Innovative cable-arch bridge proposal

Esko Järvenpää,

WSP Group, Oulu, Finland

Contact: esko.jarvenpaa@wspgroup.fi; eojarvenpaa@gmail.com

Abstract

The proposed bridge type is a modification from tied arch structure in which the tie cable is located in inclined position above the arch like the cables in cable-stayed bridges or rather like in extradosed bridges with low towers. The most effective tower height in cable-arch system is the lowest possible. The bridge type can also be understood as post tensioned curved girder with unbonded straight tendons over the girder. Traditional post tensioned girder is straight and the tendons are curved. The cable-arch type bridge allows new architectural forms, especially for pedestrian bridges. Several different applications are possible.

Keywords: cable-arch, arch-cable, tied arch, post tensioned bridge, unbonded tendons, cable-stayed bridge, extradosed bridge

1 Introduction

Arch in bridge construction has been a basic structure from past up to date. Arch bridge has become popular again with new shapes and increasing span widths. Cable-stayed bridge is a modern bridge type compared to arch bridge. The technology of cables has improved a lot recently.

In tied arch bridges the deck structure ties the ends of the arch and the structure is a single span girder on bearings.

Post tensioned girder has curved tendons in relation to neutral axis. The weight of the girder and live loads are carried with the uplift forces by the post tensioning of the tendons (Figure 1).

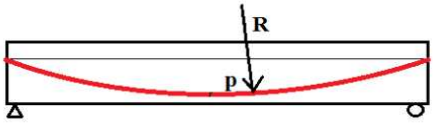

Figure 1. Post tensioned girder

In the proposed cable-arch bridge the girder is curved and the tendon is straight. The tensioning of the tie (Figure 2) lifts up the arch like the tendon lifts the girder in post tensioned girder.

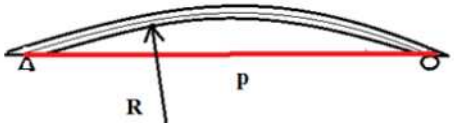

Figure 2. Tied arch, equal uplift as girder

We need not keep the tie below the arch. The tie above the arch is also effective (Figure 3).

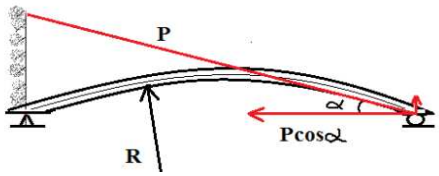

Figure 3. The tie above works also well

2 Cable-arch bridge

2.1 Different alternatives

The proposal is a new variation of bridge types mentioned above. The basic structural idea is simple and clear. It is understood that the arch as

https://doi.org/10.2749/222137817821233008