PUSH-LAUNCHED BRIDGES WITH THE PRESTRESSING CABLES DEFLECTED AFTER THE LAUNCH

Angus Low
Director
Ove Arup & Partners Ltd
13 Fitzroy Street
London W1T 4BQ
Angus.Low@arup.com

Angus Low, born 1947, graduated from Cambridge University and joined Arup in London in 1968 where he has since spent most of his career designing bridges. He is interested in understanding design at a fundamental level, which helps him to find simpler solutions.

Summary

The paper proposes a way in which the economy and durability of push-launched prestressed concrete bridges can be improved by fully exploiting the potential of external cables. The cables are stressed initially along the centroid of the section. After the launch the cables are deflected into efficient profiles. This method allows the user of greater span/depth ratios than current practice, and hence the range of applications can be extended.

1. Introduction

The construction of prestressed concrete box-girder bridges by push-launching offers many benefits which are increasingly relevant today – safety, productivity and the opportunity too be more adventurous in the selecting the shape of the concrete section. The method has been in use for many years, and an orthodoxy has developed using two-stage internal prestressing tendons. The launch cables are straight and are centred at the section centroid. The post-launch cables are profiled. This paper suggests an alternative way to use external cables in push-launched bridges. The method has not been used yet. The purpose of the paper is to widen the discussion of the proposal and to draw attention to the potential of this method.

2. The use of external cables.

External cables are now commonly used for multispan prestressed concrete viaducts. Usually they have been used in conjunction with internal cables, but this is not always the case. The approach spans of the Second Severn Crossing [ ] were built with all their cables external.

Conventionally, external cables consist of prestressing strands within a continuous HDPE sheath which is continuous from anchorage to anchorage. The sheath is threaded through curved steel deviation tubes – typically one convex tube within each diaphragm over the piers and two concave tubes in each span. These concave tubes are usually within deviation blocks at the junction of the web and the bottom flange.

The proposal presented in this paper is that by using totally external cables it is possible to launch with straight cables centred on the section centroid, and then deviate them after the launch so that, in service, all the cables follow a profile close to the optimum profile that would be used in a conventional insitu bridge.

Fig 1 shows the vertical profiles from a trial study. The centreline of the cables is shown during the launch. It is straight at the level of the centroid of the concrete section, providing uniform prestress over the section during the launch. Fig 1. also shows the centreline of the cables in service. The profile shown has a conventional short convex curve as high as can be fitted within the box-girder

https://doi.org/10.2749/222137908796293721

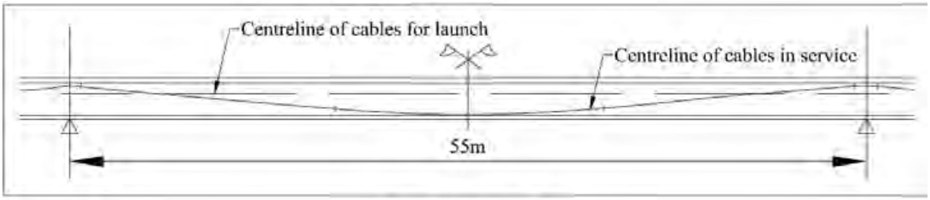

Fig.1. Vertical Profiles

over each pier, and then a straight gradient through the quarter-span regions, and quite a long, gentle convex curve as low as possible through the midspan region.

Fig 2 shows the details at the cable anchorages. These have to be adjacent to the points where the launch and service profiles cross over. After the launch the deviation of the span section of each cable is achieved with multiple small steel saddles placed over the cable in the region of the sag curve. Each saddle is connected to the bottom slab by two threaded bars. Nuts on the bars are used

to provide the deviation. To avoid imposing too much curvature on the cables each saddle is advanced a short distance in turn. The odd number saddles will be advanced in sequence, and then the even number saddles. The support region is deviated with a single steel saddle which is deviated upwards in one process. Once all the support saddles have been raised the shuttering is placed for the pier diaphragm, and it is then cast around the saddles.

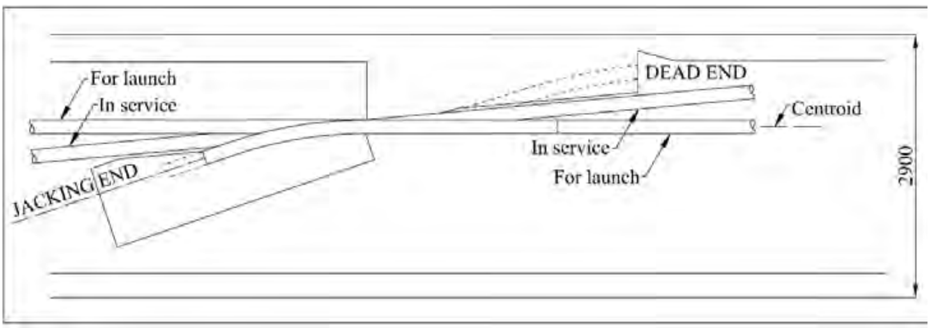

Fig.2. Cable-anchorage

3. Commentary

The main advantage of this proposal is that it increases the spans for which push launching can be considered. As the length of a push-launch bridge is limited, to some extend, by the number of piers which have to be manned and monitored during the launch, the increase in span lengths results in the possibility of longer structures. The increasing use of higher strength concrete also makes it prac