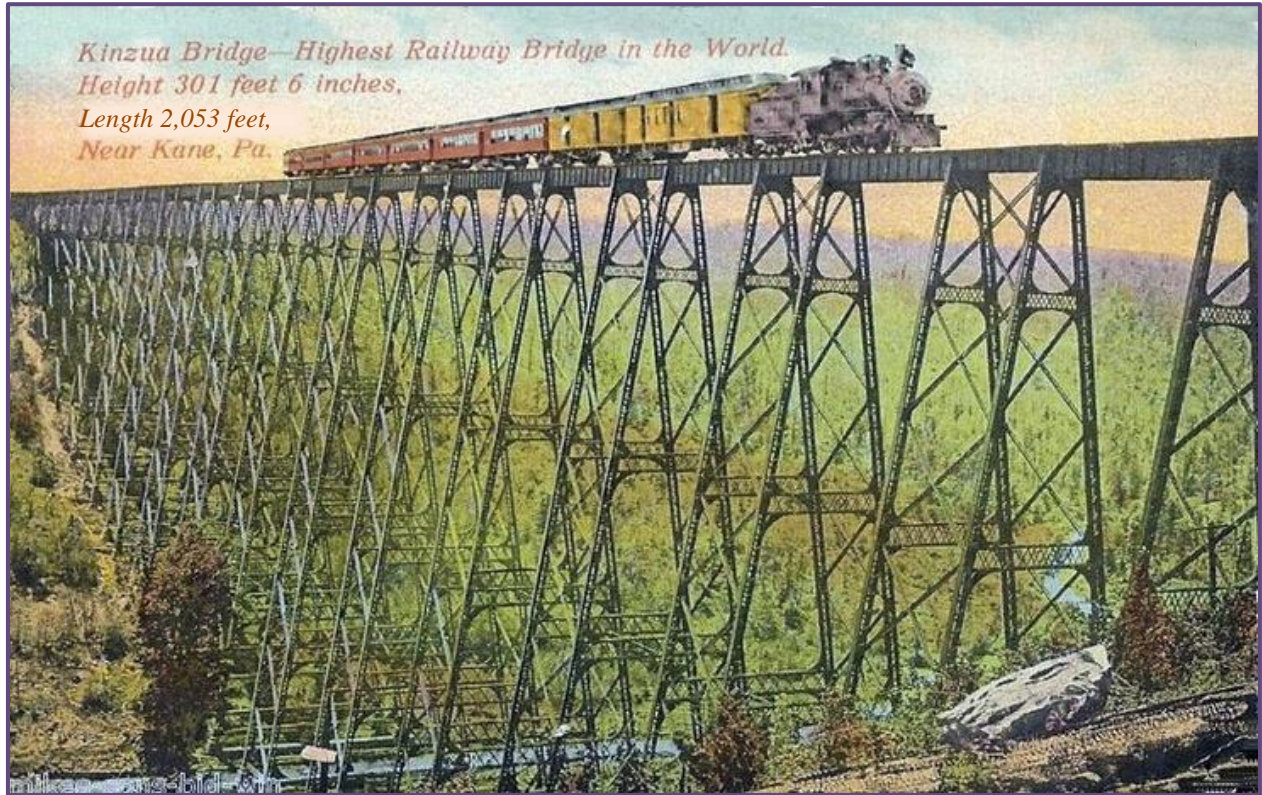


# KINZUA BRIDGE STATE PARK

## *TRACKS ACROSS THE SKY*



## EDUCATIONAL RESOURCE GUIDE

## Acknowledgements



# University of Pittsburgh Bradford

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who created this Educational Resource Guide:**

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Mitch Stickle, Kinzua Bridge State Park Manager

**The Kinzua Bridge State Park is operated by the Department of Conservation and Natural Resources. Containing 339 acres, it is located on the Allegheny Plateau in McKean County, Pennsylvania.**

### *Who is this Education Resource Guide for and what is in the Guide?*

This Education Resource Guide is designed for middle and secondary students, teachers, as well as all adults who will visit the Kinzua Bridge State Park. It is designed to prepare and enhance your visit and what you will discover.

The information in this Resource Guide gives you carefully researched materials on the *History of the Park*, the *Bridge*, *People* who were important in creating and rebuilding what was called "The Eighth Wonder of the World," *The Sky Walk*, *Primary source documents* on the *Tornado*, and many *Photos* from the early days to today.

Several activities, which meet Pennsylvania State Standards, are designed to engage your students and you before arriving, while you are at the Park, and when you return home to share what was discovered with others.

All materials in this Guide may be copied and used freely. When using photographs, please include the source and/or credit of the photographs.

We trust you will enjoy reading, seeing, and using the materials to help your visit be a memorable one for everyone.

Thank you.

# How to Use this Education Resource Guide

## Explore the Kinzua Bridge State Park



Photo credit - ANF Visitors Bureau

This Educational Resource Guide is designed to help prepare your students for an exciting, meaningful, and fun visit at the Kinzua Bridge State Park. There is a map of the area, an “Etiquette Guide” to keep you and your students safe, along with historical resources and information of things to be discovered at the Kinzua Bridge State Park Office/Visitor Center.

**This guide is designed in five sections – History, Engineering, Environment, Energy and The Sky Walk** that reflect the themes of the park and Kinzua Bridge State Park Office/Visitor Center. Each section is structured with activities and reading selections that meet Pennsylvania Standards.

At the beginning, there is a role-play activity where students can select someone they would like to be during their visit. They could even dress-up as the person. You will also find interesting bits of information scattered throughout the guide and Reflection Guides after each section.



**When you see these icons, there is a hot link to explore.**



**These icons are stopping points where you can explore or discuss a topic or question.**

**Before visiting the Kinzua Bridge State Park and the Kinzua Bridge State Park Office/Visitor Center -** Have students write 3-4 questions they would like to discover about the Bridge or predictions about what they may see. If students have chosen roles to play, organize them into groups that will explore the Kinzua Bridge State Park. They will share their discoveries with the students and other classes.

Share the Safety Guidelines with the students and the brief history of the Bridge and Park.

**Begin your journey. . .**

Have students take pictures to begin their research and story as a role they are playing.

**Glossary of important words:**

**Kinzua** - In the Seneca-Iroquois Nation, “Kinzua” is written as Tgëhjowa (tgenh-joh-wawh!) which translates as “fish on a spear”.

**Viaduct** - An elevated structure, consisting of a series of arches or spans so a railway or road is carried over a valley, road, river, or marshy low-lying ground. Like the Roman aqueducts, many early viaducts were a series of arches of roughly equal length.

**An F1 Tornado** - Has wind speeds between 73-112 mph, causes moderate damage. An F1 tornado can cause tiles to break off of roofs, cars and trailers to be pushed by wind gusts, mobile homes to be lifted off of foundations or overturned, and attached garages to be destroyed.



Photo credit - ANF Visitors Bureau

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## To Book Your Adventure, Contact:



Kinzua Bridge State Park, 1721 Lindholm Road,  
Mt. Jewett, PA 16740 - Phone: 814-965-2646

E-mail: [kinzuabridgesp@pa.gov](mailto:kinzuabridgesp@pa.gov)



[Schedule Request Form for School Field Trip](#)



Allegheny National Forest Visitors Bureau, 80 E. Corydon Street,  
Bradford, PA 16701

Phone: 800-473-9370 Destination Marketing Organization

E-mail: [info@visitANF.com](mailto:info@visitANF.com)



# Welcome

## Kinzua Bridge State Park / Kinzua Sky Walk



Photo credit - ANF Visitors Bureau

### **Department of Conservation and Natural Resources (DCNR) Bureau of State Parks Mission Statement**

The primary purpose of Pennsylvania State Parks is to provide opportunities for enjoying healthful outdoor recreation and serve as outdoor classrooms for environmental education. In meeting these purposes, the conservation of the natural, scenic, aesthetic, and historical values of parks should be given first consideration. Stewardship responsibilities should be carried out in a way that protects the natural outdoor experience for the enjoyment of current and future generations.

### **Brief History of the Kinzua Bridge State Park**

The **viaduct** was originally **built in 1882** to provide greater access to coal, timber and oil resources and to provide for the transport of the resources to the markets where they were needed.

The viaduct resulted from a challenge that faced **General Thomas L. Kane**, who was the president of the New York, Lake Erie & Western Railroad and Coal Company. Kane had to choose the best way to traverse the Kinzua Valley with a rail line.

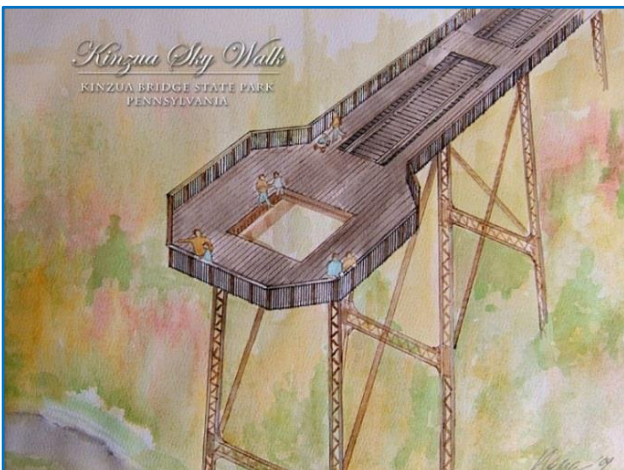
Construction began on May 10, 1882. A crew completed **the highest railroad viaduct in the world** in 94 working days. Built of iron, the viaduct was 301 feet high, weighed 3,105,000 pounds and was used for train transportation through the area's coal, timber and oil lands.

The original Kinzua Viaduct was known as the "**Eighth Wonder of the World.**" People from all over the world were attracted to the site.

After only 18 years, the towers had to be **rebuilt in 1900** out of steel to accommodate the larger loads and weight of modern train traffic. 150 men completed the project in only four months, working 10 hour days.

On August 12, 1963, Governor William Scranton signed legislation for the establishment of a state park. The park opened in 1970. On August 19, 1977, the Kinzua Viaduct was placed on the **National Register of Historic Places** by the federal Department of the Interior. Due to tornado destruction, the Kinzua Viaduct was later removed on July 21, 2004 from the register. On June 26, 1982, the Kinzua Viaduct was designated as a **National Historic Engineering Landmark**.

In 1987, the Bureau of State Parks reintroduced **excursion trains** on the Kinzua Viaduct. Trains traveled from Marienville and Kane to the park and back until 2002, when Pennsylvania Department of Transportation inspectors stopped the train from going on the bridge, but still allowed pedestrians. Pedestrians were eventually stopped from crossing the structure for safety reasons.

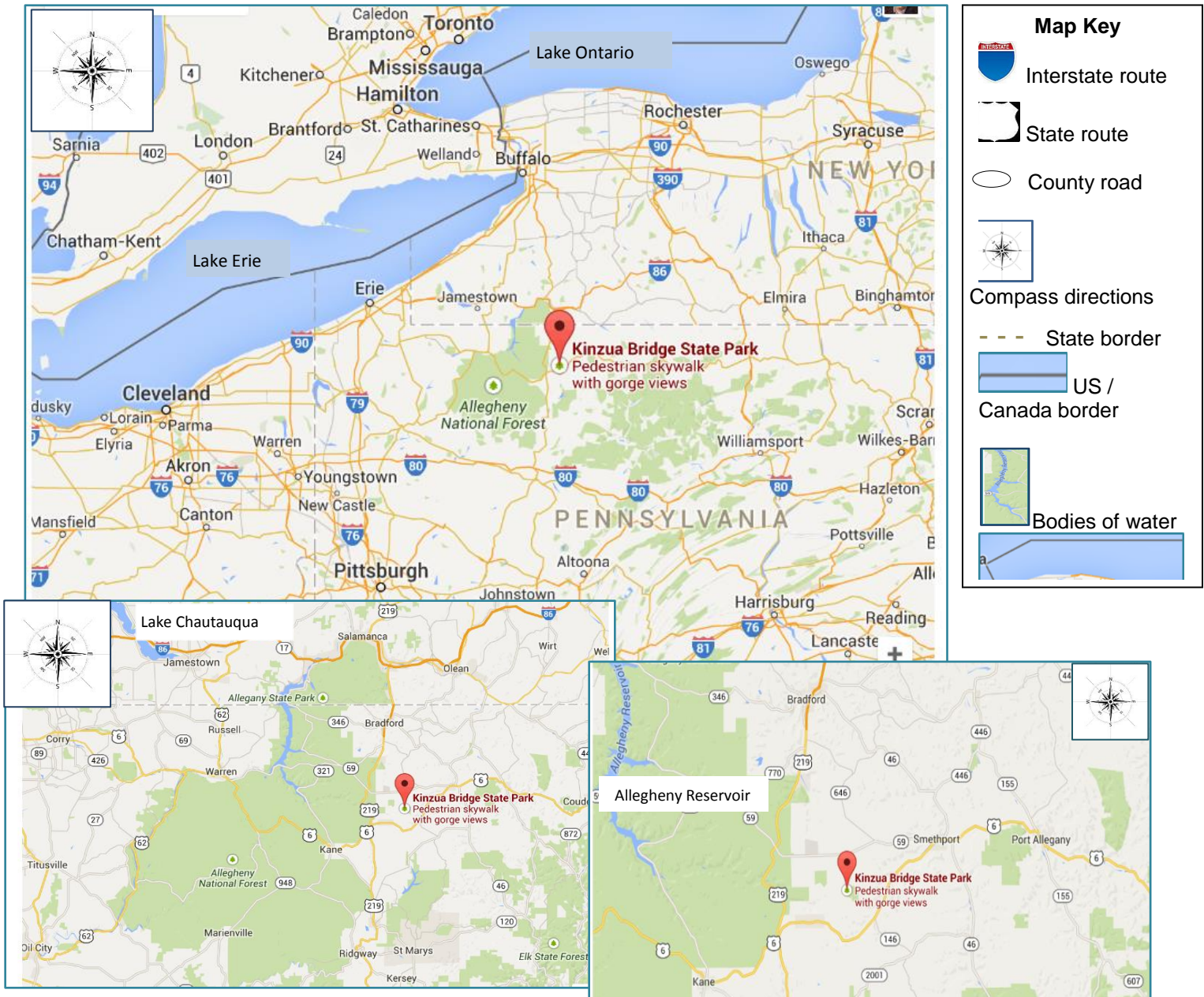


On July 21, 2003 at approximately 3:15 pm, an **F1 tornado** struck the Kinzua Viaduct knocking and twisting 11 of the viaduct's 20 towers to the valley floor and permanently changed the landscape.

In 2009, work started to reinvent the remaining towers as a **pedestrian walkway**. Today the Viaduct is the **Kinzua Sky Walk** — a spectacular walkway that once again allows the public to "Walk the Tracks across the Sky." A partial glass-bottomed observation deck enables visitors to look down at the remaining towers supporting the historic structure.

# Map of the Kinzua Bridge State Park

The Park is connected to Pennsylvania Route 6, via the state designated scenic byway, the Kinzua Bridge Scenic Byway. Pennsylvania Route 6 is officially PennDot Bicycle Route Y, and is signed the entire 400 miles across the northern tier as a bicycle route.



## Map Activities

### Suggested Activities:

1. Find and circle the following items on the map: Compass, a state highway and a state road.
2. If you were going from Pittsburgh to the Sky Walk, in what direction would you be traveling? Write your answer in your journal. Or find your town, the direction, the roads and highways you will travel.
3. Which towns are directly south of the Kinzua Bridge State Park? Write your answer in your journal.
4. Find 3 bodies of water on the map and their names.

**PA Academic: History 8.1 Historical Analysis and Skills** - Explain and analyze historical sources. Data in historical and contemporary maps, graphs and tables - 6,9,12.A.B

## *Etiquette Guide Reminders to make your visit enjoyable!*



Inform the facilitator about special medical problems before the program and alert students with allergies to take medication for precautionary measures. If they are under 18 make sure their medications are controlled by an adult.



Dispose of trash at public trash receptacles.



Have knowledge of first-aid.



Wear proper footwear. Please do not wear flip-flops.



Participants should be properly dressed for the weather.



Respect for plant life, animal life and natural features of the park should be reinforced prior to attending the park. Nothing may be picked, collected or removed from the park.



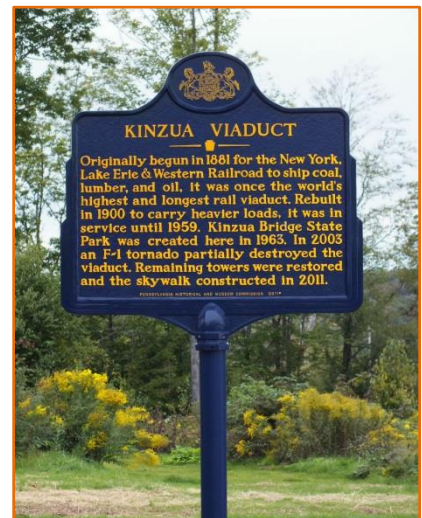
While at the park, student-aged participants remain the responsibility of adults. Make your participants' visit a safe, educational experience by remaining with your students throughout the visit. Stress proper group behavior during the program.



**Access for People with Disabilities** - If you need an accommodation to participate in park activities due to a disability, please contact the park office or the Pennsylvania Bureau of State Parks.



Photo credit - ANF Visitors Bureau



### **Before your visit:**

Complete the **Anticipation Guide**.

Read the list of people on the **Role Play** activity and identify the perspective they will want to discover.

Complete the “**Question-Answer-Response**” (**QAR**) activity.

Create questions associated with each perspective.

**Print copies of questions** to take with you on the day of the field trip.

### **During your visit:**

**Pretend** to be that role throughout the field trip. Sit together on the bus with others who share the role.

**Ask questions** to yourself and others in your group at the Kinzua Bridge State Park and Sky Walk.

**Listen** to the guides and **look** carefully at everything to be seen.

**Keep a journal** to write down things discovered, seen and other questions that will come up.

### **After your visit:**

Engage in a **Think-Pair-Share** activity.

**Think** - about the experiences and write a short paragraph, **R.A.F.T. (Role, Audience, Topic, Format)**, song or poem or news story that answers each question.

**Pair** - with someone in a small group. **Share** experiences with each other.

**Share** - the experiences with the whole class or to another class.

## **Anticipation Guide**

**Directions:** Read each statement below and decide if you think if it is true or false. During the field trip, see if you changed your beliefs. Did your visit confirm or change your opinions? Be ready to discuss your thoughts.

<b>Before True/False</b>	<b>Statement</b>	<b>During True/False</b>
	The Kinzua Viaduct was modeled after other bridges built at the time.	
	The first Kinzua Viaduct was built in just 94 days without using scaffolding.	
	It took a tornado 2 minutes to destroy the viaduct.	
	Choose something you have heard about the Kinzua Bridge, Sky Walk, and/or Viaduct.	

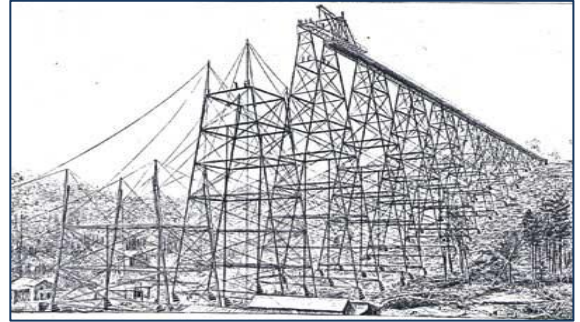



## Historical Role Play Activity (appropriate for middle and secondary grade levels)

Many people participated in solving the challenge of providing greater access to coal, timber and oil resources by transporting these resources to the markets where they were needed through the Kinzua Valley with a rail line.

**Suggested Activity:** Select who you will be as you discover this “Eighth Wonder of the World.” Research one of the people below and pretend you are that person during the visit.

**After the visit, students can create a RAFT (Role, Audience, Topic, Format) writing project, a poem, song, or news story to share the information discovered. Information begins on page 37.**



**General Thomas L. Kane,**  President of the New York, Lake Erie & Western Railroad and Coal Company and founder of the community of Kane, Pennsylvania. Served as a Union Army Colonel mustering the famous sharpshooters - “The Bucktail Regiment” during the Civil War.

**Octave Chanute** - An American Civil Engineer and aviation pioneer born in France. He worked with the Wright Brothers to offer his help and advice. He also helped to publicize their flying experiments. At his death he was hailed as the father of aviation and the “heavier-than-air flying machine.”

**Adolphus Bonzano** - of the Phoenixville Bridge Company and his **crew of 40 men** who built the first bridge beginning in 1881.

**C.W. Bucholz** - Chief Engineer of the New York, Lake Erie and Western Railroad and Coal Company and **150 men** rebuilt the viaduct in 1900 out of steel to accommodate the larger loads and weight of modern train traffic.

**Elizabeth Wood Kane** – The wife of General Thomas L. Kane. She was British born and completed a medical degree from the Women’s Medical College of Philadelphia in 1883.

**A person hired to work on the original or rebuilt bridge**

**A scientist who studies wind and nature**

**A tourist who heard about and wants to see the “Eighth Wonder of the World”**

**A train engineer traveling across the bridge**

**An environmentalist or a logger**

Each role will see, hear, smell, and touch things differently. Have each student keep a journal and write things down they discover to create a project and share their discoveries with each other.

**PA Core Standards: English Language Arts CC.1.2** - Students read, understand, and respond to informational text—with an emphasis on comprehension, vocabulary acquisition, and making connections among ideas and between texts with focus on textual evidence. 6.H; 7.H; 8.H; 9-10.H; 11-12.H.

**Reading in History and Social Studies CC.8.5** - Students read, understand, and respond to informational text – with emphasis on comprehension, making connections among ideas and between texts with focus on textual evidence. 6-8.F; 9-10.F; 11-12.F; 6-8.G; 9-10.H; 11-12.H,I.

**PA Academic for History 8.2.6,9,12.A.B.C** - Analyze the political and cultural contributions of individuals and groups to Pennsylvania history.

## Section I - *History of Kinzua Bridge*

**Suggested Activity:** As you look at these pictures and other pictures in this guide, identify things that stand out which make building the bridge and the bridge so special – like the crane, the train and the height of the bridge as a railway bridge that was built in the 1800's.



The 1883 Bridge – Do you see the man on the bridge?



Photos credit: [www.smethporthistory.com](http://www.smethporthistory.com)



Photo credit: R.C. Gleason Collection

## **QARs to Develop Comprehension, Reflective Reading and Learning**



As you explore the reading materials in this Guide, look for “**Stop points**” which are designated points where you and students can stop and develop a question that corresponds to one of the “**Question – Answer – Response**” (**QAR**) prompts. When you are at the Kinzua Bridge State Park Office/Visitor Center look for resources, artifacts, and documents that reinforce and are similar to what you discovered in the Guide.

**Good readers and learners pose questions** before, during, and after reading and learning. Remember—being a good learner involves thinking about *how* as well as *what* you read.

<b>In the Book</b>	<b>In My Head</b>
<p><b>Right There</b></p> <p>The answer is easily found in the text. The exact words for the questions and answers are located in the same sentence.</p>	<p><b>Author and You</b></p> <p>The answer is not in the text. The reader combines previous knowledge with text information to create a response.</p>
<p><b>Think and Search</b></p> <p>The answer is in the text, but requires gathering information from different places in the selection.</p>	<p><b>On My Own</b></p> <p>The answer is not in the text. The reader uses previous experience to respond.</p>

**Suggested Activity:** Students will brainstorm strategies that good readers use while reading. Explain that you are going to be asking questions while students read, and would like them to think about how this affects their understanding of the stories.

Divide the class into small groups with four students in each group. As a class, read the text, stopping periodically to ask questions.

After reading and questioning, ask students to share their questions in small groups. The groups select one question for each QAR and write them on a large piece of construction paper. Then, students pass their paper to another group. Give each group about five minutes to respond to the questions. Groups record their answers on the paper. Continue until all groups have read and responded to each other's questions. Give each group a different color marker so you can identify their responses. Post each group's questions so students can compare and use them at the field trip.

**PA Core Standards: English Language Arts CC.1.2** - Students read, understand, and respond to informational text—with an emphasis on comprehension, vocabulary acquisition, and making connections among ideas and between texts with focus on textual evidence 6.A,B,C,D,G,J,L; 7.A,B,C,D,G,J,L; 8.A,B,C,D,G,J,L; 9-10.A,B,C,D,G,J,L; 11-12.A,B,C,D,G,J,L.

**English Language Arts CC.1.4** -Students write for different purposes and audiences. Students write clear and focused text to convey a well-defined perspective and appropriate content. 6.B,C,D,G,H,I,J,L; 7.B,C,D,G,H,I,J,L; 8.B,C,D,G,H,I,J,L; 9-10.B,C,D,G,H,I,J,L; 11-12.B,C,D,G,H,I,J,L.

**Reading in History and Social Studies CC.8.5** - Students read, understand, and respond to informational text – with emphasis on comprehension, making connections among ideas and between texts with focus on textual evidence.6-8.A,B,D,E,F,H; 9-10.A,B,D,E,F,H;11-12.A,B,D,E,F,H.

**PA History - 8.1.7.B:** Identify and use primary and secondary sources to analyze multiple points of view for events.

## Section II - Engineering

**Suggested Activity:** As you discover the history, imagine you lived during those early times and what you would see. Identify things that stand out for you that make building the bridge and the bridge so special.

### Why did they build it?

Think  
About It.


#### **Solve The Problem:**

You have the Kinzua Valley to span to get a railroad across. How would you have done it in the late 1800's?

In the 1800's, the **abundant natural resources** of north central Pennsylvania attracted many men seeking challenge and fortune. By 1880, Buffalo was using around three million tons of coal a year. **The city's location** on the Great Lakes made it a **center for shipping coal** to

other industrial areas in mid America. However, between Pennsylvania's coal deposits and the awaiting industry to the north and west was an obstacle, the Kinzua Valley.

The New York, Lake Erie, and Western Railroad and Coal Company recognized the profits to be gained by transporting coal across the Kinzua Valley instead of taking the six mile route around the Valley via Emporium, Olean, New York and Warren to waiting markets in Buffalo. **An eight mile detour** would have cost an additional \$30,000.

 **General Thomas Kane**, company president and brilliant civil engineer Octave Chanute, faced the challenge. If built, the bridge would be larger than any that had been attempted, and over twice as large as the largest structure at the time: the Portage Bridge in western New York.



Think  
About It.

Questions to think about: Why didn't they just go around? How did they think they could build it? How confident do you think they were?

**KINZUA VIADUCT**  
ERECTED A. D. 1882.  
THE HIGHEST RAILROAD BRIDGE IN THE WORLD.  
Near Bradford, PA.  
Located and Designed by O. W. BARNES and A. BON-  
ZANO.  
Masonry built by JOHN C. NOAKES.  
Iron Work by PHENIX BRIDGE CO.  
CLARKE, KEEVES & CO., Contractors.  
TOTAL LENGTH, 2052 FEET.  
HEIGHT AT CENTRE, 301 FEET.  
WEIGHT OF IRON WORK, 3,500,000 LBS.  
SPANS, 40 AND 60 FEET, ALTERNATELY.  
CENTENNIAL 1882 - 1982



O. Chanute

### Octave Chanute

In the decade before the Wright brothers' historic 1903 flight, French-born, American Civil Engineer Octave Chanute developed and flew the world's most advanced aircraft. His novel biplane glider, an engineering masterpiece in 1896, was the foundation for 20th-century aircraft.

He was a mild and kind man, who was a pioneer builder and modern thinker of the American railroad. He was a structural engineer who built wood and iron trestle bridges over some of nature's most challenging barriers. Chanute designed the first railroad bridge over the Missouri River (The University of Chicago Library).

## Why build something that had never been done?

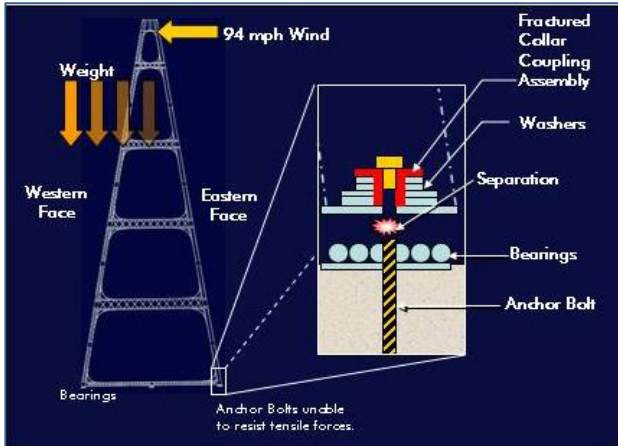
**Suggested Activity:** Before you read . . .



**Create two questions – and find the answers like,** “What were some challenges to face? How did they build the towers without the tools we have today?”

**Create your own questions about what you would like to know at the field trip and highlight the answers you find as you read the materials.**

General Kane met with **Anthony Bonzano** of the Phoenixville Bridge Works Company of Phoenixville, Pennsylvania. Mr. Bonzano told **General Kane**, “We’ll build you a bridge a thousand feet high if you’ll provide the money.”



**Due to the rugged terrain**, the creation of a viaduct was considered the optimum solution to transport the valuable natural resources north. Bonzano, along with **Oliver W. Barnes**, the chief engineer for Kane’s railroad, planned the first Viaduct. Work on the massive sandstone stone piers **began in 1881** and took six months to complete.

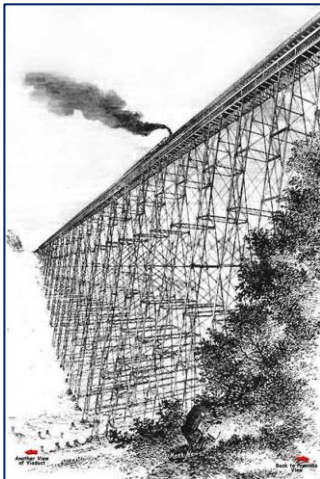
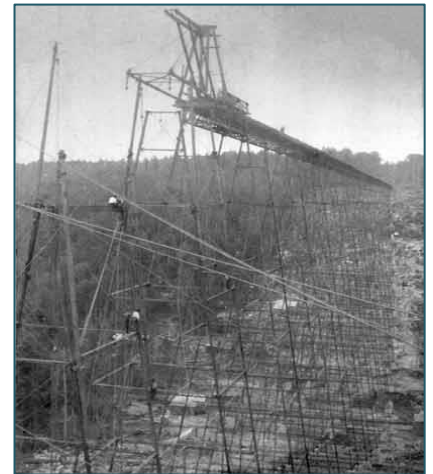
The stone piers were 35 feet below the ground and as high as 16 feet above ground. There were **bolts that measured 6-10 feet long and 1½ inches in diameter** in the 110 stone piers to attach the vast amount of iron. On September 8, 1881, the cornerstone of the Viaduct was placed on the south wall, where it is today.



### **Building the towers -**

**Ironwork began on April 10, 1882.** A temporary railroad track was laid into the valley to assist the workers in distributing the large amount of iron. The Kinzua Viaduct was completely constructed of stone and iron with the only wood being the railroad ties and railings. There were twenty lower spans of thirty-eight and one half feet, and twenty-one intermediate spans that measured sixty-one feet. The tubular wrought **iron columns which measured 9 ¾” in diameter, resembled logs** and led to the belief that the bridge was constructed of wood.

**No scaffolding was used.** A rig called a **gin pole** was used to build the first tower and a wooden crane was built at the top of the first tower and the second tower was built using the crane. This process was repeated to construct the rest of the towers.



**Two steam hoists** were used to aid in the construction of the viaduct. Thirty miles of manila rope needed for the block and tackle was used. The bridge became a powerful example of the determination and “**can do spirit**” of the people of the 19th century.

In **94 working days**, the 40 man crew completed the highest and longest railroad bridge ever built. It was 301.5 feet high and 2,053 feet long with the tallest tower having a spread of 103 feet. The thirty-six workers were paid \$2.00 to \$3.00 a day and the four foremen made \$5.00 to \$6.00 a day. The total cost was \$167,000 and contained 3,105,000 pounds of Iron.



*What do you see in the pictures that you want to know more about?*



Tourists Visiting the Kinzua Viaduct  
Photo credit: John Marconi

People from all over the world came to see this engineering marvel. Excursions from Buffalo and Pittsburgh cost **\$1.00 per person**. On a typical summer Sunday, six to eight excursion trains of ten to fourteen cars crossed the viaduct.

To cross the viaduct was a great thrill. Parties were common. These excursions were popular and raised enough money to offset the \$167,000 cost of the original structure. **The last excursion** took place just before the United States entered World War I.



**Concerns about the bridge's safety** were relieved when the structure passed safety inspections and **survived an 1889 train crash**. In July, there was a terrible crash and three cars were converted into wood splinters some 301 feet below the bridge.

**What other challenges were faced?**

In May of 1900, after only eighteen years of use, it became necessary to rebuild the entire structure to withstand the incredible weight of new trains and rolling stock.

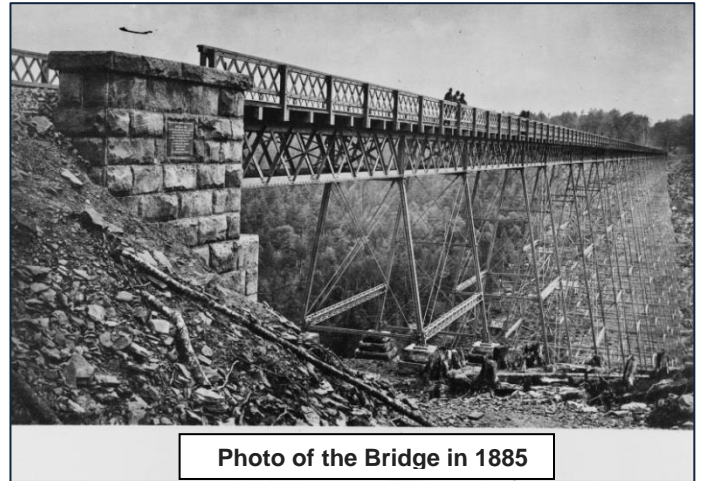
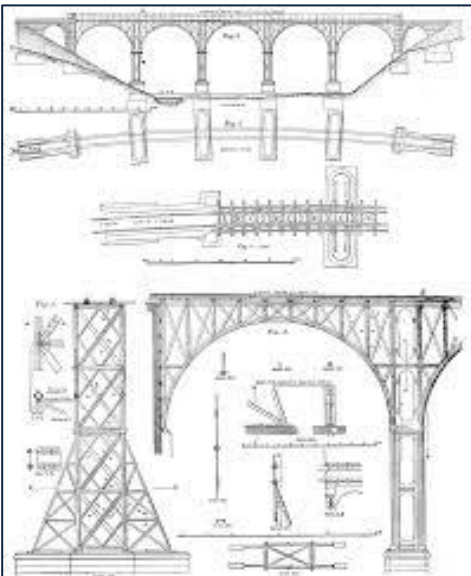
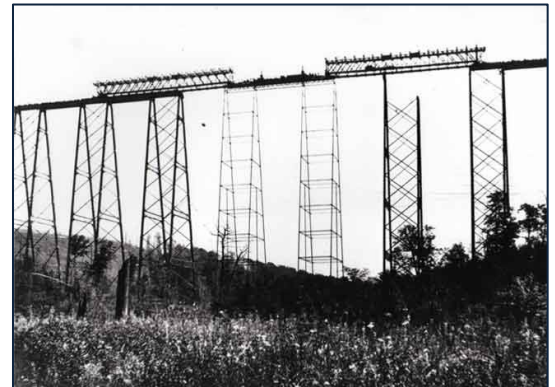


Photo of the Bridge in 1885

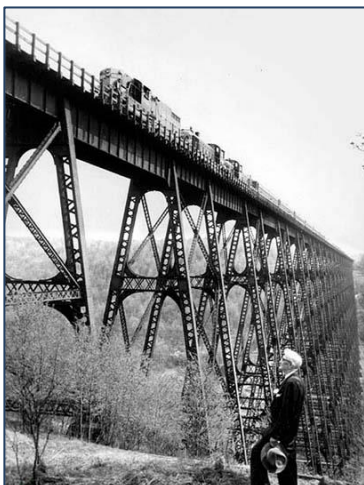


Engineer's Sketch of the new Viaduct

The construction **started on both ends and worked towards the middle** with the use of two 180 foot timber travelers that measured 16 feet in depth. The timber travelers spanned three towers and the middle tower was destroyed and then reconstructed of new steel and after the tower was finished the timber traveler moved on to the next tower and repeated the process. There were **thirty seven miles of rivet rod** used in the construction of the second structure.



The new steel viaduct had the same measurements, but now weighed 6,715,000 pounds. Construction was directed by **C.W. Bucholz**, Chief Engineer of the New York, Lake Erie and Western Railroad and Coal Company.



The skilled workers moved at a rate of **500 feet per month**. They were able to demolish the highest tower and the adjoining spans in seven and one half days. The last girder was in place on September 6, 1900 and traffic began to cross the Kinzua Valley over the new viaduct on September 25, 1900. The job was **completed in 105 days by about 100 to 150 men** working ten hours a day.



Andy Stauffer, son of Charles P. Stauffer  
Photo credit: Pittsburgh Post-Gazette Archives

**This is impressive** because during the construction there was a week-long strike, the speech of a presidential candidate in the area, and a major forest fire that began under the viaduct and burned two communities before being stopped at the edge of a third community.

**Andy Stauffer**, the son of the late bridge inspector **Charles P. Stauffer**, received the honor of removing the first bolt from the original structure and then driving the final gold rivet into the new viaduct.

After the erection of the second structure, the **viaduct was painted on an average of every seven years**. The original stone piers of the viaduct were encased in concrete between the years of 1907 and 1933. The **first diesel train crossed the viaduct in April of 1949**. The **first passenger train to cross the Viaduct was Engine 1923** of Baldwin Locomotive Works in Philadelphia, Pennsylvania. The train crossed the viaduct in **August of 1987**. This train ride was by invitation only and it concluded with the **breaking of a bottle of orange soda** on the striker plate of the chair car.

## History of the Bridge - Cloze Activity (Fill in the blanks)

(Appropriate for middle and secondary grade levels)

Viaduct	Iron	Engineers	301
Railroad	Steel	Skywalk	Inspection
Ironwork	Freight	255	Passenger

**Directions:** Use the word bank above to fill in the blanks. Not all words will be used.

Placement of the \_\_\_\_\_ stone bases began in 1881 while the \_\_\_\_\_ and entire bridge were completed in 1882. At the time, the Kinzua Viaduct was the highest \_\_\_\_\_ viaduct in the world. Built of \_\_\_\_\_, the original viaduct was approximately \_\_\_\_\_ feet high, 2,053 feet long and weighed 3,105,000 pounds. By 1900, it became necessary to rebuild the entire structure with \_\_\_\_\_ to accommodate heavier trains. \_\_\_\_\_ traffic discontinued in 1959 and in 1987, excursion trains stopped on Kinzua Viaduct before returning to its point of origin. In February 2002, \_\_\_\_\_ decided the structure needed a full-scale \_\_\_\_\_ and in June, they barred excursion trains from the bridge. On Monday, July 21, 2003, an F1– tornado struck the side of Kinzua Viaduct. Park visitors can now walk a portion of the Kinzua Bridge, built on six restored, original towers a \_\_\_\_\_ leads to a 225-foot high observation deck. (Paraphrased from DCNR).

**PA Core Standards: Reading in History and Social Studies CC.8.5** -Students read, understand, and respond to informational text in the content area – with an emphasis on comprehension, vocabulary acquisition, and making connections among ideas and between texts with a focus on textual evidence.6-8.D,H,J; 9-10.D,H,J; 11-12. D,H,J;

**English Language Arts CC.1.2** - Students read, understand, and respond to informational text—with an emphasis on comprehension, vocabulary acquisition, and making connections among ideas and between texts with a focus on textual evidence. 6.F,J,K; 7.F,J,K; 8.F,J,K; 9-10.F,J,K; 11-12.F,J,K.

### “Can do” attitude

**The original bridge was built from a crew of 40 men in just 94 working days, spanning a valley that created “the something that had never been built before.”**

**This showed that anything can be done if one puts their mind to it.**

## What about wind and the heavier trains?

**Suggested Activity:** As you read this information, consider the original structure and you will discover some interesting facts that may be used in your RAFT, song or poem.

**High winds sweeping up the valley caused the flexible bridge to sway** and sometimes even blew loads of hemlock bark off the railroad cars. The wind even blew the roofs off box cars. Trainmen shared stories when it was impossible to stand upright on the deck of the viaduct. **The strong winds blew the second viaduct 2 7/8 inches out of line** within one year of its construction. The winds were severe enough that a five mile an hour speed limit was enforced.



**Think About It.**

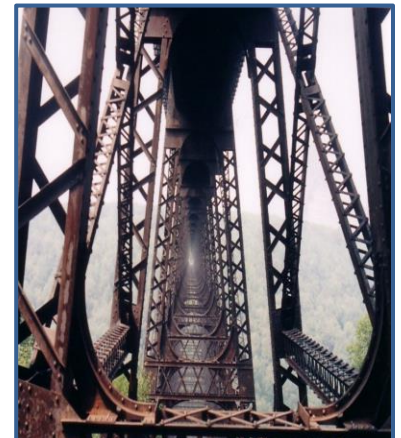
*Engineers were aware of the danger of toppling. That was why the bridge had been closed not just to trains but to pedestrians, too. If winds were high enough, then the center of gravity of Kinzua Bridge could shift. If this happened, the weight of the bridge would be placed on one side and the inevitable would happen.*

**Octave Chanute** played a role in engineering both structures. He solved the problem of wind stress on the second structure by designing it to hold up against 50 pounds of pressure per square foot when unloaded and 30 pounds per square foot when loaded. The smaller pressure for the second figure was due to being that a pressure of 30 pounds to a square foot could blow a train off of the structure.



The new viaduct's supporting posts were made of plate and lattice construction that measured 24 X 30 thirty inches. The old structure's lattice work spans were replaced by girders. They measured 5 ½ feet deep at the top and 6 ½ feet deep between the towers.

The Kinzua Viaduct is believed to be the **second highest viaduct in North America**. The Kinzua viaduct remains an engineering marvel of its time and a major tourist attraction to thousands of people a year.




The construction of each tower allows for this tunnel-like photo.

**The bridge stood for 121 years.** Steam driven trains continued until 2002 and were the last trains to ever cross the bridge.

### **The Kinzua Viaduct has several interesting stories in its history:**



One story still attracts treasure hunters. A bank robber hid \$40,000 in gold and currency in glass jars under a triangular shaped rock within sight of the viaduct at the turn of the century. The treasure was never recovered.

 **Charles Stauffer**, the **original bridge inspector**, inspected three of the towers every day. Since there were twenty towers, he inspected the entire system in one week. **Stauffer lived under the Kinzua Bridge** after he was hired by the Erie Railroad to maintain the bridge. The railroad built the family a house and provided them food and supplies. Trains would pass over the bridge and throw supplies

such as meat, flower and other supplies over the bridge and he would run up the hill to pick them up. After all, his house was 3 miles from any store.





Reflect on what you asked, what you saw and what you discovered about Engineering and the Kinzua Viaduct.

Surbeck, Han, and Moyer (1991) identified three levels of reflection:

**React** - comment on the learning experience, such as reacting with a personal concern to an event.

**Elaborate** - compare reactions with others on a theory, or a specific event, solution or idea.

**Contemplate** - focus on constructing personal insights or on problems or difficulties, as well as the feedback received after the initial reflection.

Reflective Journal		
What happened?	How do I feel about it?	What did I learn?

Hints to encourage reflection:

- ✓ View from various perspectives.
- ✓ Compare and contrast.
- ✓ Ask "what if. . . ?"
- ✓ Consider consequences.

Suggested Feedback prompts:

"What would have been the experience of a skilled worker on the original or the revised viaduct?"

"What if the ideas didn't work?"

"What would have been the experience of a train engineer on the original or the revised viaduct?"

"What would have been the experience of a tourist on the original or the revised viaduct?"

"Which questions that you asked were answered? What other questions do you have to explore?"

"What surprised you the most about the engineering of the viaduct after seeing it?"

**PA Core Standards: English Language Arts CC.1.2** - Students read, understand, and respond to informational text—with an emphasis on comprehension, vocabulary acquisition, and making connections among ideas and between texts with a focus on textual evidence. 6.A,B,G,J,K; 7.A,B,G,J,K; 8.A,B,G,J,K; 9-10.A,B,G,J,K; 11-12.A,B,G,J,K.

**Speaking and Listening CC.1.5** Students present appropriately in formal speaking situations, listen critically, and respond intelligently as individuals or in group discussions. 6-8.A; 9-10.A; 11-12.A.

**Reading in History and Social Studies CC.8.5** - 6-8.A,B,D,F,G,H,I,J; 9-10.A,B,D,F,G,H,I,J; 11-12.A,B,D,F,G,H,I,J.

# Ask yourself

(appropriate for all ages and grade levels)

## Objects and surroundings

**STEP ONE: TAKE A LOOK AROUND AND ANSWER THESE QUESTIONS.**  
Do parts of the Resource Center have their own name? If so, what does the name say about the objects?

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What is Engineering? What are some of the things displayed?

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**STEP TWO: READ A COUPLE OF THE LABELS.**

What did I learn from the labels that I wouldn't have known just by looking at the object?

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**A MUSEUM EXHIBITION IS AN ORGANIZED ARRANGEMENT OF OBJECTS.**

**OBJECTS ARE THE THINGS ON DISPLAY, INCLUDING ARTIFACTS.**

**A LABEL IS THE WRITING THAT GOES ALONG WITH AN OBJECT.**

**STEP THREE: CHOOSE ONE OBJECT THAT INTERESTS YOU AND ANSWER THESE QUESTIONS ABOUT IT.**

Why did I choose this object?

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Have I seen something like it before? Where?

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How would I describe it to a friend?

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Why is it here? Why should I care about it?

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## Focus on an object

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**STEP FOUR: MY DESCRIPTIONS**

Find words for the objects' function, as well as their colors, shape, size, etc.

**STEP FIVE: MY SKETCHES**

Turn away from what you saw and draw it from memory as General Kane, or a person you are playing would see it. Then turn back and fill in the details you forgot.



**PA Core Standards: ELA CC.1.2 - Students read, understand, and respond to informational text** - 6.C; 7.C; 8.C; 9-10.C; 11-12.C.

**Reading in History and Social Studies CC.8.5** - .6-8.B,C,E,G,I; 9-10.B,C,E,G,I; 11-12.B,C,E,G,I.

**PA Academic History 8.1 Historical Analysis and Skills** - 6,9,12.A.B.



# Mathematical Connections

(Appropriate for middle and secondary grade levels)



The Brooklyn Bridge



The Kinzua Viaduct

The Kinzua Viaduct soared at 301 feet high which is 24 feet higher than the Brooklyn Bridge.

**How high is the Brooklyn Bridge?**

The Kinzua Viaduct once soared 301 feet high 2053 feet across from end to end. If this were a rectangular object, **what would the perimeter be?**

Using 6.7 million pounds of steel held together by 895,000 rivets, if you were the engineer, **how many rivets per pound of steel would you use?**



If you were the foreman on the reconstruction of the viaduct and had a crew of 100 to 150 men working 11 hour days and you had to finish the construction in 4 months, **how many total hours would you have to have the workers assuming they worked 5 days a week?**

Columns measuring  $9\frac{3}{4}$  inches in diameter formed the towers from 20 to 280 feet. The legs of each tower sloped inward at the top at the ratio of one to six and the width of each tower was nine feet. – **Create a  $\frac{1}{2}$  inch scale drawing of the bridge showing the angles of all towers.**

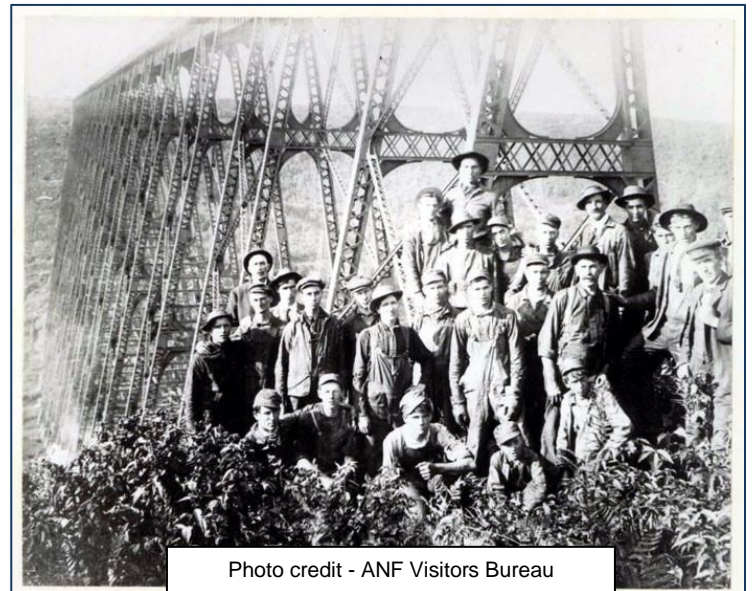


Photo credit - ANF Visitors Bureau

**PA Core Standards: CC.2.1 Mathematics Numbers and Operations -7.D.1.**

**CC.2.2.** Apply and extend previous understandings of arithmetic to algebraic expressions. 6.B.1;7.B.3.

**CC.2.5.** Develop a plan to analyze a problem, identify the information needed to solve the problem, carry out the plan, apply estimation skills as appropriate, check whether the plan makes sense, and explain how the problem was solved in grade appropriate contexts 8.11.A.

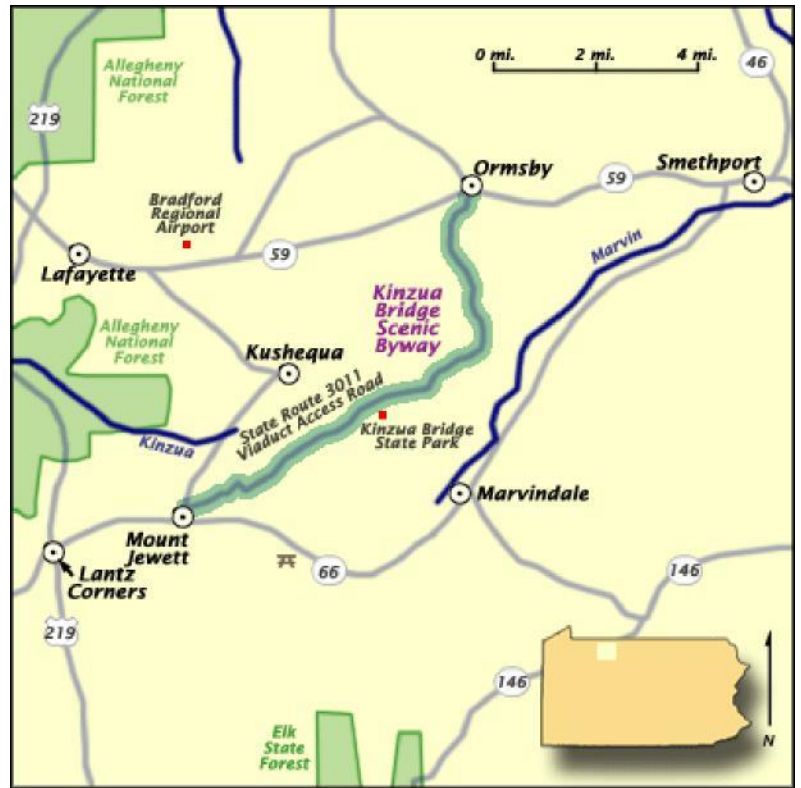
**CC.2.3.** Apply appropriate tools to solve real-world and mathematical problems 6.A.1.

## Section III – Environment

### **Park Features and Attractions:**

Kinzua Bridge State Park is the **home of the National Engineering Landmark, the Kinzua Viaduct**, reinvented as the **Kinzua Sky Walk**, which was constructed on the historic six towers of the viaduct remaining on the park side of the Kinzua Gorge following the tornado of 2003.

**Natural assets** include the flora and fauna of a Pennsylvania Hardwood forest. These include signature hardwood Black Cherry and abundant wildlife including a wide variety of bird species. Four distinct seasons provide spectacular fall foliage and abundant snow fall. **The Kinzua Gorge** is the most significant natural feature of the park, with stunning views of Kinzua Creek and heavily forested hillsides.



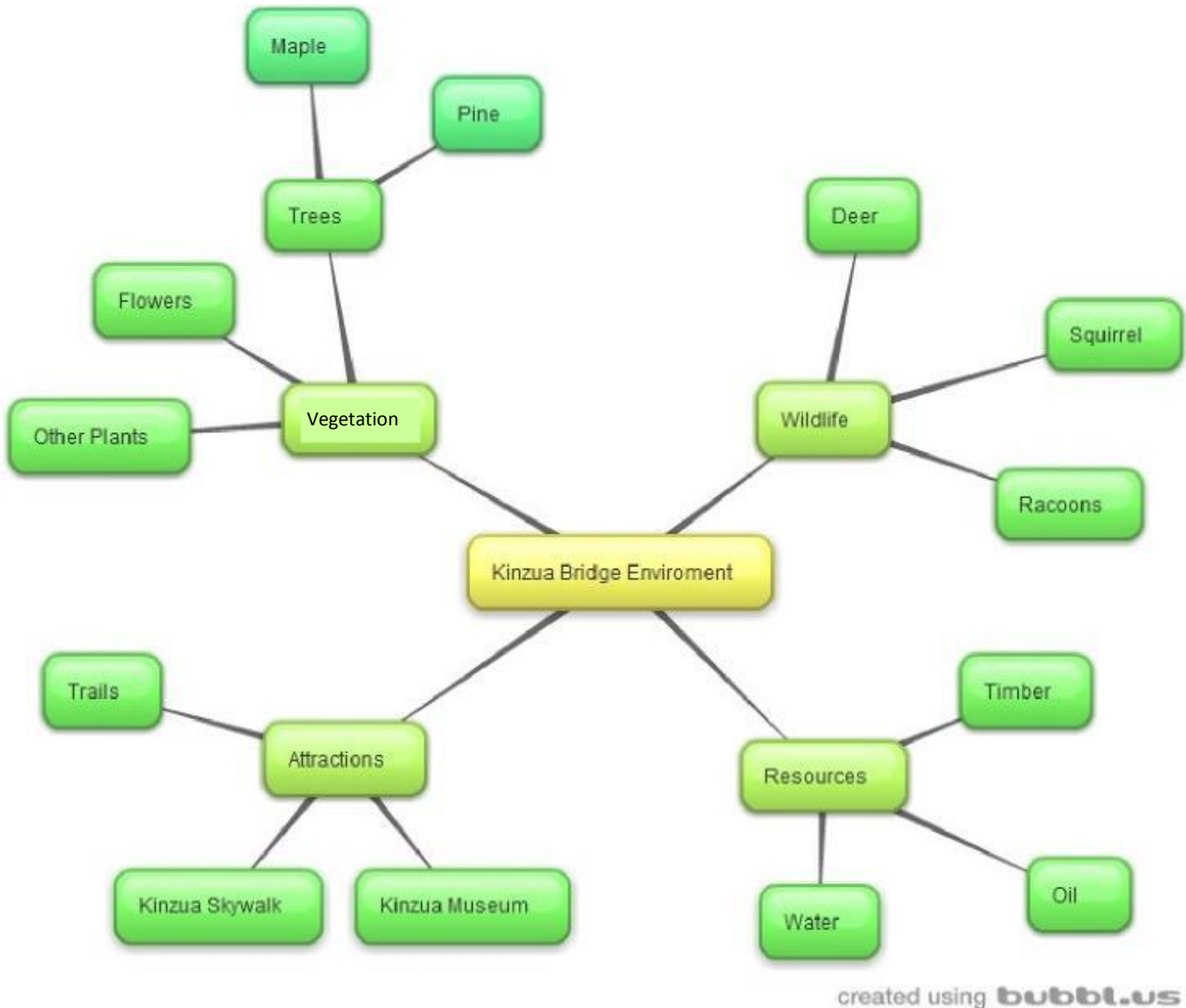
This is the view underneath of what remains of the bridge.

Photo credit - ANF Visitors Bureau



Young chestnut trees on the North Country Trail.

## A Brainstorm Journey with the Environment



**Suggested Activity:** Students will Brainstorm connections based on what they discovered with the resources and information at the Kinzua Bridge State Park Office/Visitor Center.

1. Divide Students into groups of 3 or 4.
2. Place a large piece of paper up on the wall.
3. Give each group 5 minutes to come up with a concept map like the one above.  
(Giving each group a different section could also work).
4. Each group sends a representative to draw out their section of the Concept Map.

Save the map so that information can be added to it later on.

**PA Core Standards: CC.8.5.** Introduce and state an opinion on a topic CC.1.4.8.H; Cite specific textual evidence to support analysis of primary and secondary sources, connecting insights gained from specific details to an understanding of the text as a whole 11-12.A,C,G.

## FORESTRY AND CONSERVATION

**Suggested Activity:** Look for and highlight what “Forestry” is, what it does, and **careers** in this industry as you read the following information on forests, as well as **people** and **companies** who made a difference in sustaining our forests. Also, discover the people and companies who helped to make what you are seeing possible and what “Conservation” means to you and to our world.



Photo credit - ANF Visitors Bureau

**Forestry** is the science, art, and craft of creating, managing, using, conserving, and repairing forests and associated resources in a sustainable ways to meet goals, needs, and values for human benefit. A **challenge** of forestry is to create systems that are socially acceptable while sustaining all resources that may be affected. Forest science belongs to the biological, physical, social, political and managerial sciences. One who works in the industry is known as a “forester.”

**Modern forestry addresses a wide range of concerns**, known as “multiple-use management.” This includes timber, fuel wood, wildlife habitat, natural water quality management, recreation, landscape and community protection, employment, aesthetically appealing landscapes, biodiversity management, watershed management, erosion control, and preserving forests as 'sinks' for atmospheric carbon dioxide.

Forest **ecosystems** are the most important component of the biosphere. Forestry is a vital science, craft, and technology.

### [Rachel Carson](#)

Rachel Carson, writer, scientist, and ecologist, grew up simply in the rural river town of Springdale, Pennsylvania. She was hired by the U.S. Bureau of Fisheries to write radio scripts during the Depression and supplemented her income writing articles on natural history for the Baltimore Sun. She began a fifteen-year career in the federal service as a scientist and editor in 1936 and rose to become **Editor-in-Chief of all publications for the U. S. Fish and Wildlife Service**. She wrote pamphlets on **conservation and natural resources** and edited scientific articles.



In her free time, she turned her government research into lyric prose. Disturbed by the use of synthetic **chemical pesticides** after World War II, Carson reluctantly changed her focus in order to warn the public about the long term effects of misusing pesticides. In *Silent Spring* (1962) she challenged the practices of agricultural scientists and the government, and called for a change in the way humankind viewed the natural world. Carson was attacked by the chemical industry and some in government as an alarmist, but courageously spoke out to remind us that we are a vulnerable part of the natural world subject to the same damage as the rest of the **ecosystem**. Testifying before Congress in 1963, Carson called for new policies to protect human health and the environment. Rachel Carson died in 1964 after a long battle against breast cancer. Her witness for the beauty and integrity of life continues to inspire new generations to protect the living world and all its creatures.” (<http://www.rachelcarson.org/Biography.aspx#.VSWITJNUXk0>)

## [Collins FSC Certified Forest](#)

The Collin's Forest Stewardship Council (FSC) Certified Forest in Pennsylvania has been independently certified by the [Scientific Certification Systems, Inc.](#) (SCS Global Service) for being in conformance with the FSC, standards and policies.



Three Collins Forests combine **307,000 acres of timberlands**. These are biodiverse, multi-layered, and canopied forests that do not just include one single species. The **Forests contain more wood than they did 100 years ago and are self-sustaining**. The Forests are home to bald eagles, black bears, wild turkeys, beavers, great blue Heron Rookeries, and the endangered Goose Lake Redband trout.

[Become FSC Certified](#)

## *Pennsylvania Forest Overview*

[Kane Hardwood](#), a division of Collins, manages the 119,000-acre FSC-certified Collins



There is no logging allowed on the rivers, streams, creeks or wetlands in the Collins PA Forest.

Pennsylvania Forest in the **center of the finest black cherry hardwood forests in the world**, which are the Allegheny Mountains of northern Pennsylvania. There are red and white oak, soft and hard maple, ash, beech, yellow poplar, and basswood. This thriving hardwood forest came about due to “the Collins family’s commitment to sustainable forestry, ecosystem management, and natural biodiversity.”

The goal is to “Let the land dictate the practices, not the mill’s need for logs. Be patient, be prudent, be good stewards of the whole forest—the watersheds, the birds, the plants, the animals.”

With there being an abundance of natural resources, the area is valuable for its commercial veneer and hardwood lumber products, its water quality, recreational opportunities, and wildlife habitat.

“Let the people enjoy the forest. Be open. Be a good neighbor. Be a partner in the community. Protect the land for hiking and hunting, for camping and fishing, for the pure aesthetic joy of the forest.”

Kane Hardwood is a company with **eight professional foresters** who believe in “sustainable forestry. Our foresters are personally responsible for selecting the sites to be harvested. Careful planning allows our harvests to actually increase the quantity and quality of

future yields by concentrating on the regeneration which will become the next stand.”

In addition to harvests from our company lands, Kane Hardwood purchases timber from the Allegheny National Forest, Pennsylvania State Game Lands, State Forest lands, and other local private lands.

The practices of Kane Hardwood reflect the Collins philosophy of **conservation** – “the careful balance maintained between logging for a business and maintaining the ecosystem health. Logging roads are carefully located to protect water quality. Potential denning and nesting trees are reserved in our harvest areas, and plenty of woody debris is left to enrich the soil of the forest floor.”

[\(http://www.collinsco.com/pennsylvania-overview/\)](http://www.collinsco.com/pennsylvania-overview/)



## Kane Hardwoods



“**Located in Northwestern Pennsylvania**, Kane Hardwood is close to where **The Collins Companies** started operations on July 8, 1855. Today, the company is still family-owned and is the second largest private landowner in the state.”

The mill processes black cherry, red maple, red oak, hard maple, beech, and ash. Approximately 85% of their products are sold in the U.S. Approximately 40% of their products are purchased by manufacturers to be made into FSC certified products, including the panels that were used to build “The Wall” at the San Francisco International Airport.

Most of the materials processed by the Kane mill are from the 126,000-acre **Collins Pennsylvania Forest**, which is managed by Kane Hardwood. Receiving FSC Forest Management certification from Scientific Certification Systems in 1994, these lands sit in the center of the finest black cherry hardwood forest in the world.

Kane’s customers are a wide range of manufacturers, wholesalers, and retailers, which include The Freeman Corporation, Charles Shackleton, C.F. Martin & Co., Berkeley Mills, Holgate Toy Company, Northland Forest Products, and Columbia Forest Products.

Kane Hardwood has a **strong commitment to the local community**. The company employs about 120 people and is the largest sawmill employer in McKean County, Pa.

Their employees donate many hours and services to a wide range of community projects, and are very active in local schools.

The company has a **strong emphasis on youth and education**. Employees give speeches on careers and conduct Project Learning Tree activities with local elementary schools.

For more information on Kane Hardwood and if they could come to your school, please visit [www.CollinsWood.com](http://www.CollinsWood.com).



More information can be found at FSC Newsletter Stories <https://us.fsc.org/newsletter.239.178.htm>



## “A commitment to sustainable forestry”

Collins' vision of **sustainability** was first articulated in 1940 by the third generation, **Truman W. Collins**. He was half a century ahead of the rest of the forest products industry in implementing **sustainable practices** to protect the integrity of the total forest ecosystem—an idea almost unheard of at that time. Even today, the ideas, as well as the practice, remain rarities.



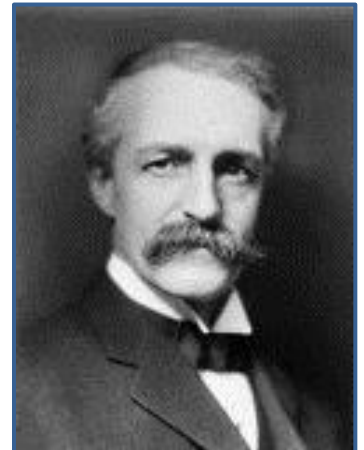
Collins' long-standing **commitment to land and resource stewardship** demands that we:

- Maintain the health of the total forest ecosystem;
- Support the production of wood on a sustained, renewable basis; and
- Provide social and economic benefits to the surrounding areas and communities.”

<http://www.collinsco.com/certified-forests> 

## Gifford Pinchot

**Gifford Pinchot** was an American **forester** and politician who served as the first Chief of the United States Forest Service from 1905 until 1910. He also became the Governor of Pennsylvania from 1923-27 and again from 1931-35. He is “known for reforming the management and development of forests in the United States and for advocating the conservation of the nation's reserves by planned use and renewal.” He called it “the art of producing from the forest whatever it can yield for the service of man.” Pinchot coined the term “**conservation ethic**” as applied to natural resources. Pinchot's main contribution was his **leadership** in promoting scientific forestry and emphasizing the controlled, profitable use of forests and other natural resources so they would be of maximum benefit to mankind. **He was the first** to demonstrate the practicality and profitability of managing forest for continuous cropping. **His leadership put conservation** of forests high on America's priority list.



Gifford Pinchot  
1865 - 1946  
The First  
Conservationist

CONSERVATION MEANS THE  
WISE USE OF THE EARTH AND  
ITS RESOURCES FOR THE  
LASTING GOOD OF MEN.

Gifford Pinchot

**Suggested Activity:** Using the materials and other things you discovered, **Compare and Contrast** the images of the logging industry. What did they do in the past that we don't do now? What do we do differently today than they did back then? How did the people and companies make a difference so we see the forests of today?



Photo credit [www.dcnr.state.pa.us](http://www.dcnr.state.pa.us)



Photo credit <http://sfiofpa.org/page/logging-safety/>



Photo credit [www.pottercountypa.net](http://www.pottercountypa.net)



Photo credit [www.pennforestproducts.com](http://www.pennforestproducts.com)

**OLD Logging Industry**

**VS**

**Current Logging Industry**


**PA Academic Standards: S8.D.1.2.2** Describe potential impacts of human-made processes (e.g., manufacturing, transportation, mining) on Earth's resources, both nonliving (i.e., air, water, or earth materials) and living (i.e., plants and animals).

**S8.B.3.3.1.** Explain how human activities may affect local and regional environments.

**S6.A.1.2.2.** Identify variables that cause changes in natural or human-made systems.

## ***Day at Kinzua Sky Walk Bingo***

See how many of these things you can find on your trip to the Sky Walk!

Keep your eyes and ears open for the different animals and wildlife throughout the park.

<b>Tourist</b>	<b>Kinzua Creek</b>	<b>Beech Tree</b>	<b>Squirrel</b>	<b>Backpacker</b>
<b>Cherry Tree</b>	<b>Bigfoot</b>	<b>Birch Tree</b>	<b>Chestnut Tree</b>	<b>"Kinzua Viaduct"</b>
<b>Fox</b>	<b>Someone Taking a Picture</b>	<b>Kinzua Sky Walk Free Space</b>	<b>Grouse</b>	<b>Maple Tree</b>
<b>Osprey</b>	<b>Hawk Weed</b>	<b>Wood-Sorrel</b>	<b>Wild Turkey</b>	<b>Cardinal</b>
<b>Bridge Tower</b>	<b>"Length of Bridge"</b>	<b>Rabbit</b>	<b>Railroad tracks</b>	<b>Robin</b>

**First one to get "Bingo" may get a special prize  
selected by your teacher!**

# You are the Designer



**Description:** You will see that the longer side of the Kinzua Viaduct became the Sky Walk, but what ever happened to the shorter side which also survived?

**Suggested Activity:** Your job is to **create a sustainable alternative** to leaving the other side unfinished and closed off. In groups of 3 to 4, design a new lease on life for the shorter side of the Viaduct.

Options to students (Select at least 2 or 3 of these options):

- Write a paper about your idea
- Design and create a model of your idea
- Sketch and draw your idea
- Create a poster presentation for your idea
- Any other ideas you may have, cleared with your teacher

Presentation:

- Each group will present their idea to the class as a whole
- This presentation must be 3-6 minutes in length

**PA Academic Standards: Natural Resources 4.3.** Identify questions and concepts that guide scientific investigations, Formulate and revise explanations and models using logic and evidence.  
Recognize and analyze alternative explanations and models.



**Reflect on what you asked, what you saw and what you discovered about Environment and the Kinzua Viaduct.**

**Hints to encourage reflection:**

- ✓ View from various perspectives.
- ✓ Compare and contrast.
- ✓ Ask "what if. . . ?"
- ✓ Consider consequences.

**Suggested Discussion Prompts:**

- "What would have been the experience of a skilled worker on the original or the revised viaduct?"
- "What if the ideas didn't work?"
- "What would have been the experience of a train engineer on the original or the revised viaduct?"
- "What would have been the experience of a tourist on the original or the revised viaduct?"
- "Which questions that you asked were answered? What other questions do you have to explore?"
- "What surprised you the most about the environment around the viaduct after seeing it?"

<b>Reflective Journal</b>		
What happened?	How do I feel about it?	What did I learn?

**PA Core Standards: English Language Arts CC.1.2** - Students read, understand, and respond to informational text—with an emphasis on comprehension, vocabulary acquisition, and making connections among ideas and between texts with a focus on textual evidence. 6.A,B,G,J,K; 7.A,B,G,J,K; 8.A,B,G,J,K; 9-10.A,B,G,J,K; 11-12.A,B,G,J,K.

**Speaking and Listening CC.1.5**- Students present appropriately in formal speaking situations, listen critically, and respond intelligently as individuals or in group discussions. 6-8.A; 9-10.A; 11-12.A.

**Reading in History and Social Studies CC.8.5** - 6-8.A,B,D,F,G,H,I J; 9-10.A,B,D,F,G,H,I J; 11-12.A,B,D,F,G,H,I,J.



KINZUA SKY WALK, KINZUA STATE PARK, MT. JEWETT, PA

## Section IV - Energy

### Tornado blew Kinzua Viaduct down

By KATE DAY SAGER, The Times Herald - 07/23/2003

<http://www.smethporthistory.org/kinzuaviaduct/viaductcollapse2003/kinzuacollapse2003.html>



**Suggested Activity:** As you read these articles printed the day after the tornado hit the Kinzua Viaduct, look for specific information about what this **force of nature and energy did** and how **quickly it occurred**. Compare and share the information with friends as if you were reporting the event. Also compare the reports.

**Pa Core Standards: CC. 8.5.** Determine the central ideas or information of a primary or secondary source. Evaluate authors' differing points of view on the same historical event or issue by assessing the authors' claims, reasoning, and evidence - CC.8.5. B, H F.

MT. JEWETT, Pa. - The mood was somber Tuesday when area officials and members of the press toured what was left of the Kinzua Bridge.

The center of the historic 103-year-old structure was destroyed by a tornado Monday. Confirmation that an F-1 tornado did strike the bridge was made by an official with the National Weather Service. Meteorologists in State College said the tornado that struck the bridge area hit between 3:15 and 3:30 p.m., had wind speeds up to 100 mph and was 3 1/2 miles long and a 1/3 of a mile wide.

During a tour of the bridge, state Rep. Martin Causer said he would make every effort to push for the rebuilding of the bridge. "It's crucial to the area. It's the biggest tourist attraction in the whole region," Mr. Causer said after walking back from the bridge.

Walking to the bridge now requires officials to walk around toppled trees and down steep grades to reach the train tracks. Railroad cars that housed the concession area at the park are now covered with large branches and treetops. Train tracks that once covered a distance of 2,053 feet along the top of the bridge can be seen bulging up at the end of the truncated bridge before dropping over the edge and dangling down a couple of hundred feet. Looking down, visitors could see a 1,200 foot expansion of the bridge lying at the bottom of the gorge, as though a giant hand had pushed it over on its side. One construction worker at the site Monday told others he heard several loud booming sounds when the tornado hit. "This is all that is left," Mr. Clark said in a quiet tone as he looked in the direction of the bridge.

Most of the men were not at the site during the day of the tornado because of bad weather. No one was injured except a park employee who was trapped in a maintenance building when trees fell on the building. Mr. Brode said the situation is hard for the company because it had employed approximately 30 men for the restoration project. He said only about half of the crew have been called in to work since the tornado. "This is going to affect everything ... the hotels we're staying at ... my guys eat every night, drink beer every night, all that stuff adds up," Mr. Brode said.

# After 121 years, Viaduct Falls Victim to Tornado

Wednesday, July 23, 2003 - <http://old.post-gazette.com/localnews/20030723kinzuar3.asp>



By Lillian Thomas and Patrick Hernan – Pittsburgh Post-Gazette

After standing 121 years and bearing some of the world's heaviest trains across a 301-foot-high gorge in McKean County, the center of the Kinzua Viaduct "just laid over on its side," in the face of a tornado Monday afternoon.

Workers with a crew renovating what once was the world's highest and longest railroad span fled as the destruction roared toward them.

They tried to leave the work site in Kinzua Bridge State Park, but were forced to scramble from their vehicles for safety in ditches as trees crashed down around them and blocked their route.

Then came the booming sounds - apparently the death knell of the deteriorated viaduct collapsing at its center into twisted heaps on the valley below.

Decades ago, the span was proclaimed the "Eighth Wonder" of the engineering world.

In February, work began on the \$10 million renovation project; now, officials must decide whether to rebuild it or demolish what remains.

"As the crew was leaving the site, trees were falling down across the access road," said Steven Brode of W.M. Brode Co. of Newcomerstown, Ohio, the company working on the bridge. "That's when my superintendent said he thought at first he was hearing more trees falling; he heard this series of booms -- boom, boom, boom, boom. Later he realized that was probably the towers falling. He called me to tell me he thought part of the bridge had fallen."

The crew also contacted Barrett Clark, manager of Kinzua Bridge State Park, before evacuating. He arrived to find trees snapped off, a tangle of debris and a park worker trapped inside a collapsed shed.

After the worker was freed, Clark crawled through the debris to look at the Kinzua Viaduct.

A 1,400-foot section of the bridge had "just laid over on its side."

Six of the bridge's 20 support towers still stood on the park side of the gorge, three on the other side. The ones that remained standing had been recently renovated. The other 11 towers crashed onto the valley floor after bolts on their bases snapped. One tower had been twisted 180 degrees before it toppled.

In addition, thousands of trees were down, reminding Clark of the Agent Orange deforestation he saw three decades ago in Vietnam.

The National Weather Service reported yesterday that a tornado touched down between 3:15 and 3:30 p.m. in a wooded area about a mile west of the viaduct. It continued moving northeast for 3 1/2 miles, packing winds of 100 mph and cutting a one-third-mile-wide swath that took down thousands of trees, including black cherry, beech and maple. It was an F1 tornado, with winds from 73 to 112 mph.

The engineer on the bridge renovation project, Brian Emberg, drove up from Harrisburg when he got the word, arriving around 8:30 p.m.



Engineers assess damage to the historic Kinzua Viaduct a day after a 1,400-foot section of the railroad bridge was ripped from its footings and dumped to the ground by an F1 Class tornado packing 100 mph winds.



"It was very eerie. The whole valley was filled with fog, it was very dusky, and it almost looked like a battle scene, with the fog and this structure crumpled up," said Emberg, vice president of Herbert Rowland & Grubic, an engineering firm in Harrisburg.

Meteorologists from the National Weather Service were on the scene yesterday, along with engineers and officials from the state Department of Conservation and Natural Resources, which runs the park.

Officials will continue their assessment of damage today and start to consider whether the state will rebuild the bridge or demolish what's left.

Clark, who is from Juniata County but had come to the area every year since the 1950s before becoming park manager last year, said he can barely comprehend how the landscape changed in a matter of minutes.

"Looks like somebody took a lawn mower down through. The devastation is incredible."

Brode said that as he and his crew tried to salvage equipment yesterday, he thought about the months of work and the uncertain future.

"It's pretty tough," said Brode. "We have 25 guys out here that have been working this thing since February, going hard at it. We won't know where we go from here, and of course, it's a beautiful structure that we've put all that work into."

## **Tornados**

**Myths and facts of tornados – See how many you know or thought you knew.**

**“Tornados only happened in flat areas like Kansas or Oklahoma? *Truth or Myth?***

**Myth!** Tornadoes can travel up and down hillsides, and are just as violent and dangerous. Living on a hill will not protect you from a tornado. Tornadoes can occur almost anywhere in the world, but the United States is the country with the highest frequency of tornadoes. About 1,000 tornadoes hit the United States each year.

**“Tornadoes cannot cross lakes, large rivers or wide bodies of water.” *Truth or Myth?***

**Myth!** Tornadoes that form on land can cross bodies of water, including rivers and lakes. Tornadoes can also form on water. These tornadoes are called “waterspouts.” Never think that a body of water will protect you from a tornado.

**“Tornadoes can always be seen from far away.” *Truth or Myth?***

**Myth!** Not only do tornadoes not always have to appear as a visible funnel cloud, but they can also be hidden by heavy rainfall during the day or by darkness at night.

**“A tornado always forms and appears as a funnel cloud.” *Truth or Myth?***

**Myth!** A tornado can cause damage on the ground even when a visible funnel cloud has not formed. Also, if you see a funnel cloud that does not appear to be touching the ground, the wind and circulation may still reach the ground and cause extensive damage.

**“If a tornado is not coming directly towards me, I am out of harm’s way.” *Truth or Myth?***

**Myth!** Tornadoes do not follow a specific path or route, and can change directions at any time. The only safe place to be during a tornado is in a location that offers shelter from high winds and debris.

[Kinzua-bridge-once-worlds-longest.](#)

This is an excellent website with pictures and historical facts.



## What more would you like to know about tornados?

Check these websites –

<http://stormaware.mo.gov/tornado-myths/> 

<http://www.livescience.com/3589-12-twisted-tornado-facts.html> 

<http://www.weatherexplained.com/Vol-1/Tornadoes.html> 

[How do tornados work?](#) 

[Create a Tornado](#) 

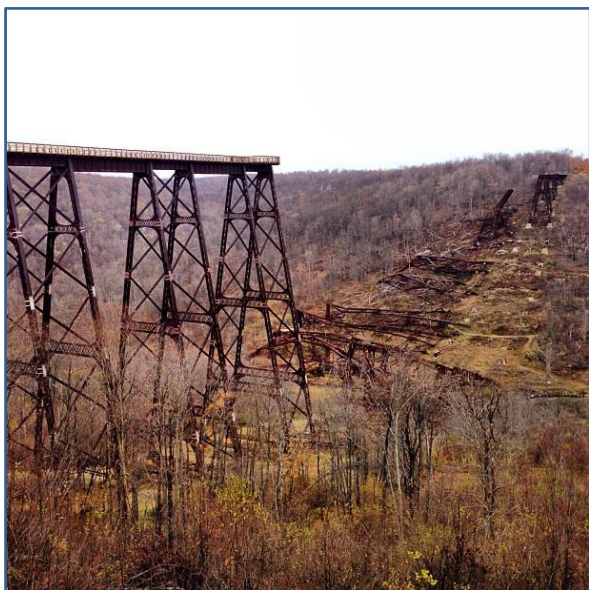


Photo credit of all photos - ANF Visitors Bureau



**Suggested Activity:** Look at the differences on two sides of the bridge in this picture and when you are there. Share what you see and how this happened.

What would it have been like to be there when it happened?  
What would you have seen, heard, felt?

**Think  
About It.**

**Suggested Activity:** Compare these pictures with other pictures of the Viaduct earlier in this Guide. At the Viaduct, discuss your reactions to actually seeing these images.



Reflect on what you asked, what you saw and what you discovered about Energy and the Kinzua Viaduct.

**Compare** reactions with others on a theory, or a specific event, solution or idea.

**Contemplate** - Focus on constructing solutions such as creating a museum.

Reflective Journal		
What happened?	How do I feel about it?	What did I learn?

**PA Core Standards: English Language Arts CC.1.2** - Students read, understand, and respond to informational text—with an emphasis on comprehension, vocabulary acquisition, and making connections among ideas and between texts with a focus on textual evidence. 6.A,B,G,J,K; 7.A,B,G,J,K; 8.A,B,G,J,K; 9-10.A,B,G,J,K; 11-12.A,B,G,J,K.

**Speaking and Listening CC.1.5**- Students present appropriately in formal speaking situations, listen critically, and respond intelligently as individuals or in group discussions. 6-8.A; 9-10.A; 11-12.A.

**Reading in History and Social Studies CC.8.5** - 6-8.A,B,D,F,G,H,I J; 9-10.A,B,D,F,G,H,I J; 11-12.A,B,D,F,G,H,I,J.

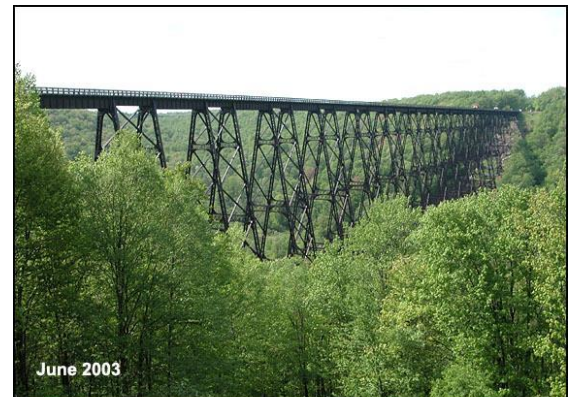
### How did the Bridge fall?

**Failure occurred at the base of the towers** on the windward side. Collars over the anchor bolts were damaged by water penetrating over time, but the enormous weight of the towers held the bridge vertically in place. If winds were high enough, the **center of gravity** of Kinzua Bridge could shift, then the weight of the bridge would be placed on one side and could fall.

**Towers 10 and 11 were the first to go**, falling to the west.

**Twisting clockwise**, towers 4 to 9 collapsed, the steel frame screeching as it contorted. Towers 12, 13 and 14 were lifted off their foundations and moved. **In a second**, they were plonked back down, still erect. Only the railroad tracks held them together. Spiraling downwards in a counter clockwise direction, eleven towers were gone in **thirty seconds**.

**Floyd Quillen**, site supervisor for renovations: “At 3:00 pm, I sent my crews back to the motel when severe rain hit the job compound. Myself and a crew-member heard four to five loud booms. The wind noise was deafening. Looking towards the north, trees were bending and blowing over by the dozens. Then, as quick as it arrived the wind was gone. At this time I looked through the valley and saw the bridge was down.”

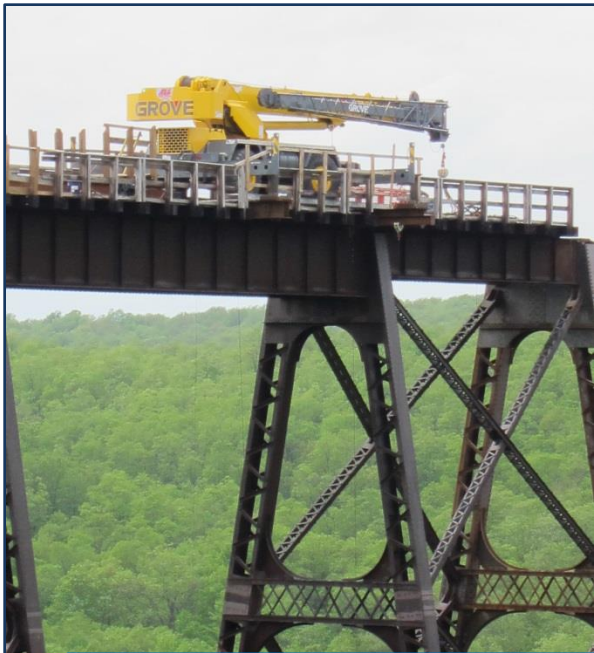


What would you ask Floyd Quillen if you could?  
What would you ask the crew who worked on the bridge if you could?

**Section V - How was the Kinzua Sky Walk created?**

**“Dreams that shaped the viaduct continue to inspire the imagination.”**

**From this --**



**To this --**



Photo credit of all photos - ANF Visitors Bureau

## ***R.A.F.T. Writing project*** - (Acronym: Role, Audience, Format, and Topic)

As the students travel back home, have them organize their discoveries with partners or alone with the intent of creating a **R.A.F.T. project** that shares their discoveries.

This strategy encourages creative thinking and motivates students to demonstrate understanding in a nontraditional written format. The student can use the role they played and as they think in that role, they talk to a given audience using a selected format. This strategy encourages students to process information rather than just write answers to questions. You may even ask the students to develop their own creative RAFT assignment for each other based on essential questions.

### **How to use it:**

1. Using information in the Resource Guide and information at the Park, along with your essential questions presented in the classroom, analyze the important ideas or information you want students to learn. Consider how writing might enhance students' understanding of a topic (e.g., creating the Kinzua Sky Walk). This focus establishes the writing topic. The topic can be a creative title or stated in general terms, as long as it is clear to the student the goal of the assignment.
2. Explain RAFT to the students and list the role, audience, format, and topic for writing. You may want to choose different roles from which they can choose based on the same knowledge, reading, or concept. This strategy works with all disciplines and across disciplines as an exciting strategy for student writing.
3. Brainstorm possible roles students could assume in their writing. For example, a student could be Mrs. Kane sharing her concerns with her husband or describing the conversations between her husband and Mr. Chanute.
4. Next, decide the audience for this communication. Using that audience, determine the writing format. For example, Mrs. Kane could be writing in the format of a diary entry to be read by her children about what their father accomplished.

### **Suggested RAFT Choices**

<b><i>Role</i></b>	<b><i>Audience</i></b>	<b><i>Format</i></b>	<b><i>Topic</i></b>
<b>General Thomas Kane</b>	<b>Octave Chanute</b>	<b>Letter</b>	<b>Plans and invitation for his help to build the Viaduct</b>
<b>Visitor riding across the Viaduct in the early 1900's</b>	<b>Friends back home</b>	<b>A postcard with photograph</b>	
<b>Worker rebuilding the viaduct</b>		<b>Writing in a personal diary</b>	
<b>Environmentalist</b>		<b>Poem of at least 8 lines</b>	

**Pa Core Standards: 1.4 Writing:** Students write for different purposes and audiences. Students write clear and focused text to convey a well-defined perspective and appropriate content - A,B,C,D,E,F,H,K,L,Q,R,S,V,X.

**CC.1.5.A. Speaking and Listening:** Students present appropriately in formal speaking situations, listen critically, and respond intelligently as individuals or in group discussions

**8.1.12.C.** Analyze, synthesize, and integrate historical data, creating a product that supports and appropriately illustrates inferences and conclusions drawn from research.

## Write a Poem or Song

The first step in writing is choosing a good topic. Choose a topic that can be described using a variety of words or phrases.

Brainstorm possible topics that you discovered about which to write. Choose topics that can be easily described or ones that evoke strong feeling or opinion.

Write *Line 1* on the board and invite students to name a noun that describes the topic. List their suggestions in the *Line 1* row. Continue by writing *Line 2* on the board and asking students to name nouns that describe the topic. Continue the process through *Line 5*.

### Cinquain Pattern example

**Line 1: One word - Knights**  
**Line 2: Two words - Armor, shields**  
**Line 3: Three words - Fighting, charging, slaughtering**  
**Line 4: Four words - Worried, delighted, brave, fearsome**  
**Line 5: One word - Crusaders**

### Create a Diamante Poem

A Diamante Poem follows a very specific format. There are seven lines, and each line must have a specific number and type of words. When you're finished, the poem is a diamond!

Line 1 = Topic (**noun**)

Line 2 = **Two** describing words (**adjectives**)

Line 3 = **Three** action words (-ing **verbs**)

Line 4 = **Four** words: Two words about the topic and two words that are opposite of those in line 2

Line 5 = **Three** action words for the ending noun (-ing **verbs**)

Line 6 = **Two** words to describe ending noun (**adjectives**)

Line 7 = Ending **noun** (opposite of Line 1)

An example of a diamante poem about a meteor shower:

**Fireball**  
**Brilliant, beautiful**  
**Flashing, shining, dashing**  
**Bright, wondrous, black, nothing**  
**Staring, hoping, missing**  
**Deep, quiet**  
**Darkness**



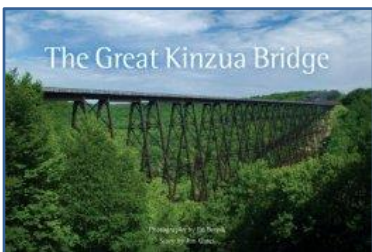
Photo credit - ANF Visitors Bureau

**Pa Core Standards** – CC.1.4.6.D,F,H,J,L,R,S; CC.1.4.D, F, H, J, L,R,S; CC.1.4.8.D,F,H,J,L,M,,R,S; CC.1.4.9-10.D,F,,H,J,,L,M,R,S; CC.1.4.11-12.D,F,H,J,L,M,R,S; CC.8.5.6-8.E; CC.8.5.9-10.E; CC.8.5.11-12.E; CC.8.6.6-8.A; CC.8.6.9-10.A; CC.8.6.11-12.A; CC.8.6.6-8.C; CC.8.6.6-8.F; CC.8.6.6-8.G;CC.8.6.6-8.H.

## Suggested Reading and Websites

### Kinzua Bridge Books

***The Great Kinzua Bridge*** by Jim Gates



A hardcover book released by Forest Press is a pictorial history of this remarkable structure. With previously unpublished archived and contemporary images, the book delves into the details of this astounding achievement and the implicit wealth of the natural resources locked within the Pennsylvania wilderness.

The book features more than 150 photos, rare nineteenth century images of the construction of the viaduct, and detailed photos of the steel restoration project undertaken in 1900 and illustrations from historical archives and contemporary images captured by Ed Bernik, award-winning Pennsylvanian photographer, the book chronicles the design and engineering of the original iron bridge, its refurbishment in steel, and its ultimate transformation into a monument celebrating American ingenuity and optimism.

The story includes profiles of the people whose stories intertwine with the bridge, from Civil War hero and builder Thomas L. Kane, to renowned design engineer Octave Chanute and daredevil Odo Valentine who flew an aircraft between its towers.

***Railways of America: Their Construction, Development, Management, and Appliances***

by Thomas McIntyre Cooley and Thomas Curtis Clarke

This is an EXACT reproduction of a book published before 1923. This book may have occasional imperfections such as missing or blurred pages, poor pictures, errant marks, etc. that were either part of the original artifact, or were introduced by the scanning process.

### Websites

***Histories of the counties of McKean, Elk, and Forest, Pennsylvania*** by Michael A Leeson.

[https://archive.org/stream/historyofcountie00lees/historyofcountie00lees\\_djvu.txt](https://archive.org/stream/historyofcountie00lees/historyofcountie00lees_djvu.txt) 

***Walk the Tracks across the Sky***

<http://visitanf.com/kinzua-state-park-sky-walk/> 

***The History of the Kinzua Viaduct***

<http://www.smethporthistory.org/kinzuaviaduct/> 

***Kinzua Viaduct Historical Marker***

<http://explorepahistory.com/hmarker.php?markerId=1-A-1B6> 

**Behind the Marker** - Andrew Kinzua Stauffer was named for Kinzua [Viaduct] by his father, inspector of the structure [first] built in 1882. Andrew drove the last rivet in the present bridge.

***Octave Chanute: A Bibliography*** by Pearl Young

<http://spicerweb.org/chanute/Biblio2.aspx> 

Patents; Manuscripts and correspondence in various archives

***Railroad Bridge named Eighth Wonder of the World when built in 1882 opens as Sky Walk Way over valley 301-feet below***

<http://www.dailymail.co.uk/news/article-2038391/Kinzua-Viaduct-Railroad-bridge-Pennsylvania-named-8th-Wonder-World.html#ixzz3X2ABMyF0> 

***Kinzua Bridge State Park / Kinzua Sky Walk  
Field Trip Teacher Evaluation Form***

In order to continue to improve the quality of educational programming visits to the Kinzua Bridge State Park, we appreciate you taking a few minutes of your time to complete this evaluation. Your comments and suggestions will help us plan future events and field trips to meet your educational needs. Thank you.

**DATE OF FIELD TRIP:**

**NAME OF SCHOOL:**

**TEACHER:**

**GRADE LEVEL AND NUMBER OF STUDENTS:**

**1. Please rate the effectiveness of the Resource Guide to prepare for your field trip and include any comments. (5 being excellent and 1 being not useful)**

**2. Please rate the effectiveness of the Resource Guide to enrich your field trip and include any comments. (5 being excellent and 1 being not useful)**

**3. Which activities/sections did you find most helpful to prepare and enrich the field trip?**

**4. The quality of the resources/activities was adequate for learning. (5 being excellent and 1 being not useful)**

**5. What was an exciting moment during the field trip?**

**6. Share something important that you and your students learned.**

**7. Where did you learn about this Field Trip?**

Printed brochure \_\_\_\_ Colleague \_\_\_\_ Website \_\_\_\_ Other:

**Use the back of this form to write your suggestions for future topics, as well as comments on how this program and Resource Guide could be improved to meet your educational needs. Thank you.**

**Please mail forms to:** Allegheny National Forest Visitors Bureau, PO Box 371, 80 E. Corydon Street, Bradford, PA 16701.