

Lesson 1

How can we build a sturdy wall?

Suggested Time

One 30-minute session

Lesson Overview

Students will investigate the properties of sturdy structures by constructing a LEGO wall. The wall must be about 6 bricks high and withstand the “Flick Test”. The Flick Test involves flicking the top of the wall to see if the wall fails or tips over.

- Predicting structurally sound building practices
- Class discussion of different building methods.
- Building a sturdy wall activity and testing
- Recording design and test results in Engineering Journal

Learning Objectives

By the end of this lesson, students will be able to:

- Determine the best design for a sturdy structure
- Define engineering design as the process of creating solutions to human problems through creativity and the application of math and science knowledge.

*Teacher Background****Structural Strength Introduction***

* info & technical terms*

Engineering Design

Engineers typically work together to solve the problems that face society. Engineering design is the process of creating solutions to human problems through creativity and the application of math and science knowledge. The basic steps within the design process include:

- i. Identifying a problem –**
Observing a problem and seeing a need for a solution.
- ii. Researching possible solutions –**
Coming up with ideas to address the problem.
- iii. Picking the best solution –**
Determining which idea best addresses the problem. This decision may involve monetary, practicality, material, and property concerns.
- iv. Building a prototype –**
Build a working model of the chosen design
- v. Testing the prototype –**
Be sure the working model solves the problem and holds up to any important material property tests.
- vi. Repeating any steps needed to improve the design –**
The engineering design process is not always a step-by-step

Lesson 1 How can we build a sturdy wall?

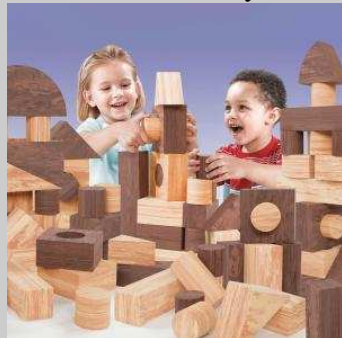
process, as engineers often repeat steps or go back and forth between the other five steps.

Vocabulary

Engineering – the process of creating solutions to human problems through creativity and the application of math and science knowledge.
Material – Any substance used for constructing or making an object. A material can be a solid, liquid or a gas.
Strength –
 *more terms related to activity

Materials

- For each student**
- Engineer’s Journal Part 1
- For each student pair**
- WeDo kit
- For the class**
- Pictures of sturdy structures and flimsy structures



How High Winds Affect Buildings

Translation or Sliding
(Lateral Movement)

Overturning

Material Failure

Figure 3-3. Building failure may occur in several ways.

Rocking
(Lateral Collapse)

Figure 3-4. This building failure is the result of inward wind forces and uplift wind forces acting on a building during a high wind event.

From FEMA 342, see also <http://www.fema.gov/mibspat>

Lesson 1

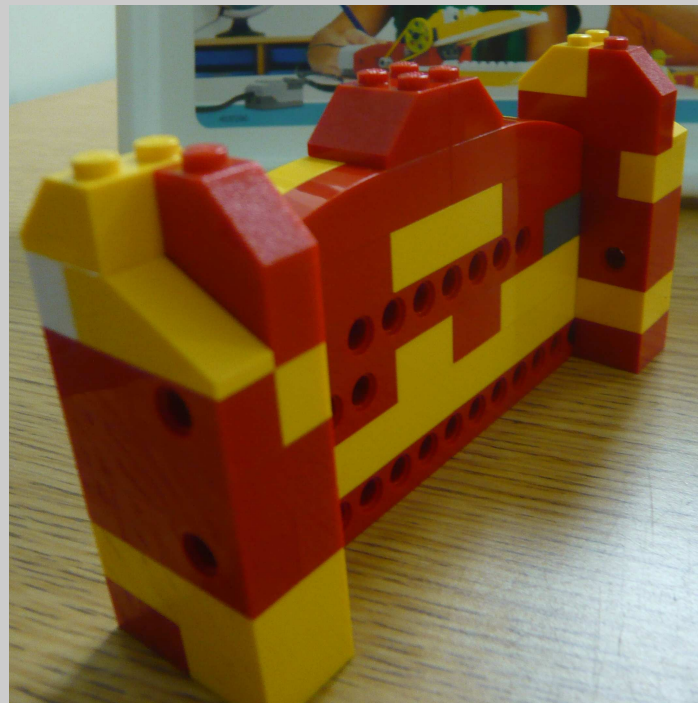
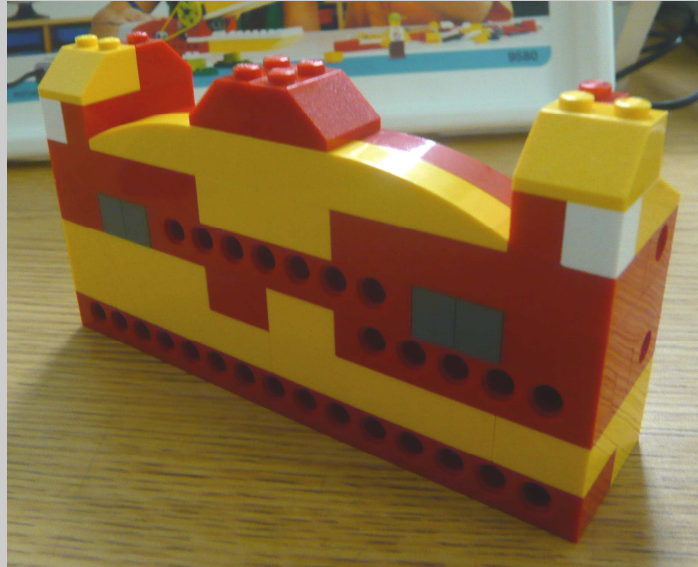
How can we build a sturdy wall?

Preparation

- Distribute Engineering Journals

Instructions for Teachers

Constructing a Sturdy Wall



Lesson 1

How can we build a sturdy wall?

Activity Instructions

- 1) Show students the photos of the flimsy structures and ask them what they find wrong with them. Ask them what could have been done to prevent the structures from failing. Then show them the photos of the sturdy structures and ask the students what makes these structures better. Explain to them that using engineering good practices helps engineers to make a safe and functional product.
- 2) Ask students to brainstorm what makes some structures sturdier than others. They should discuss their ideas with their partner and then write their ideas in their Engineer's Journal. After two or three minutes of brainstorming, explain that they will be focusing on building a sturdy wall.
- 3) Explain that the students' main task in completing this engineering design challenge is to determine how to design structures that stay together.
- 4) Tell students to use the LEGO bricks to create a wall that is about 6 bricks high. They can use the LEGO beams, bricks and angled bricks to build their wall. Students should test their design by the Flick Test to see if the structure stays together.
- 5) Allow five to ten minutes for student pairs to construct a wall. They should try the Flick Test to determine their wall's strength. Students should describe their method of building in their Engineer's Journal.
- 6) Gather students together and ask each pair to tell the class about their design. Have them demonstrate their wall's strength by the Flick Test. As they describe and test their designs, record on a class chart their method of construction.
- 7) After each pair has shared their design, explain that these methods of building are all utilizing the engineering design process. If they encountered a problem while testing their wall, they went back to try a different design. Explain to them why some of their walls are stronger than others because of overlapping different lengths of LEGO bricks. This is similar to the way people construct brick houses and inner building walls.
- 8) Conclude the lesson by reviewing the methods of constructing sturdy structures and its importance. Buildings must be made to withstand a lot of weight and contain people. If a building was not safe, people would not be allowed in... thus engineers must design a safe and sturdy building. Anything that involves a human life must be made safely, including cars.