



Ultra-Long Span Arch Feasibility

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Summary

Currently the longest span arch bridge in the world is the Chaotianmen Bridge in Chongqing, China, with a main span of 552 metres. Recently there have been several proposals for much longer span arch bridges but these have yet to progress to design and construction. This paper reports on a pilot study to assess the feasibility of constructing an arch bridge with a main span of 750 metres.

Keywords: arch; bridge, long-span; steel; erection; design.

1. Introduction

Arch bridges are one of the oldest bridge forms, are aesthetically pleasing and have great inherent strength. Arch bridges built by the Romans over 2000 years ago are still in existence and continue to function as intended, including the Pont du Gard aqueduct near Nîmes, France.

This paper reports on a pilot study to assess the feasibility of constructing an arch bridge over open water with a main span of 750 metres with an emphasis on identifying the significant design issues. Inspiration for the concept is taken from the Al Sharq Crossing proposals in Doha, Qatar. The study was funded by an internal CH2M HILL grant for technology innovation.

Ultra long span arch bridges pose a number of significant challenges and require complex erection sequences which continue to influence the structure in its final state. This paper reports on the parametric assessment of a reference scheme to assess certain design choices that are required to develop long span arch concepts.

2. Literature review

A limited number of papers have been written on long span arch bridges compared to other forms such as cable stayed bridges which reflects the economic competitiveness of arch bridges.

The main source of recent papers is the International Conference on Arch Bridges. China is well represented having constructed 19 of the 30 longest span arch bridges in the last 10 years. Of the remaining 11 bridges in the top 30 outside of China, all were constructed more than 30 years ago.

Several papers record the typical span/rise ratios for common construction materials and forms. The typical ratio is 1:5 with the greatest variation being for steel arch bridges.

Seven of the 10 longest span arch bridges in the world are of steel construction (the other three bridges being Concrete Filled Steel Tubes). Steel arch bridges feature either box girder or truss arch ribs. The longest concrete arch bridge is 420m. A number of papers have considered the feasibility of constructing concrete arches with spans up to 1000m using Reactive Powder Concrete (RPC) with compressive strengths of 200MPa and tensile strengths in excess of 20MPa. Currently RPC bridges exist up to a maximum span of 120m,