Chicago Historical Society

HISTORY LAB

INVENT IT!

Grade level: Late elementary

Estimated time: Seven class periods

Topic: The Ferris wheel of the World's Columbian Exhibition of 1893

Subtopic: Number conversions from English to the Metric system

Teacher background information

George Washington Gale Ferris invented the first Ferris wheel for the World's Columbian Exposition of 1893. Ferris modeled his invention after the structural principles of a bicycle wheel: at any given time in the rotation, the bottom half of the wheel held up the entire structure. The Ferris wheel was supported by an enormous axle and powered by a 1,000-horsepower steam engine.

The Ferris wheel was Chicago's answer to the Eiffel Tower, the landmark of the 1889 exhibition in Paris. This gigantic ride gave an impressive bird's-eye view of the exposition, as each sightseer was elevated 250 feet above the ground in a gentle and quiet movement. It had thirty-six wooden cars that could each hold sixty people.

On June 21, 1893, the Ferris wheel had its first riders: George Ferris, his wife, and invited guests, including the entire City Council and a forty-piece band. From that day on, the Ferris wheel ran every day from 8:00 A.M. until 11:00 P.M.

The first Ferris wheel (CHS, ICHi-25054)

The ride cost fifty cents and included two revolutions of the wheel, one of which was uninterrupted. The Ferris wheel proved to be financially successful and contributed significantly in balancing the books of the Fair. The wheel cost $380,000 to build and paid for itself by September 1, 1893; the same day, Ferris forwarded $25,000 to the exposition as royalty on the first profits. The original Ferris wheel was reused at the St. Louis exposition in 1904. Today, countless riders around the world enjoy Ferris wheels of all different sizes.

Key concepts
Engineering, inventions, entertainment, international measurement, and advertising

Key questions
Why was the Ferris wheel built? Why was the Ferris wheel considered an awesome engineering achievement? Why are units of measurement included on the poster? How does the Ferris wheel influence amusement parks today?

Goals of this lesson
Through discussion and image analysis, students will learn about both Chicago history and math metric conversion.

Objectives

1. Students will learn that the World's Columbian Exposition in Chicago made history with the invention of the world's first Ferris wheel.
2. By analyzing photographs and a poster of the first Ferris wheel, students will come to understand the engineering achievements of the Ferris wheel: how it worked, how it was built, and its immense size.
3. Students will compare and contrast the first Ferris wheel with the Ferris wheels of today.
4. Students will apply a practical math conversion.
5. Students will analyze the advertising power of the Ferris wheel poster, invent their own fair rides, and create posters for those rides.

Materials
Master copies of Ferris wheel poster, photographs, and student handout are provided.

1. Poster of the Ferris wheel (CHS, Winters Art Lithograph, Co., c. 1893, lithograph)
2. Photographs of the Ferris wheel:
   a. Ferris wheel on the Midway (CHS, ICHi-25054)
   b. Axle of the Ferris wheel (CHS, ICHi-25032)
3. "Math Conversion" worksheet
4. Calculator
5. School supplies: writing paper, pens, poster paper, markers, crayons, and colored pencils

Procedures

Day 1
In advance, create a bulletin board display of the provided Ferris wheel images. Use this display as a resource center for students and plan to add completed student work to it as the lesson progresses.

Take a class poll: How many students have ever ridden a Ferris wheel? Ask those who have to describe their experience. Ask students to brainstorm the following: Where and when do they think Ferris wheels were invented? Why do they think a Ferris wheel is called a "Ferris" wheel? Explain that "Ferris" is the last name of the inventor. Are they surprised? What do they think might have inspired George Ferris to invent the wheel? To sum up the discussion, provide background information on George Ferris and the World Columbian Exposition of 1893.

Divide the students into small groups and distribute a copy of the Ferris wheel poster to each group. Ask students to study the Ferris wheel. How is it different from the Ferris wheels they have seen or ridden? Instruct students to write down three differences and three similarities between the original Ferris wheel and today's Ferris wheels.

Day 2
Divide students into small groups and distribute copies of the Ferris wheel poster and Ferris wheel photographs to each group.

Instruct students to examine the images. Ask the class: What shape is the Ferris wheel (circle)? From what material was it made (steel)? Using the images, ask students to locate the following structural features: axle, spokes, and steel towers.

Explain that George Ferris modeled his Ferris wheel on a bicycle wheel, and give students more information about the structural characteristics of the Ferris wheel:

> An **axle** is a pin or shaft on which a pair of wheels revolves. The Ferris wheel's axle was forty-five-feet long, thirty-two inches in diameter, and weighed seventy tons. At the time, it was the largest piece of steel ever forged. Unlike a bicycle wheel, which is supported by the ground, this enormous axle supported the Ferris wheel.

Spokes are small radiating bars inserted in the hub of a wheel to support the rim. Just like with a bicycle wheel, at any given time in the rotation, the bottom half of the wheel supported the entire structure.

The **steel towers** served as a base on which the axle rested. The towers were 140-feet high and sunk into the earth thirty-five feet deep.

If possible, show students an image of the Eiffel Tower and explain:

This tower was a landmark of the world's fair held in Paris in 1889. It was a large, imposing structure and, at the time, was the tallest building in the world. Although initially unpopular with the French people, the Eiffel Tower became a symbol of Paris and was regarded as an impressive example of modern engineering. People could see it from far away, and fair visitors could ride elevators inside the tower to emerge on a viewing platform and see a spectacular aerial view of the fair grounds and the city.

In the early 1890s, the organizers of Chicago's World's Columbian Exhibition looked for a new innovation that would create even more excitement than the Eiffel Tower. Inventors proposed many ideas for building towers at the fair. Some designs looked very different from the Eiffel Tower, others were very similar, and almost all were taller. George Ferris's proposal took a very different approach. As a child, Ferris was captivated by a water wheel near his home in western Nevada. He imagined the water wheel carrying people, a childhood experience that inspired his design. Eventually, fair organizers selected George Ferris's design as the winner.

Ask students to describe the similarities and differences between the Ferris wheel and the Eiffel Tower.

Day 3
Instruct students look at the Ferris wheel poster and discuss the measurements printed on it. Use a math lesson to present units of measurement and metric conversions. As a class, solve sample conversion problems on the blackboard. Students may also use their calculators.

Day 4
Distribute the "Math Conversion" worksheet as an assessment tool. Ask students, either individually or in small groups, to complete the worksheet. Collect the worksheets at the end of class.

Day 5
Return the "Math Conversion" worksheets to the students and review the calculations as a class. If appropriate, assign specific students to complete problems on the blackboard.

Math Conversion Worksheet Answer Key:
Highest line of vision: 258 feet equals 78.63 meters; highest point of wheel: 264 feet equals 80.5 meters; diameter of wheel center pins: 250 feet equals 76.2 meters; total weight of wheel and cars: 2,100 tons equals 1,911 metric tons; total weight of people per trip: 150 tons equals 136.5 metric tons; total weight of wheel, levers, and machinery: 4,300 tons equals 3.913 metric tons

Day 6
Direct the class's attention to the Ferris wheel poster. What kind of information does it give about the Ferris wheel? What images are on the poster?

Explain to students that, like George Ferris, they will become inventors of exciting amusement park rides! Ask students to design a poster to advertise their invention. Students must name their ride and include the following "facts": height, weight, speed, length of time of the ride, number of riders at one time, and ticket price. All measurements should be metric measurements. Distribute art supplies and give students time in class to work on their posters. (If necessary, instruct students to finish the poster as homework.)

Day 7
Ask students to give oral presentations about their posters, either to the class or in small groups. In their oral presentations, encourage students to "sell" their invention to potential investors (i.e., classmates or group members) by explaining in detail the most exciting parts of the ride.

Passengers aboard the first Ferris wheel (CHS, ICHi-21808)

Suggestions for student assessment

Use the "Math Conversion" worksheet and amusement park advertisement to assess student knowledge and understanding of the subject. If possible, devise a rubric for grading and share it with your class in advance.

Extension activities

1. Imagine that Chicago is hosting another world's fair and your students are the fair officials and planners. Display the posters of student-invented rides, and take a class vote on which attraction should be selected for the fair. If appropriate, ask students to support their votes.
2. Ask students to build models of their amusement ride inventions.
3. Take a field trip to the Chicago Historical Society to learn more about both the 1893 and the 1933 world's fairs hosted by Chicago.
4. Take a field trip to Navy Pier to see and study a modern Ferris wheel and take a ride!

Additional resources

Appelbaum, Stanley. *The Chicago World's Fair of 1893*. New York: Dover Publications, 1980.

Barnes, Sisley. "George Ferris' Wheel: The Great Attraction of the Midway Plaisance." *Chicago History*, fall 1977, 177–182. (Available at the Chicago Historical Society.)

Burg, David F. *Chicago's White City of 1893*. Lexington: University of Kentucky Press, 1976.

Web resources

Chicago Historical Society
www.chicagohistory.org

Hyde Park Historical Society
www.hydeparkhistory.org

This lesson fulfills the following Illinois Learning Standards:

English Language Arts

State Goal 1: Read with understanding and fluency.
State Goal 2: Listen and speak effectively in a variety of situations.
State Goal 5: Use the language arts to acquire, assess, and communicate information.

Mathematics

State Goal 6: Demonstrate and apply a knowledge and sense of numbers, including basic arithmetic operations, number patterns, ratios, and proportions.
State Goal 7: Estimate, make, and use measurements of objects, quantities, and relationships and determine acceptable levels of accuracy.

Science

State Goal 13: Have a working knowledge of the relationships among science, technology, and society in historical and contemporary contexts.

Social Science

State Goal 16: Understand events, trends, individuals, and movements shaping the history of Illinois, the United States, and other nations.
State Goal 18: Understand social systems, with an emphasis on the United States.

Fine Arts

State Goal 27: Understand the role of the arts in civilizations, past and present.

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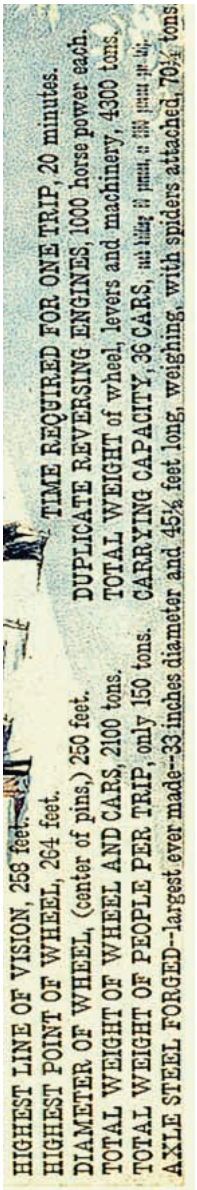
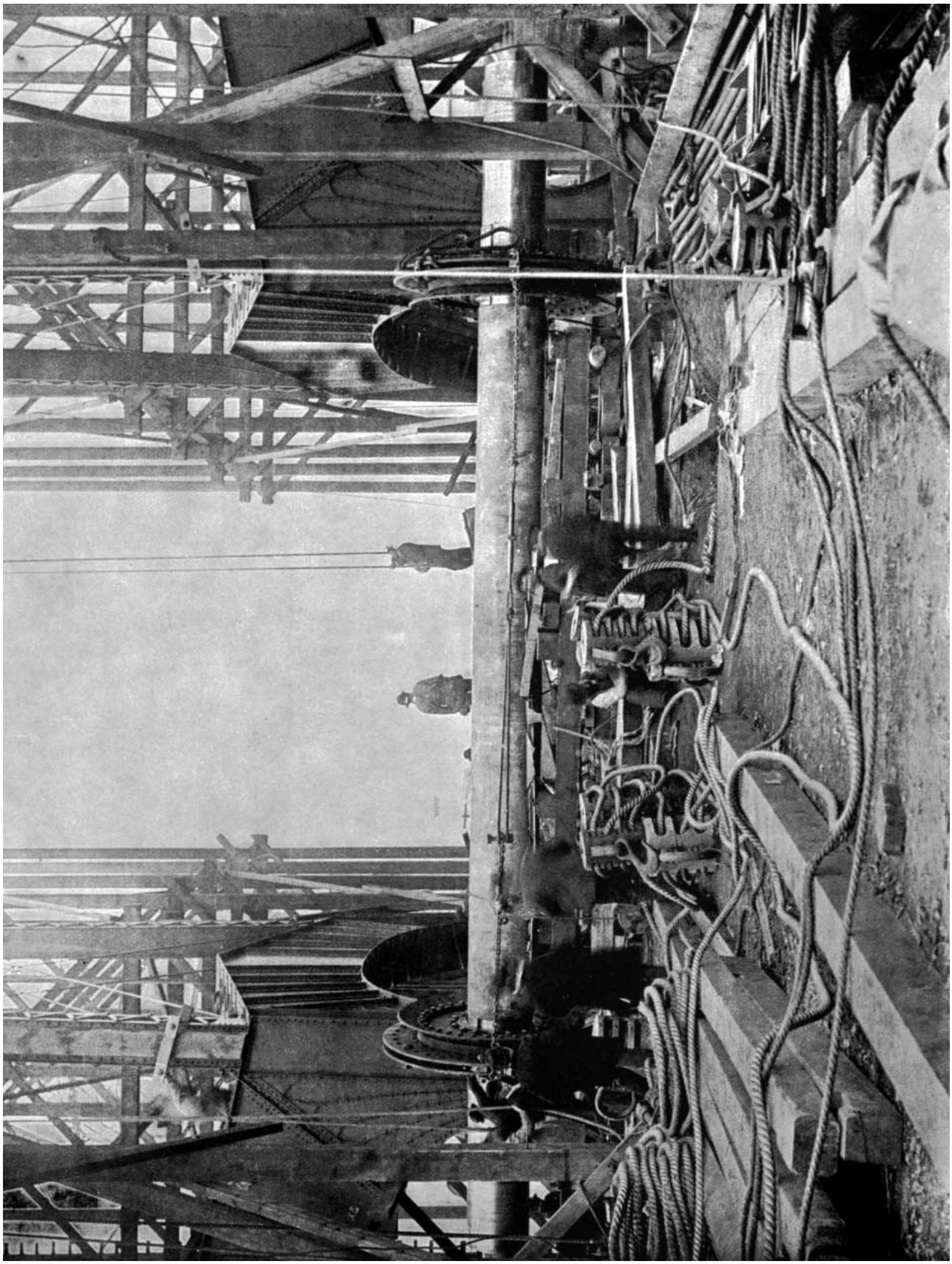


DETAIL

Ferris wheel poster by Winters Art Lithograph, Co., c. 1893 (lithograph)

Chicago Historical Society, ICHi-25054



Chicago Historical Society, ICHi-25032

MATH CONVERSION WORKSHEET

Framework of the first Ferris wheel (Chicago Historical Society, ICHi-02434)

Conversion Table

f = foot m = meter

1 foot = .30 meters

To convert feet to meters multiply by 0.3048

t = ton mt = metric ton

1 t = 2,000 lbs. or 907.18 kilograms

To convert tons into metric tons multiply by 0.91

Highest line of vision . . . . . 258f = _____m

Highest point of wheel . . . . . 264f = _____m

Diameter of center of pins . . . . . 250f = _____m

Total weight of wheel and cars . . . . . 2,100t = _____mt

Total weight of people per trip . . . . . 150t = _____mt

Total weight of wheel, levers, and machinery . . . . . 4,300t = _____mt

HISTORY LAB | FEEDBACK FORM

Please give us your feedback! After reviewing and using this *History Lab* lesson, please send us your feedback. Your ideas and honest assessment will ensure that these lessons keep improving and will provide us with useful insight for future teacher fellows. To fill out this form online or discover additional *History Lab* activities, visit the educators section of the Chicago Historical Society's website at www.chicagohistory.org.

Name:_____ E-mail:_____

School:_____ Grade you teach: _____

Are you a CHS member? (circle one): yes no

Name of unit you are evaluating _____

Name of lesson you are evaluating:_____

1. On a scale of one to five (with five being the best) rate this lesson in terms of the quality of the student learning experience it provides (circle one):

5 4 3 2 1

2. What were the strengths of this lesson? _____

_____

_____

_____

3. What aspects of this lesson needed additional fine-tuning?_____

_____

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_____

4. What advice, tips, or suggestions would you give to future users of this lesson? _____

_____

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_____

5. Where does this lesson fit in your course of study (scope, sequence, unit)?_____

_____

_____

_____

6. If applicable, how did the use of primary sources impact student learning?_____

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Thank you for your time. Please send the completed form to:
Chicago Historical Society, Clark Street at North Avenue, Chicago, Illinois, 60614-6071,
Attn: History Programs **Fax: 312-266-2077**