

# Lesson 3: BUILDING A SKYSCRAPER

grade level: elementary (4-6)

## ► OVERVIEW

Students will examine primary source documents from the construction of the Empire State Building. Through historical analysis, students will understand the scope and challenge of building a skyscraper, both by using their own documents and learning from the documents of others.

## ► GUIDING QUESTIONS

- How does a skyscraper stand up?
- What factors must architects and engineers consider when designing a skyscraper?
- What technological innovations allowed skyscrapers to be built?
- What jobs/professions are involved in the construction and maintenance of a building?



## ► MATERIALS and PREPARATION

- Copies of both Activity Sheets for each student, as well as skyscraper images from the Skyscraper Photograph Master.
- Determine student grouping for primary resource examination. The nine documents that comprise Activity Sheet 3 are ordered from easiest to most challenging, in order to assist in preparation.

## LEARNING OBJECTIVES

Students will:

- Analyze historical documents for information about skyscraper construction
- Interpret historical documents to understand the thought processes behind important building decisions
- Understand and appreciate the many worker roles in constructing a skyscraper
- Synthesize various documents into a cohesive picture of the construction process.

## ► MATERIALS to download

- Activity Sheet 2: Parts of a Skyscraper; Activity Sheet 3, pages 1-19
- Skyscraper Photograph Master
- Optional: Overhead projector and a transparency of Activity Sheet 2
- Hundreds of images of the construction of the Empire State Building are available at [www.skyscraper.org/VIVA2](http://www.skyscraper.org/VIVA2)

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## ► VOCABULARY

**Beams:** Horizontal supports that attach to columns within the frame

**Bedrock:** Solid rock found deep underground below the dirt and soil; the foundation is usually built on top of this rock

**Column:** A vertical support within the frame

**Excavate:** To remove material from the ground by digging

**Façade:** The outer walls of a building made from glass or stone that rest on the frame; also called a curtain wall

**Foundation:** The lowest part of a building, usually underground

**Reinforced Concrete:** Concrete that is made stronger by adding steel rods or wires; It also protects the steel from changes in temperature due to fire or weather

**Skeleton Frame:** A system of columns and beams that carries the weight and load of a building

**Steel:** A strong metal made from a mixture (*alloy*) of iron and carbon that can be shaped into columns and beams

## ► I. INTRODUCTION: *HOW ARE SKYSCRAPERS BUILT?*

Distribute Student Activity Sheet 2, and use this as a basis for student notetaking during delivery of the following content. A transparency of the Activity Sheet may shorten time spent on this section. Remind students that they will begin writing at the bottom of the page, just as building construction begins at the base.

Like the roots of a tree, a skyscraper's **foundation** is actually laid below ground in order to create the most stability. Ask students to draw an analogy between the foundation and their real life experiences. In order to do this, a construction site must first be **excavated**, which involves digging out sand and dirt in order to get to the **bedrock**. Once the foundation has been laid, the **skeleton frame** is constructed by connecting **steel columns** and **beams** in a grid pattern. Sometimes, **reinforced concrete** is used as well, in order to protect the steel from extreme temperature changes. The skeleton frame is strong enough to hold up the entire weight of the building.

The **façade**, usually made from stone, brick, metal, or glass, is laid over the skeleton frame to create the exterior wall of the building. The façade hangs on the frame like a curtain, but does not support the building in any way. Workers often begin constructing the façade on the ground floor of the building while the upper floors of the skeleton frame are still being erected. As the façade rises, interior systems, such as electric wiring, telephone and internet cables, heating and cooling systems, and plumbing, are installed. After these systems are inspected, walls, floors, and ceilings are installed. In the final stages of construction, the interior of the building is painted and decorated.

**NOTE:** For teachers with limited class time, this lesson is designed to be split over two days, with the introductory material on day 1 and the document examination on day 2.

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## ► *Vocabulary Building Activity*

Give individuals or small groups of students pictures of skyscrapers to label. These may be printed from the Skyscraper Photograph Master (see “Materials to Download”), or you may select your own images at [www.skyscraper.org/bankerstrust](http://www.skyscraper.org/bankerstrust) or [www.skyscraper.org/VIVA](http://www.skyscraper.org/VIVA).

- Instruct students to label each feature of the skyscraper they recognize from the vocabulary they have just learned, including **foundation**, **frame**, **columns**, **beams**, **elevator shaft**, and **façade**.
- Choose one element for each group to share with the class as a wrap-up. Be sure to allow students to share the name of the building so that other students can become acquainted with these notable parts of the New York City skyline.

## ► II. INSTRUCTION: *BECOMING HISTORIANS*

Begin by asking students what types of documents a historian might examine to learn about a particular time period or event. Explain that today they will become historians of the construction of the Empire State Building, examining different documents to learn something about what construction was like at that time.

Review with student the process of “Close Looking” (see Lesson 2). Explain that, even if your document has no pictures, using the steps to close looking will help you understand the document.

Some other tips:

1. Read all of the questions on the sheet, then look at the document again. Reading the questions can help you find what you are looking for.
2. Each sheet has some vocabulary words on it. Read these closely and try to use them in your document; understanding all of the words in a document is important.
3. Don't spend a lot of time on things you don't understand. Focus on what the document tells you and the questions you can answer.

### **The Impact of Technology**

Many innovations from the 1800s paved the way for skyscraper construction. Before the invention of steam-powered **digging and drilling machines** in the 1830s, it would have been impossible to excavate a construction site in order to build on bedrock. Likewise, though **steel** was first created in the 13th Century BC, it was impractical until Henry Bessemer invented a simple method of mass production in 1855. Finally, the **elevator** was invented by Elisha Otis in 1853, allowing people and goods to travel to the top floor of buildings quickly and easily.

Other innovations of the time allowed people to exist comfortably on the top floors of skyscrapers. Such technological improvements as **electric lighting** (1870s), **steam heating** (1830s), and **indoor plumbing** (1830s) were also crucial to the popularity of skyscrapers.

More recent technological innovations, such as **fire-resistant materials**, **sprinkler systems**, **cranes and bulldozers**, **central air conditioning**, **high-speed elevators** and the like, allow skyscrapers to reach new heights.

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Practice examination of one primary source document as a class if need be.

Divide students into groups and provide one Activity Sheet 3 set to each member of the group. Remember, sheets are numbered in order of difficulty.

Invite each group to summarize their document for the class in order to promote discussion and to help students begin synthesizing the documents into a single coherent picture of construction. Use the following questions to guide your discussion.

1. Why do you think the document was saved?
2. Who do you think created your document?
3. How is this document useful to historians?



## ► III. ASSESSMENT: *BUILDING THE EMPIRE STATE*

Have students complete writing assignments relating to their particular document, or to the class document exploration as a whole.

Some writing ideas:

- Write a dialogue between two workers, or between a boss and a worker
- Write a journal entry from the perspective of a worker or the project foreman
- Write a persuasive letter to the project foreman, asking to be an onsite vendor
- Write a song about working on the construction of the Empire State Building

The “Literacy Extensions” section of [www.skyscraper.org](http://www.skyscraper.org) also has writing ideas and rubrics to download.

## ► New York State LEARNING STANDARDS

- Math, Science, & Technology Standards 1, 4, and 7.