Intermediate Prestressed Concrete Fixing Method “i-Fix”

PC 中間定着工法「アイ・フィクス」


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1. Introduction

As the large-scale renewal of social infrastructure begins in earnest, the scope of planned replacements has been extended to concrete bridges exhibiting advanced deterioration.

Fig.1 shows a cross-section of a prestressed concrete (PC) T-girder bridge. In view of the working conditions for such a project, one way to enable continued bridge traffic during the renovation of this bridge is to divide the bridge in half lengthwise, remove one half while allowing the combined use of the other half, switch the traffic to the new half after it is completed, and then complete the remaining half. For such an approach, transversal prestressing tendons are placed on the main-girder upper flanges (the deck of the bridge) and cross beams. When they are divided, the tendons will be cut at the same time, eliminating the prestress near the location of the cut and making the remaining side, with its narrow width, difficult to use.

To address this problem, exposing the transversal prestressing tendon at the point of division and fixing a temporary fixing device to the concrete on the remaining side before the cut is made can ensure that the prestress on the remaining side is maintained and the surface can be made available for use. This is the intermediate fixing method of transversal prestressing tendons.

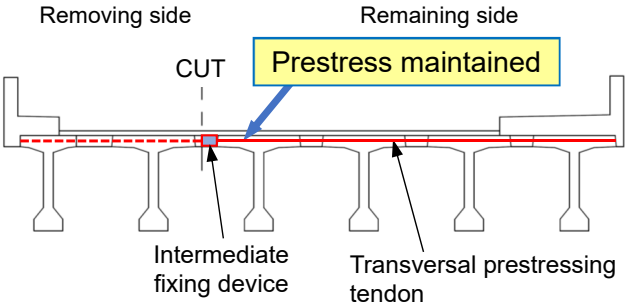

Fig.1 Cross-section of PC T-girder bridge

2. Intermediate Fixing Method “i-Fix”

(1) i-Fix Fixing Device

Fig.2 shows the i-Fix fixing device. The rectangular component on the left is the fixture and the plate-shaped component on the right is the equalizer. In this method, these two components are used in combination to perform the intermediate fixing.

With i-Fix, multi-wire “12φ5” or “12φ7”, which is

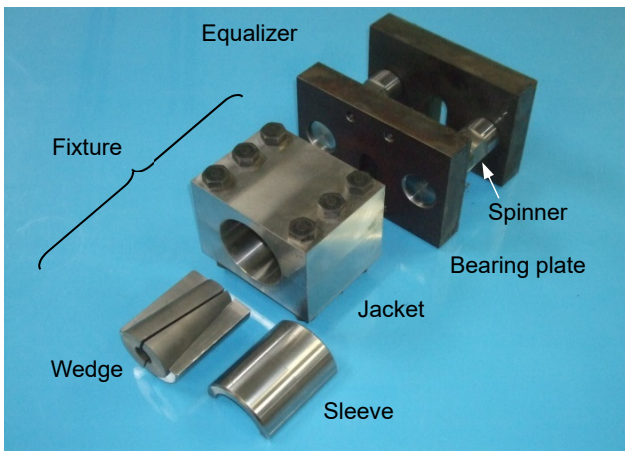

Fig.2 i-Fix fixing device

widely used for transversal prestressing tendons, is fixed intermediately with a wedge. The benefits of this wedge-fixing method are that the structure is simple and easy to handle, and no curing is required so the fixing operation can be completed in a short time. In addition, with this method the tensile force of each tendon can be controlled in accordance with the construction specifications. These major benefits have not been available with previous fixing solutions.
The fixture comprises a wedge, a sleeve, and a jacket. The fixing force is applied by clamping the device around the tendon and pressing the wedge into the sleeve. A special feature to note is the set of slits in the wedge, which are spiral-shaped to prevent the parallel wires from protruding into the slits when the wedge is press-fitted.
The equalizer is composed of two bearing plates with two “spinners” between them. Turning the spinners changes the distance between the two plates, enabling the equalizer to be inserted between a fixture and the concrete on the remaining side, after which the spinners can be turned to push the bearing plates outward and exert a fixing force.

(2) Wedge Press-fitting Device

Press-fitting of the wedges uses the device shown in **Fig.3**. This consists of two rod-linked reaction plates. The device is placed around the fixture and the wedge is driven in with jacks at high pressure to prevent the tendon slipping while being cut.

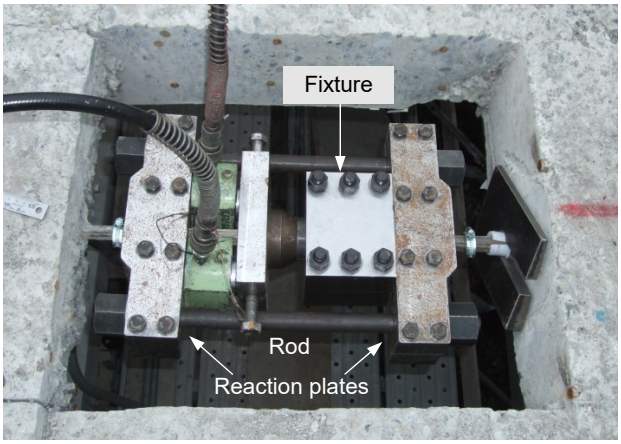

Fig.3 Wedge press-fitting device

3. Application

i-Fix was used for intermediate fixing during the project to renovate the Uta Viaduct on Japan National Route 8. This viaduct is a simply supported girder bridge with 32 spans and a length of 991.6m, 31 spans of PC T-girder. More than 40 years had elapsed since its completion in 1975, and because of the coastal location of the bridge the majority of deterioration that had occurred was due to salt damage. Following inspection, PC T-girder replacement was chosen for all spans[1]. **Fig.4** shows the situation regarding intermediate fixing.

Fig.4 Situation of intermediate fixing

4. Conclusion

To address the severe conditions of the project, the “i-Fix” method was proposed for the intermediate fixing of transversal prestressing tendons to enable main-girder renovation without stopping the flow of traffic on the bridge, and the method was used in the actual project. The authors are honored to offer this method as a way to renew variously located PC bridges that are in need of renovation because of aging.
Photographs of the execution were provided by the Takada River and National Highway Office.

Reference

[1] Iwasaki, Y., Kawajiri, K., *The Renovation of a 40-Year-Old Salt-Damaged Bridge in a Coastal Area*, Hokuriku Regional Development Bureau, 2013 Project Research Presentations, July 2013. (in Japanese)

概　要

PC 中間定着工法「アイ・フィクス」は，PCT 桁橋などの架替え工事において，橋上交通を確保するために幅員を切断，分割し，その一方を供用しながら施工を進める場合に，横締め PC 鋼材を切断前に中間定着することにより，残存側の横締めプレストレスを維持し，供用を可能とする工法で，マルチワイヤーの中間定着をターゲットとして開発した。特長は，定着体にウェッジを使用することで施工性が高く，しかも鋼材張力を施工仕様に合わせてコントロールできる点にある。本工法は，古くから北陸路の交通の難所として知られる親不知地区に位置する，国道 8 号歌高架橋の架替え事業に適用された。