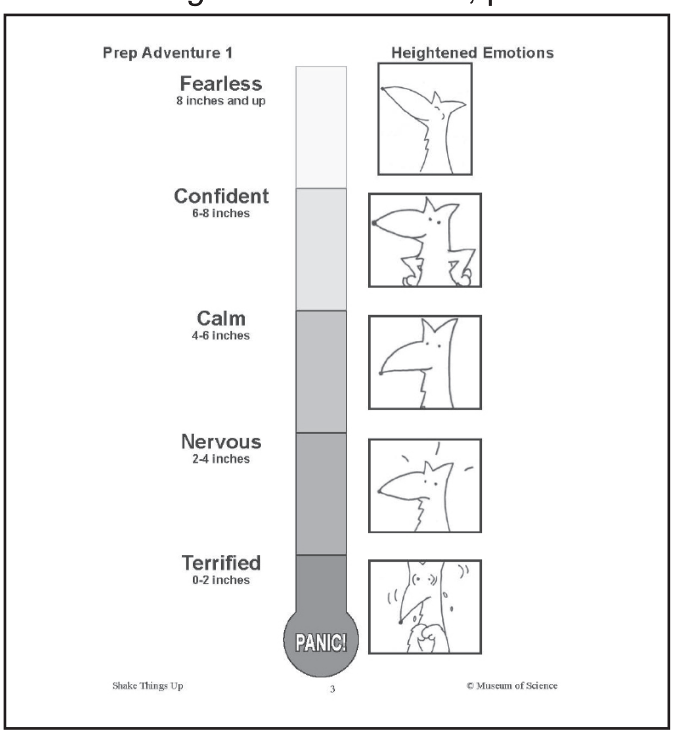
Cut it!

Will any of these ideas help your group build a tower? What other ideas do you have?

Talk with your group to figure it out!

Shake Things Up 2 © Museum of Science

Heightened Emotions, p. 3


Prep Adventure 1 Heightened Emotions

Fearless
8 inches and up

Confident
6-8 inches

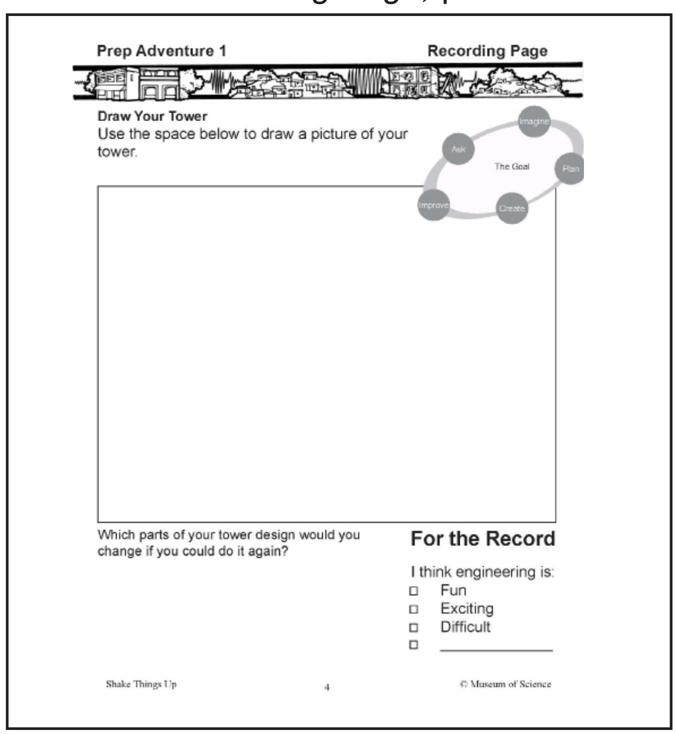
Calm
4-6 inches

Nervous
2-4 inches

Terrified
0-2 inches

Shake Things Up 3 © Museum of Science

Recording Page, p. 4


Prep Adventure 1 Recording Page

Draw Your Tower
Use the space below to draw a picture of your tower.

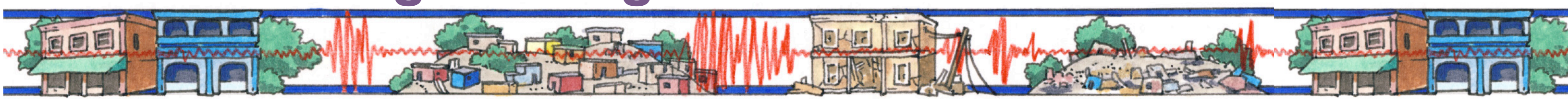
Which parts of your tower design would you change if you could do it again?

For the Record

I think engineering is:
- ☐ Fun
- ☐ Exciting
- ☐ Difficult
- ☐ ________

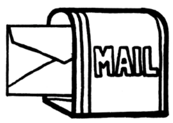
Shake Things Up 4 © Museum of Science

What is Engineering? Tower Power



Kids will learn:

- the Engineering Design Process is a tool they can use to help solve problems.



Present the Message from the Duo (5 min)

1. Tell kids that India and Jacob are a brother and sister team who travel the world. They find problems and solve them using engineering.
2. Explain that India and Jacob have sent the kids a message about a problem they would like them to solve. Have kids turn to *Message from the Duo*, p. 1 in their Engineering Journals, for more details. Play track 1.

Set the Stage (5 min)

1. Tell kids that today they are going be engineers and use the Engineering Design Process to solve India and Jacob's problem.
2. To check for understanding, ask:
   - **What do India and Jacob need us to engineer?** *A tower to lift the animal up 10 inches, so it does not get eaten by alligators.*
3. Show groups the *Engineering Design Process* poster and tell them they are going to *ask* questions about the problem, *imagine* ways to solve it, *plan* a design, *create* and test it, and then think about ways to *improve* it.

Imagine (5 min)

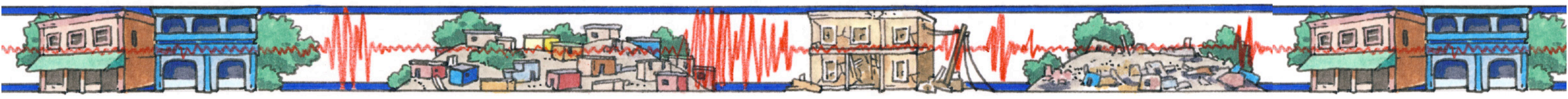
1. Tell kids it is time to look at the materials they can use and *imagine* different ways to make them work.
2. Split kids into groups of 3-5 and give each group a few index cards, scissors, ruler, and tape. Ask:
   - **Can you *imagine* any ways you could use these materials to engineer a tower?**
3. If your kids want to see examples, show them the index card samples you prepared or have them look at *Building with Cards*, p. 2 in their Engineering Journals. Ask:
   - **Do you think any of these ideas might work well? Why?**

Tip: You may choose to offer unlimited tape, or to challenge groups by limiting the tape to one or two feet.

Plan and Create (at least 20 min)

1. Tell kids it is time to *plan* and *create* their towers.
2. Show the stuffed animal and explain that:
   - The challenge is to work in groups to engineer a tower that can hold the animal 10 inches in the air for at least 10 seconds.
   - Each group will have (at least) 20 minutes.

Tip: If you can, you may want to offer more time for this challenge.



- Groups can only use index cards and tape in the tower. The scissors and ruler are tools only and cannot be used in the tower.
- Groups can hold the stuffed animal briefly, but they cannot test it on their tower until the 20 minutes are up.

3. Give each group 1 pack of index cards and let them begin.
4. As groups work, circulate around the room. Ask questions like:
    - **Why do you think your design will work well?**
    - **Which step of the Engineering Design Process are you using right now? How do you know?**

Tower Showcase (10 min)

1. Have each group present their tower. Ask each group questions like:
    - **Can you tell me about your design?**
    - **Which steps of the Engineering Design Process did your group use?**
2. Use a ruler to measure the group's tower. Compare the measurement to the diagrams on *Heightened Emotions*. Give one kid from the group the stuffed animal and have him or her place it on top of their tower. Count to 10 and observe what happens. Whether or not their tower stands. Ask:
    - **What parts would you *improve* if you could design your tower again? Why?**

Reflect (5 min)

1. Go through the *Engineering Design Process* poster with kids and have them talk about how they used each step to solve the problem. Ask questions like:
    - **How did you use this step of the Engineering Design Process to solve the problem?** *We* asked *about the challenge; we* imagined *ways to build with cards; we* planned *when we decided what design to use; and we* created *and* improved *when we built and fixed the tower.*
    - **Why do you think it is important to use these steps?** *It helps us keep track of our ideas and make sure we are meeting our goal.*
    - **Do you think you are an engineer?**
2. Tell kids that they have just used the same steps that engineers use to solve problems. This means that they are engineers, too! Tell kids they will have the opportunity to engineer solutions to even bigger problems with India and Jacob later on.
3. Give kids time to record their thoughts on *Recording Page*, p. 4 in their Engineering Journals. Allowing kids to draw and write about their work in this adventure will help them remember what they learned.

Prep Adventure 1 Email
What is Engineering? Tower Power

reply | forward | archive | delete

from:	engineeringadventures@mos.org
to:	You
subject:	Engineering a Tower

11:11 AM

Hi everyone,

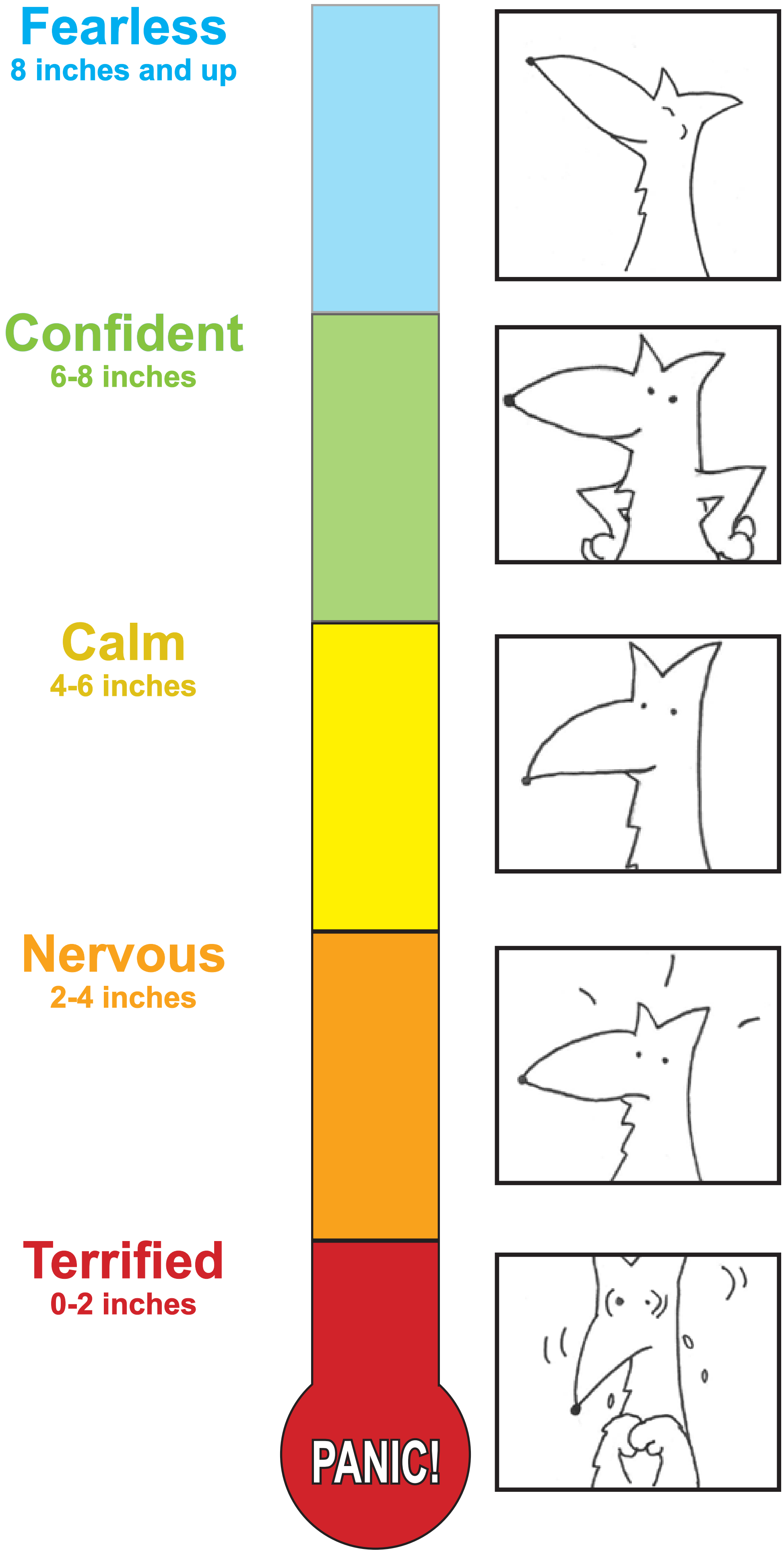
We're so excited to meet you! Our names are India and Jacob. We do a lot of traveling all over the world. We meet interesting people and see some amazing countries. Each place is unique, but we've found one thing in common. Everywhere we go in the world, we find problems that can be solved by engineers.

Engineers are problem solvers. They're people who design things that make our lives better, easier, and more fun! We heard you might be able to help us engineer solutions to some of the problems we find. That means you'll be engineers, too!

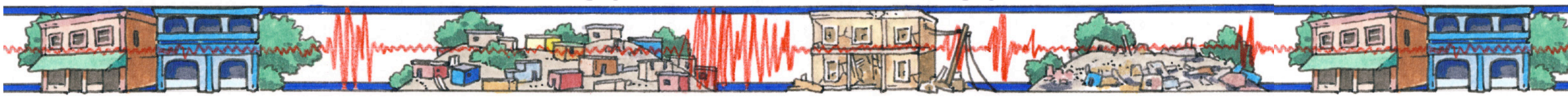
Today, we came across an engineering challenge we think you can help us solve. There are some animals living in a swamp along with lots of hungry alligators. The animals need to be at least 10 inches above the alligators to be out of their reach. India and I thought we could build a tall tower that the animals could stand on. Do you think you can engineer a tower to help?

We sent you one tool that we usually find really helpful when we're trying to engineer a solution to a problem. It's called the Engineering Design Process. Take a look at it and see if it can help you!

Good luck!
India and Jacob


Fearless
8 inches and up
Confident
6-8 inches
Calm
4-6 inches
Nervous
2-4 inches
Terrified
0-2 inches
PANIC!

What is Technology? Technology Detectives

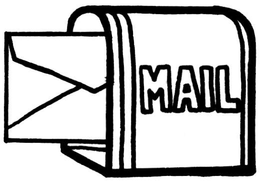


Overview: Kids will examine some technologies and brainstorm ways to *improve* them.

Note to Educator: Many people think of technologies as things that are only electronic or things that are "high-tech." Technology is actually any thing designed by humans to help solve a problem.

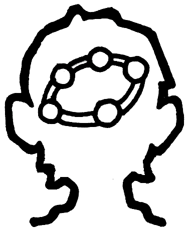
Find alternate versions of this activity at www.engineeringadventures.org/resources.

Duo Update (5 min)



Activity (15 min)

Reflect (20 min)



Materials

For the whole group:

- ☐ *Message from the Duo*, track 2 or Engineering Journal, p. 5
- ☐ *Engineering Design Process* poster
- ☐ large sheet of paper or other writing space
- ☐ rock or leaf
- ☐ a cloth or bag large enough to cover technologies

Technologies (choose 8):

- ☐ bag
- ☐ book
- ☐ button
- ☐ construction paper
- ☐ dice
- ☐ electronic device (e.g. phone or calculator)
- ☐ glue stick
- ☐ hair clip
- ☐ hat
- ☐ juice box
- ☐ key
- ☐ roll of tape
- ☐ ruler
- ☐ scissors
- ☐ spoon
- ☐ stapler
- ☐ stuffed animal
- ☐ sweater
- ☐ water bottle

For each kid:

- ☐ Engineering Journal

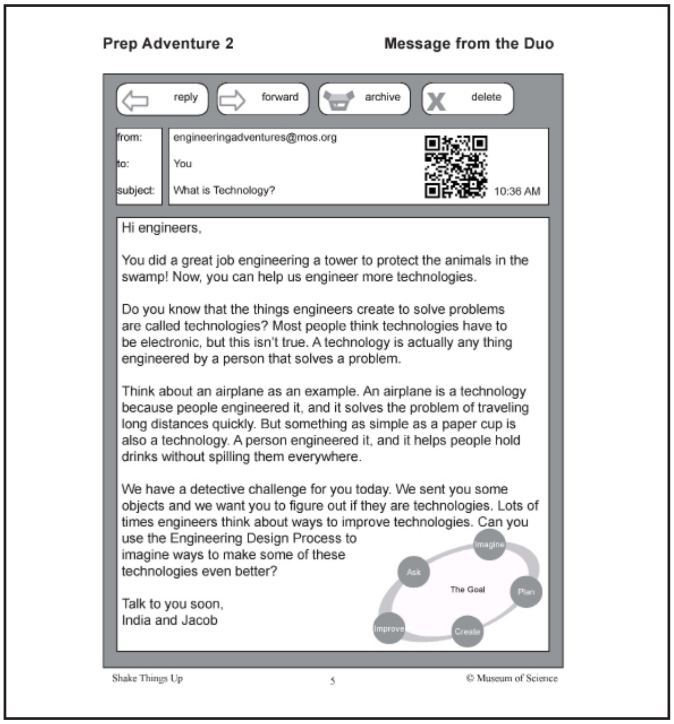
Preparation

Time Required: 10 minutes

1. Have the *Message from the Duo* ready to share.
2. Post the *Engineering Design Process* poster.
3. Place 8 technologies (see above) on a table or floor and cover them with a cloth or bag.
4. On a sheet of large paper, make the *Technology Detective Tool* chart as shown on the next page.

Journal Pages for Prep Adventure 2

Message from the Duo, p. 5



Prep Adventure 2 — Message from the Duo

reply | forward | archive | delete

from: engineeringadventures@mos.org
to: You
subject: What is Technology?
10:36 AM

Hi engineers,

You did a great job engineering a tower to protect the animals in the swamp! Now, you can help us engineer more technologies.

Do you know that the things engineers create to solve problems are called technologies? Most people think technologies have to be electronic, but this isn't true. A technology is actually any thing engineered by a person that solves a problem.

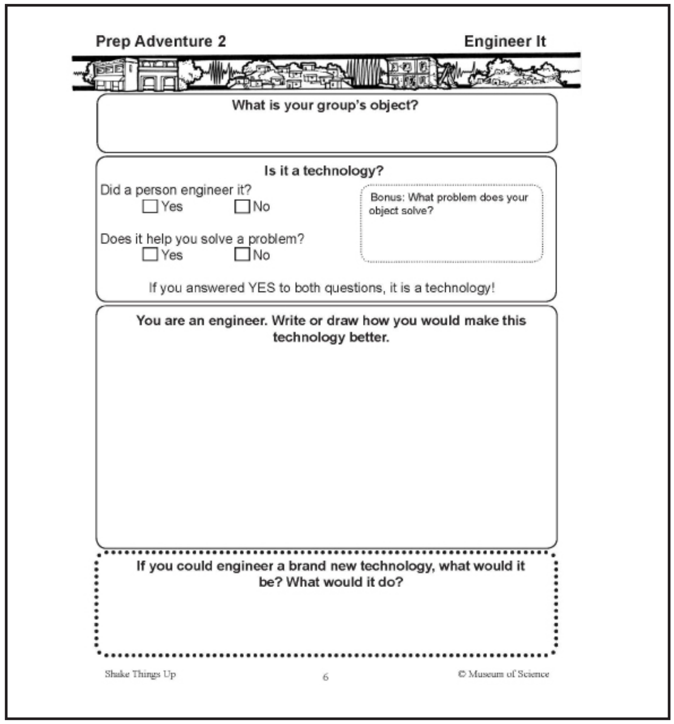
Think about an airplane as an example. An airplane is a technology because people engineered it, and it solves the problem of traveling long distances quickly. But something as simple as a paper cup is also a technology. A person engineered it, and it helps people hold drinks without spilling them everywhere.

We have a detective challenge for you today. We sent you some objects and we want you to figure out if they are technologies. Lots of times engineers think about ways to improve technologies. Can you use the Engineering Design Process to imagine ways to make some of these technologies even better?

Talk to you soon,
India and Jacob

Shake Things Up 5 © Museum of Science

Engineer It, p. 6



Prep Adventure 2 — Engineer It

What is your group's object?

Is it a technology?

Did a person engineer it?
☐ Yes ☐ No

Does it help you solve a problem?
☐ Yes ☐ No

Bonus: What problem does your object solve?

If you answered YES to both questions, it is a technology!

You are an engineer. Write or draw how you would make this technology better.

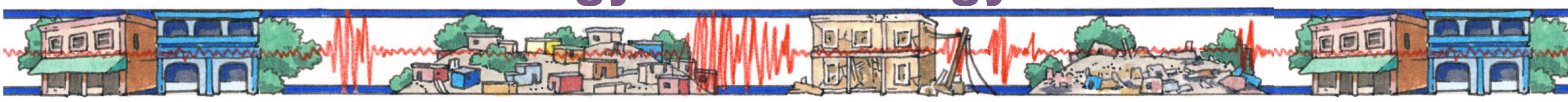
If you could engineer a brand new technology, what would it be? What would it do?

Shake Things Up 6 © Museum of Science

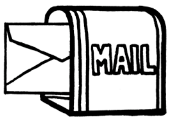
Chart for Prep Adventure 2

Technology Detective Tool
Did a person engineer it?
Does it help you solve a problem?
If you answered YES to both, it is a technology!

What is Technology? Technology Detectives



Kids will learn:
- technology is any thing designed by people to help solve a problem.
- engineers *create* and *improve* technologies.



Present the Message from the Duo (5 min)

1. Tell kids that India and Jacob sent them a message with more information about what engineers do. Have kids turn to *Message from the Duo*, p. 5 of their Engineering Journals, to see the message. Play track 2.
2. To check for understanding, ask:
   - **India and Jacob said that a technology is anything designed by people to solve a problem. What are some technologies you can think of?** *Accept all answers at this point.*
3. Give the kids about one minute to name all the technologies they can think of. If kids are only naming electronics, remind kids that India and Jacob mentioned that things like paper cups are also technology.

Tip: You may want to write down a list of the technologies kids say so you can refer back to it at the end of the adventure.

Undercover Detectives (15 min)

1. Explain to kids that now they will get the chance to think about more technologies—some that might surprise them.
2. Tell kids that under the cover on the table are some objects that might be technologies, or might not. They will use detective skills and teamwork to figure out which objects are technologies and what problems they solve.
3. Split kids into groups of 3-5.
4. Show them the *Technology Detective Tool chart* and explain they can use it to help figure out if the objects are technologies.
5. Pull the cloth and give groups a minute to decide what object they will take.
6. Have each group choose one object they would like to focus on in their groups.
7. Tell kids that they will now think like an engineer. They will use the *Technology Detective Tool* to decide whether their object is a technology. Then, they will *imagine* ways to *improve* the object they chose.
8. Have kids open to *Engineer It,* p. 6 in their Engineering Journals. Give groups about 10 minutes to complete the first three boxes. If groups are

Tip: If kids are having trouble understanding what it means to engineer something, let them know that words like invent, design, and improve have a similar meaning.The more you use the term engineer, the more comfortable they will become with it!

struggling, ask:

- **How can you make your technology more fun?**
- **How can you make your technology easier to use?**

Reflect (20 min)

1. Tell kids they are going to present their technology ideas to their fellow detectives. Encourage them to use the *Technology Detective Tool* chart and the *Engineer It* page in their journals to help them present. Ask each group:
   - **What is your technology?**
   - **How do you know it is a technology?** *Refer to the* Technology Detective Tool *chart.*
2. After all groups have presented, check for understanding about technology. Ask:
   - **Were all the objects you saw technologies? Why or why not?** *Yes, because people engineered them and they help solve a problem.*
3. Tell kids you have one more object for them to think about. Show them the rock/leaf. Ask:
   - **Is this a technology? Why or why not?** *No, because a person did not engineer it.*
4. Tell kids that they were engineers today by thinking about technologies that already exist and how to *improve* them. Engineers also *imagine* brand new technologies that no one has thought of before!

Tip: A rock, leaf, or other natural objects on their own are not technologies. If people turn those objects into tools, however, they could become technologies! For example, using a rock to grind corn or making it into an arrow head makes the rock a technology.

5. Have kids think about the engineering they have already done. Ask:
   - **Why do you think the tower you made before was a technology?**
6. Tell kids that in this unit they will be working in groups to engineer technologies that will help solve a problem.
7. Give kids a few moments to complete the last box on the *Engineer It* page of the journal. Thinking about things they might engineer in the future will help kids see themselves as engineers.

Tip: If you have enough time, encourage kids to share their ideas with a partner.

Prep Adventure 2 — Message from the Duo
What is Technology? Technology Detectives

reply | forward | archive | delete

from:	engineeringadventures@mos.org
to:	You
subject:	What is Technology?

10:36 AM

Hi engineers,

You did a great job engineering a tower to protect the animals in the swamp! Now, you can help us engineer more technologies.

Do you know that the things engineers *create* to solve problems are called technologies? Most people think technologies have to be electronic, but this isn't true. A technology is actually any thing engineered by a person that solves a problem.

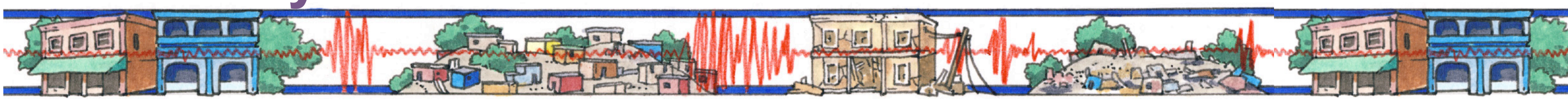
Think about an airplane as an example. An airplane is a technology because people engineered it, and it solves the problem of traveling long distances quickly. But something as simple as a paper cup is also a technology. A person engineered it, and it helps people hold drinks without spilling them everywhere.

We have a detective challenge for you today. We sent you some objects and we want you to figure out if they are technologies. Lots of times engineers think about ways to *improve* technologies. Can you use the Engineering Design Process to *imagine* ways to make some of these technologies even better?

Talk to you soon,
India and Jacob

Adventure 1
A Shaky Situation

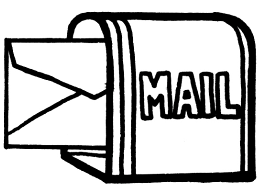
Educator Page: Preview



Overview: Kids will watch a video and read an article about the 2010 earthquake in Haiti. Then, they will build a shake table and explore how it simulates earthquakes. This table will be used throughout the unit.

Note to Educator: Haiti was struck by a magnitude 7.0 earthquake in January 2010. There was massive destruction partly because of the lack of building codes and reinforced walls. As you introduce the earthquake to your kids, be aware that some kids may have experienced a major earthquake and the reminder of that may be disturbing. Consider providing additional support to those kids who need it.

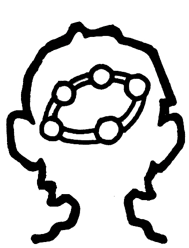
Duo Update (5 min)



Ask (15 min)

Activity (15 min)

Reflect (10 min)



Materials

For the entire group:

- ☐ *Message from the Duo*, track 3 or Engineering Journal, p. 7
- ☐ *Engineering Design Process* poster
- ☐ *Reconstructing Haiti* video
- ☐ assorted classroom items (e.g., toys, pencils)

For each group of 3-5 kids:

- ☐ *Magnitude Meter*, p. 21 of this guide
- ☐ 1 index card
- ☐ 1 marker
- ☐ 1 roll of masking tape
- ☐ 2 plastic tubes
- ☐ 2 sheets of foam core board
- ☐ 2 rubber bands
- ☐ 4 blocks of self adhesive foam
- ☐ 16 hex nuts

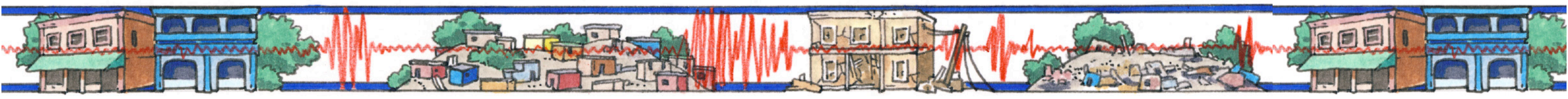
For each kid:

- ☐ Engineering Journal

Preparation

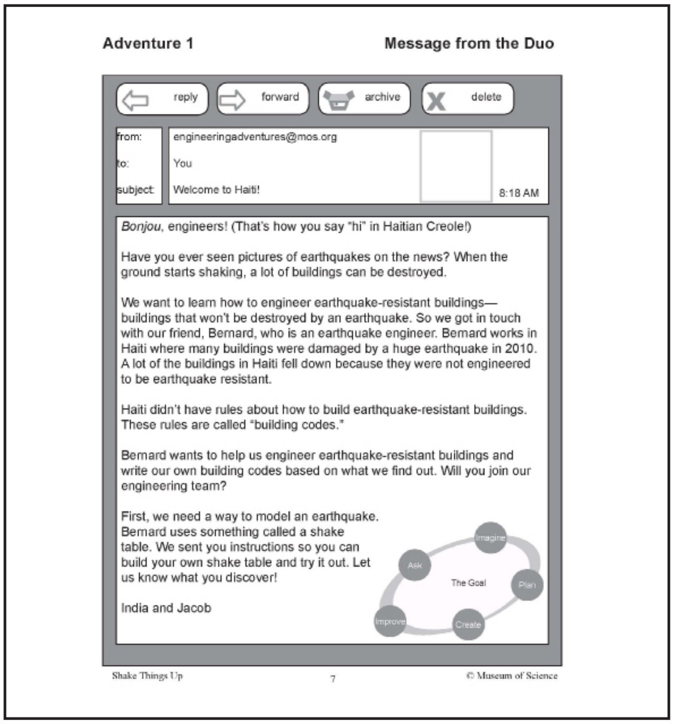
Time Required: 15 minutes

1. Have the *Message from the Duo* ready to share.
2. Post the *Engineering Design Process* poster.
3. Preview and prepare to play the full video from the University of Buffulo, *Reconstructing Haiti* (0:00-2:39) http://tinyurl.com/p8se7qu.
4. Copy, cut, and attach *Magnitude Meters* to index cards for each group.



Journal Pages for Adventure 1

Message from the Duo, p. 7



Adventure 1 Message from the Duo

reply forward archive delete

from: engineeringadventures@mos.org
to: You
subject: Welcome to Haiti!
8:18 AM

Bonjou, engineers! (That's how you say "hi" in Haitian Creole!)

Have you ever seen pictures of earthquakes on the news? When the ground starts shaking, a lot of buildings can be destroyed.

We want to learn how to engineer earthquake-resistant buildings—buildings that won't be destroyed by an earthquake. So we got in touch with our friend, Bernard, who is an earthquake engineer. Bernard works in Haiti where many buildings were damaged by a huge earthquake in 2010. A lot of the buildings in Haiti fell down because they were not engineered to be earthquake resistant.

Haiti didn't have rules about how to build earthquake-resistant buildings. These rules are called "building codes."

Bernard wants to help us engineer earthquake-resistant buildings and write our own building codes based on what we find out. Will you join our engineering team?

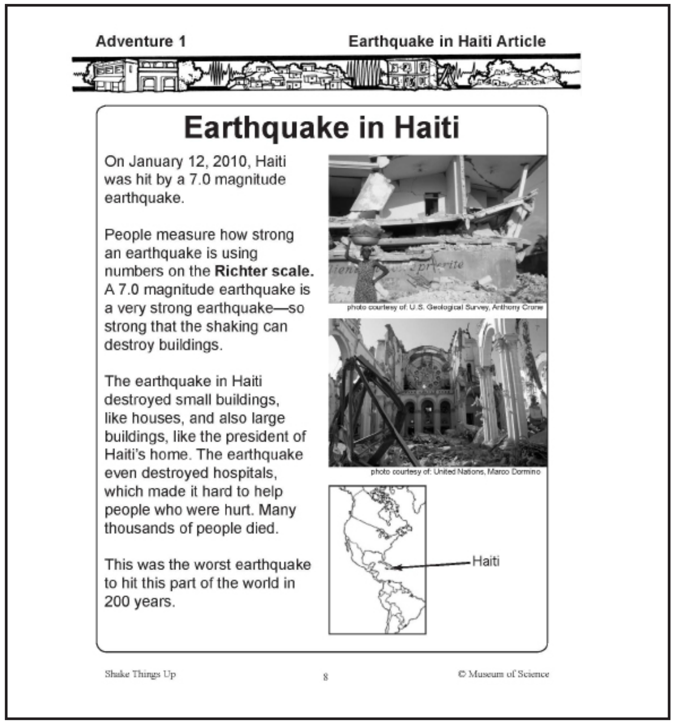
First, we need a way to model an earthquake. Bernard uses something called a shake table. We sent you instructions so you can build your own shake table and try it out. Let us know what you discover!

India and Jacob

Imagine, Plan, Create, Improve, Ask, The Goal

Shake Things Up 7 © Museum of Science

Earthquake in Haiti Article, p. 8



Adventure 1 Earthquake in Haiti Article

Earthquake in Haiti

On January 12, 2010, Haiti was hit by a 7.0 magnitude earthquake.

People measure how strong an earthquake is using numbers on the **Richter scale.** A 7.0 magnitude earthquake is a very strong earthquake—so strong that the shaking can destroy buildings.

The earthquake in Haiti destroyed small buildings, like houses, and also large buildings, like the president of Haiti's home. The earthquake even destroyed hospitals, which made it hard to help people who were hurt. Many thousands of people died.

This was the worst earthquake to hit this part of the world in 200 years.

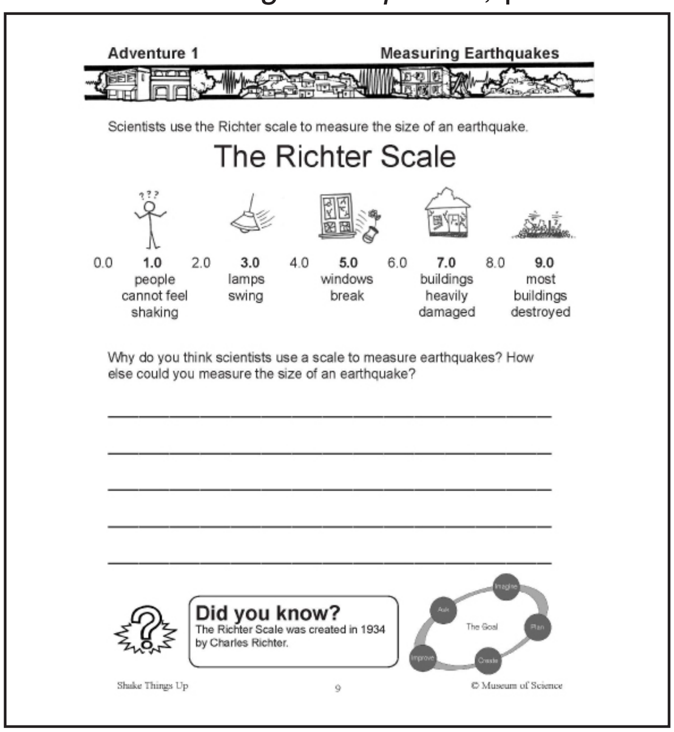
photo courtesy of: U.S. Geological Survey, Anthony Crone

photo courtesy of: United Nations, Marco Dormino

Haiti

Shake Things Up 8 © Museum of Science

Measuring Earthquakes, p. 9



Adventure 1 Measuring Earthquakes

Scientists use the Richter scale to measure the size of an earthquake.

The Richter Scale

0.0 — **1.0** people cannot feel shaking — 2.0 — **3.0** lamps swing — 4.0 — **5.0** windows break — 6.0 — **7.0** buildings heavily damaged — 8.0 — **9.0** most buildings destroyed

Why do you think scientists use a scale to measure earthquakes? How else could you measure the size of an earthquake?

____

____

____

____

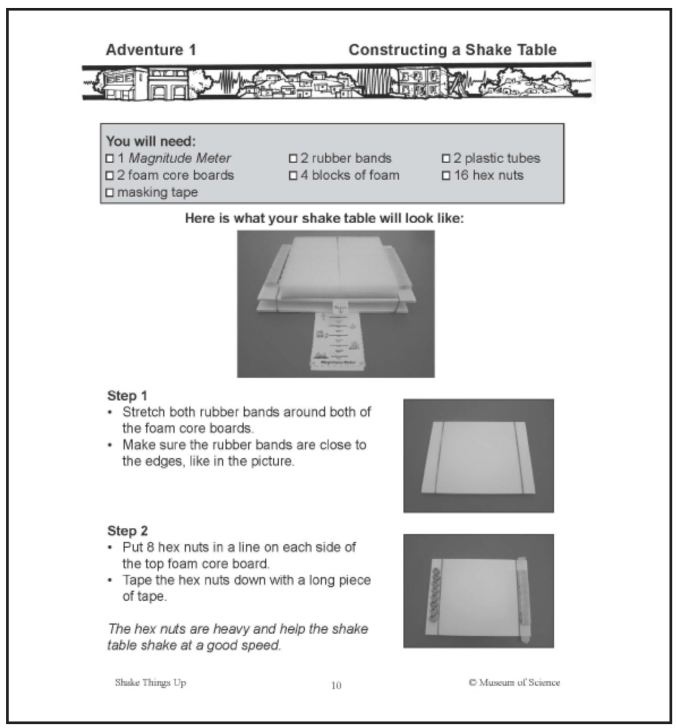
____

Did you know?
The Richter Scale was created in 1934 by Charles Richter.

Imagine, Plan, Create, Improve, Ask, The Goal

Shake Things Up 9 © Museum of Science

Constructing a Shake Table, pp. 10-12



Adventure 1 Constructing a Shake Table

You will need:

- ☐ 1 *Magnitude Meter*
- ☐ 2 foam core boards
- ☐ masking tape
- ☐ 2 rubber bands
- ☐ 4 blocks of foam
- ☐ 2 plastic tubes
- ☐ 16 hex nuts

Here is what your shake table will look like:

Step 1

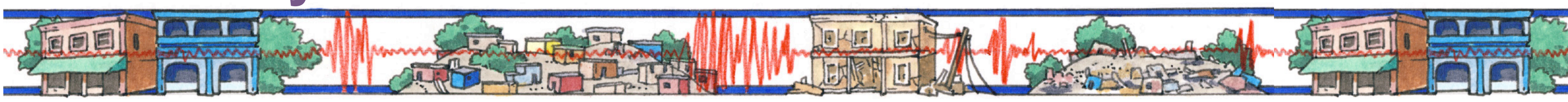
- Stretch both rubber bands around both of the foam core boards.
- Make sure the rubber bands are close to the edges, like in the picture.

Step 2

- Put 8 hex nuts in a line on each side of the top foam core board.
- Tape the hex nuts down with a long piece of tape.

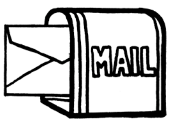
The hex nuts are heavy and help the shake table shake at a good speed.

Shake Things Up 10 © Museum of Science



Kids will learn:

- the 2010 earthquake in Haiti damaged many buildings that were not earthquake resistant.
- they can use shake tables to model the back and forth motion of an earthquake.



Present the Message from the Duo (5 min)

1. Have kids turn to *Message from the Duo*, p. 7 in their Engineering Journals, to read along with a message from India and Jacob about a big problem they need help solving. Play track 3.
2. To check for understanding, ask:
   - **What did India and Jacob tell us about buildings that are not earthquake resistant?** *They can fall down during earthquakes.*

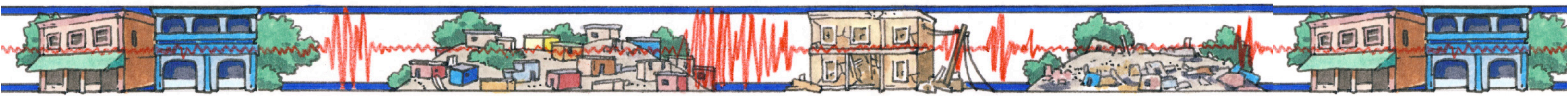
Ask: What do Earthquake Engineers Do? (15 min)

1. Tell kids they are going to watch a video about an earthquake engineer from Haiti.
2. Show kids the full video from the University of Buffulo, *Reconstructing Haiti* (0:00-2:39) http://tinyurl.com/p8se7qu.
3. To check for understanding, ask:
   - **How do you think you would feel if you were Pierre?** *Upset, worried about future earthquakes, motivated to engineer safer buildings, etc.*
   - **Why do you think earthquake engineering is important?** *People can get hurt if their buildings are not earthquake resistant.*
4. Have kids read *Earthquake in Haiti Article*, p. 8 in their Engineering Journals and look at the photos (or do this as a read-aloud activity).
5. To check for understanding, ask:
   - **What types of buildings were destroyed in the earthquake?** *Small buildings like houses, and larger buildings like the president's house and hospitals.*
   - **As earthquake engineers, what can we can do to minimize the chance of this happening again?** *Engineer earthquake-resistant buildings.*

Make a Shake Table (15 min)

1. Tell kids they will make shake tables to help them model earthquakes of different strengths. They will use these shake tables to test the buildings they will engineer.
2. Walk through *Measuring Earthquakes,* p. 9 in their

Tip: Challenge kids to mimic different magnitudes of earthquakes by shaking pieces of foam core board with their hands before they build their shake tables. How would a gentle tremor be different from a massive earthquake?



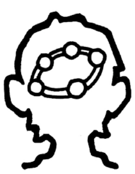
Engineering Journals. Tell kids that the magnitude, or strength, of earthquakes is measured on the Richter scale.

3. Walk kids through *Constructing a Shake Table*, pp. 10-12 in their Engineering Journals.
4. Place kids in groups of 3-5 and pass out their shake table materials. Each group should make one shake table using the directions.
5. Demonstrate how to use the shake table. Have 1-2 volunteers hold down the bottom board, then pull back the tab on the top board to the desired magnitude, and let go.
6. Let kids experiment for several minutes by putting approved objects from the room on their shake tables and observing what happens at different magnitudes.

Tip: Objects may fly off shake tables. Use caution.

See it!: Download the iPhone app, iSeismometer, from ObjectGraph, LLC to gather real-time data of the shaking motion!

Tip: You may want to try using a large binder clip to attach the bottom board of the shake tables to a table or chair.



Reflect (10 min)

1. Gather kids around the *Engineering Design Process* poster and have them reflect on their findings. Ask questions like:
   - **What did you notice when you shook items on the shake table?**
   - **What difference did you see between a small magnitude earthquake and a large magnitude earthquake?**
   - **How do you think you will use the steps of the Engineering Design Process to engineer an earthquake-resistant building?** Ask *about how to make buildings earthquake-resistant,* imagine *ideas,* plan *designs,* create *and test them,* improve *them, etc.*
2. Tell kids that for the rest of this unit, they will be earthquake engineers. They will engineer a model building that can withstand a 7.0 magnitude earthquake on the shake table. They will also write building codes so that others can learn how to build an earthquake-resistant building.
3. Give kids time to record thoughts on *Measuring Earthquakes*, p. 9 in their Engineering Journals. Having kids record their ideas will help them remember what they learned and apply it in the next adventure.

reply | forward | archive | delete

from:	engineeringadventures@mos.org
to:	You
subject:	Welcome to Haiti!

8:18 AM

Bonjou, engineers! (That's how you say "hi" in Haitian Creole!)

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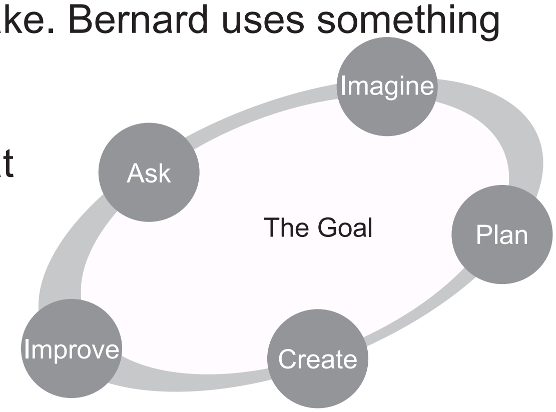
We want to learn how to engineer earthquake-resistant buildings—buildings that won't be destroyed by an earthquake. So we got in touch with our friend, Bernard, who is an earthquake engineer. Bernard works in Haiti where many buildings were damaged by a huge earthquake in 2010. A lot of the buildings in Haiti fell down because they were not engineered to be earthquake resistant.

Haiti didn't have rules about how to build earthquake-resistant buildings. These rules are called "building codes."

Bernard wants to help us engineer earthquake-resistant buildings and write our own building codes based on what we find out. Will you join our engineering team?

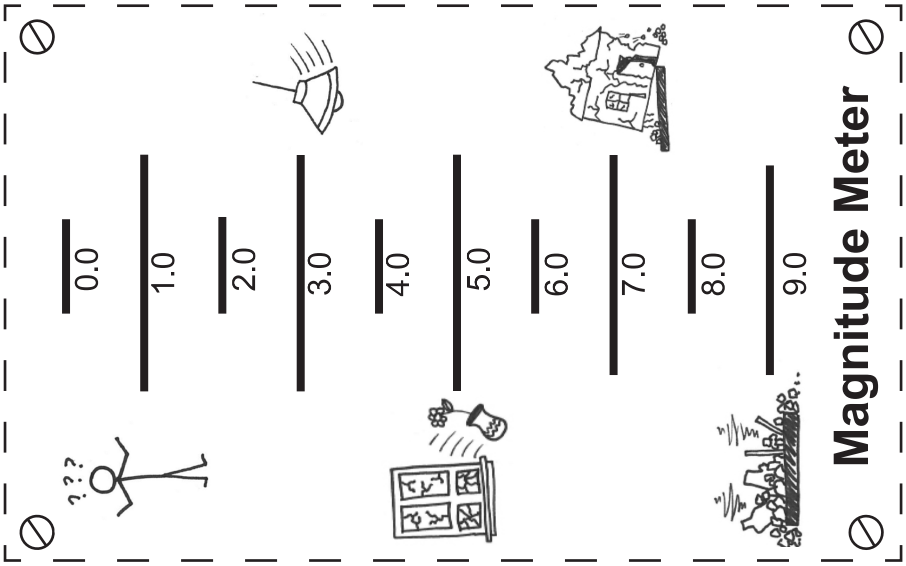
First, we need a way to model an earthquake. Bernard uses something called a shake table. We sent you instructions so you can build your own shake table and try it out. Let us know what you discover!

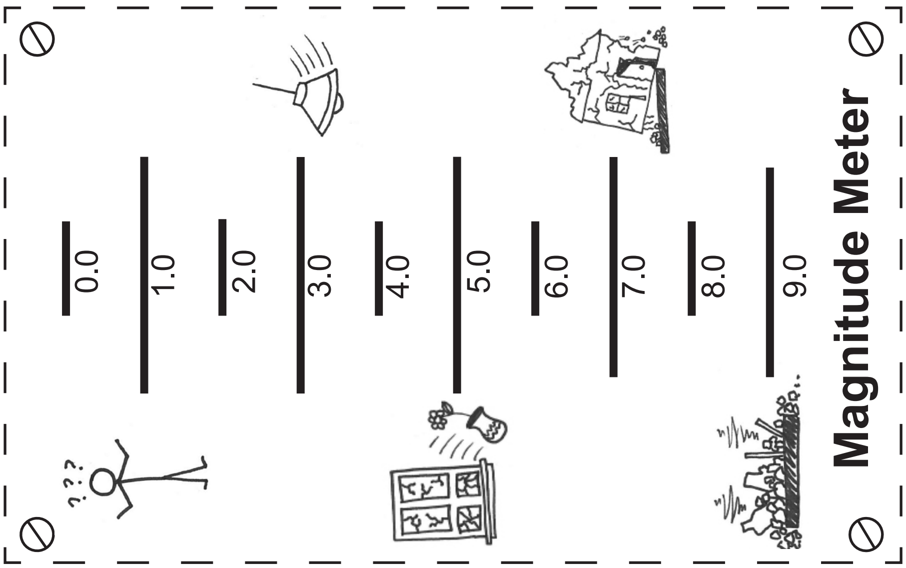
India and Jacob

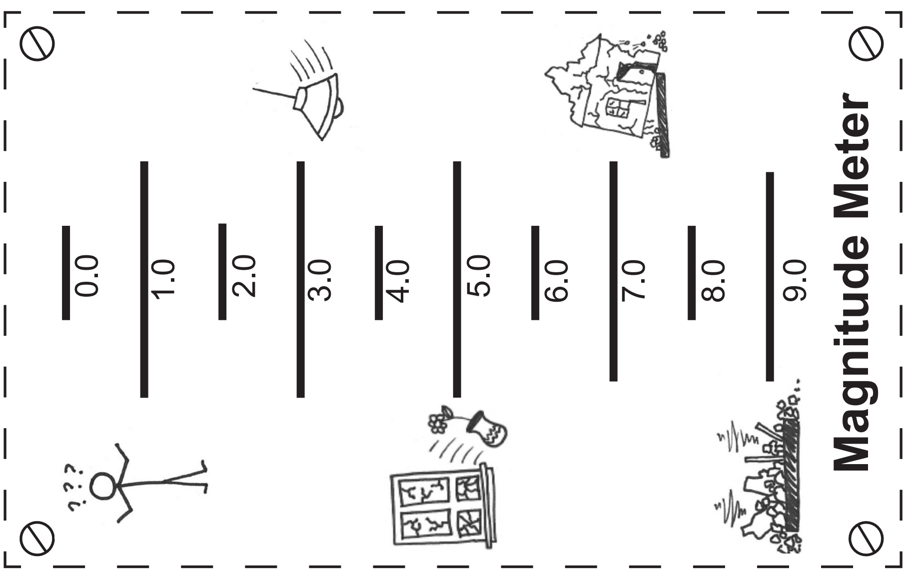


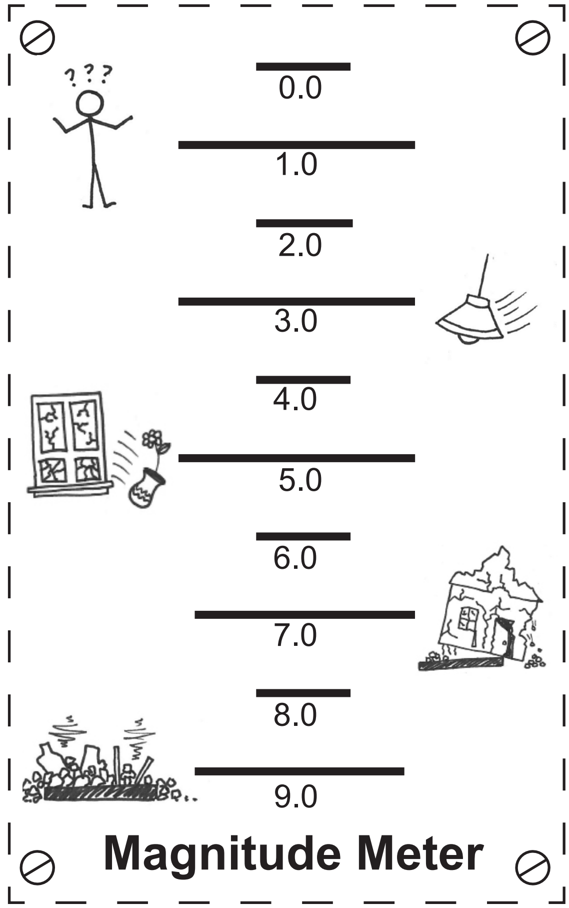
Magnitude Meters

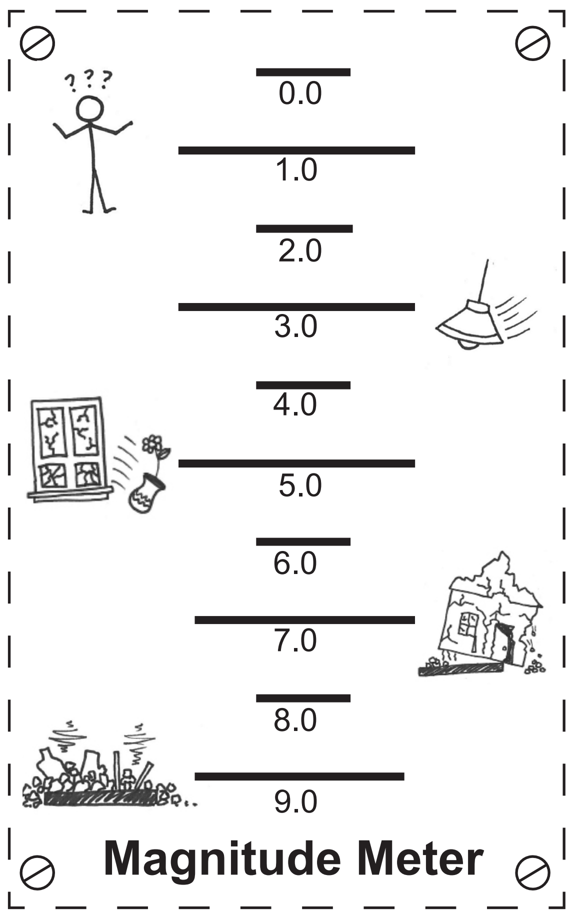
Cut out one *Magnitude Meter* for each group.



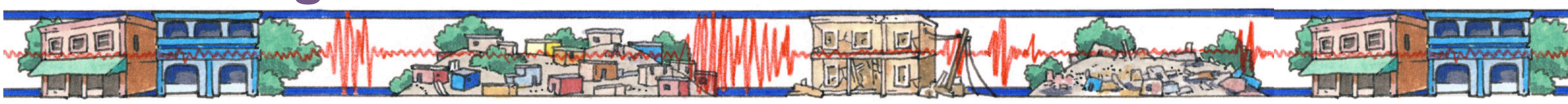








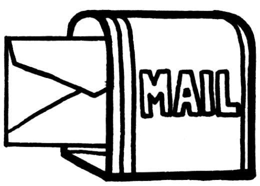
Building Skeletons



Overview: Kids make building units, then stack them up to make models of buildings. They use the shake table to determine which shape and size buildings best withstand earthquakes.

Note to Educator: Even though kids are focusing on models of buildings in this unit, the thought processes they are using and the problems they are thinking about are the same as the ones earthquake engineers use and think about when working with real buildings. **Save the building units and *Building Codes* chart for kids to use in later adventures!**

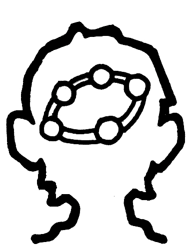
Duo Update (5 min)



Ask (5 min)

Activity (25 min)

Reflect (10 min)



Materials

For the entire group:

- ☐ *Message from the Duo*, track 4 or Engineering Journal, p. 13
- ☐ *Engineering Design Process* poster

For each group of 3-5 kids:

- ☐ 1 roll of masking tape
- ☐ 1 shake table
- ☐ 15-20 paper clips

For each kid:

- ☐ Engineering Journal
- ☐ 2 index cards
- ☐ 4 coffee stirrers (see below for preparation)
- ☐ 4 pipe cleaners (see below for preparation)

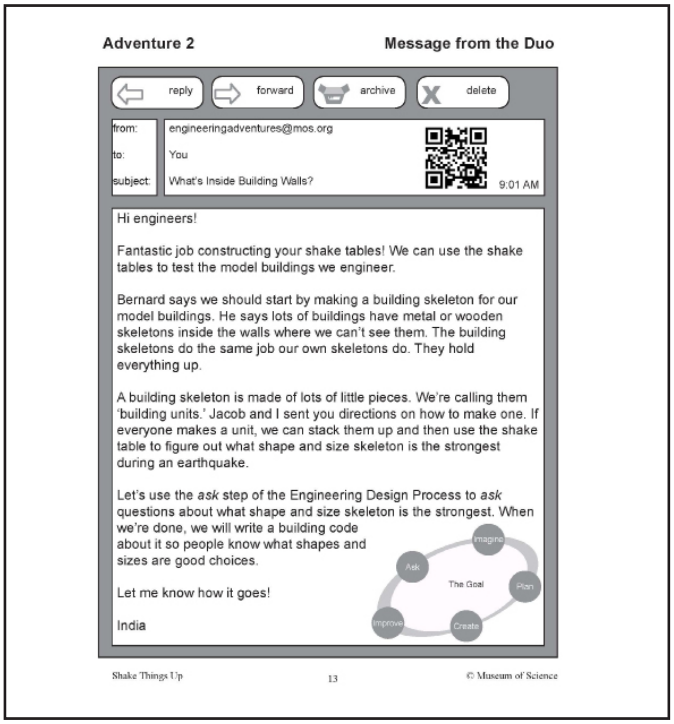
Preparation

Time Required: 20 minutes

1. Have the *Message from the Duo* ready to share.
2. Post the *Engineering Design Process* poster.
3. Make the *Building Codes* chart (see p. 24 of this guide for details).
4. Set up a Materials Store with the index cards, pipe cleaners, coffee stirrers, and tape.
5. Prepare the materials by sliding a pipe cleaner into each coffee stirrer. Prepare four of these for each kid.
6. Optional: Make an example building unit.

Journal Pages and Chart for Adventure 2

Message from the Duo, p. 13



Adventure 2 Message from the Duo

reply forward archive delete

from: engineeringadventures@mos.org
to: You
subject: What's Inside Building Walls?
9:01 AM

Hi engineers!

Fantastic job constructing your shake tables! We can use the shake tables to test the model buildings we engineer.

Bernard says we should start by making a building skeleton for our model buildings. He says lots of buildings have metal or wooden skeletons inside the walls where we can't see them. The building skeletons do the same job our own skeletons do. They hold everything up.

A building skeleton is made of lots of little pieces. We're calling them 'building units.' Jacob and I sent you directions on how to make one. If everyone makes a unit, we can stack them up and then use the shake table to figure out what shape and size skeleton is the strongest during an earthquake.

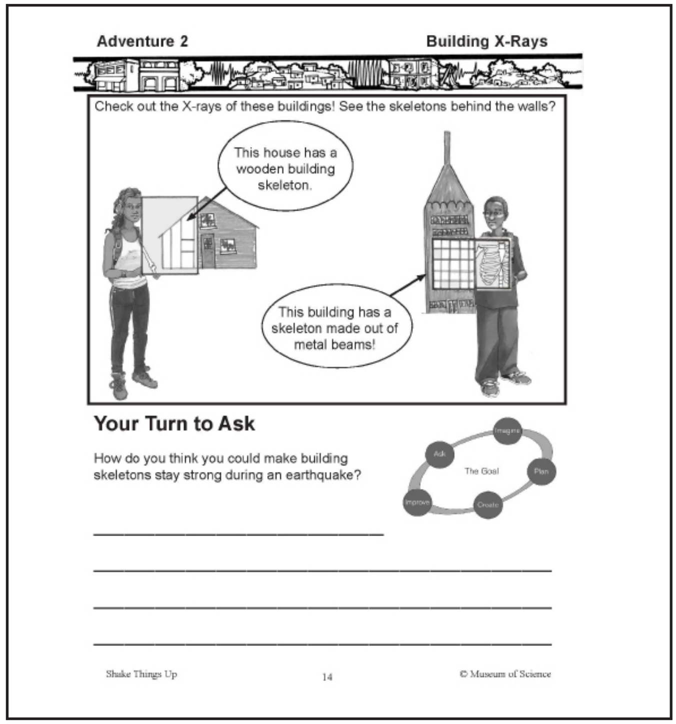
Let's use the *ask* step of the Engineering Design Process to *ask* questions about what shape and size skeleton is the strongest. When we're done, we will write a building code about it so people know what shapes and sizes are good choices.

Let me know how it goes!

India

Shake Things Up 13 © Museum of Science

Building X-Rays, p. 14



Adventure 2 Building X-Rays

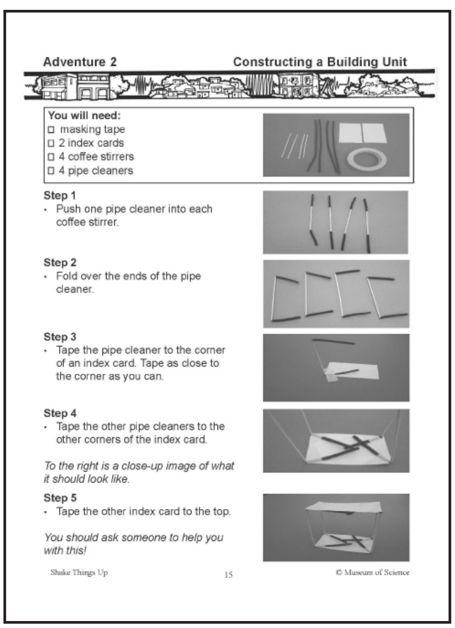
Check out the X-rays of these buildings! See the skeletons behind the walls?

Your Turn to Ask

How do you think you could make building skeletons stay strong during an earthquake?

Shake Things Up 14 © Museum of Science

Constructing a Unit, p. 15



Adventure 2 Constructing a Building Unit

You will need:
- ☐ masking tape
- ☐ 2 index cards
- ☐ 4 coffee stirrers
- ☐ 4 pipe cleaners

Step 1
- Push one pipe cleaner into each coffee stirrer.

Step 2
- Fold over the ends of the pipe cleaner.

Step 3
- Tape the pipe cleaner to the corner of an index card. Tape as close to the corner as you can.

Step 4
- Tape the other pipe cleaners to the other corners of the index card.

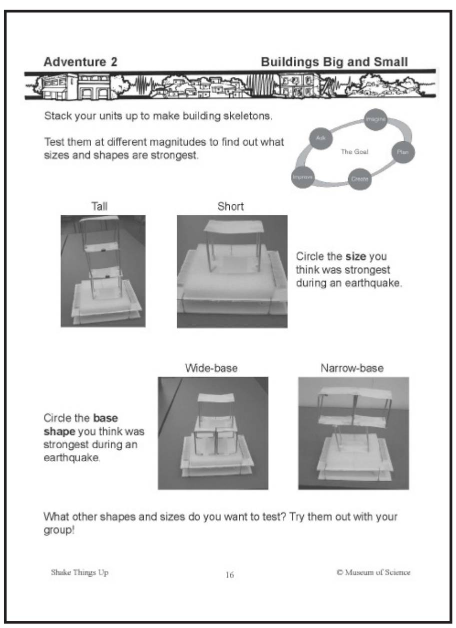
To the right is a close-up image of what it should look like.

Step 5
- Tape the other index card to the top.

You should ask someone to help you with this!

Shake Things Up 15 © Museum of Science

Buildings Big and Small, p. 16



Adventure 2 Buildings Big and Small

Stack your units up to make building skeletons.

Test them at different magnitudes to find out what sizes and shapes are strongest.

Circle the **size** you think was strongest during an earthquake.

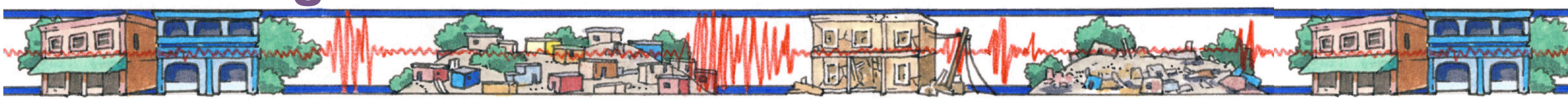
Circle the **base shape** you think was strongest during an earthquake.

What other shapes and sizes do you want to test? Try them out with your group!

Shake Things Up 16 © Museum of Science

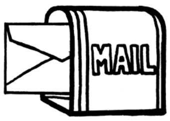
Building Codes Chart

Our model building codes are:



Kids will learn:

- their model buildings are made of units that act like a skeleton to support the building.
- they can arrange building units in different ways to affect how stable the entire building is in an earthquake.



Present the Message from the Duo (5 min)

1. Tell kids that India has some ideas about how to get started engineering an earthquake-resistant building. Have kids turn to *Message from the Duo*, p. 13 in their Engineering Journals, to find a message from India. Play track 4.
2. To check for understanding, ask:
   - **What is India asking you to do?** *Make building units, then stack them up to make building skeletons. Use the shake table to figure out what shapes and sizes are strongest during an earthquake.*
   - **What steps of the Engineering Design Process will you use?** Ask *about building skeletons in other buildings,* imagine *ways to stack our units to make building skeletons, etc.*

Ask: What is on the Inside? (5 min)

1. Remind kids that India said many buildings have strong skeletons inside them that people cannot see. Ask:
   - **What are some parts of buildings you have heard of?** *Walls, beams, foundations, windows, doors.*
   - **Which parts do you think help a building stay strong during an earthquake? Why do you think so?** *Encourage all responses.*
2. Have kids turn to *Building X-Rays*, p. 14 in their Engineering Journals, to see the pictures India sent. Ask:
   - **What do you see inside the two buildings in the picture?** *Beams and supports. Kids might also say a skeleton.*
   - **Why do you think these building skeletons help support the buildings in an earthquake?** *They are a strong skeleton that everything else is connected to, making everything stronger in an earthquake.*

Build a Skeleton (15 min)

1. Tell kids that they will each make a building unit that their group can stack up together in order to make a complete building skeleton to test on the shake table.
2. Each kid should put together one unit. Have kids turn to *Constructing a Building*

Tip: Ask kids why they think there are coffee stirrers around the pipe cleaners (for extra strength). Kids can use this idea to strengthen other parts of their building units later on.

Unit, p. 15 in their Engineering Journals, for directions. Kids can get their materials from the Materials Store. Encourage kids to help each other!

Test It Out (10 min)

1. Tell kids it is time to figure out what shapes and sizes of building skeletons are strongest in an earthquake.
2. Have kids form groups of 3-5. Pass out a shake table and paperclips to each group. They can use the paperclips to attach building units together.
3. Groups can arrange their building units to make building skeletons that are different shapes and sizes. Encourage groups to test several ideas on their shake table. If kids get stuck, they can use *Buildings Big and Small*, p. 16 in their Engineering Journals as examples.

Tip: Kids will notice that the building units are not very strong. They fall off the shake table and collapse easily. Tell kids they will engineer solutions to these problems later on. For now, they may use small pieces of masking tape to attach their building skeleton to the shake table in order to test different sizes and shapes.

Reflect (10 min)

1. Remind kids that India wants them to use what they found out today to write a building code (or codes) that will teach others what shape and size building skeletons best survived the earthquake.
2. Show kids the *Building Codes* chart. Tell kids they will keep track of what is working well in their model buildings on this chart as they move through the unit. Ask:
   - **What shapes and sizes did you try that best survived the earthquakes? Why do you think so?**
   - **Based on this, what do you want your building code(s) to say?** *The building code(s) should refer to something kids found out today about shape and size. For example, if kids found that short building skeletons are safest during an earthquake, a building code could read, "Building skeletons should be as short as possible."*
3. Write the building code(s) on the *Building Codes* chart. Keep this chart to use later in the unit! Ask:
   - **How could you use these ideas to engineer real buildings that need to survive during an earthquake?** *Accept all responses.*
4. Gather kids around the *Engineering Design Process* poster. Ask:
   - **What steps of the Engineering Design Process did you use today? How did these steps help you?** *Possible responses include:* Ask *about building skeletons,* imagine *possible skeletons,* create *building skeletons.*
5. Give kids time to record their thoughts on *Building X-Rays*, p. 14 in their Engineering Journals. They can refer to this in upcoming adventures.

reply | forward | archive | delete

from:	engineeringadventures@mos.org
to:	You
subject:	What's Inside Building Walls?

9:01 AM

Hi engineers!

Fantastic job constructing your shake tables! We can use the shake tables to test the model buildings we engineer.

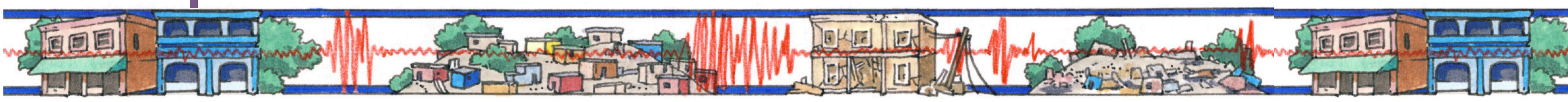
Bernard says we should start by making a building skeleton for our model buildings. He says lots of buildings have metal or wooden skeletons inside the walls where we can't see them. The building skeletons do the same job our own skeletons do. They hold everything up.

A building skeleton is made of lots of little pieces. We're calling them 'building units.' Jacob and I sent you directions on how to make one. If everyone makes a unit, we can stack them up and then use the shake table to figure out what shape and size skeleton is the strongest during an earthquake.

Let's use the *ask* step of the Engineering Design Process to *ask* questions about what shape and size skeleton is the strongest. When we're done, we will write a building code about it so people know what shapes and sizes are good choices.

Let me know how it goes!

India

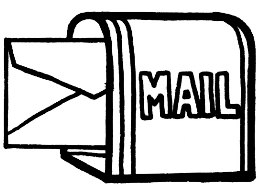


Overview: Kids work in groups to experiment with ways to stop their building units from sliding.

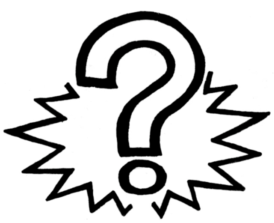
Note to Educator: If you have additional time, this adventure can be combined with the next adventure, in which kids engineer ways to stop their building units from shearing during an earthquake.

Save the building units and *Building Codes* chart for kids to use in later adventures!

Duo Update (5 min)

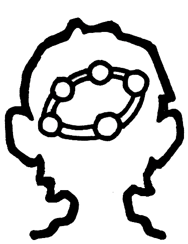


Ask (5 min)



Activity (25 min)

Reflect (10 min)



Materials

For the entire group:

- ☐ *Message from the Duo*, track 5 or Engineering Journal, p. 17
- ☐ *Engineering Design Process* poster
- ☐ *Building Codes* chart from the previous adventure
- ☐ 1 roll of string
- ☐ 50 brass fasteners
- ☐ 100 paper clips
- ☐ 100 toothpicks

For each group of 3-5 kids:

- ☐ building unit (from previous adventure)
- ☐ scissors
- ☐ shake table

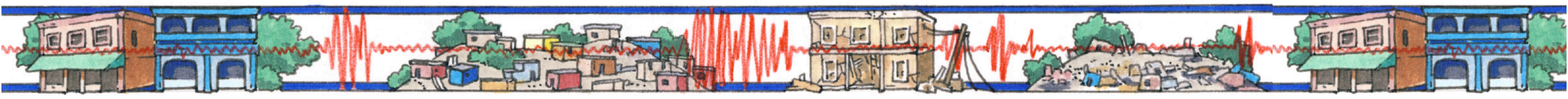
For each kid:

- ☐ Engineering Journal

Preparation

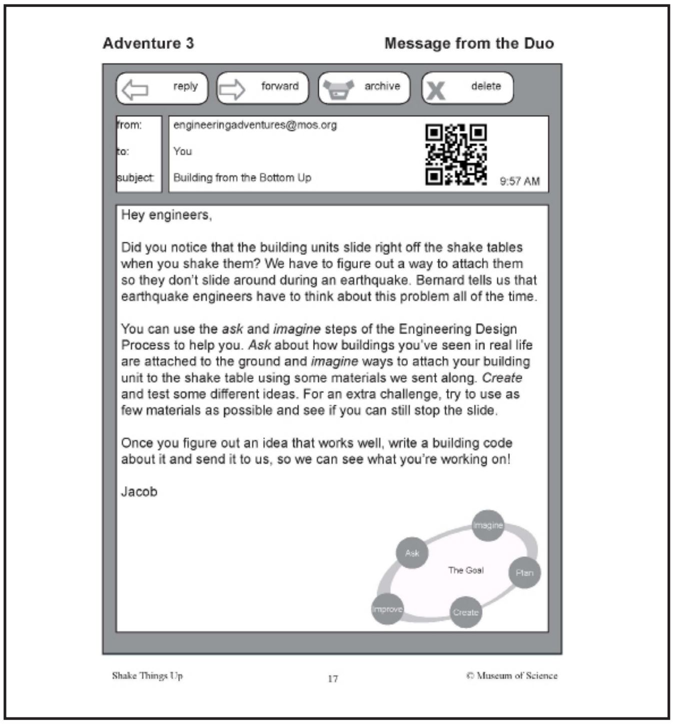
Time Required: 10 minutes

1. Have the *Message from the Duo* ready to share.
2. Post the *Engineering Design Process* poster and the *Building Codes* chart.
3. Cut an approximately 12-inch piece of string for each group.
4. Set up a Materials Store with toothpicks, brass fasteners, string, and paper clips.



Journal Pages for Adventure 3

Message from the Duo, p. 17



Adventure 3 **Message from the Duo**

reply forward archive delete

from: engineeringadventures@mos.org
to: You
subject: Building from the Bottom Up
9:57 AM

Hey engineers,

Did you notice that the building units slide right off the shake tables when you shake them? We have to figure out a way to attach them so they don't slide around during an earthquake. Bernard tells us that earthquake engineers have to think about this problem all of the time.

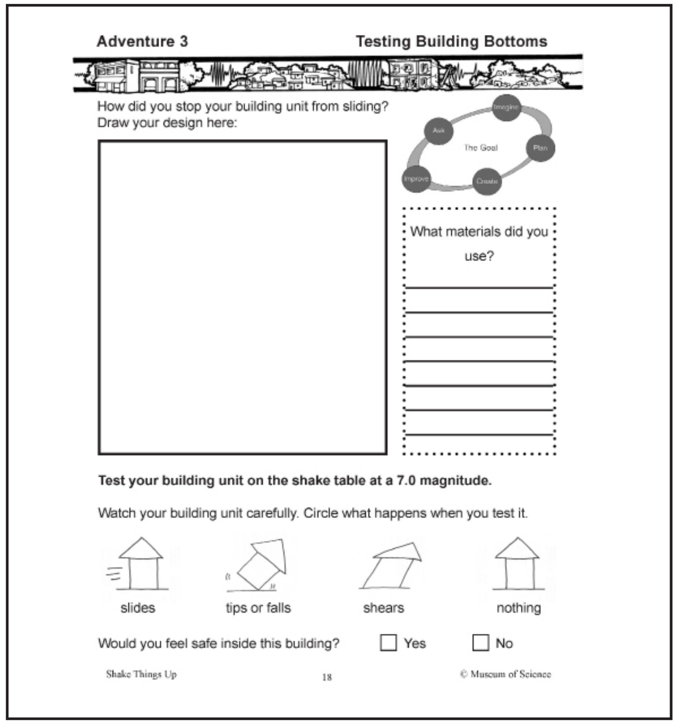
You can use the *ask* and *imagine* steps of the Engineering Design Process to help you. *Ask* about how buildings you've seen in real life are attached to the ground and *imagine* ways to attach your building unit to the shake table using some materials we sent along. *Create* and test some different ideas. For an extra challenge, try to use as few materials as possible and see if you can still stop the slide.

Once you figure out an idea that works well, write a building code about it and send it to us, so we can see what you're working on!

Jacob

Shake Things Up 17 © Museum of Science

Testing Building Bottoms, p. 18



Adventure 3 **Testing Building Bottoms**

How did you stop your building unit from sliding? Draw your design here:

What materials did you use?

Test your building unit on the shake table at a 7.0 magnitude.

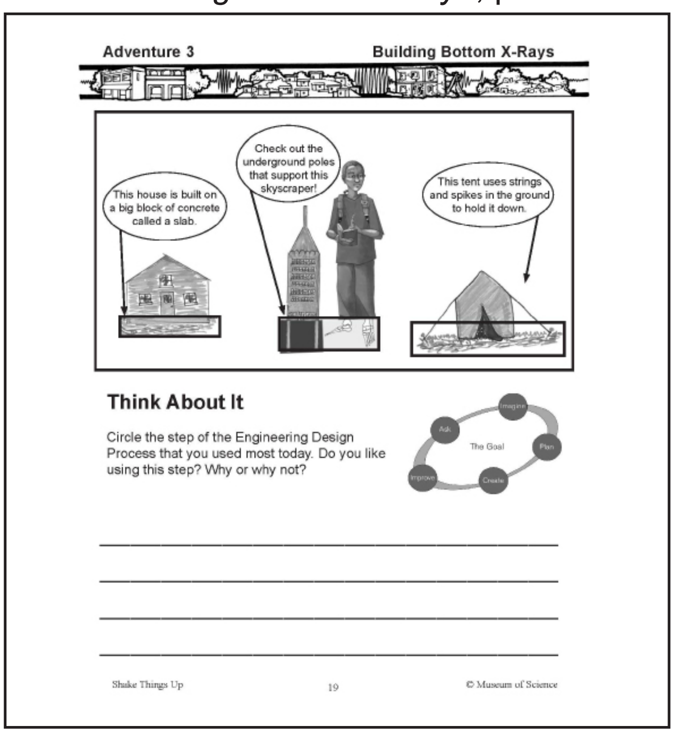
Watch your building unit carefully. Circle what happens when you test it.

slides tips or falls shears nothing

Would you feel safe inside this building? ☐ Yes ☐ No

Shake Things Up 18 © Museum of Science

Building Bottom X-Rays, p. 19



Adventure 3 **Building Bottom X-Rays**

Think About It

Circle the step of the Engineering Design Process that you used most today. Do you like using this step? Why or why not?

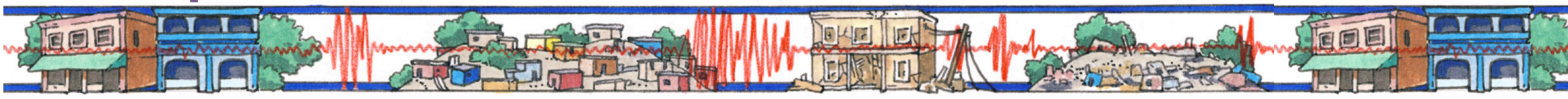
Shake Things Up 19 © Museum of Science

Building Codes Chart

Our model building codes are:

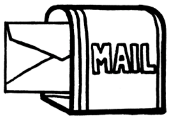
Adventure 3 — Stop the Slide

Educator Page: Adventure Guide



Kids will learn:

- they can engineer many ways to stop the building units from sliding during an earthquake.



Present the Message from the Duo (5 min)

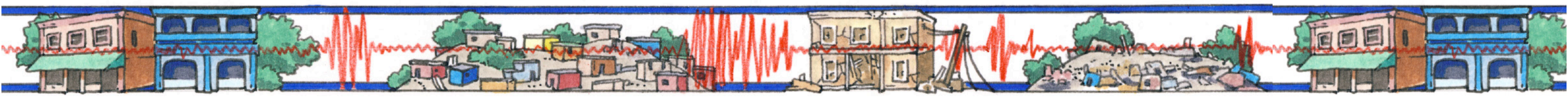
1. Explain to kids that Jacob wants them to engineer ways to keep their building units from sliding during an earthquake. Have kids turn to *Message from the Duo,* p. 17 in their Engineering Journals, to see the message from Jacob. Play track 5.
2. To check for understanding, ask:
   - **What is Jacob asking you to do?** *We need to figure out how to attach our building units to the ground.*
   - **What steps of the Engineering Design Process will help you?** *We can* ask *and* imagine *ways to attach the buildings to the ground, then* create *and test our designs.*

Ask and Imagine: How to Stop the Slide? (5 min)

1. Remind kids that Jacob said the units slid right off the shake table. Have one group demonstrate this by placing one unit on a shake table and testing at increasing magnitudes until the unit slides off the shake table.
2. Have kids get into groups of 3 to 5 and give each group a building unit, a piece of string, a toothpick, a paperclip, and a brass fastener.
3. To get kids thinking, ask:
   - **How do you think you could use these materials to make sure your units do not slide during an earthquake?** *Challenge kids to come up with as many ideas as possible. Encourage them to discuss the pros and cons of each idea and material.*
4. Tell kids their goal is to figure out how to stop their building module from sliding during a 7.0 magnitude earthquake, like the one in Haiti.

Try it Out: Plan and Create (25 min)

1. Give kids 5 minutes to *plan*. Challenge kids to come up with a *plan* using the fewest materials possible. Let kids know that, later on in the unit, they will work within a budget, so it is good practice to start using fewer materials now.
2. Send one member of each group to gather materials from the Materials Store and a shake table.
3. Give groups 20 minutes to *create* and test their designs at magnitude 7.0.
4. Groups should record what they find on *Testing Building Bottoms*, p. 18 in their Engineering Journals.



Reflect (10 min)

1. Have kids look at *Building Bottom X-Rays*, p. 19 in their Engineering Journals. To get kids talking about their designs, ask:
   - **What is the same about these drawings and the ideas you tried?**
   - **What stopped your unit from sliding? Why did that work well?**
2. Remind kids that Jacob wants them to use what they found out today to write a building code (or codes) that will teach others how to stop building units from sliding.
3. Ask:
   - **What do you want your building code(s) to say?** *The building code(s) should refer to something kids found out today. For example, if kids found that toothpicks worked well to attach their building unit to the shake table, a building code could read, “Building units should be attached to the ground with toothpicks.”*
   - **How do you think you could use these ideas to stop real buildings from sliding during an earthquake?** *Accept all responses.*
4. Write the building code(s) on the *Building Codes* chart. Keep this chart to use later in the unit.
5. Gather kids around the *Engineering Design Process* poster. Ask:
   - **What steps of the Engineering Design Process did you use today? How did these steps help you?** *We* asked *and* imagined *how to stop the building from sliding, then* created *and tested our designs, and made* improvements *based on what happened. These steps helped us try different solutions.*
6. Give kids time to record their thoughts on *Building Bottom X-Rays*, p. 19 in their Engineering Journals. Writing about what they did today will help kids internalize and remember what they found out in the next adventures.

Adventure 3
Stop the Slide

Email

reply | forward | archive | delete

from: engineeringadventures@mos.org

to: You

subject: Building from the Bottom Up

9:57 AM

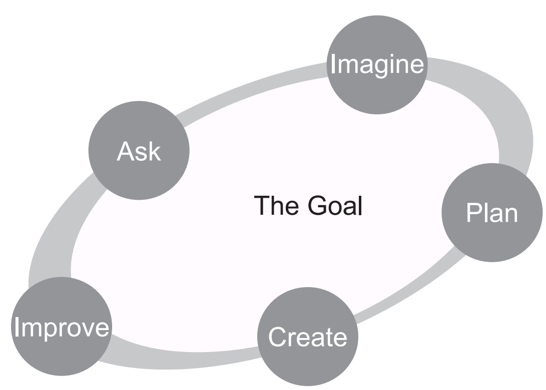
Hey engineers,

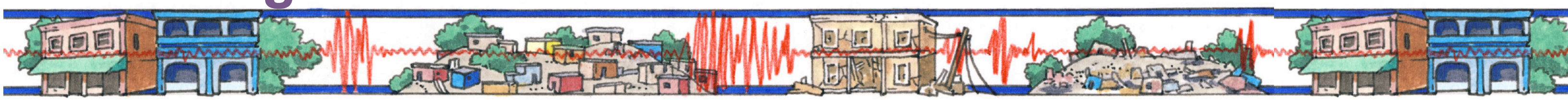
Did you notice that the building units slide right off the shake tables when you shake them? We have to figure out a way to attach them so they don't slide around during an earthquake. Bernard tells us that earthquake engineers have to think about this problem all of the time.

You can use the *ask* and *imagine* steps of the Engineering Design Process to help you. *Ask* about how buildings you've seen in real life are attached to the ground and *imagine* ways to attach your building unit to the shake table using some materials we sent along. *Create* and test some different ideas. For an extra challenge, try to use as few materials as possible and see if you can still stop the slide.

Once you figure out an idea that works well, write a building code about it and send it to us, so we can see what you're working on!

Jacob

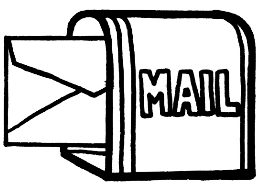




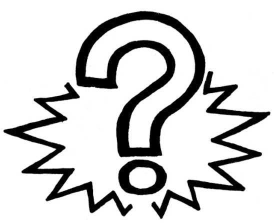
Overview: Kids will engineer a way to prevent their buildings from shearing.

Note to Educator: The side-to-side motion of an earthquake can cause the top and bottom of a building to move in different directions, causing damage. This force is called shear. Earthquake engineers can minimize the impact of shear on buildings by reinforcing them with braces.

Duo Update (5 min)

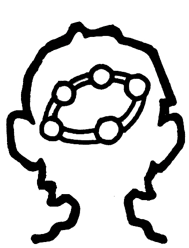


Ask (5 min)



Activity (25 min)

Reflect (10 min)



Materials

For the entire group:

- ☐ *Message from the Duo*, track 6 or Engineering Journal, p. 20
- ☐ *Engineering Design Process* poster
- ☐ *Building Codes* chart from the previous adventure
- ☐ 1 roll of string
- ☐ 28 medium binder clips
- ☐ 100 brass fasteners
- ☐ 100 coffee stirrers
- ☐ 100 paper clips
- ☐ 100 pipe cleaners
- ☐ 100 straws
- ☐ 100 toothpicks

For each group of 3-5 kids:

- ☐ 1 ruler
- ☐ 1 shake table
- ☐ several building units

For each kid:

- ☐ Engineering Journal

Preparation

Time Required: 15 minutes

1. Have the *Message from the Duo* ready to share.
2. Post the *Engineering Design Process* poster and the *Building Codes* chart.
3. Cut an approximately 12-inch piece of string for each group.
4. Set up a Materials Store with all materials for the entire group.

Journal Pages for Adventure 4

Message from the Duo, p. 20

Adventure 4 **Message from the Duo**

reply | forward | archive | delete

from: engineeringadventures@mos.org
to: You
subject: Let's Make Our Building Stronger!
10:15 AM

Greetings engineers!

We have another problem with our building units. They flop over and change shape when we test them on the shake table. Has this happened to you, too?

Bernard told us that the building units are floppy because the bottom moves fast and the top can't keep up. That makes the unit flop over and change shape. This is called 'shear.' We need to engineer a way to make sure our building units don't shear during an earthquake!

How can we engineer a way to stop the shear during an earthquake? Jacob and I are going to use the Engineering Design Process to help us *imagine*, *plan*, *create*, and test some technologies that we think will stop the shear. Then, we'll write a building code about what we find out.

Bernard said that earthquake engineers usually choose their materials based on a budget. Do you think you can engineer a technology to stop the shear using a budget of 10 materials or less? It's a challenge, but I think you're up to it.

Good luck!

India

Shake Things Up 20 © Museum of Science

Testing Braces, p. 21

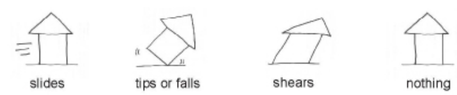
Adventure 4 **Testing Braces**

How did you stop your building unit from shearing? Draw your design here:

What materials did you use?

Test your building unit on the shake table at a 7.0 magnitude.

Watch your building unit carefully. Circle what happens when you test it.

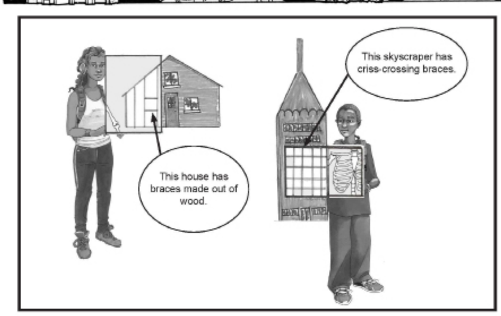


Would you feel safe inside this building? ☐ Yes ☐ No

Shake Things Up 21 © Museum of Science

Brace X-Rays, p. 22

Adventure 4 **Brace X-Rays**



Think About It

Would you like to be an earthquake engineer? Explain your answer.

Shake Things Up 22 © Museum of Science

Building Codes Chart

Our model building codes are:

Getting Braces

Kids will learn:

- there are many different ways to engineer braces to strengthen the building units.

Present the Message from the Duo (5 min)

1. Tell kids that India wants them to experiment with ways to brace the walls of their structure. Have kids turn to *Message from the Duo,* p. 20 in their Engineering Journals, to see the next message from India. Play track 6.
2. To check for understanding, ask:
   - **What does India want us to do?** *Find a way to stop the building units from shearing and write a building code about it.*

Ask: What Materials are Strong? (5 min)

1. Have kids get into groups of 3-5 and give each group a building unit, a toothpick, a piece of string, a coffee stirrer, a pipe cleaner, a straw, and a brass fastener.
2. To get kids thinking, ask:
   - **How do you think you could use these materials to make sure your building unit does not shear during an earthquake?** *Challenge kids to come up with as many ideas as possible. Encourage them to discuss the pros and cons of each idea and material.*

Create: Stop the Shear (25 min)

1. Tell kids that their goal is to design a technology that stops the building units from shearing during a 7.0 magnitude earthquake, like the one in Haiti.
2. Challenge kids to stop the shear using 10 materials or less. Each item at the Materials Store counts as one material.
3. Have one member from each group collect a shake table and the materials they need from the Materials Store.
4. Groups should *create* and test their designs at a 7.0 magnitude earthquake level on the shake table.
5. Kids should record their findings on *Testing Braces*, p. 21 in their Engineering Journals.

Tip: For materials like string and tape that come in a roll, one foot of each counts as one item from the store.

Reflect (10 min)

1. Have kids look at *Brace X-Rays*, p. 22 in their Engineering Journals. To get kids talking about their designs, ask:
   - **What is the same about these drawings and the ideas you tried?**
   - **What ideas did you try that stopped your unit from shearing? Why**

do you think those designs worked well? *Allow groups to share their designs, and demonstrate using their shake tables.*

2. Remind kids that India wants them to use what they found out today to write a building code (or codes) that will teach others how to stop a building from shearing. Ask:
   - **What do you want your building code(s) to say?** *The building code(s) should refer to something kids found out today. For example, if kids found that tying string around the building unit worked well to stop the shear, a building code could read, "Wrap string around each building unit."*
3. Write the building code(s) on the *Building Codes* chart. Keep this chart to use later in the unit. Ask:
   - **How could you use these ideas to engineer real buildings that will not shear during an earthquake?** *Accept all responses.*
4. Gather kids around the *Engineering Design Process* poster. Ask:
   - **What steps of the Engineering Design Process did you use today? How did these steps help you?**
5. Give kids time to record their thoughts on *Brace X-Rays*, p. 22 in their Engineering Journals. This will provide them with notes they can refer back to in the next adventures as they *create* and *improve* their earthquake-resistant buildings.
6. Let kids know that during the next adventure, they will be engineering a new building from scratch. They will use all of their expertise in earthquake engineering to make sure the building they engineer is earthquake resistant.

reply | forward | archive | delete

from:	engineeringadventures@mos.org
to:	You
subject:	Let's Make Our Building Stronger!

10:15 AM

Greetings engineers!

We have another problem with our building units. They flop over and change shape when we test them on the shake table. Has this happened to you, too?

Bernard told us that the building units are floppy because the bottom moves fast and the top can't keep up. That makes the unit flop over and change shape. This is called 'shear.' We need to engineer a way to make sure our building units don't shear during an earthquake!

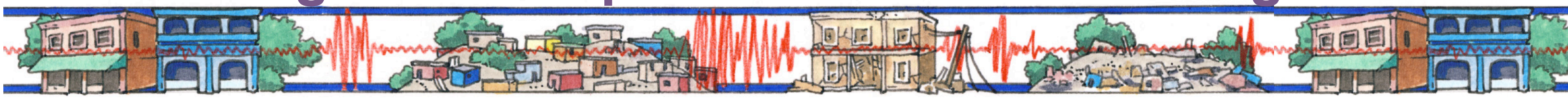
How can we engineer a way to stop the shear during an earthquake? Jacob and I are going to use the Engineering Design Process to help us *imagine, plan, create,* and test some technologies that we think will stop the shear. Then, we'll write a building code about what we find out.

Bernard said that earthquake engineers usually choose their materials based on a budget. Do you think you can engineer a technology to stop the shear using a budget of 10 materials or less? It's a challenge, but I think you're up to it.

Good luck!

India

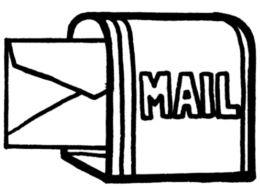
Creating an Earthquake-Resistant Building



Overview: Kids will work in groups to engineer a model earthquake-resistant building that can withstand a 7.0 magnitude earthquake.

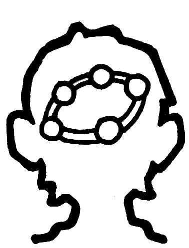
Note to Educator: Be sure to save the buildings each group engineers for Adventures 6 and 7!

Duo Update (5 min)



Activity (30 min)

Reflect (10 min)



Materials

For the entire group:

- ☐ *Message from the Duo*, track 7 or Engineering Journal, p. 23
- ☐ *Engineering Design Process* poster
- ☐ *Building Codes* chart from the previous adventure
- ☐ 1 roll of masking tape
- ☐ 1 roll of string
- ☐ 8 rulers
- ☐ 100 coffee stirrers
- ☐ 100 craft sticks
- ☐ 100 index cards
- ☐ 100 pipe cleaners
- ☐ 100 straws
- ☐ 100 toothpicks
- ☐ 200 brass fasteners
- ☐ 200 paper clips

For each group of 3-5 kids:

- ☐ 1 pair of scissors
- ☐ 1 shake table
- ☐ building units

For each kid:

- ☐ Engineering Journal

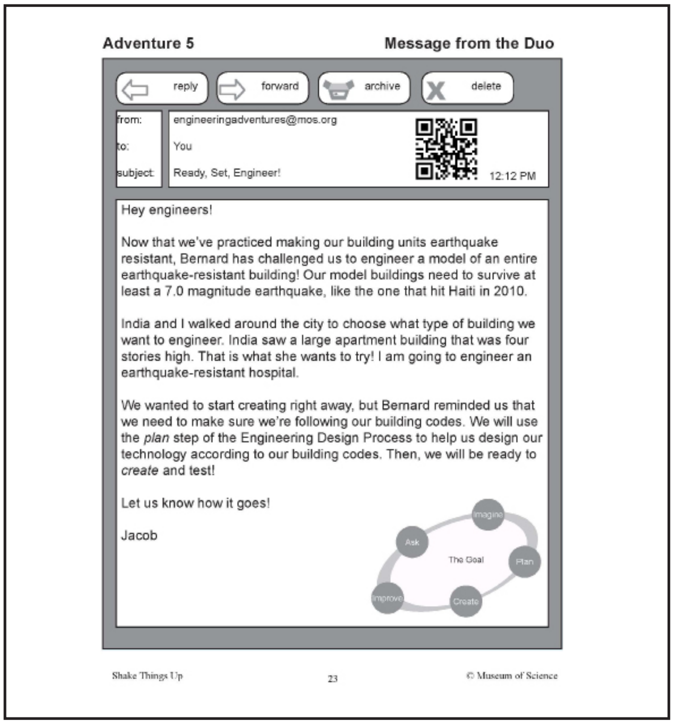
Preparation

Time Required: 15 minutes

1. Have the *Message from the Duo* ready to share.
2. Post the *Engineering Design Process* poster and the *Building Codes* chart.
3. Set up a Materials Store with all materials for the entire group.
4. Clear the shake tables of designs from previous adventures.
5. Optional: Prepare extra building units, as each group will need several.

Journal Pages for Adventure 5

Message from the Duo, p. 23



Adventure 5 Message from the Duo

reply forward archive delete

from: engineeringadventures@mos.org

to: You

subject: Ready, Set, Engineer! 12:12 PM

Hey engineers!

Now that we've practiced making our building units earthquake resistant, Bernard has challenged us to engineer a model of an entire earthquake-resistant building! Our model buildings need to survive at least a 7.0 magnitude earthquake, like the one that hit Haiti in 2010.

India and I walked around the city to choose what type of building we want to engineer. India saw a large apartment building that was four stories high. That is what she wants to try! I am going to engineer an earthquake-resistant hospital.

We wanted to start creating right away, but Bernard reminded us that we need to make sure we're following our building codes. We will use the *plan* step of the Engineering Design Process to help us design our technology according to our building codes. Then, we will be ready to *create* and test!

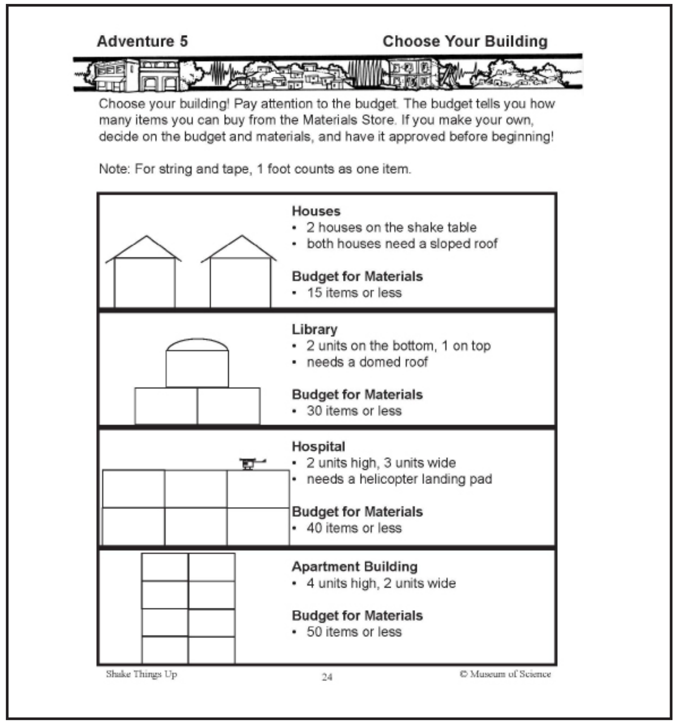
Let us know how it goes!

Jacob

Imagine Ask The Goal Plan Improve Create

Shake Things Up 23 © Museum of Science

Choose Your Building, p. 24



Adventure 5 Choose Your Building

Choose your building! Pay attention to the budget. The budget tells you how many items you can buy from the Materials Store. If you make your own, decide on the budget and materials, and have it approved before beginning!

Note: For string and tape, 1 foot counts as one item.

Houses
- 2 houses on the shake table
- both houses need a sloped roof

Budget for Materials
- 15 items or less

Library
- 2 units on the bottom, 1 on top
- needs a domed roof

Budget for Materials
- 30 items or less

Hospital
- 2 units high, 3 units wide
- needs a helicopter landing pad

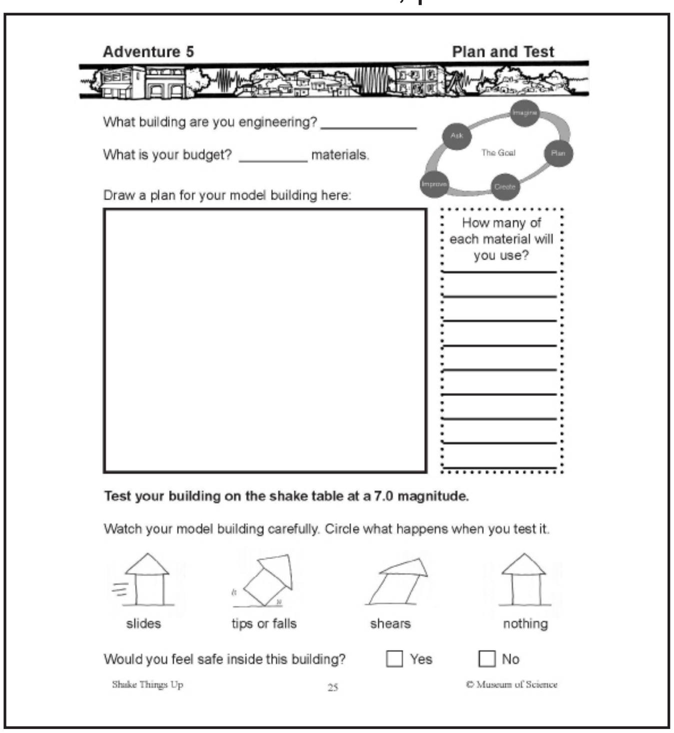
Budget for Materials
- 40 items or less

Apartment Building
- 4 units high, 2 units wide

Budget for Materials
- 50 items or less

Shake Things Up 24 © Museum of Science

Plan and Test, p. 25



Adventure 5 Plan and Test

What building are you engineering? ____________

What is your budget? ________ materials.

Imagine Ask The Goal Plan Improve Create

Draw a plan for your model building here:

How many of each material will you use?

Test your building on the shake table at a 7.0 magnitude.

Watch your model building carefully. Circle what happens when you test it.

slides tips or falls shears nothing

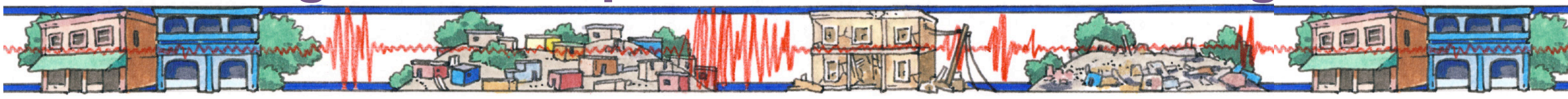
Would you feel safe inside this building? ☐ Yes ☐ No

Shake Things Up 25 © Museum of Science

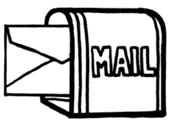
Building Codes Chart

Our model building codes are:

Creating an Earthquake Resistant Building



Kids will learn:
- the *plan* step of the Engineering Design Process can help them figure out what materials they need before building.
- they can use the Engineering Design Process to design technologies to solve problems.



Present the Message From the Duo (5 min)

1. Tell kids Jacob wants them to use all of their engineering skills to engineer their final model earthquake-resistant buildings. Have kids turn to *Message from the Duo,* p. 23 in their Engineering Journals, and read the message from Jacob. Play track 7.
2. To check for understanding, ask:
   - **What is Jacob asking you to do?** *He wants us to engineer a model building that will withstand a 7.0 magnitude earthquake. We also have to follow our building codes.*
   - **Which steps of the Engineering Design Process do you think will be the most helpful?** *The* plan*,* create*, and* improve *steps.*

Plan (10 min)

1. Tell kids that, just like India and Jacob, they will use their building codes to make a *plan* for how they will create their building.
2. Walk kids through *Choose Your Building*, p. 24 in their Engineering Journals. Point out that each building has certain rules kids must follow, along with a budget limiting the number of materials they can use. Groups can choose to engineer one of these buildings, or they can design their own. If designing their own, groups must have their rules and budget approved.
3. Point out the posted *Building Codes* chart. Tell kids that they should try to follow these rules as they engineer their building to make sure it is earthquake-resistant.
4. Have kids work in groups to draw and label their design on *Plan and Test*, p. 25 in their Engineering Journals. Groups should show you their *plan* before collecting materials at the Material Store.

> **Tip:** For materials like string and tape that come in a roll, a one foot piece of each counts as one item from the store.

> **Tip:** Check to see if kids understand the budget rules. Ask: Could I use 10 straws, two feet of tape, and six paper clips to build my houses? *No! That's 18 items, and you can only use 15 for the houses.*

Create (20 min)

1. Give kids 20 minutes to *create* their buildings. Kids may need to make more

building units, if there are not enough to go around.

2. Let kids know that they can exchange materials they are not using, but that they may not go over their materials budget.
3. As kids test their buildings, have them record their results on *Plan and Test*, p. 25 in their Engineering Journals.
4. As kids *create*, ask:
   - **Can you tell me about your design?**
   - **What step of the Engineering Design Process are you using right now? How do you know?**
   - **How are you following the building codes?**

Reflect (10 min)

1. Bring kids together and have them share what they have worked on. As each group shares their design, ask questions like:
   - **What did you do to make your model building earthquake-resistant?**
   - **Do you think your design is working well? How do you know?**
   - **What would you like to *improve* for next time?**
2. Review the *Building Codes* chart. Ask:
   - **Based on what you just did, are there any building codes you want to change?**
   - **Are there any new building codes you want to add?**
3. Gather kids around the *Engineering Design Process* poster. Ask:
   - **What steps of the Engineering Design Process did you use today? How did these steps help you?**
4. Give kids time to complete *Plan and Test*, p. 25 in their Engineering Journals. Kids can use this page to revisit and consider how they will *improve* their designs during the next adventure.

Adventure 5 — Email
Creating an Earthquake Resistant Building

reply | forward | archive | delete

from:	engineeringadventures@mos.org
to:	You
subject:	Ready, Set, Engineer!

12:12 PM

Hey engineers!

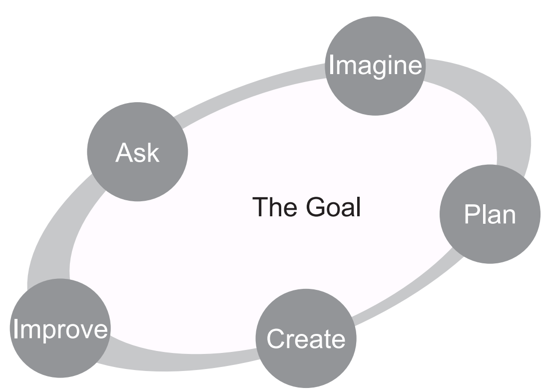
Now that we've practiced making our building units earthquake resistant, Bernard has challenged us to engineer a model of an entire earthquake-resistant building! Our model buildings need to survive at least a 7.0 magnitude earthquake, like the one that hit Haiti in 2010.

India and I walked around the city to choose what type of building we want to engineer. India saw a large apartment building that was four stories high. That is what she wants to try! I am going to engineer an earthquake-resistant hospital.

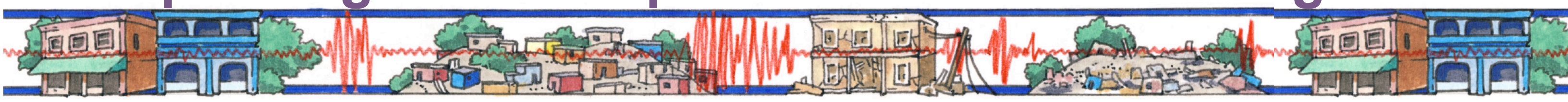
We wanted to start creating right away, but Bernard reminded us that we need to make sure we're following our building codes. We will use the *plan* step of the Engineering Design Process to help us design our technology according to our building codes. Then, we will be ready to *create* and test!

Let us know how it goes!

Jacob



Improving an Earthquake Resistant Building

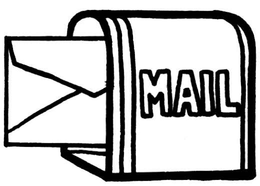


Overview: Kids will work in groups to *improve* their model earthquake-resistant buildings and finalize their building codes.

Note to Educator: The next adventure is the Engineering Showcase, which is a time for groups to share their work. If possible, invite other staff members, kids in the program, families, and community members to attend.

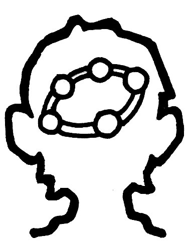
Be sure to save the buildings each group engineers for the Adventure 7!

Duo Update (5 min)



Activity (30 min)

Reflect (10 min)



Materials

For the entire group:

- ☐ *Message from the Duo*, track 8 or Engineering Journal, p. 26
- ☐ *Engineering Design Process* poster
- ☐ *Building Codes* chart from the previous adventure
- ☐ chart paper and marker

Materials Store (remaining materials from Adventure 5):

- ☐ 1 roll of masking tape
- ☐ 1 roll of string
- ☐ 100 coffee stirrers
- ☐ 100 craft sticks
- ☐ 100 index cards
- ☐ 100 pipe cleaners
- ☐ 100 straws
- ☐ 100 toothpicks
- ☐ 200 brass fasteners
- ☐ 200 paper clips, #1 size

For each group of 3-5 kids:

- ☐ 1 pair of scissors
- ☐ 1 shake table
- ☐ building units

For each kid:

- ☐ Engineering Journal

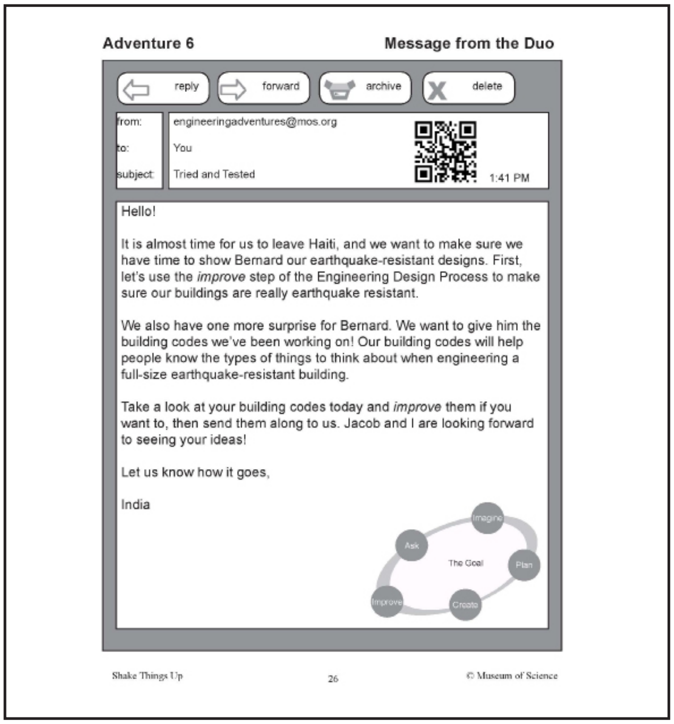
Preparation

Time Required: 15 minutes

1. Have the *Message from the Duo* ready to share.
2. Post the *Engineering Design Process* poster and the *Building Codes* chart.
3. Set up a Materials Store with all materials for the entire group.

Journal Pages for Adventure 6

Message from the Duo, p. 26


Adventure 6 Message from the Duo

reply forward archive delete

from: engineeringadventures@mos.org
to: You
subject: Tried and Tested
1:41 PM

Hello!

It is almost time for us to leave Haiti, and we want to make sure we have time to show Bernard our earthquake-resistant designs. First, let's use the *improve* step of the Engineering Design Process to make sure our buildings are really earthquake resistant.

We also have one more surprise for Bernard. We want to give him the building codes we've been working on! Our building codes will help people know the types of things to think about when engineering a full-size earthquake-resistant building.

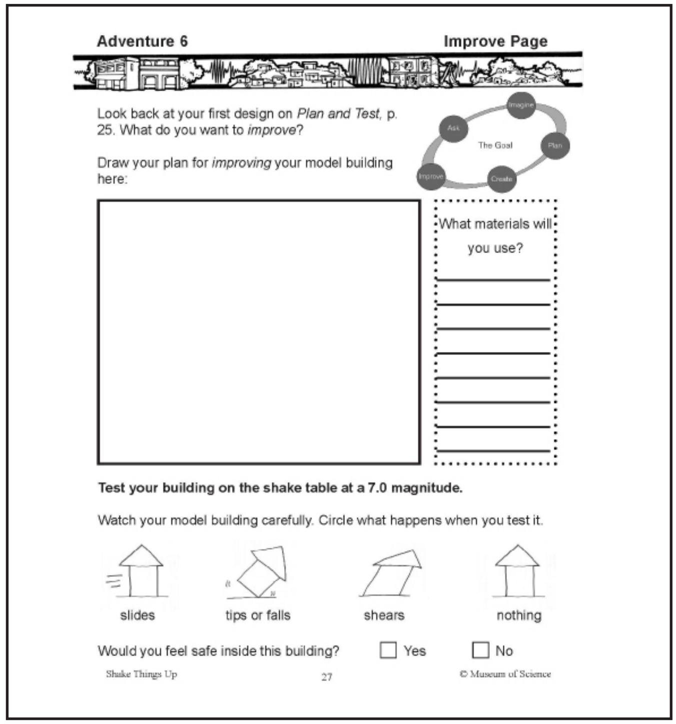
Take a look at your building codes today and *improve* them if you want to, then send them along to us. Jacob and I are looking forward to seeing your ideas!

Let us know how it goes,

India

Shake Things Up 26 © Museum of Science

Improve Page, p. 27


Adventure 6 Improve Page

Look back at your first design on *Plan and Test*, p. 25. What do you want to *improve*?

Draw your plan for *improving* your model building here:

What materials will you use?

Test your building on the shake table at a 7.0 magnitude.

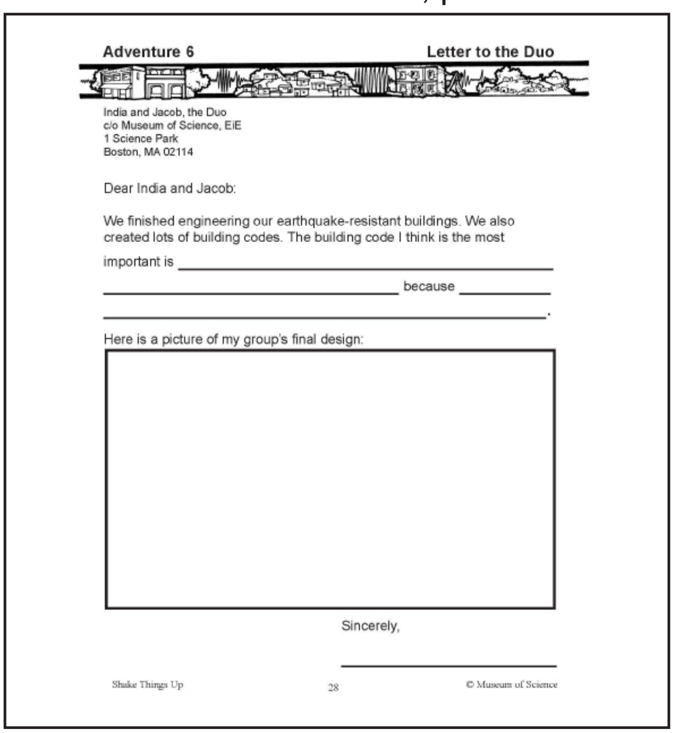
Watch your model building carefully. Circle what happens when you test it.

slides tips or falls shears nothing

Would you feel safe inside this building? ☐ Yes ☐ No

Shake Things Up 27 © Museum of Science

Letter to the Duo, p. 28


Adventure 6 Letter to the Duo

India and Jacob, the Duo
c/o Museum of Science, EiE
1 Science Park
Boston, MA 02114

Dear India and Jacob:

We finished engineering our earthquake-resistant buildings. We also created lots of building codes. The building code I think is the most important is ______________________ because ______________________.

Here is a picture of my group's final design:

Sincerely,

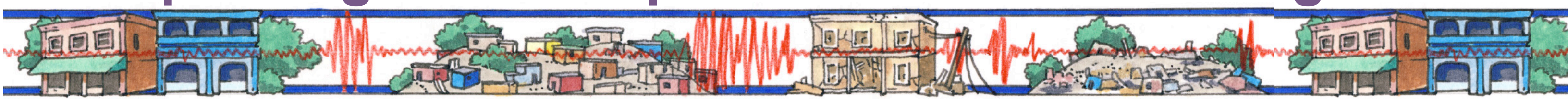
____

Shake Things Up 28 © Museum of Science

Building Codes Chart

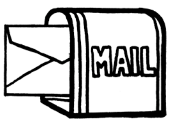
Our model building codes are:

Improving an Earthquake Resistant Building



Kids will learn:

- engineers often go back and *improve* their designs.
- building codes are rules created to help make sure structures are safe and strong.

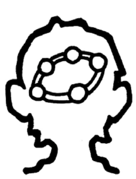


Present the Message from the Duo (5 min)

1. Tell kids that India wants them to *improve* their earthquake-resistant buildings and send a surprise to Bernard. Have kids turn to *Message from the Duo,* p. 26 in their Engineering Journals, to read the message from India. Play track 8.
2. To check for understanding, ask:
   - **What is India asking you to do?** *To* improve *our model buildings so they are earthquake resistant, and to send Bernard our building codes.*

Improve (30 min)

1. Have a volunteer go over the *Building Codes* chart from the previous adventures*.* Ask groups:
   - **Are there any building codes you want to change?**
   - **Are there any building codes you want to add?**
2. Have each group refer back to their *Plan and Test*, p. 25 in their Engineering Journals. Give kids 5 minutes to talk with their groups about the following questions:
   - **Which building codes are you taking into account in your building?**
   - **How do you want to *improve* your building today?**
3. Have groups make a new *plan* using *Improve Page*, p. 27 in their Engineering Journals, and then collect materials at the Material Store. Once groups have collected their materials, they should start their *improvements*, and test as they go, recording their results on the *Improve Page*.
4. As kids work, ask:
   - **What are you *improving*? How do you think this will make your model building more earthquake resistant?**
   - **What step of the Engineering Design Process do you think you are using right now? How do you know?**



Reflect (10 min)

1. Gather kids together and have them share what they have worked on. As each group shares their designs, ask questions like:
   - **What steps of the Engineering Design Process did you use today? How did these steps help you?**
   - **How did you *improve* your model buildings?**
   - **Do you think your design is working well? How do you know?**

2. Review the *Building Codes Chart*. Remind kids that even though they are focusing their building codes on small models, they are thinking about the same types of problems that earthquake engineers think about when they engineer full-size buildings. Ask:
    - **Based on what you just did, are there any building codes you want to change or add?**
3. Remind kids that India and Jacob want to share their building codes with Bernard. Have kids write a letter to India and Jacob using *Letter to the Duo,* p. 28 in their Engineering Journals. Kids will draw their final design and write about the building code they think is the most important.

    Tip: Kids can email the Duo directly at engineeringadventures@mos.org.

4. Congratulate kids on the engineering work they have done so far and encourage them to invite friends and family members to the Engineering Showcase in Adventure 7. During the Showcase, groups will share their final designs and test all of the designs together, as part of a big model city.

Improving an Earthquake Resistant Building

reply forward archive delete

from:	engineeringadventures@mos.org
to:	You
subject:	Tried and Tested

1:41 PM

Hello!

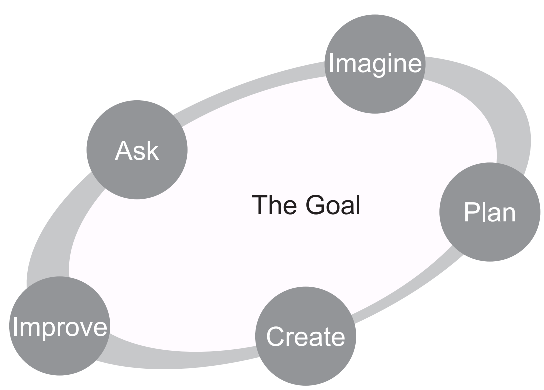
It is almost time for us to leave Haiti, and we want to make sure we have time to show Bernard our earthquake-resistant designs. First, let's use the *improve* step of the Engineering Design Process to make sure our buildings are really earthquake resistant.

We also have one more surprise for Bernard. We want to give him the building codes we've been working on! Our building codes will help people know the types of things to think about when engineering a full-size earthquake-resistant building.

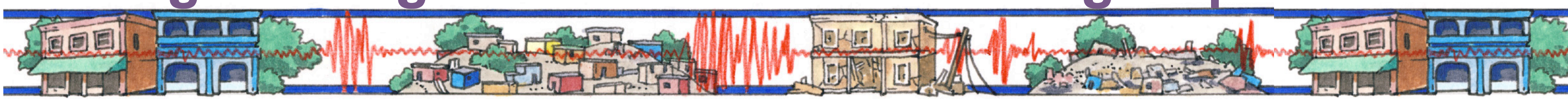
Take a look at your building codes today and *improve* them if you want to, then send them along to us. Jacob and I are looking forward to seeing your ideas!

Let us know how it goes,

India



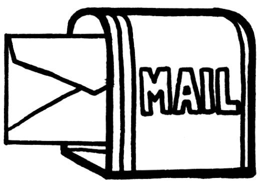
Engineering Showcase: Shake Things Up



Overview: Kids will present their work and explain how they used the Engineering Design Process to engineer their model buildings. Kids then combine their shake tables to create a model city and test how earthquake-resistant the city is.

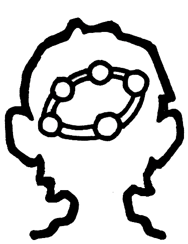
Note to Educator: The Engineering Showcase is a time for kids to show off what they have learned and all of their hard work! Consider inviting guests to watch groups present their model buildings, share their building codes, and see how well the city fares when all of the shake tables are combined.

Duo Update (5 min)



Activity (30 min)

Reflect (10 min)



Materials

For the entire group:

- ☐ *Message from the Duo*, track 9 or Engineering Journal, p. 29
- ☐ *Engineering Design Process* poster
- ☐ *Building Codes* chart from the previous adventure
- ☐ 28 medium binder clips

For each group of 3-5 kids:

- ☐ final building from Adventure 6
- ☐ shake table

For each kid:

- ☐ Engineering Journal

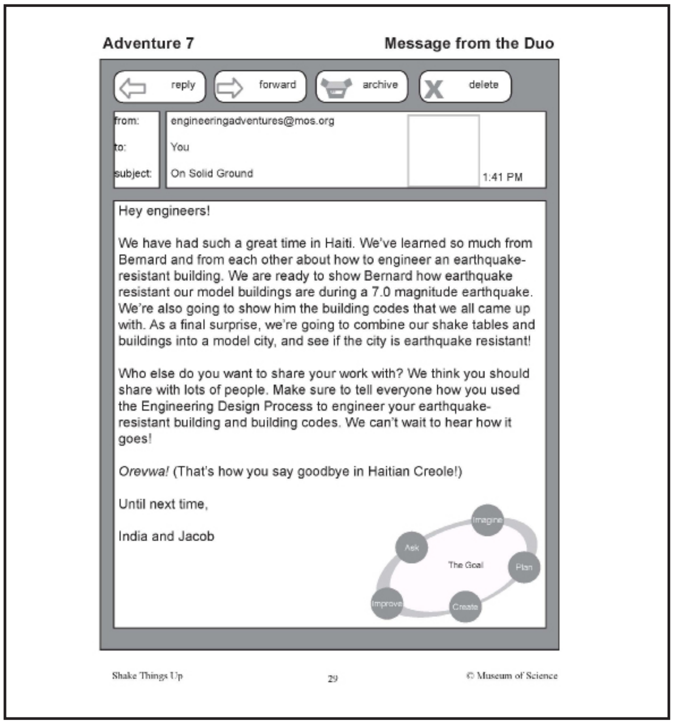
Preparation

Time Required: 5 minutes

1. Have the *Message from the Duo* ready to share.
2. Post the *Engineering Design Process* poster and the *Building Codes* chart.

Journal Pages for Adventure 7

Message from the Duo, p. 29



Adventure 7 **Message from the Duo**

reply forward archive delete

from: engineeringadventures@mos.org
to: You
subject: On Solid Ground
1:41 PM

Hey engineers!

We have had such a great time in Haiti. We've learned so much from Bernard and from each other about how to engineer an earthquake-resistant building. We are ready to show Bernard how earthquake resistant our model buildings are during a 7.0 magnitude earthquake. We're also going to show him the building codes that we all came up with. As a final surprise, we're going to combine our shake tables and buildings into a model city, and see if the city is earthquake resistant!

Who else do you want to share your work with? We think you should share with lots of people. Make sure to tell everyone how you used the Engineering Design Process to engineer your earthquake-resistant building and building codes. We can't wait to hear how it goes!

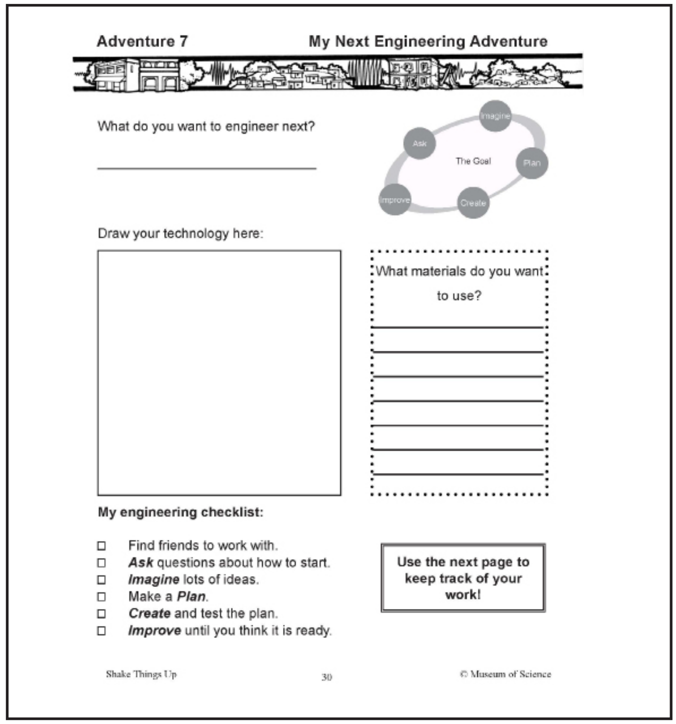
Orevwa! (That's how you say goodbye in Haitian Creole!)

Until next time,

India and Jacob

Shake Things Up 29 © Museum of Science

My Next Engineering Adventure, pp. 30-31



Adventure 7 **My Next Engineering Adventure**

What do you want to engineer next?

Draw your technology here:

What materials do you want to use?

My engineering checklist:

- ☐ Find friends to work with.
- ☐ ***Ask*** questions about how to start.
- ☐ ***Imagine*** lots of ideas.
- ☐ Make a ***Plan***.
- ☐ ***Create*** and test the plan.
- ☐ ***Improve*** until you think it is ready.

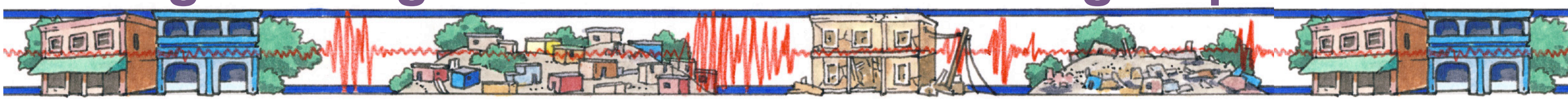
Use the next page to keep track of your work!

Shake Things Up 30 © Museum of Science

Building Codes Chart

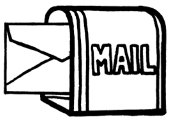
Our model building codes are:

Engineering Showcase: Shake Things Up



Kids will learn:

- every step of the Engineering Design Process was used in designing each model building.



Present the Message from the Duo (5 min)

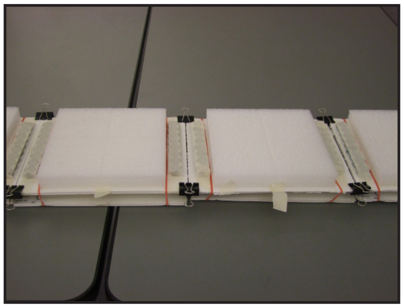
1. Tell kids that India and Jacob are excited for the kids to show off their work! Have kids turn to *Message from the Duo,* p. 29 in their Engineering Journals, to read the message from India and Jacob. Play track 9.
2. To check for understanding, ask:
   - **What are India and Jacob asking you to do?** *Share our building codes and then combine all of the shake tables to see how earthquake resistant our city is during a 7.0 magnitude earthquake.*

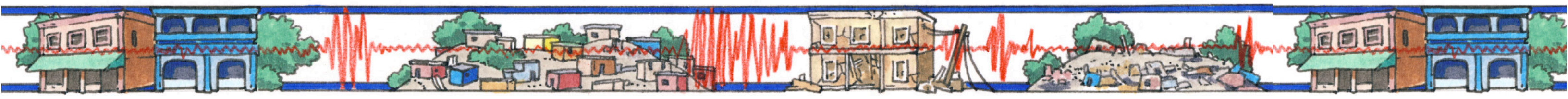
Engineering Showcase (20 min)

1. Have volunteers present the list of building codes from the *Building Codes Chart*. Ask questions like:
   - **Why do you think this building code is important?**
   - **How did you come up with this building code?**
   - **Would this be important to think about in a full-size building? Why?**
2. Have each group set up their shake table and model building from Adventure 6.
3. Have all groups take turns sharing about their buildings. Each group should demonstrate how well their design survives a 7.0 magnitude earthquake on the shake table. As groups present, ask questions like:
   - **Can you tell us about your design? How did you engineer your model building so that it is earthquake resistant?**
   - **What steps of the Engineering Design Process helped you the most as you engineered your model building? Why?**

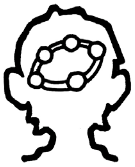
Bring it all Together (10 min)

1. Tell kids that they will combine all of the shake tables to make a city that they can test in a 7.0 magnitude earthquake.
2. Have some volunteers help you put the city together. Attach each shake table to another along the upper layer with two medium binder clips. Connect the shake tables until they are all in a single line (see photograph at right for an example).
3. Once all of the shake tables are connected, have volunteers hold the bottom layer of the shake tables down, while others pull the top layer back





to mimic a 7.0 magnitude earthquake. Have the volunteers release the top layer at the same time and see how the model city fares!



Reflect (10 min)

1. Gather kids together to do a final share of their work throughout the unit. Ask the group questions like:
    - **Were you surprised by what happened when our city experienced an earthquake? Why or why not?**
    - **How do you think the building codes we created could help people engineer full-size earthquake-resistant buildings?** *Encourage kids to think about the same ideas on a larger scale. For example, full-size buildings also have to be attached to the ground and have bracing.*
    - **What would you *improve* about your building if you had more time?**
2. Show kids the *Engineering Design Process* poster. Remind kids that they used all of these steps as they engineered their buildings. Ask:
    - **How do you think you can use the steps of the Engineering Design Process to solve other problems? What is an example?**
    - **What do you want to engineer next?**
3. Give kids time to complete *My Next Engineering Adventure*, pp. 30-31 in their Engineering Journals. Having kids record their ideas will help them consolidate what they learned throughout the unit and apply their new skills in their everyday lives.

Adventure 7
Engineering Showcase: Shake Things Up

Email

reply | forward | archive | delete

from:	engineeringadventures@mos.org
to:	You
subject:	On Solid Ground

1:41 PM

Hey engineers!

We have had such a great time in Haiti. We've learned so much from Bernard and from each other about how to engineer an earthquake-resistant building. We are ready to show Bernard how earthquake resistant our model buildings are during a 7.0 magnitude earthquake. We're also going to show him the building codes that we all came up with. As a final surprise, we're going to combine our shake tables and buildings into a model city, and see if the city is earthquake resistant!

Who else do you want to share your work with? We think you should share with lots of people. Make sure to tell everyone how you used the Engineering Design Process to engineer your earthquake-resistant building and building codes. We can't wait to hear how it goes!

Orevwa! (That's how you say goodbye in Haitian Creole!)

Until next time,

India and Jacob