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Artikel: Reduction in shrinkage and expansion stresses by the systematic use of concrete joints: application to the Philippe de Girard bridge, Paris

Autor: Ridet, J.

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Reduction in Shrinkage and Expansion Stresses by the Systematic Use of Concrete Joints. — Application to the Philippe de Girard Bridge, Paris.

Verminderung der Wärme- und Schwindspannungen durch systematische Anwendung von Betonierungsfugen. — Anwendung für den Bau der Philippe de Girard-Brücke in Paris.

Diminution des efforts dus au retrait et à la dilatation par l'emploi systématique de reprises de bétonnage. — Application au cas du pont Philippe de Girard, à Paris.

J. Ridet,
Ingénieur en Chef Adjoint, Chemins de fer de l'Est, Paris.

The Philippe *de Girard* bridge, crossing the railway tracks outside the Gare de l'Est at Paris, consists of a concrete arch of 41 m opening (Fig. 1). The metal centreing was not erected underneath the arch but inside it, and later embedded in the concrete — an arrangement that was necessary in order to allow the passage of traffic while work was in progress.

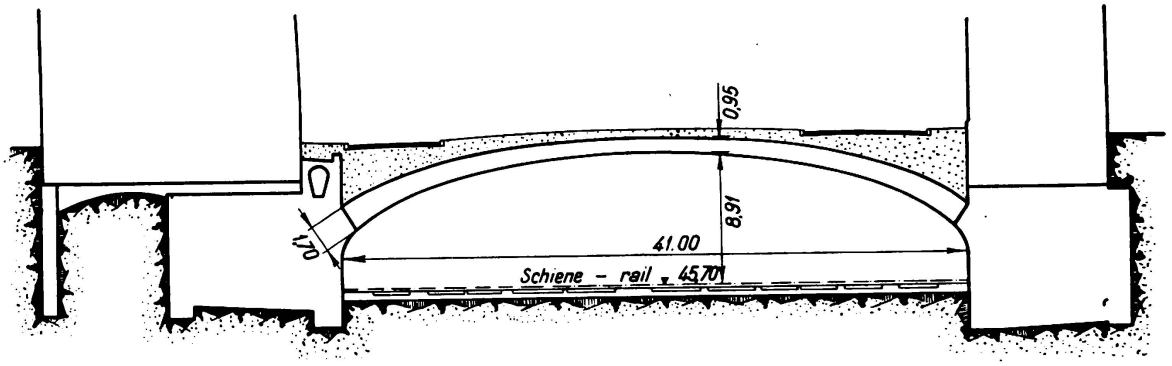

Fig. 1.
Philippe de Girard Bridge. Cross section.

The design of the arch was first attempted with due allowance for shrinkage on the assumption that the effect of this could be represented by a variation of temperature of 27° C. This implied considerable fixing moments at the springing, amounting to something of the order of 350 tonne-metres per m width of arch, and a considerable amount of reinforcement would have been necessary to resist them (Fig. 2). Such a design would have been complicated by the need

to accomodate the reinforcing bars in the spaces left free by the ribs and bracings carrying the arch (Fig. 3), and the cost of the work would have been considerably greater in consequence.

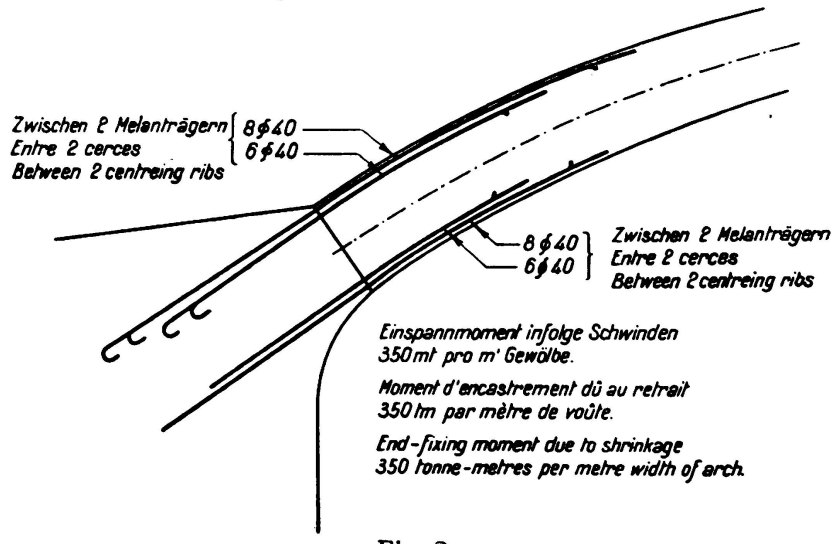

Fig. 2.

Section through haunch.

Ultimately, however, it was found possible to avoid the need for reinforcement by reducing shrinkage to a minimum, this being done by taking advantage of the fact that most of the shrinkage associated with the drying of the concrete occurs

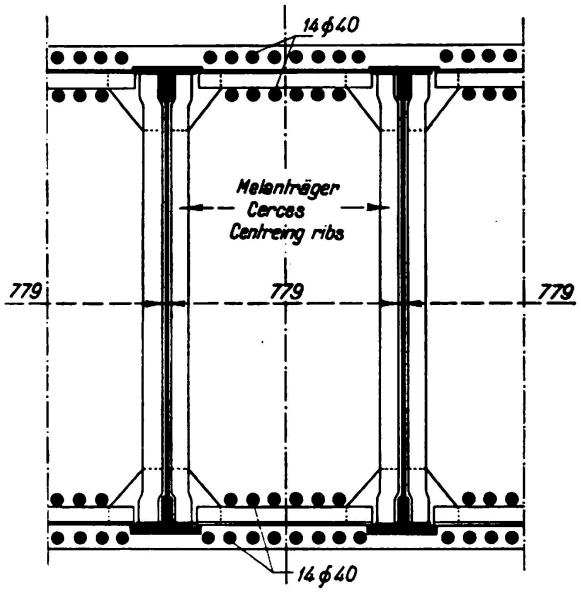

Fig. 3.

Section of arch.

when it first begins to harden: instead of pouring the whole of the arch in a continuous operation the latter was divided into voussoirs (Fig. 4), and these were concreted separately at a sufficient interval to allow of shrinkage taking place in each voussoir independently: in other words no concrete was placed in

any given voussoir until a definite time had elapsed after completing the adjacent ones, during which the greater part of the shrinkage might be assumed to have occurred.

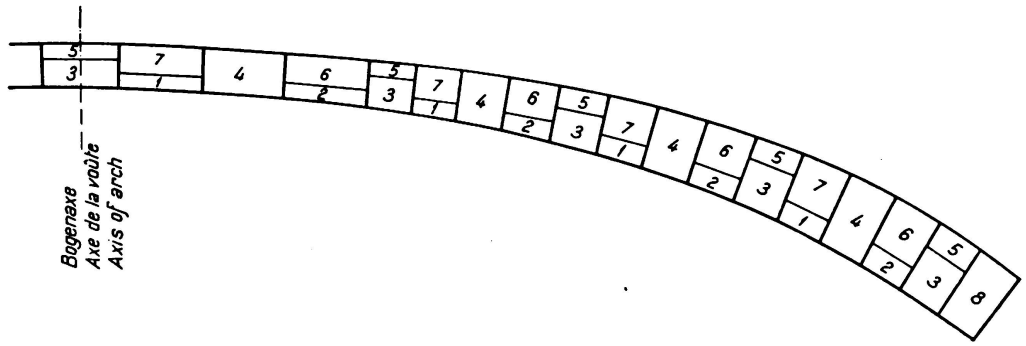

Fig. 4.

Sequence of concreting the voussoirs.

Moreover, the final closing of the arch at the haunches was delayed until the last voussoir was old enough to justify the assumption that its shrinkage had been practically finished.

By suitably planning the sequence of concreting on these lines it becomes possible considerably to reduce the effects of shrinkage, to lighten the construction, and to reduce its cost.