



## Discover Portage Road Lesson Plan

# The First Michigan Central Railroad Bridge

Subject Area: Science

**Grades 5-8**

**Subject Area**      Science

### **New York State P-12 Common Core Learning Standards for Mathematics, Science and Technology**

Standard 1: Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seeks answers, and develop solutions.

#### 1.1 Scientific Inquiry

1.11 The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process

1.12 Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity

Standard 2: Students will access, generate, process, and transfer information using appropriate technologies

#### 2.1 Information Systems

2.11 Information technology is used to retrieve, process, and communication and as a tool to enhance learning

### **Overview**

Built only for rail traffic, the first Michigan Central Railway Bridge was located just South of the Whirlpool Bridge. It was the dream of owner/businessman Cornelius Vanderbilt who needed a rail link between Canada and the United States. Vanderbilt was not willing to pay the high rental price which the owners of the Lower Arch Bridge charged for using the use of their bridge. Vanderbilt owned the Michigan Central Railway. He also had controlling interest in the Canadian Southern Railway. Instead of paying rent, he decided to build a new bridge. Vanderbilt formed the Niagara River Bridge Company and received a charter to build a new bridge.

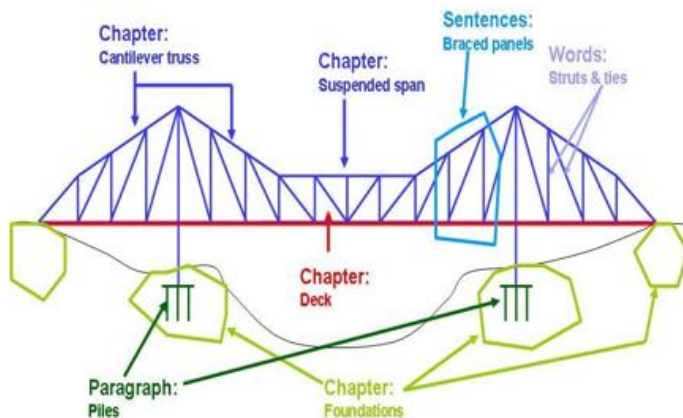
The Niagara River Bridge Company on April 9th 1883 signed a contract with the Central Bridge Works Company of Buffalo New York to build this bridge. The chief engineer was Charles C. Schneider was designated chief engineer.

At a site just south of the Lower Arch Bridge, this cantilever bridge was built across the Niagara Gorge by engineer Edmund Hayes, of the Central Bridge Works Company. Construction began on April 15th 1883.

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Although the Niagara Falls Gazette newspaper reported that the cantilever construction used at Niagara Falls was the first time it had been used in America, the first cantilever bridge in the United States was designed by Charles Smith for the Cincinnati Southern Railroad. Built in 1876-1877, it crossed the Kentucky River. Cantilever was defined as erection by overhang

The contractors were working under a deadline of November 1st. Every day afterwards, the contractor had to pay a penalty of \$500 per day. The 132.6 feet high towers were completed on October 11th. Soon, the contractor realized that it would be impossible to complete the bridge and railway tracks by November 1st. They figured they could put 125 feet sections onto each side of the bridge every two days and connect the center span in five days. Each cantilever measured 325 feet long and 26 feet high. They were anchored in place by November 18th. Two 25 feet long sections were attached and extended from each cantilever. After it was measured, the center span was sent to the company's Buffalo, New York plant for fabrication.



Each end consisted of a steel section extending from each shoreline nearly half way across the gorge. Each section was supported near its center by a steel tower from which extended two lever arms. one arm reached the shore while the other extended over the river 175 feet beyond the towers. The towers on each side rose from the water level below. The bridge span was 495 feet.

Because the ends of the cantilevers extended 395 feet from the abutments, there was a gap of 120 feet which was filled by an ordinary truss type bridge hung forming the ends of the cantilever.

To allow for expansion and contraction, provisions were made to permit the ends to move freely as the temperature changed. With a total length of 906 feet, bridge had a double track .It had the capacity to bear the weight of two trains crossing at the same time producing a side pressure equal to a 75 mile per hour wind. The railway was 240 feet above the Niagara River. The cost of constructing the bridge was \$700,000 US dollars. The bridge was officially completed on December 1, 1883.

On the morning of December 20th 1883, a ceremony by invitation took place at the bridge. A team of seven heavy freight trains crossed the bridge without mishap. Before a gathered crowd of more than 10,000 people at 12.08 PM, twenty locomotives pulling loaded gravel cars crossed the bridge.


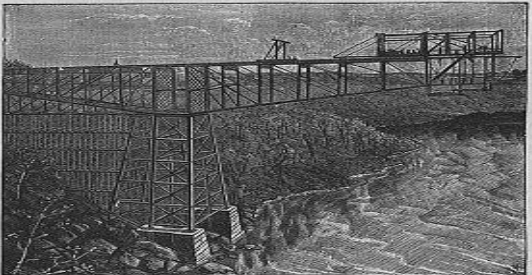
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They travelled in two groups consisting of ten locomotives and twelve loaded gravel cars. Each train crossed the bridge simultaneously from opposite ends. as a result both sets of tracks were fully occupied when both trains passed each other. The bridge, therefore, successfully passed this load test. After the trains completed their respective journeys, they celebrated by blowing their whistles.

At the Monteagle House in Niagara Falls, New York, 4,000 guests attended a banquet. The remaining crowds were allowed to walk back and forth across the bridge.

Because of speed of erection of a new style bridge and its remarkable performance made the first Michigan Central Railway Bridge one of the most innovative bridges in the world during its time.

The Cantilever Bridge operated for more than forty years until much heavier modern trains necessitated the building of the much stronger steel arch bridge.

 <p data-bbox="386 1222 646 1234">Continued Bridge of Niagara Falls on the Michigan Central Railway.</p>	<p data-bbox="847 1012 1149 1045">1895 guidebook engraving</p> <p data-bbox="847 1075 938 1108">Source:</p> <p data-bbox="847 1121 1377 1201"><a href="http://en.wikipedia.org/wiki/Michigan_Central_Railway_Cantilever_Bridge">http://en.wikipedia.org/wiki/Michigan_Central_Railway_Cantilever_Bridge</a></p>
 <p data-bbox="311 1537 743 1549">Sectional View of Cantilever Bridge, during Process of Construction.</p>	<p data-bbox="847 1264 1328 1327">Construction view showing traveling crane and shore side falsework,</p> <p data-bbox="847 1369 954 1402">Source:</p> <p data-bbox="847 1411 1377 1474"><a href="http://en.wikipedia.org/wiki/Michigan_Central_Railway_Cantilever_Bridge">http://en.wikipedia.org/wiki/Michigan_Central_Railway_Cantilever_Bridge</a></p>

### **Activity:**

1. Access *Cantilever bridge* at [http://en.wikipedia.org/wiki/Cantilever\\_bridge](http://en.wikipedia.org/wiki/Cantilever_bridge).
2. Access *Cantilever bridge* at [http://simple.wikipedia.org/wiki/Cantilever\\_bridge](http://simple.wikipedia.org/wiki/Cantilever_bridge)
3. Write a short essay describing the characteristics of cantilever bridges

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### **References**

*Bridges Over Niagara Falls* at <http://www.niagarafrontier.com/bridges.html>

*Cantilever bridge* at [http://en.wikipedia.org/wiki/Cantilever\\_bridge](http://en.wikipedia.org/wiki/Cantilever_bridge)

*Cantilever bridge* at [http://simple.wikipedia.org/wiki/Cantilever\\_bridge](http://simple.wikipedia.org/wiki/Cantilever_bridge)

*Niagara Cantilever Bridge* at

[http://en.wikipedia.org/wiki/Michigan\\_Central\\_Railway\\_Cantilever\\_Bridge](http://en.wikipedia.org/wiki/Michigan_Central_Railway_Cantilever_Bridge)