Connecting short-span steel girders for continuity

Connecting Short-Span Steel Girders for Continuity

Assemblage pour la continuité de poutres courtes en acier

Verbindungen zur Durchlaufwirkung kurzer Stahlträger

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1. INTRODUCTION

A continuous system of bridge girders has an obvious advantage over a simply supported system by resulting in smaller bending moments and smaller cross section of the girders. Other design advantages include the capability of redistributing the horizontal forces from traffic over a greater number of piers and a reduction in the number of expansion joints in the deck. Against those advantages the engineer must evaluate the benefit of the lower cost of the fabrication and erection of simply supported units.

The best attributes of both systems can be utilized by designing the girders as simply supported for carrying the self weight and concrete deck weight but as a continuous system under the traffic loads. Such design is gaining popularity in Australia due to the development of field connections which make use of the longitudinal deck reinforcement to carry tensile forces in the superstructure over the piers. The sequence of concreting the deck incorporating continuous connections and the concept of girder supports are shown in Fig. 1.

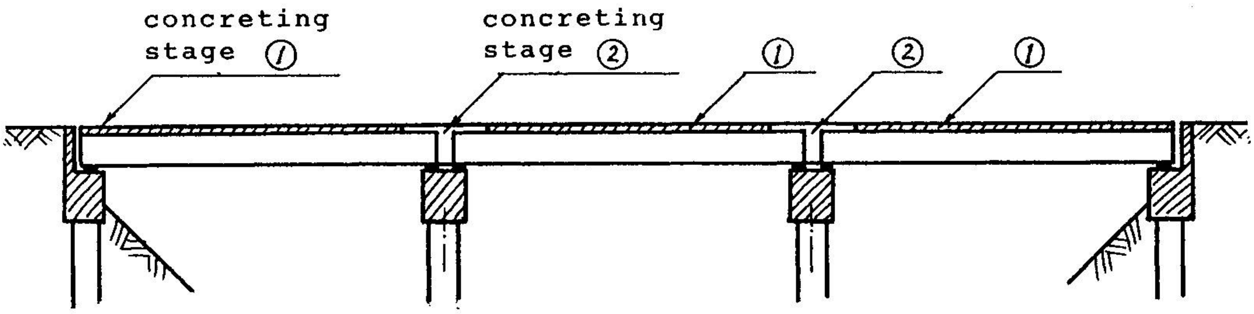

FIG. 1 Sequence of concreting the deck

2. END-PLATE CONNECTION

Laboratory tests on end-plate type connections were initiated in the Department of Main Roads of New South Wales in 1965 and a number of bridges with different variants of the connection were built since then. The connection was found to be structurally adequate but problems were experienced with the design of the end plates of sufficiently small size for a simple fabrication and easy transport. For the above reason the design of a continuous system for the live load only was found to be preferable to the design for the dead load and live load. Also, it was found necessary to provide some form of tensile connection at the bottom of the joint to accommodate stresses caused by the vibration of the deck and the expansion and contraction due to temperature variation. Fig. 2 shows the concept of this type of the connection.

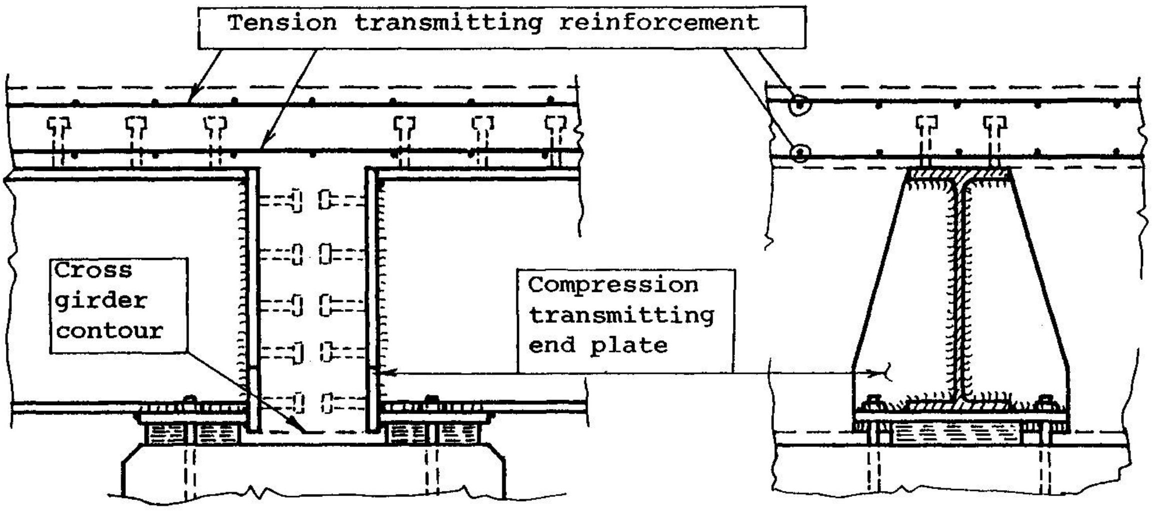

FIG.2 End-plate type connection for continuity under Live Load. (Cross girder reinforcement is not shown for clarity.)

3. CONNECTION WITH WELDED BOTTOM FLANGE

The portability of welding equipment, which became much smaller in the last decade, allowed construction of simple field joints in small bridges at a lower cost. Fig. 3 shows a variant a continuous connection where the bearing plate was utilized for the transmission of compressive forces in the girder. A welded joint of the bottom flange results in a positive connection of the girder. However, apart from the problem of bringing the welding equipment on the bridge during construction, some measures must be taken to protect the bearings from the temperature developed during welding. In spite of the problems mentioned, the type of the connection shown allows a more economic design than the traditional bolted connection which is usually located at the point of contraflexure of the girders. The location of the connection over the piers enables a more expedient construction of the bridge superstructure.

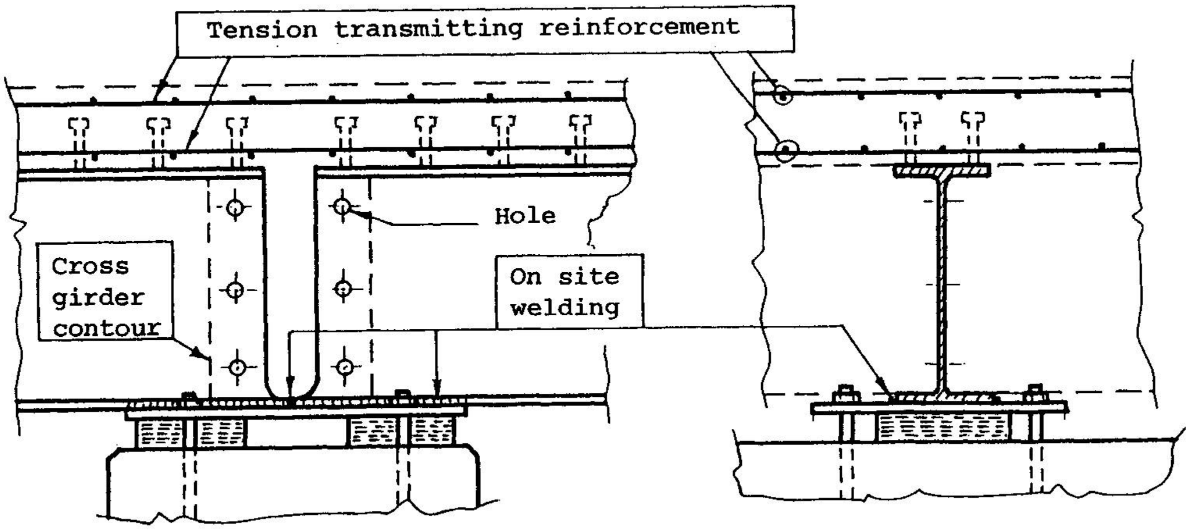

FIG. 3 Welded bottom flange connection for continuity