



ACTIVITY INSTRUCTIONS/LESSON PLAN

Activity Name: Edible Asphalt

Project Name	Edible Asphalt
No. of MSA facilitators	2-3
Age of Students	4-8 Grade
Estimated Time to Complete	5 minutes or less/student
Service Areas	Transportation
Questions? Contact	Dan Borchardt
<p>Ingredients/Materials (approx. 150 Students/1 hr event based on Ziplock container size). Bulk supplies will last multiple events</p> <p>40 oz Container</p>  <p>72 oz Container</p> 	<ul style="list-style-type: none"> • 5oz cup (Drum Mixer) 450 count 5oz cups bag from Sams Club \$11.00 • Popsicle Sticks (Mixer) 100/\$2.50 Walmart • Parchment Paper (6"Wx11"T) 205ft Roll 2 pack \$11.00 will last multiple events Sams Club • Gravel: Ground up Oreo Cookie 70oz Ziplock container full (food processor, 10 bag pack from Sam's Club \$10.00) • Sand: Ground up Graham Crackers 40oz square Ziplock container (4 box container from Sams Club \$8.00) • Recycled Asphalt Pavement: Ground up Reece's Peanut Butter MM's or Crispy MM'S 40oz square Ziplock container mm3lbs bag \$10.00 Sams Club • Shingles: Ground up Instant Oatmeal 40oz square Ziplock container 5lbs bag \$10.00 Sams Club • Bitumen: Chocolate Mixture: Melt in crock pot about 120oz <ol style="list-style-type: none"> 1) Semi Sweet Chocolate: Melt 80 oz Chips (Sams Club Bag = \$10.00 2) Peanut Butter Creamy about a half a 20-24 oz jar (Sams Club 2 40oz pack = \$8.00) 3) Small can of Sweetened Condensed Milk (\$1.00 Walmart) 4) Chocolate Almond Milk about 32oz or till a good consistency is achieved. \$3.00/ half gallon (Whole Milk and

	vegetable oil also work.) A longer day exhibit may cause the chocolate to dry out so thinning the mixture more keep the mixture from drying out may be beneficial. Mixture freezes well and can be used for multiple events.
Cost of materials	\$87.00 Initially to \$50/Reoccurring event for restocking supplies necessary.
Additional Materials	<ul style="list-style-type: none"> • A large poster with photos of an asphalt plant (drum mixer type), laboratory mixing and compacting equipment, a paver/screed and a compaction roller helps to illustrate the field processes. • Different textured rocks and samples of loose and or compacted pavement samples or photos of actual construction materials also help to illustrate the concepts. • Bowls, spoons, and measuring cups should be set up prior to the presentation and can be reused for each group of students.

Description:

Asphalt is a key building material primarily used for building our transportation system. Real asphalt uses a type of recipe similar to the one used for baking cookies including a binder and a combination of aggregate materials such as gravel and sand. Well...you won't be eating sand, but you can eat asphalt today, sort of.

Allergy note: some ingredients may include gluten, milk, nuts and soy. Eating the mixture is optional.

Purpose

The process of making these cookies parallels the procedures used to produce asphalt pavements. Asphalt is a black sticky substance used in road construction to hold rocks together. When heated asphalt liquefies; as it cools, it hardens and becomes solid. A mixture of asphalt and rocks make good roadway material after it hardens. The similarities between making cookies and preparing pavement include using a hot liquid added to a variety of dry ingredients and mixed together which when cooled hardens and gains strength.

Objectives:

- Introduce the civil engineering area of paving and materials to fourth through seventh grade students.
- Create a hands-on activity for groups of five to 10 students that lasts approximately 15 minutes.
- Explain the physical properties of asphalt and discuss road construction techniques
- Use an easy-to-prepare cookie recipe as an analogy for making asphalt.
- Illustrate how engineering affects our daily lives, but often goes unnoticed.

Ingredient Breakdown:

Asphalt (2 Scoop Batch)

- (1 Scoop) Gravel (Oreo Cookie)
- (1/2 Scoop) Sand (Graham Cracker)
- (1/4 Scoop) Recycled Asphalt Pavement (Recess M&M's)
- (1/8 Scoop) Shingles (Oatmeal)
- (1/8 Scoop) Bituminous Liquid (Liquid Chocolate)

Asphalt

- 50% Gravel (Oreo Cookie)
- 30% Sand (Graham Cracker)
- 15% Recycled Asphalt Pavement (Recess M&M's)
- 3% Shingles (Oatmeal)
- 2% Bituminous Liquid (Liquid Chocolate)

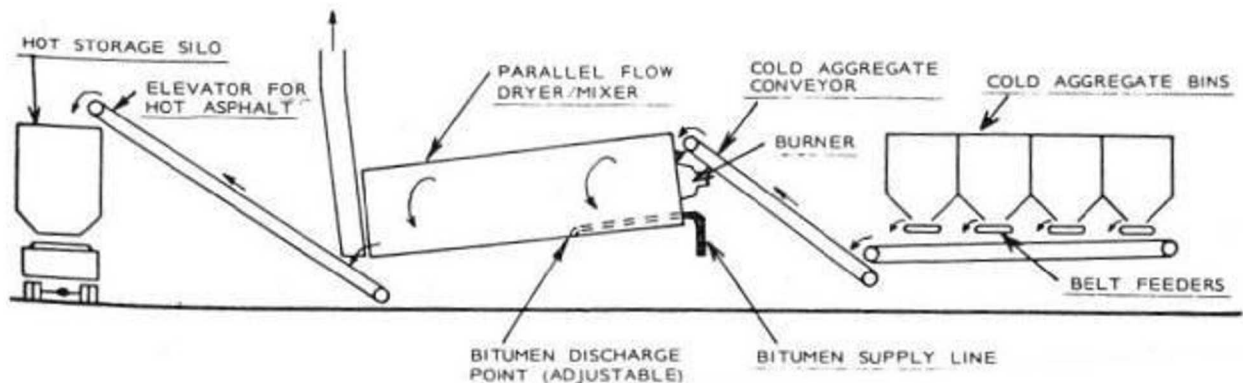
Instructions:

1. A variety of materials is used in the preparation of paving materials. Discuss the different sizes and textures of the rocks used.
2. Engineers select and calculate the correct quantities of each rock size needed to produce a strong asphalt pavement. Calculated percentages of the different sizes of rocks are combined to determine the appropriate blend of rock materials. The mixture of rocks and asphalt binder are then compacted and put through a series of tests which smash, stretch, and freeze the pavement to determine the best blend of rocks to use in a certain climate.
3. Explain that different measuring techniques are used in the field than in the laboratory. In the field engineers use huge quantities of each rock size and weigh them on scales as large as a garage. In the lab, much smaller quantities of each material are needed and ordinary measuring utensils are used.
4. Discuss the properties of the edible construction materials to be used in the demonstration and compare with original materials. Encourage each student to measure the recommended quantities of all construction materials (ingredients)

into their mixing bowl: 1/8 cup old fashioned oats -1 /8 cup quick oats -1 tablespoon walnuts -1 tablespoon coconut.

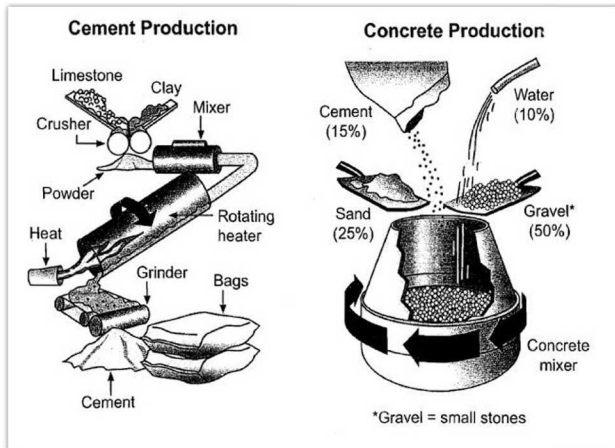
5. Point out that the drum mixer at the asphalt plant tumbles all of the ingredients until they are well coated with the asphalt binder. The tumbler works like a clothes dryer. Mixing the ingredients in the bowls is a similar process.
6. Show the liquid form of the chocolate asphalt in the crock pot to the students and explain that when asphalt is heated to 300 degrees F, it is also a liquid.
7. Measure and pour 1/4 cup chocolate asphalt into the materials mixture. Students should stir the combination until all of the particles are well coated. Notice that as the mixture cools while it is being stirred, it becomes stiffer and starts to stick together. Asphalt behaves in the same manner.
8. When the materials are thoroughly mixed, each student should pour and mound the mixture on to a square of wax paper. Cover with a second piece of wax paper.
9. In the field, the pavement is spread with the paver and then rolled into a thin mat with a roller. The roller is very heavy and smashes all of the air out of the pavement which helps to make the asphalt very strong. Each student should now use a can to roll their cookie out to a 1/4" to 1/3" thick cookie.
10. When the cookies are flat, show the students that they can still identify the different materials they put in their cookies. The oatmeal, walnuts and coconut are visible through the wax paper.
11. Have each student feel the heat coming off the top of the cookie. Immediately after pavement is rolled out it is still very hot. Just like the asphalt, the cookies will harden as they cool.

Congratulations! You made it through the demonstration and the students may take their asphalt cookies with them. When the cookies have cooled, they can be peeled off the wax paper and eaten.

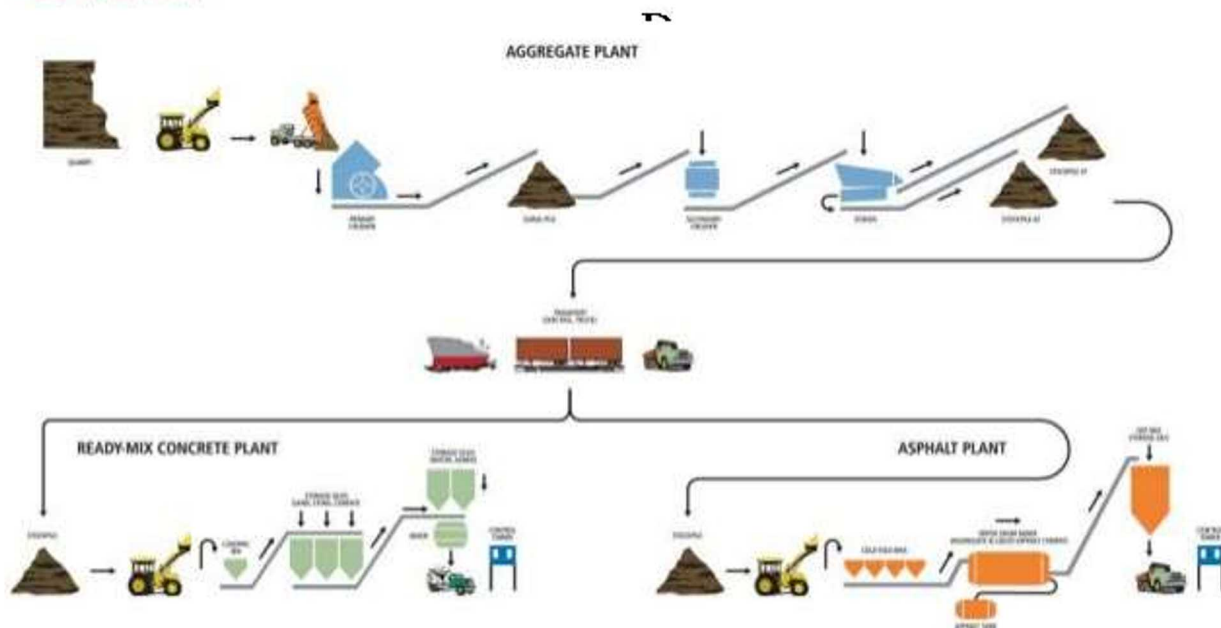


Background:

Concrete is a key building material. It strengthens foundations and covers all kinds of structures. More than six billion tons are used in the U.S. every year. Real building concrete uses a type of recipe similar to the one for your cookie. Concrete is made of portland cement, an aggregate (the combination of two materials like gravel and sand), and water. In the edible concrete cookie, the graham cracker crumbs are the aggregate. The powdered sugar is the Portland cement. The orange juice concentrate and corn syrup represent the water.



Fabrication and Production



Real Life:

- Concrete
 - 50% Gravel
 - 25% Sand
 - 13% Cement
 - 2% Flyash
 - 10% Water
- Asphalt
 - 50% Gravel
 - 30% Sand
 - 15% Recycled Asphalt Pavement
 - 3% Shingles
 - 2% Bituminous Liquid

STEM:

- Concrete
 - 50% Gravel (Chocolate Chips or Recess M&M's)
 - 25% Sand (Grahm Cracker)
 - 13% Cement (Powered Sugar)
 - 2% Flyash (Sugar)
 - 10% Water (Corn Syrup)
- Asphalt
 - 50% Gravel (Oreo Cookie)
 - 30% Sand (Grahm Cracker)
 - 15% Recycled Asphalt Pavement (Recess M&M's)
 - 3% Shingles (Oatmeal)
 - 2% Bituminous Liquid (Liquid Chocolate)