

# Lesson 1 – Introduction to Concrete

## 1. Background Narrative:

Concrete is an important part of society’s infrastructure. Everyday life is greatly affected by concrete in numerous ways. It’s all around us. Concrete is a useful construction material and innovations are constantly being made in new types and applications for it.

This is the first lesson of the Concrete Curriculum. It engages the students and helps them begin to think about concrete and how important it is in everyday life. A brief introduction of the fellows to the students will begin the lesson, and then it will progress into an overview of concrete, the ingredients, and why we’re learning about it.

## 2. Performance Objectives

- Students will be able to identify different types of concrete.
- Students will be able to recognize the different uses of concrete.
- Students will be able to answer questions about three different types of concrete.

## 3. Standards

NYS Integrated: 3.1, 2.3, 6.1,7.2

US Science: 2.3

US Technology: 1.3, 3.2

## 4. Resources

- Characterize Concrete Activity worksheet
- Concrete Types worksheet
- Concrete cylinders (3 per group-one of each type)
- Aggregate samples (1 fine, 1 coarse)

## 5. Vocabulary

<b>Concrete</b>	<b>Fine Aggregate</b>
<b>Cement</b>	<b>Course Aggregate</b>
<b>Aggregate</b>	<b>Water</b>

## 6. Instructional Plan

### Introduction to Concrete: (15 minutes)

Have the students look around the room. Ask the following questions: What do they see? What is this room made of? What materials went into its construction? The floors and the walls may be made of concrete. Talk about these, and the fact that this classroom or the school wouldn’t be here without them. Cinder blocks are a significant component of construction.

Put the word “concrete” on the board. Ask the students what they know about concrete. This can be anything that they know. Write these on the board. Ask questions to prompt answers, some examples are:

“What do we use concrete for?”

“What is concrete made of?”

Everyone is affected by concrete in some way every day. Concrete is a part of everyday life. We have some uses for concrete already on the board. Can anyone think of other places where concrete is used? (List these on the board as well) Did you go over any bridges today? How many people walked to school today? You probably walked on a concrete sidewalk for some of that distance.

Show the PowerPoint presentation. Talk a little bit about each of the pictures. The first part of the slideshow shows uses for concrete. The second part is of concrete failures. There is a script at the end of this document.

Briefly discuss the uses for concrete that the students came up with, and any other ones that would be good to include that were not. Discuss the fact that there is a broad range of applications. Some of the uses for concrete are for cars to drive on, for constructing buildings and bridges, and even for making a backyard basketball court. Be sure to emphasize that concrete is an exciting construction material because there is still so much more to learn about it and the ways to use it.

Do all of these applications need the same type of concrete? Will the same concrete that you use in your backyard on the basketball court work for building a high rise building, a bridge, or a dam? What are some of the important characteristics of concrete that could help you decide what kind you need? (strength, weight, cost, aesthetics)

### **Activity: (20 minutes)**

Show a sample of concrete to the class (not one of the sample types). Discuss some of its characteristics. Ask the class what color it is, what it looks like it’s made up of, what else they notice about it. You’re modeling the questions that the students will have to ask during the activity.

Before we analyze the concrete samples, we should decide what characteristics we will all be looking at. That way, when we get back together we can talk about them as a group. What characteristics should be used to analyze the concrete? (weight, texture, color) List characteristics on board.

Divide the class into groups of 3 or 4. Distribute 3 concrete cylinders and worksheets (one worksheet per student). Allow approximately 10 minutes for students to observe the different samples and complete the characteristics worksheet.

Make sure to walk around the room while the groups are describing the cylinders. Ask the students questions to spur thinking about the questions on the worksheet, and to get all of the members in each group participating.

### **Probing Questions:**

Which characteristics are you choosing to observe? Why are you choosing them?

What other characteristics can you consider?

What is the affect of the different characteristics for cylinders? How do you know? - test

Once everyone has finished describing the cylinders, have them move back to their seats. What did you notice about the first cylinder? Write the responses on the board, briefly summarize what is said. Now that we've looked at all of these different concrete samples, what do you notice is the same in all of them? What do they have in common? All of the concrete samples have this "gray stuff". This is cement, and holds the concrete together. It's the glue for the rest of the material in the concrete. What is different between the concrete samples? Those "chunks" in the concrete are the aggregates. They are another part of the concrete that gets held together with the cement.

### **Concrete Information: (15 minutes)**

(This could be the beginning of the next day, so a recap of some of the uses and characteristics of concrete would be good. Recall the activity as well.)

We know that concrete is an important part of everyday life. There is concrete all around you. What do we know about concrete though? We know that it is used as a construction material for a wide variety of applications, but what is concrete? What is concrete made of?

Pass out the vocabulary sheet. Make sure the students are filling out the definitions as you go along. Have an transparency or projection of the worksheet. Write in the definitions so that the students have the correct definitions. We will only do the first 6 definitions today. Be sure hold onto the sheet. Put it in your binders.

During the activity, we took a look at a few different types of concrete. What did these have in common? All of them had "gray stuff." That's the cement and it acts like the glue in concrete. Another ingredient that was in each of the concrete types is aggregate. There are two types of aggregates in concrete. These are Fine and Course aggregates. Show the students examples of a fine and a coarse aggregate. The last ingredient in concrete can't be seen in the samples we looked at earlier. Water is added to the concrete while it is being mixed to react with the cement and make the concrete hard.

These are the definitions for the vocabulary sheet the students have:

**Concrete** – A non-uniform mixture of cement, water, and aggregate.

**Cement** – The "glue" that holds the concrete together.

**Aggregate** – Makes up 60-70% of total concrete mixture. The "chunks" in the concrete.

**Fine Aggregate** - Generally consist of natural sand or crushed stone with most particles ranging in size from 0.025 to 4.75 mm.

**Course Aggregate** – Any particles greater than 4.75 mm, but generally range between from 6.5 to 38 mm in diameter and generally consisting of crushed stone and gravel.

**Water** – Reacts with the cement to start the hardening process of the mixture.

**Closure and Recap: (5 minutes)**

Why are we studying concrete? How might engineers use concrete? Why would engineers be interested in looking at concrete and new ways to use it?

Make sure that the students hold onto their worksheets. They will be using them later on for another activity. Their only homework is to pay attention to all of the concrete they see until the next time we meet. We'll discuss these observations when we come in next time.

## **Power Point Presentation Script:**

**Slide 1:** Introduce concrete

**Slide 2:** This might be something you can relate to. Skate parks across the country and around the world are made with concrete. They can be formed into many different configurations.

**Slide 3:** The Hoover Dam is considered to be one of the greatest engineering feats of its time. At the time, it was the world's largest concrete structure and the largest electric power producing facility. It is made up of 3.33 million cubic meters of concrete and is the 5<sup>th</sup> busiest US National Park.

**Slide 4:** This is an interesting ad that shows one possible application for concrete. The ad is for a type of quick curing concrete.

**Slide 5:** Believe it or not, some types of concrete can let light pass through them. Light transmitting concrete is made of a combination of glass optical fibers and fine concrete. It is used in a variety of applications such as walls, pavement, design, and art.

**Slide 6:** All of the world's tallest buildings incorporate concrete into their construction. These are the world's tallest buildings that have been built or will be finished by 2009.

**Slide 7:** Concrete can be formed into interesting and artistic shapes that can be part of architectural design. Many modern buildings take this into consideration.

**Slide 8:** Read Did You Know?

**Slide 9:** Read Fun facts

**Slide 10:** PIE students made this bench at Clarkson during one of their meetings. There is currently one bench outside of the Rowley Building at Clarkson.

**Slide 11:** This road surface failed which means that the structure can't be used for its intended purpose.

**Slide 12:** This is an example of column failure. It is a compressive failure of the concrete. The concrete was not strong enough to hold the load from above it. It shows the importance of engineering design in a structure.

**Slide 13:** This is an example of beam failure. It is a tensile failure of the concrete. How would you like to drive to school on this bridge?

**Slide 14:** During the failure of this dam, 450 people were killed downstream. This is another example of why engineering design is so important.

**Slide 15:** When this bridge collapsed, there was no traffic load on it, and was caused by the weather. Two people were killed and four more were injured.

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Characterize Your Concrete!

As a class, we have decided on what characteristics to analyze for three concrete cylinders. Write those characteristics in the column labeled "Characteristic."

Describe the Cylinders based on the characteristics.

Characteristic	Cylinder 1	Cylinder 2	Cylinder 3

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Concrete Vocabulary:

- Concrete – \_

\_\_\_\_\_

- Concrete Ingredients:

1. Cement –

\_\_\_\_\_

2. Aggregate-

\_\_\_\_\_

\_\_\_\_\_

- a. Fine Aggregate - 

\_\_\_\_\_

\_\_\_\_\_

- b. Coarse Aggregate -

\_\_\_\_\_

\_\_\_\_\_

3. Water –

\_\_\_\_\_

- Hydration –

\_\_\_\_\_

\_\_\_\_\_

- Curing –

\_\_\_\_\_

\_\_\_\_\_

- Compressive strength -

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- Pounds Per Square Inch (PSI) –

\_\_\_\_\_

