Stepping-Stone Activity

Technology Activity Brief

Developed by: Bryan Weber and Steve Dungan

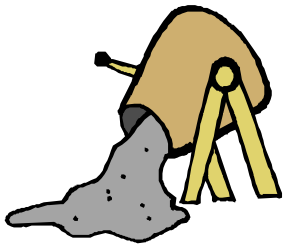
Context:

Concrete was first developed by the Romans and used successfully as early as the 3rd century B. C. After the fall of the Roman Empire in 400 A.D. it disappeared from existence for over 1,000 years. Since its rebirth it has been used in a variety of ways such as roads, sidewalks, foundations, pipes among many other things. Concrete, has been referred to by some as the universal man-made rock. It is present almost everywhere that people live. Its large consumer use is a result of its many favorable characteristics, such as its durability, molding ability, resistance of fire, strength and resistance to pests.

There are three main ingredients, which are responsible for many of the characteristics that concrete is noted for. The ingredients are water, cement and aggregate. Without all of these working together concrete would not function as it does today.

Water is a key ingredient in concrete. It is responsible for hydrating the mixture. It creates a chemical reaction, which causes the concrete to harden. An excess, as well as a lack of water can be detrimental to the strength and workability of the concrete. Too little water cause poor workability and hinders strength. Too much water make the concrete running and also results in poor strength.

Aggregate is another important ingredient. Its job is to help bind the cement together. There are different size pieces of aggregate for each specialized job. A job such as building the Hoover Dam would require huge pieces of aggregate such as boulders, but there are also jobs that require small pieces of gravel as aggregate. It all depends on the strength required for the job.



The last ingredient is known as cement. It is not uncommon for people to confuse cement with concrete, but they are definitely not the same. Cement can be thought of as the paste that binds everything together. The most common kind of cement is known as Portland Cement.

Major Terms Defined:

Cement: finely powdered mixtures of inorganic compounds, which when combined with water, hardens with hydration.
Concrete: a hard compact building material formed when a mixture of cement, sand, gravel, and water undergoes hydration.
Aggregate: particle material such crushed rock, sand, and gravel. Added to concrete mixture to provide additional strength.
Slump Test: test used to determine concrete workability.
Workability: how easily fresh concrete can be placed and consolidated

Your challenge is to produce a reinforced concrete stepping-stone with final dimensions of 1 1/2” X 12” X 12” inches. You will complete this objective while working with a partner. You will be required to assist in mixing, reinforcing, placing, finishing, and extracting the concrete stepping-stone.

Remember: Your ultimate goal is to produce an eye appealing, reinforced, structurally sound stepping-stone by completing the required procedures. Good Luck!

Materials and Equipment List:

Mixing Trough
Mixing Rod
Concrete Mixture
Form
Water
Concrete Tools (float, trowel)
Wire Mesh

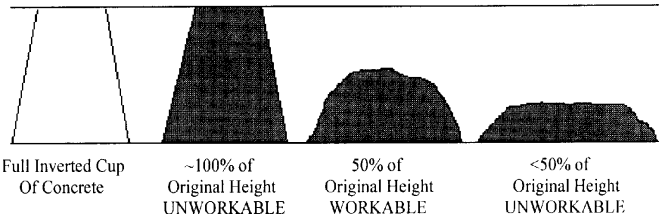


Figure 1 –An illustration of how concrete reacts differently in a slump test.

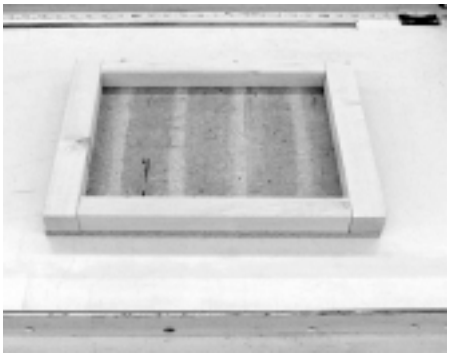


Figure 2 – This is an example of the form you will use for your stepping-stone.

Objectives:

• By the end of this activity you should have a fabricated and reinforced concrete stepping-stone measuring 1 _ X 12 X 12 in.

• By the end of this activity you should be able to correctly perform a slump test on a given batch of concrete.

• By the end of this activity you should be able to correctly mix, reinforce, place, finish, and extract a concrete stepping-stone.

Procedures: The following step-by-step procedures should be used as a checklist. After completing each procedure check it off.

Read the entire design brief.
Break into assigned teams of two.
Review concrete mixture as a class.
Cut wire mesh to 9 X 9 inch square.
Prepare forms with mold release.
Begin mixing concrete to manufacturer ’s specifications.
Perform slump test (See Figure 1).
Record results on concrete mixture / slump test handout.
Seek teacher approval for your group’ s concrete mixture.
Place reinforcement wire mesh into concrete form.
Finish filling form until full.
Be sure concrete is compact and fills form completely.
Use appropriate finishing techniques.
Clean tools and working area.
Allow adequate curing time (48 hours).
Remove concrete forms from stepping-stones.
Fill out evaluation form.
Turn in final stepping-stone and Design Brief with all pages attached and completed.

References:

• Mawson (1998). *How much slump?*. Retrieved March 19, 2002 from http:// www.mawsons.com.au/yp_slump.html.

• Mawson (1999). *Concrete: A guide for younger persons*. Retrieved March 19, 2002 from http://www.mawsons.com.au/ yp_conctrete.htm

• Portland Cement Association (1968). *Design and control of concrete mixtures* (11th ed.) Stokie, Illlinois: Author.

• Portland Cement Association (1960). *Cement mason's manual for residential construction.* Skokie, Illinois: Author.

Name(s) _____ Date:_____

_____

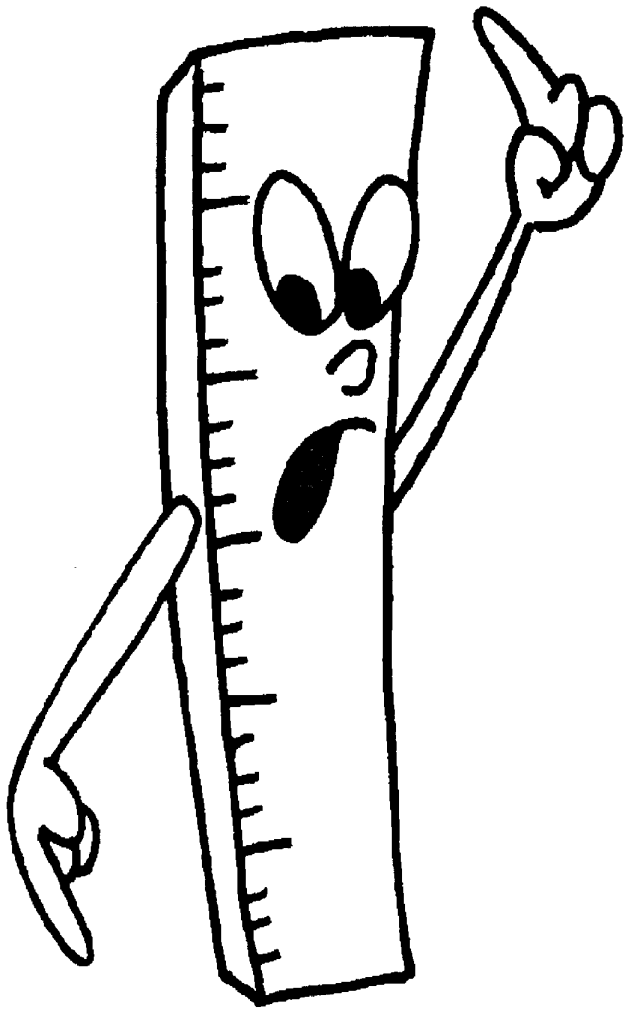
Stepping-Stone Activity

Slump Test Results

In the space provided below, record your slump test results.

- ❑ Height _____
- ❑ Teacher Approval

Also be sure to record the mixture amounts for your concrete!



Water _____(amount)

Concrete Mixture _____(amount)

Stepping-Stone Activity

Name: _____ Date: _____

Follow-Up Questions

Please complete the following questions.

1. **What are the major ingredients in concrete, and what role do they play?**

2. **What is the purpose of using wire mesh in the stepping-stone?**

3. **What test is used to determine concrete workability?**

4. **Explain the process of performing a slump test?**

5. **Briefly discuss the proper water to cement ratio.**

These documentation sheets are designed to be enlarged to 8.5" x 11" for use in the classroom.

Stepping-Stone Activity

Name:_____
Date:_____

Evaluation

Equipment Design Sheets

- All design brief pages completed **0-5 pts.** _____
  -Handed in on time
  -Neatly done
- Recorded slump test results **0-10 pts.** _____
  -Teacher's signature
  -Filled in all spaces
- Follow-up Questions **0-15 pts.** _____
  -Correct number

Stepping-stone Assessment

- Stepping-stone completed **0-10 pts.** _____
  -Completed on time
  -Accurate size
  -Durability
- Visual Appeal **0-10 pts.** _____
  -Level
  -Smoothness
- Adheres to dimensions **0-15 pts.** _____
  -1 _ X 12 X 12 inches

Group Assessment

- Group cooperation **0-10 pts.** _____
  -Used time effectively
  -Worked well with others

Total: _____/75

Stepping Stones Activity Sheets