

Photo Description



This image shows concrete with many different colored rocks, pebbles, and stones mixed inside. The concrete appears gray and smooth, while the rocks are various colors including brown, orange, red, black, and yellow. You can see both large and small pieces of rock scattered throughout the concrete surface.

Scientific Phenomena

The anchoring phenomenon shown here is a composite material - concrete mixed with aggregate (rocks and pebbles). This represents how humans engineer materials by combining different substances to create something stronger than the individual parts. The concrete acts as a binding agent that holds all the rock pieces together, while the rocks provide strength and durability. This happens because the cement in concrete undergoes a chemical reaction with water (hydration) that creates strong bonds around the aggregate materials.

Core Science Concepts

1. Material Properties: Different materials have different properties - concrete is strong when hard but was once liquid, while rocks are naturally hard and durable.
2. Mixtures vs. Solutions: This concrete represents a mixture where you can still see the individual components (rocks, sand, cement) rather than a solution where materials dissolve completely.
3. Engineering Design: Humans combine materials to solve problems - in this case, creating a strong building material by mixing cement, water, sand, and rocks.
4. Physical vs. Chemical Changes: The concrete formation involved a chemical change (cement + water reaction), while the rocks maintain their original properties through physical mixing.

Pedagogical Tip:

Have students bring in small rock collections from home or the playground to examine the variety of colors, textures, and sizes. This hands-on exploration helps them connect to the concept before introducing the engineering aspects.

UDL Suggestions:

Provide multiple ways for students to explore materials - visual sorting activities, tactile exploration of different textures, and audio descriptions of material properties to support diverse learning needs.

Zoom In / Zoom Out

1. Zoom In: At the microscopic level, cement crystals grow and interlock around sand grains and rock surfaces, creating incredibly strong chemical bonds that hold everything together like tiny molecular hooks.

2. Zoom Out: This concrete is part of larger human infrastructure systems - sidewalks, buildings, bridges, and roads that connect communities and allow transportation of people and goods across vast distances.

Discussion Questions

1. What patterns do you notice in the sizes and colors of rocks in this concrete? (Bloom's: Analyze | DOK: 2)
2. How might the properties of this concrete change if we used only small pebbles versus only large rocks? (Bloom's: Evaluate | DOK: 3)
3. What other materials do humans combine to make something stronger or more useful? (Bloom's: Apply | DOK: 2)
4. Why do you think engineers chose to mix rocks with concrete instead of using just concrete alone? (Bloom's: Analyze | DOK: 3)

Potential Student Misconceptions

1. Misconception: "Concrete and cement are the same thing."
Clarification: Cement is just one ingredient in concrete, like flour in a cake recipe. Concrete is the mixture of cement, water, sand, and rocks.
2. Misconception: "The rocks were added after the concrete dried."
Clarification: The rocks (aggregate) are mixed in while the concrete is still wet and liquid, then everything hardens together as one solid material.
3. Misconception: "All rocks in concrete are the same, just different colors."
Clarification: These are actually different types of rocks with different properties - some may be harder, some softer, some from different geological processes.

NGSS Connections

- Performance Expectation: 5-PS1-3 - Make observations and measurements to identify materials based on their properties
- Disciplinary Core Ideas:
 - 5-PS1.A - Structure and Properties of Matter
 - 3-5-ETS1.A - Defining and Delimiting Engineering Problems
- Crosscutting Concepts:
 - Patterns - Observable patterns in the sizes, colors, and distribution of materials
 - Structure and Function - The structure of concrete (rocks held by cement) relates to its function (strong building material)

Science Vocabulary

- * Aggregate: Small rocks, pebbles, and sand that are mixed into concrete to make it stronger.
- * Composite: A material made by combining two or more different materials together.
- * Properties: The characteristics of a material, like how hard, smooth, or colorful it is.
- * Mixture: When two or more materials are combined but keep their own properties.
- * Engineering: Using science and math to design and build things that solve problems.
- * Durable: Able to last a long time without breaking or wearing out.

External Resources

Children's Books:

- "Material World: A Substantial Story" by Bruce Koscielniak
- "What Is the World Made Of? All About Solids, Liquids, and Gases" by Kathleen Weidner Zoehfeld
- "Rocks and Minerals" by Steve Tomecek

YouTube Videos:

- "How Concrete is Made" - Simple explanation of concrete mixing process for kids: <https://www.youtube.com/watch?v=UOHURuAf5iY>
- "Properties of Materials for Kids" - Exploring different material characteristics: <https://www.youtube.com/watch?v=UK78-7OBqzI>