Descriptive and brooklyn bridge report examples

Law, Security

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Engineering

Abstract

The Brooklyn Bridge is probably underappreciated by most of the people who use it today but it is still an example of great engineering. The chief engineer, Roebling, designed a suspension bridge that was fifty percent longer than any other suspension bridge of the times. His design for weighting of the bridge to keep it stable when there was wind is a very important lesson for today’s suspension bridge designers. The health and safety issues of the height of the bridge and the use of the Caisson boxes have been discussed. The approximately 27 deaths that took place during construction were due to those to safety issues. The use of the caisson boxes to shovel excess sand and mud off the river floor so the foundation could be built on hard rock has also been discussed. Drawings and photos of the historical Caisson boxes to a modern day design have been included. A Gantt timeline has been included to show the different stages of the construction of the bridge that was happening on both sides of the river at the same time. The Brooklyn Bridge is a testament to the importance of engineering in the world.

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Introduction

Purpose

The purpose of this report is to give an in-depth description of the construction of the Brooklyn Bridge, the longest suspension bridge of its time when it was built in 1863.

Background

The Brooklyn Bridge was a startling example to people of the time of the power of engineering. The suspension bridge was twice as long as any other suspension bridge existing in 1853. Even today Roebling’s work is respected for his good, solid designing of the bridge and suspension bridge. His work is still important today

Scope

The scope of this paper is to explain the building of the Brooklyn Bridge, the impact of some of the chief engineer’s decisions (Roebling), and some discussion of the Brooklyn Bridge in contemporary times. The design of suspension bridges is included, the health & safety issues related to building the Brooklyn Bridge, the caissons, and a Gantt timeline of the project.

Terms of Reference

This report was requested by

Sources of Information

New York city Infrastructure Bridges, PBS, ABC News, The Brooklyn Museum, the History Channel, Internet Archives

Health and Safety

Health and safety issues included the heights workers were needed to go to do their jobs and the pressure changes from working in the caissons. Approximately 27 workers died building the bridge. The figure below pictures the height of the bridge in proportion to the four men walking along the thick cable. The men were proving that they could paint the bridge. Walking on the cable at that height was part of applying for the job. The bridge is 83 meters high.

A terrible accident occurred on June 1878 when a cable strand on the New York side tower was being adjusted. The cable broke loose and flying over the tower, into the East River, it hit a rigger in the head and knocked a rigger off the anchorage. During the same accident a rigger’s foot was caught in drum that was feeding wire and he was killed. Workers died due to falling from the great height or were hit by falling equipment. Two or more men

were killed when blocks crushed them as the blocks were being put into place.

Deaths from working in the Caisson were from the air pressure causing the bends. A modern day example of the bends in caused when diving equipment malfunctions. During the building of the Brooklyn Bridge and after it was known as the Caisson disease. Both the designer of the bridge and his son, the Roeblings, were injured. Roebling was injured and he became sick from tetanus, dying 17 days later. His son, Washington Roebling suffered from the Caisson disease. He was an invalid for the rest of his life. After Washington’s accident his wife, E. Roebling, became his assistant chief engineer. She was the site engineer and made sure the plans for the construction were carried out appropriately.

Figure 1. Four men at top of Brooklyn Bridge

Source: Topical Press Agency/Getty Images

Caissons

Work in the Caissons was dangerous, but it was absolutely necessary. Air tight boxes were lowered into the river at the point where the foundations for the bridge needed to be built. The foundations needed to be built on hard rock. So workers in the Caisson boxes had to scoop up the sand and mud on the river bed and send it to the surface. The work continued until enough bedrock had been exposed for building the foundation

Figure 2. A caisson of Brooklyn BridgeNew York side, 1870

" The manufacturer and builder", Mai 1870

Figure 3. Brooklyn Bridge cutaway view of cassion. originally in Harper’s Weekly

March 19, 1870, p. 181. Engraving. Brooklyn Museum Libraries

Figure 4. Triger's cassion design

Caisson designed in 1846 by Jules Triger

Figure 5. another cutaway view of the cassion

Figure 6. modern design of caissons

Wind and Stability

Roebling studied the failures of the past to deal with the problem of wind causing motion. Roebling “ explicitly stated that the deck of a successful suspension bridge must be heavy, have a stiffening truss and have supplementary cables to check unwanted motion.”

Modern solution

With the design of the George Washington Bridge by Othmar Ammann (1930s) changes were made in the design of the suspension bridge that make Brooklyn Bridge stand out as historically unique. For example Ammann understood that the cable stays were not necessary. Later engineers started designing for aesthetics forgetting the historical lessons of Roebling. Less weight and less stiff weights resulted until in contemporary times the Tacomas Narrows Bridge was twisted apart by a moderate wind.

Figure 7. design for suspension bridge

the pylon, anchorage, main cable, hanger and the stiffening girder

Figure 8. Suspension bridge in relationship with river

SPECIFICATION

The specifications for the Brooklyn Bridge are listed in the table below.

The Brooklyn Bridge is still being used today. There are three traffic lanes heading to Manhattan and three traffic lanes headed back to Brooklyn. The

bridge now supports an upper level for bikes and pedestrians.

Figure 9. Schmatic today's Brooklyn Bridge

Gantt timeline

(The Timeline is available in on page as Appendix C)

Part 1

Part 2

Part 3

Conclusion

The courage and persistence of the Roebling’s and the workers who built the Brooklyn Bridge cannot be overstated. The building of the suspension bridge truly made history and the Brooklyn Bridge is still making history every single day. The engineering work of Roebling is as valuable now as it was when he was alive.

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Appendix A

- Other Title: Some pamphlets have title: Specifications for the East River BridgeSome pamphlets have title

Appendix 1. Details of specifications

- : Specifications for the East River Suspension BridgeSome pamphlets have title: Specifications for the New York and Brooklyn Bridge

- Related Names: Roebling, Washington Augustus, 1837-1926. Martin, C. C.

- Medium: 2 v. (77 items) ; 36 cm.

- Summary: Miscellaneous construction specifications, published between 1870 and 1893, for the Brooklyn Bridge, or as it is referred to in these pamphlets, the " East River Bridge," the " East River Suspension Bridge," or the " New York and Brooklyn Bridge."

- Reproduction Number: ---

- Call Number: TG25. N53 [P&P] ESL 78-79

- Repository: Library of Congress Prints and Photographs Division Washington, D. C. 20540 USA

- Collection (Library of Congress)

- Contents: Contents listed as bound in volume marked ESL 78Specifications for cut granite facestone, required for the New York tower, East River Bridge, 1873 Specifications for cut facestone, backing, & archstone of limestone, required for the New York anchorage, East River Bridge, 1875 Specifications for corners, facing and archstone, or granite, required for the New York anchorage, East River Bridge, 1875 Specifications for steel cable wire for the East River Suspension Bridge, 1876 Specifications for granite cut stone required for the parapets at the roadway, Brooklyn and New York towers, East River Bridge [1876] Specifications for steel wire ropes for the suspenders of the East River Suspension Bridge, 1877 Specifications for granite face, arch, and other stone, required for the New York and Brooklyn approaches to the East River Bridge, 1877 Specifications for wrought iron cable bands and bolts for the suspenders of the East River Suspension Bridge, 1877 Specifications for steel wire working rope for the East River Suspension Bridge, 1878 Specifications for galvanized iron wire, for cable wrapping, for the East River Bridge, 1878 Specifications for American hydraulic cement, for the New York and Brooklyn Bridge, 1878 Specifications for the iron work of the suspended superstructure of the East River Bridge, 1878 Specifications for the steel and iron work of the suspended superstructure of the East River Bridge, 1879 General specifications for the superstructure of street bridges, Brooklyn approach, East River Bridge, June

1880 Specifications for granite paving blocks, East River Bridge approaches, June 1880 Specifications for the construction of a bridge on the line of the East River Bridge, across Franklin Square, in the city of New York, June 1880, no. 2 Specifications for the design and construction of a bridge on the line of the East River Bridge, across Franklin Square, in the city of New York, July 1880 New York and Brooklyn Bridge proposals for supplying southern yellow pine and white oak lumber for the floor of the New York and Brooklyn Bridge, and for the street railways on the approaches thereto [1880] Specifications for steel wire ropes for the over-floor stays and storm cables of the East River Suspension Bridge, 1880 Specifications for certain steel work required for the completion of the suspended superstructure of the East River Bridge, 1881 Specifications for the rope driving machinery for operating the railway of the New York and Brooklyn Bridge, 1882 New York and Brooklyn Bridge March 1882, proposals for about 150, 000 feet, board measure, of white pine, and for about 260, 000 feet, board measure, of spruce, to be endorsed, " Proposals for white pine and spruce lumber" New York and Brooklyn Bridge proposals for supplying southern yellow pine and white oak lumber for the floor of the New York and Brooklyn Bridge [1878] Specification for timber for New York anchorage, East River Bridge [1875] New York and Brooklyn Bridge June 1882, proposals will be received for about 10, 000 gallons of paint to be endorsed, " Proposals for paint" Specifications for the construction of an iron viaduct and station building on the Brooklyn approach of the East River Bridge, July 1882 Specifications for the design and construction of passenger cars for the railway of the New York and Brooklyn Bridge, 1882 Additional specifications for building warehouses in the arches of the New York

approach of the East River Bridge, June 25th, 1883 Specifications for laying flag and curb stones on streets about the approaches of the New York and Brooklyn Bridge, July 1883 New York and Brooklyn Bridge, extension of railway platform at the New York Station, specifications for superstructure, May 15, 1885 New York and Brooklyn Bridge, specifications for footbridges and stairways at Brooklyn Station [1885] New York and Brooklyn Bridge, warehouses, New York approach, specifications for girders and beams [1885] New York and Brooklyn Bridge, specifications for completing the warehouses, New York approach [1886] New York and Brooklyn Bridge, completion of warehouses in blocks A and C, New York approach [1886] Warehouses in block A, facing Dover Street, and in block C, New York approach, girders, beams, and connections [1886] New York and Brooklyn Bridge, specifications for cable driving plant [1886] New York and Brooklyn Bridge, general specifications for wrought iron and steel columns, girders, beams and connections [189-] New York and Brooklyn Bridge, specifications for the extension of the roadways at New York Station [1891] New York and Brooklyn Bridge, extension of the roadways at New York Station, approximate bill of materials [1891] New York and Brooklyn Bridge, specifications for the extension of the railway platform at Brooklyn Station [1891] New York and Brooklyn Bridge, extension of the railway platform at Brooklyn Station, approximate bill of materials [1891] Canvass of proposals for the extension of the cable driving plant, New York and Brooklyn Bridge, opened July 20, 1891 New York and Brooklyn Bridge, specifications for the extension of the cable driving plant, exclusive of the steam engine and the friction clutches [" A.-July 1, 1891"] New York and Brooklyn Bridge, extension

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http://www. loc. gov/pictures/item/2007570228/

Appendix B

Appendix 2. Daily wages of workers

Pay for workers building the Brooklyn Bridge

Source: Opening ceremonies of the New York and Brooklyn Bridge, May 24, 1883 (1883)

Internet Archives, http://www. archive. org/details/openingceremonie00broorich

Appendix C

Appendix 3. Gantt chart on one worksheet