



Building Bridges

All Aboard: History, Culture, and Innovation on the Florida East Coast Railway

Grade Level:

5th Grade

Materials:

- Book:
Bridges! Amazing Structures to Design, Build and Test by Carol A. Johnson and Elizabeth J. Rieth
- Photo of:
Henry M. Flagler
- Bridge Designs introduced in the Book
- Map:
FEC Extension to Key West
- Additional Supplies:
 - A Piece of Paper for Each Student
 - Pencils
 - Two Large Blocks
 - Popsicle Sticks
 - Glue Dots or Wood Glue
 - Three Objects of Varying Weights (Light, Medium, Heavy)
 - Rulers

Curriculum Connections:

Math, Social Studies, Science, Art, Florida Education

Objectives:

Students will be introduced to the Overseas Railway and will understand structural concepts related to bridge building.

Standards:

MAFS.5.MD: Measurement and Data

SC.5.P: Physical Science

SS.5.G: Geography

VA.5.H: Historical and Global Connections

VA.5.F: Innovation, Technology, and the Future

Corresponding Map Hot Spot:

Seven Mile Bridge, FL

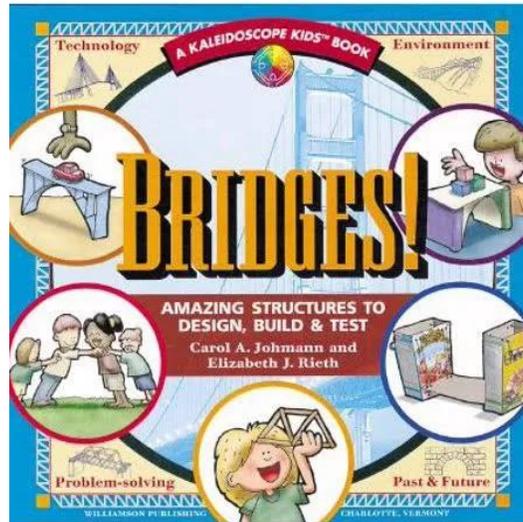
Lesson Procedure

Introduction:

Introduce the theme of the lesson, the Florida East Coast Railway and Key West Extension. Have a brief discussion about the importance of connecting the Keys with mainland Florida, inviting the students to imagine what life would have been like before the Overseas Extension and later, the Overseas Highway. Use the pictures of the Overseas Extension and Henry Flagler (the man responsible for the railroad project) to facilitate this discussion.

Literacy Component:

Use the book, *Bridges! Amazing Structures to Design, Build and Test* By Carol A. Johnson and Elizabeth J. Rieth, to introduce the students to the many different types of bridges and discuss how each design provides the basics for a strong structure.

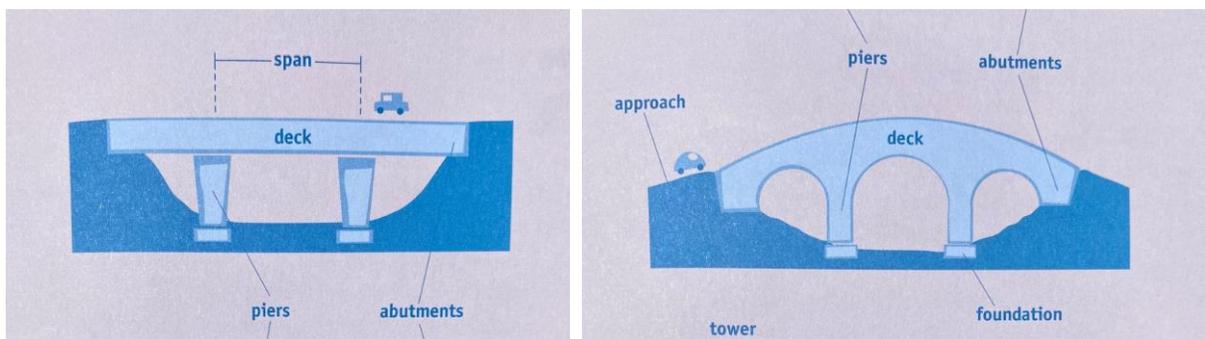


Key Terms:

Parts of a Bridge

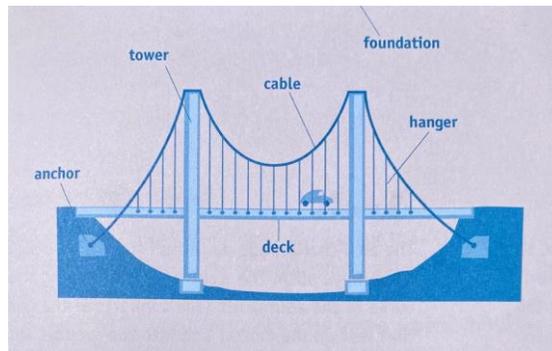
- Deck – The deck is used by pedestrians and drivers to cross the bridge.
- Supports – Supports are used to support the bridges deck.
- Span – The span is the distance between the supports.
- Foundations – Foundations connect the bridge to the ground and are located under the bridge's supports.
- Approach – The approach is the space or road that is right before the bridge begins.

Beam and Arch Bridge Terms



- Abutments – These are found on beam and arch bridges. They are the supports found at the ends of the bridge.
- Piers – These are found on beam and arch bridges. These are the supports in the middle of the bridge.

Suspension Bridge Terms



- Towers – In a suspension bridge, the middle supports, which are also the tallest, are called the towers.
- Cables – Long wire cables are strung over the towers and secured in anchors buried underground.
- Anchors – These buried anchors secure the cable wires that are strung over the support towers.
- Hangers – These run from the cables to the deck to hold the bridge up.

Source: *Bridges! Amazing Structures to Design, Build and Test*

Making Plans:

Explain to the students that the first thing that happens in the bridge building process is planning the design. Give each student a piece of paper and a pencil and ask them to make a sketch of a bridge design of their choice.

Build a bridge:

Now work together as a class to construct a bridge made out of popsicle sticks. You can call up volunteers to help with each step of the process.

1. Set out two large blocks.
2. Measure the distance between the two blocks.
3. Construct four long vertical strips by gluing popsicle sticks together with glue dots or wood glue. Make sure they will span the distance.
4. Make the two sides of the bridge by adding supports (popsicle stick triangles) connecting the top and the bottom (use two of the vertical strips you created above for each side).
5. Add angled supports to connect these two sides at the tops. Explain to the students that each support you add will create a stronger bridge.
6. Now, flip the bridge over and create the “road” by gluing popsicle sticks horizontally across the length of the bridge.
7. Test it out! Set it on the two supports you built and bring out three things of varying weight (light, medium, heavy). Make predictions together with the students about what the bridge will hold and then test them all out.

Closure:

Briefly review the concepts of bridge supports.

**Additional Resources:**[Overseas Railway Timeline](#)

This timeline on the Key West Art & Historical Society's website provides additional information about Henry M. Flagler's life, career, history and the development of the Florida East Coast Railway and extension to Key West, Florida.

[Online Collections Database](#)

With a collecting history that extends back to 1949, the Key West Art & Historical Society has unrivaled collections of contemporary and historic art and artifacts. Its collections, which number more than 35,000 works in all media, range from historical to present-day and span the entire Florida Keys.

Map of the Florida East Coast Railway Showing the Key West Extension

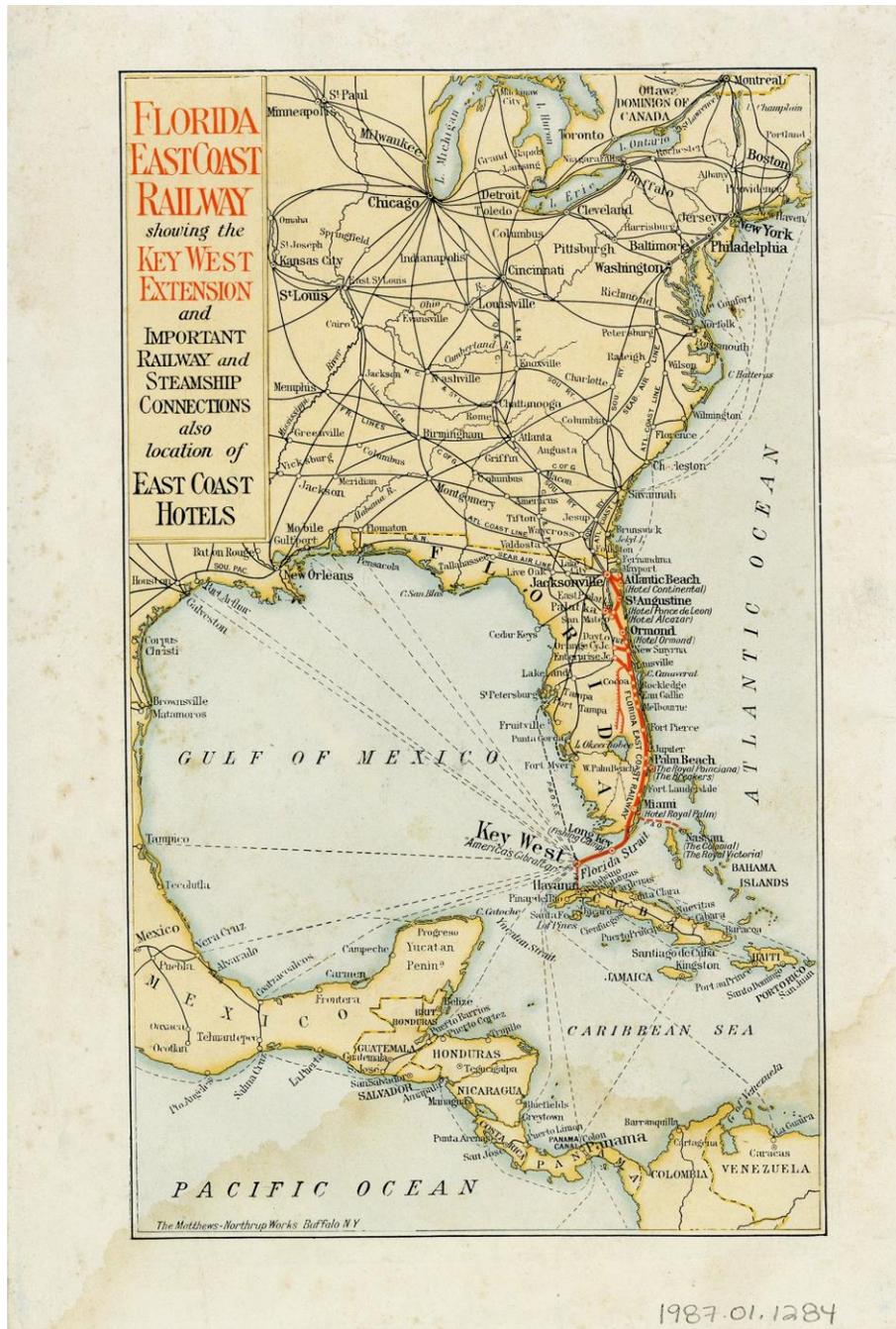


Photo: Key West Art & Historical Society

Map of the Florida East Coast Railway Key West Extension

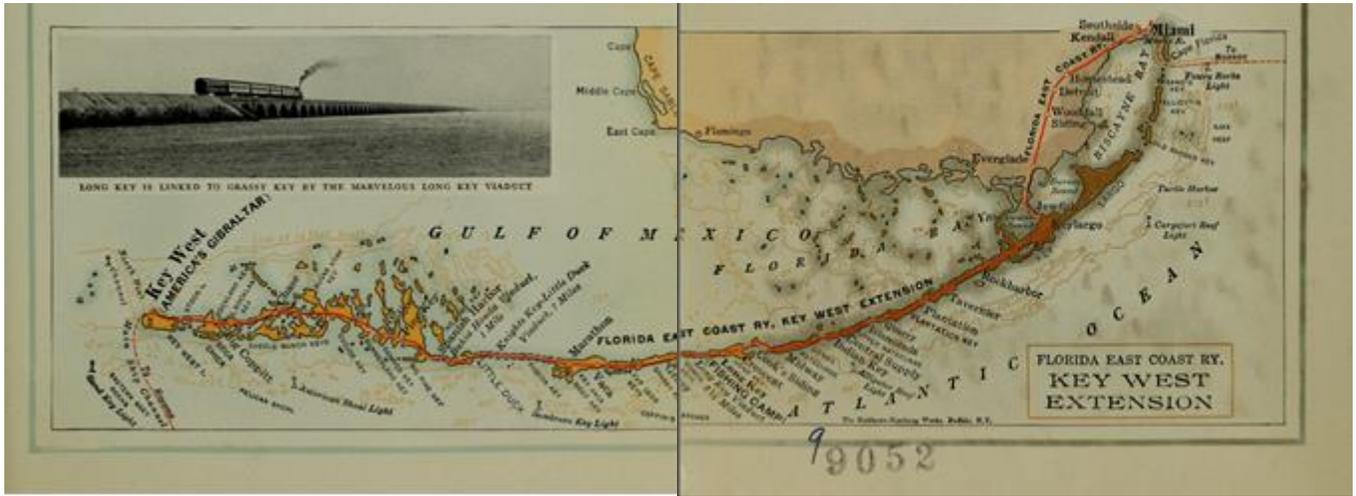


Photo: Florida East Coast Railway

Henry M. Flagler

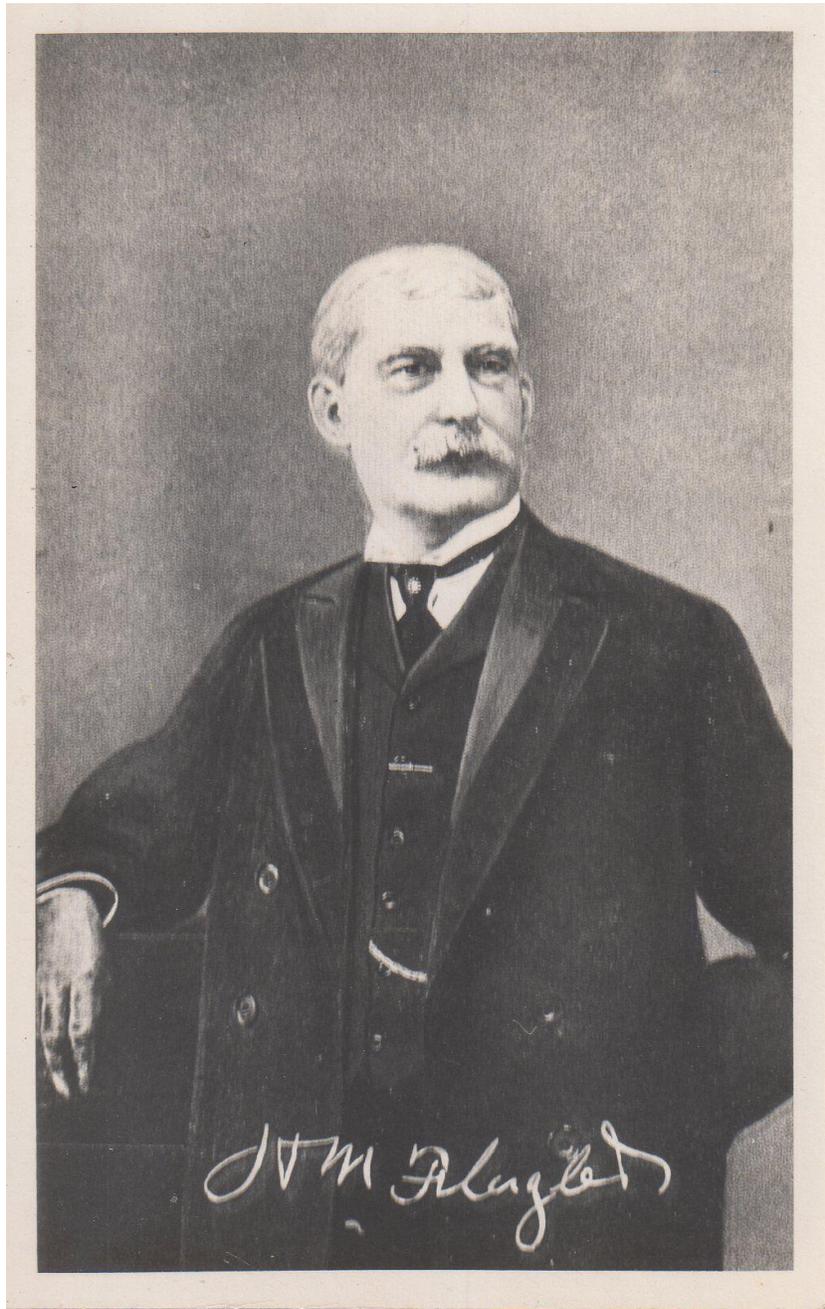


Photo: Key West Art & Historical Society

Beam Bridge

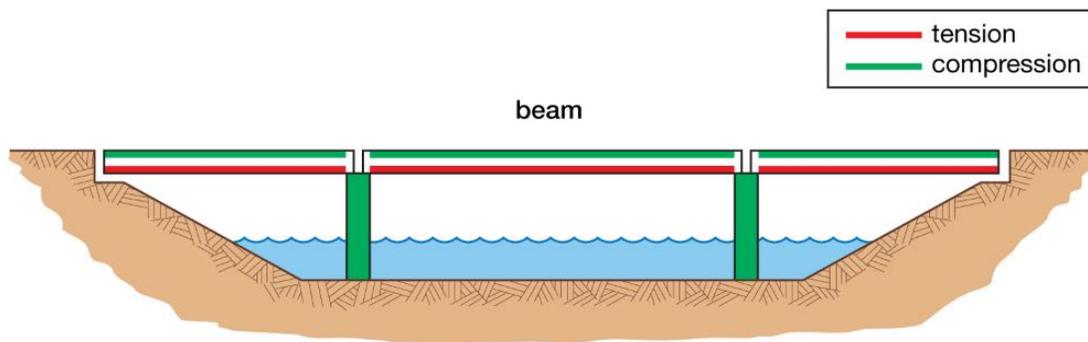
Beam bridges are the simplest structural forms for bridge spans. The weight of the load is passed along the beam, and down through the bridge supports to the ground.

Source: *Bridges! Amazing Structures to Design, Build and Test*



An FEC steam powered passenger train on the Seven Mile Bridge. This scene, which was repeated daily (and, in the Florida boom years of the 1920s, several times a day) shows the magnificence of a trip on the Oversea Railroad.

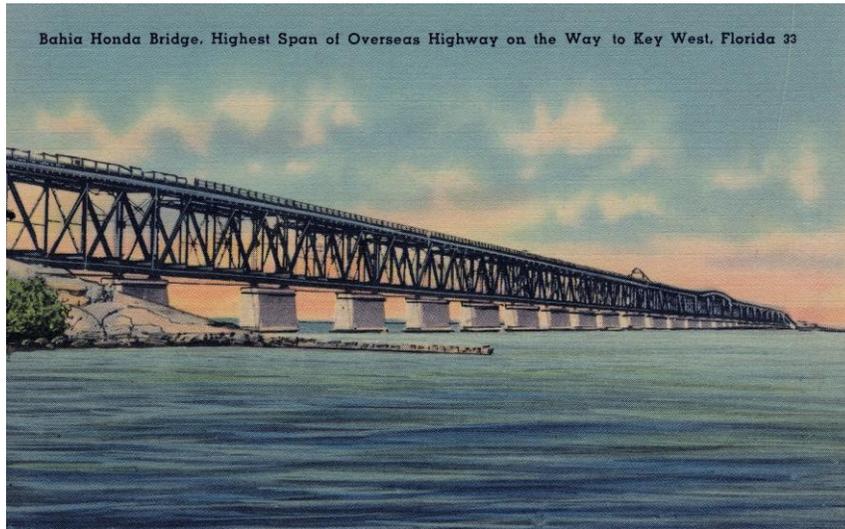
Photo: Broward County Library Digital Archives



© 2012 Encyclopædia Britannica, Inc.

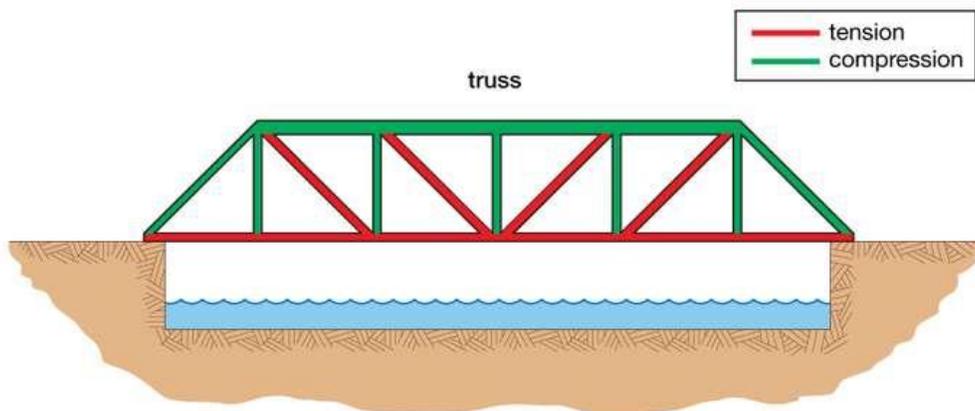
Truss Bridge

A truss bridge is similar to a beam bridge. The truss is a lightweight option added to the top or bottom of the structure to provide additional support.



Bahia Honda Bridge, Highest Span of Overseas Highway on the Way to Key West, Florida.

Photo: Key West Art & Historical Society



© 2012 Encyclopædia Britannica, Inc.

Suspension Bridge

The load pulls down on hangers, which pull on cables. The cables pull on the towers and anchors, and the anchors pull back, or resist the pull on them, because they are heavy and buried in the ground. All of these parts are in tension. The towers are also compressed and as the cables push down on them and their foundations.

Source: *Bridges! Amazing Structures to Design, Build and Test*



The Golden Gate Bridge in San Francisco, California.

Photo: Golden Gate Bridge Highway & Transportation District



© 2012 Encyclopædia Britannica, Inc.

Arch Bridge

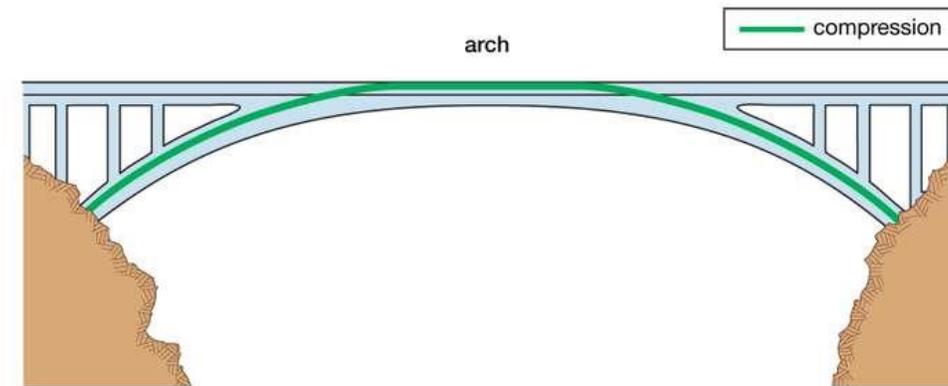
The arch changes the downward force of gravity into a sideways push. The weight is carried along the curve to the abutments and into the ground. This creates lots of compression, but little tension.

Source: *Bridges! Amazing Structures to Design, Build and Test*



Overseas Railway Train on Long Key Viaduct.

Photo: Key West Art & Historical Society



© 2012 Encyclopædia Britannica, Inc.

Cable-Stay Bridge

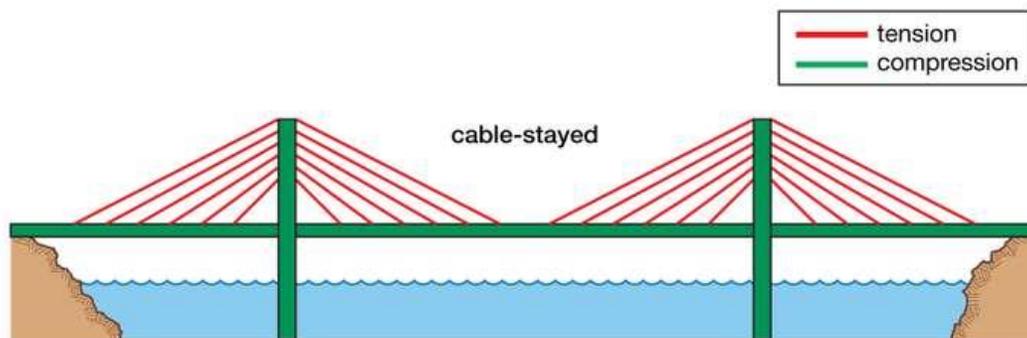
Cable-stayed bridges carry the vertical main-span loads by nearly straight diagonal cables in tension. The towers transfer the cable forces to the foundations through vertical compression.

Source: Encyclopædia Britannica



Sunshine Skyway Bridge in St. Petersburg, Florida.

Photo: Encyclopædia Britannica



© 2012 Encyclopædia Britannica, Inc.

Bibliography:

*Information is in the order that it appears in the document

The Matthews-Northrup Works Buffalo, N.Y. *Map of Florida East Coast Railway*. Circa 1917. Key West Art & Historical Society, Florida. kwahs.pastperfectonline.com/webobject/255FD84A-8976-4EE3-97CE-354071993920.

Florida East Coast Railway. *Key West extension, Florida East Coast Railway, opened January 22, 1912*. Matthews Northrop Works, 1912. doi: www.doi.org/10.5479/sil.56485.39088001792985.

S.n. *Studio Portrait of Henry M. Flagler*. 1904. Key West Art & Historical Society, Florida. kwahs.pastperfectonline.com/photo/3A0FC45E-3C0C-4A56-82B7-243218404905.

S.n. *Photographs - - 1912 - 1935 - - Key West by rail*. 1912-1935. Broward County Library Digital Archives, Florida. <https://digitalarchives.broward.org/digital/collection/greatdays/id/305/rec/6>.

Encyclopædia Britannica, Inc. *A beam bridge, with forces of tension represented by red lines and forces of compression by green lines*. 2012. www.britannica.com/technology/bridge-engineering.

Tichnor Quality Views. *Bahia Honda Bridge, Highest Span of Overseas Highway on the Way to Key West, Florida*. Circa 1940s. Key West Art & Historical Society, Florida. <https://kwahs.pastperfectonline.com/webobject/59E43A34-71A6-485E-8CA3-534408430138>.

Encyclopædia Britannica, Inc. *A single-span truss bridge, with forces of tension represented by red lines and forces of compression by green lines*. 2012. www.britannica.com/technology/bridge-engineering.

Golden Gate Bridge Highway & Transportation District. *Golden Gate Bridge*. N.d. <https://www.goldengate.org/contemporary-photos/>.

Encyclopædia Britannica, inc. *A suspension bridge, with forces of tension represented by red lines and forces of compression by green lines*. 2012. www.britannica.com/technology/bridge-engineering.

S.n. *Overseas Railway Train on Long Key Viaduct*. Circa 1920s. Key West Art & Historical Society, Florida. <https://kwahs.pastperfectonline.com/photo/A6BB0F78-C722-4A4F-92C1-579277521046>

Encyclopædia Britannica, Inc. *An arch bridge, with forces of compression represented by the green line*. 2012. Encyclopædia Britannica www.britannica.com/technology/bridge-engineering.

Encyclopædia Britannica, Inc. *Tampa Bay: Sunshine Skyway Bridge*. N.d. <https://www.britannica.com/place/Sunshine-Skyway-Bridge#/media/1/574072/160839>.

Encyclopædia Britannica, Inc. *A cable-stayed bridge, with forces of tension represented by red lines and forces of compression by green lines*. 2012. www.britannica.com/technology/bridge-engineering.