



## The Development of Cable-Stayed Bridges since John Röbling

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Holger Svensson, born 1945, received his structural engineering degree from the University of Stuttgart in 1969. He has extensive experience in the design, construction engineering and supervision on site of cable-stayed and other long-span bridges all over the world.

### Summary

John Roebling was one of the most visionary bridge engineers of the 19th Century. He started the fabrication of bridge cables and pioneered the design of suspension bridges for which he initiated the use of stay cables to stiffen them. After WW2 the use of stay cables was re-discovered and the new type of cable-stayed bridges became very successful. The developments Roebling started 150 years ago are still in progress today.

**Keywords:** Suspension bridges, stay cables, cable-stayed bridges, bridge construction, bridge ropes, deflections, aerodynamics, parallel wire cables, parallel strand cables, concentrated tendons

### 1. Introduction



Fig. 1 *Johann August Roebling*

Johann August Roebling, Fig.1, was born in 1806 in Mühlhausen, Thuringia, not far away from Weimar. After primary school he went to a college in Erfurt where he received an excellent mathematical education. At the same time he learned to draw, both important skills for his future work. In 1824 he attended the Academy of Civil Engineering in Berlin. In addition to his formal education he studied Navier's book on suspension bridges. After initial work for the state on various civil projects in Germany he emigrated in 1831 to the U.S., together with a group of friends. For the next six years he worked as a farmer in the newly founded village of Saxonburg. After receiving U.S. citizenship in 1837 he changed his name to John A. Roebling and started again to work as an engineer, initially as a surveyor. In this connection he came in touch with the design of canals and bridges. He experienced that the hemp ropes used to tow boats on rails up and down a steep hill in the run of canals frequently broke and on occasion caused fatal accidents, [1],[2].

### 2. Bridge Ropes

In 1841 Roebling developed the little information he had from Germany on the production of wire ropes into practical use in the U.S. and applied for a patent on wrapped parallel wire cable. When applying it to the ship tow he realized that for this purpose spun coil ropes are required which can be pulled around wheels at both ends of the slipway. He, therefore, developed the type of open coil rope shown in Fig. 2, together with the required machinery. Both types of ropes are still being used and are further developed until today.