

A Tale of Three Arches: Grosvenor (Chester, UK), Union/Cabin John (Washington, DC, USA) and Adolphe (Luxembourg, LU)

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Abstract

It was the age of grandiosity and of political expansion; a time of social advancement and prodigious industrial production, and a period of libertarianism and freedom, and of economic risks and often outsized rewards; yet it was an era – for many – of bare subsistence, factory workers' slums, cholera, typhoid and violent upheavals such as riots or war. It was also an epoch of technological prowess, where giant iron ships and continent-crossing railroads were conceived and built, connecting peoples and countries with greater speed and frequency. No technology – ancient or contemporary -- seemed immune to the vision and confidence of the 19th century inventors and engineers. This propensity for scaling up, stretching out, extending over and pushing further applied to most types and forms of structures, including masonry arch bridges. This paper attempts to examine the motivations for and achievements of three of the most ambitious arch bridges of the Victorian era.

Crossing the River Dee on a narrow Medieval bridge was a slow and laborious undertaking at the start of the 19th century. When Thomas Telford recommended a new road between Shrewsbury and Holyhead to provide more efficient access to ferries en route to Ireland, the city of Chester finally awakened to potential competition and secured commitments to design and build the largest arch bridge in the world at that time, with a span of 200 feet and a height of 50 feet. The unfinished link – constructed largely of Anglesey limestone -- was officially christened by Princess Victoria of Saxe-Colburg-Saalfeld and her daughter Princess Alexandrina Victoria of Kent on October 17, 1832.

At least in form, a nearly identical bridge structure was designed and constructed near Washington, DC between 1857 and 1864. The bridge was designed by Alfred Landon Rives and constructed under the direction of Lieutenant Montgomery C. Meigs. Because Meigs chose to serve the Union, while Rives joined the Confederate States, the design engineer's name was stricken from the bridge records, signage and plaques. Similarly, the "Cabin John" name was discarded in favor of "Union Arch" but the locals have persisted calling the bridge by its original name (it spans over Cabin John Creek, a tributary of the Potomac River) to this day. The Cabin John/Union Arch became the largest masonry arch bridge in the world with a span of 218 feet and a height of 57 feet.

In the 19th century, Luxembourg City was comprised of some of the most formidable fortifications in the world. It was known as "Gibraltar of the North" with massive stone forts, batteries bristling with cannon and a warren-like underground with connecting passageways. Much of the contemporary fortification had been designed by Marshal Vauban, and despite thousands of soldiers billeted in the town, the city was officially neutral. In 1867, a diplomatic dispute between France and Prussia over the status of Luxembourg almost precipitated war when Napoleon III offered to buy Luxembourg City. Crisis was averted by negotiating and signing the Second Treaty of London. To reconnect the city, the government asked for a new bridge to span the Petrusse River connecting with the Boulevard Royal. Albert Rodange – later assisted by Paul Sejourne – conceived an open spandrel arch bridge with a middle long span of 277 feet and clearance to the river below of 138 feet.

In the 20th and 21st centuries, load-bearing masonry arch bridges have lost much of their technological luster for practicing engineers, due to the popularity of more economical construction materials and techniques. Structurally and analytically, these newer bridges are not true arches, and instead function as beams, albeit with arch shapes. This paper will endeavor to reveal some of the contemporaneous motivations for development and construction of the three 19th and early 20th century spans, and comment on the re-constructed – or at least skewed – memories associated with these iconic arch bridges.