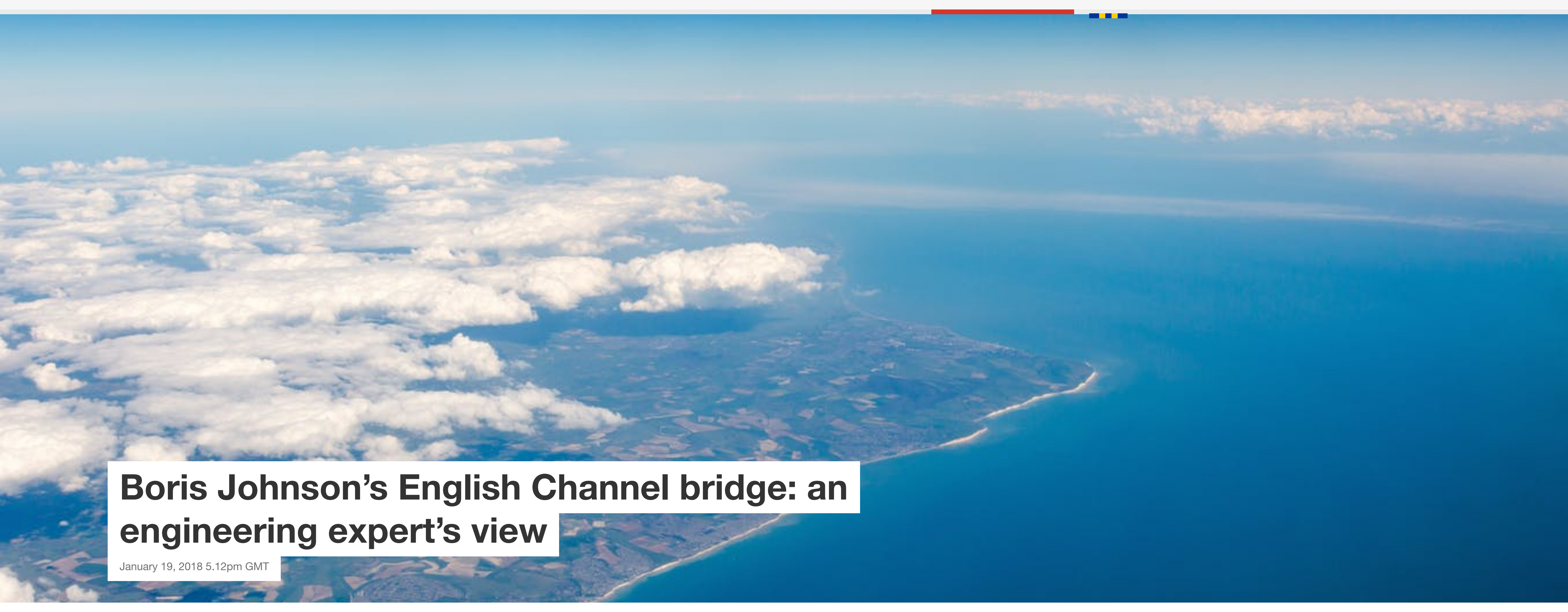

# Boris Johnson's English Channel bridge: an engineering expert's view

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Boris Johnson, the UK foreign secretary, has proposed building a bridge across the English Channel to connect England and France, to complement the rail tunnel that opened in 1994. Leaving aside the political and financial challenge of such a project, would it even be feasible to build such a long structure over the open sea and one of the busiest shipping lanes in the world?

For spanning long distances we use either cable stayed or suspension bridges, because they are light compared to conventional bridges and provide large areas unobstructed by pylons.

The longest suspension bridge built to date is in Kobe, Japan, measuring 3.9 km in total, with clear space between its pylons of almost 2km.

The longest bridge with a single cable-stayed span built to date is the Sutong Yangtze River Bridge near Suzhou, China. Its two pylons are separated by a 1km main span and it is 8km long in total. But it is not a completely suspended structure, with a number of densely spaced pylons on either side of the main span.

The Sutong Bridge. Shutterstock

Similarly, the longest bridge in the world is the Danyang–Kunshan Grand Bridge in China. It is mostly a conventional bridge made from columns sunk into the seabed, although it has a cable-stayed section. The bridge is 165km long (just over 100 miles) but the short distance between the columns would not do for the busy Channel.

A bridge over the English Channel that wouldn't disrupt shipping would require a span of 22 miles, or 38km in total, which is an order of magnitude larger than anything else built to date. This presents a considerable civil engineering challenge for a number of reasons.

## Tallest bridge ever

The channel is between 40m and 60m deep and some passenger ships are more than 70m tall. So to let ships pass underneath, the pylons supporting the bridge would have to be around 150m tall. To support the cables you would have to add pylons above the deck, which would mean a total pylon height well above 500m. Again, nothing this tall has ever been built.

Apart from the challenge of building them, the high pylons would need a very careful assessment of how the wind would affect them and the attached cables. This would have to be supported by a vibrational analysis to prevent potential failure. As the wind hits the pylons and the cables, it causes them to vibrate. In some instances, this can grow into a phenomenon known as "flutter", causing the entire structure to become unstable, as happened to the Tacoma bridge, which collapsed in 1940.

To prevent the cables from becoming overstressed, you would need a relatively large number of pylons to hold the bridge up. But again, this conflicts with the requirement of having unobstructed space on the water for ships to pass through.

The cables would also have to be very strong and light cables, possibly stronger than the very expensive carbon fibre composites. To make them we would probably need to research new materials and find a way to make it affordable.

Another big unknown quantity is the undersea ground conditions, which would need to be carefully investigated to see if they would be suitable for the pylons' foundations. This means we also don't know how much the foundations would add to the cost.

## Possible solution

Following the lead of the Danyang–Kunshan Grand Bridge in China, it may be possible to combine a cable-supported structure, for the part where a clear sailing space is needed, with a conventional column bridge style. This might ease problems of construction and cost, although it may still disrupt shipping routes to a certain degree.

But the only thing we can say for sure is that cost of the project would likely run into billions of pounds. It's a project that would require a lot of further research into the properties of cable materials, not to mention a proper feasibility study.

Engineering | Boris Johnson | Bridges | English Channel | Civil engineering



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