



## Design and behavior analysis of a long free expansion length, multi-span, V-shaped pier supported bridge

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### Abstract

In order to complete the connection between the A15 and A12 highways in the Dutch region Gelderland, a bridge complex over the river Pannerdensch Kanaal will be constructed. The bridge complex consists of a main span over the river summer bed, and two approach bridges over the eastern and western floodplains. This contribution presents the design vision of the bridge complex that focusses on an inclusive design connecting the local residents, the fauna and the flora. The design of the approach bridge is presented in more detail in this paper. The design of the main span is presented in another paper.

The eastern and western approach bridges only have expansion joints at their end supports and hence have a free expansion length of approximately 600m and 1200m. They consist of a longitudinally and transversally post-tensioned concrete deck with approximate span of 36m and width of 30m. The deck is supported by 54 piers in total with two bearings per pier, of which one transversally guided and one free sliding. Furthermore, the structure contains a steel bicycle bridge that is suspended below the deck and passes through the two supports of the V-shaped piers. The slender piers, part of them in an old sand mining pit, are subjected to important second order effects and, due to their V-shape, high tensile stresses that are controlled by an additional steel tie between both supports.

Due to its uncommon characteristics, the multi-span approach bridge is characterized by the complex interaction between superstructure and substructure. The large width of the bridge, allowing large eccentric traffic loads, and the V-shaped piers create important transversal interaction forces between deck and piers. The large free expansion length in combination with a plan curvature also creates transversal forces due to temperature effects and results in large longitudinal loads on the fixed points.

**Keywords:** ViA15; nature-inclusive design; road bridge; bicycle bridge; post-tensioning; steel tie; pier-deck interaction.