Zeitschrift: IABSE congress report = Rapport du congrès AIPC = IVBH Kongressbericht

Band: 2 (1936)

Artikel: Means of increasing the tensile strength and reducing crack formation in concrete

Autor: Coyne, M.

DOI: https://doi.org/10.5169/seals-3265

IIb 4

Means of Increasing the Tensile Strength and Reducing Crack Formation in Concrete.

Mittel zur Erhöhung der Zugfestigkeit und zur Verminderung der Rissebildung im Beton.

Moyens d'augmenter la résistance à la traction et de diminuer la formation des fissures dans le béton.

M. Coyne,
Ingénieur en Chef des Ponts et Chaussées, Paris.

The writer has had occasion during the past few years to construct a large number of retaining walls of the following type: the face is entirely of masonry or of reinforced concrete of limited thickness, regardless of the height of the

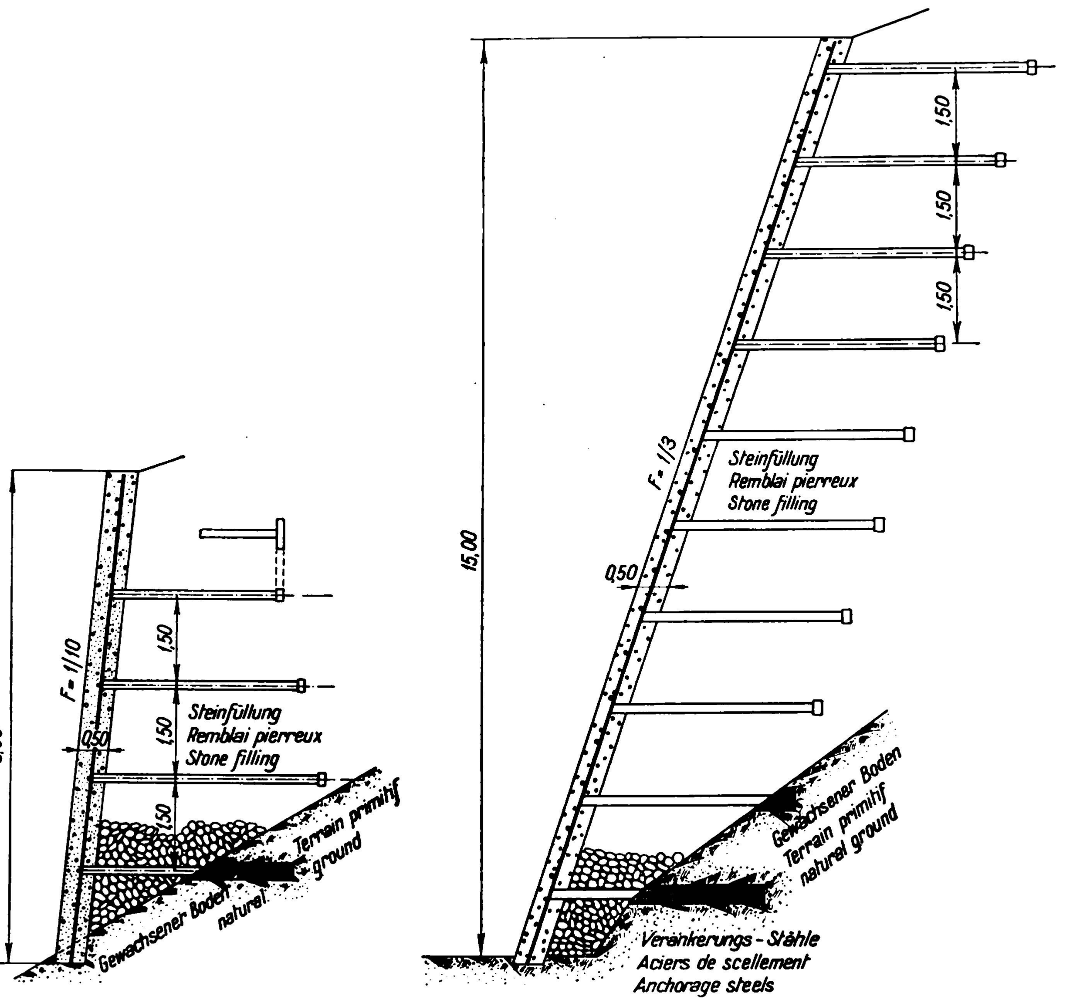

Fig. 1. Retaining walls on Coyne's ladder system — Cross sections.

wall, stability being obtained through the agency of relatively short tie-bars which are contained almost entirely within the prism of pressure.

An explanation of the mechanism whereby the stability of these structures is ensured will be found in an article in Le Génie Civil dated 29th October, 1927.

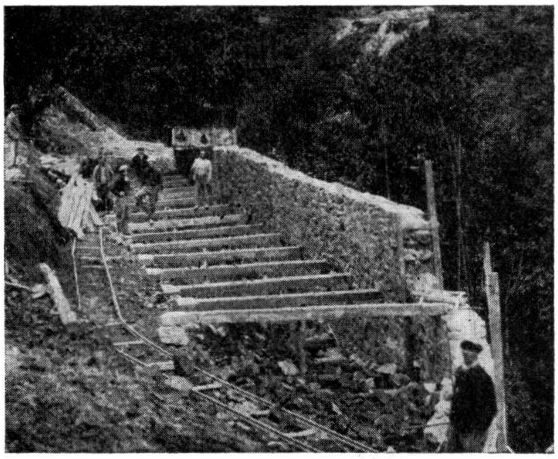

Fig. 2.
Retaining wall, ladder system (8 m high).

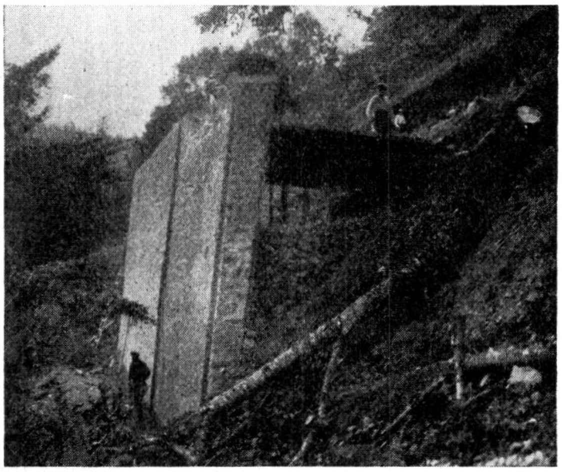

Fig. 3.
Retaining wall, ladder system (8 m high).

The name "ladder retaining walls" has been applied to them. A few examples are shown in Figs. 1, 2 and 3.

The construction of the tie-bars, which are of reinforced concrete, involves a special problem, in that the settlement of the ground causes the tie-bars to deflect, whereas as indicated in Fig. 4 the wall itself undergoes no settlement.

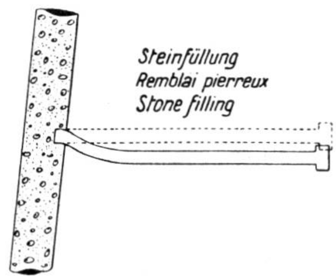

Fig. 4.
Diagram showing the bending of a tie bar due to settlement of the back-fill.

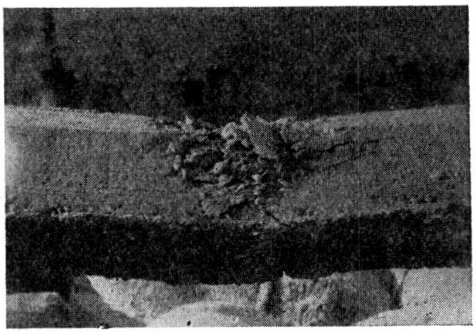

Fig. 5.
The concrete around the tie bar subjected to tension and bending develops cracks which expose the reinforcement to rusting, even though ordinary hooping steel is provided.

The concrete being thus subjected to tension in addition to bending is apt to crack and the steel is thereby exposed to corrosion (Fig. 5). The problem is to reduce this tendency to crack; hence the justification for mentioning the matter under the present heading. The solution is as follows:

The steel is situated at the centre of the tie-bar, and the concrete sleeve which encloses it is in turn surrounded by a steel hoop, the object of which is to prevent or restrain the formation of cracks. If however, this hooping is done in the ordinary way it is useless, since a crack may be formed between successive turns

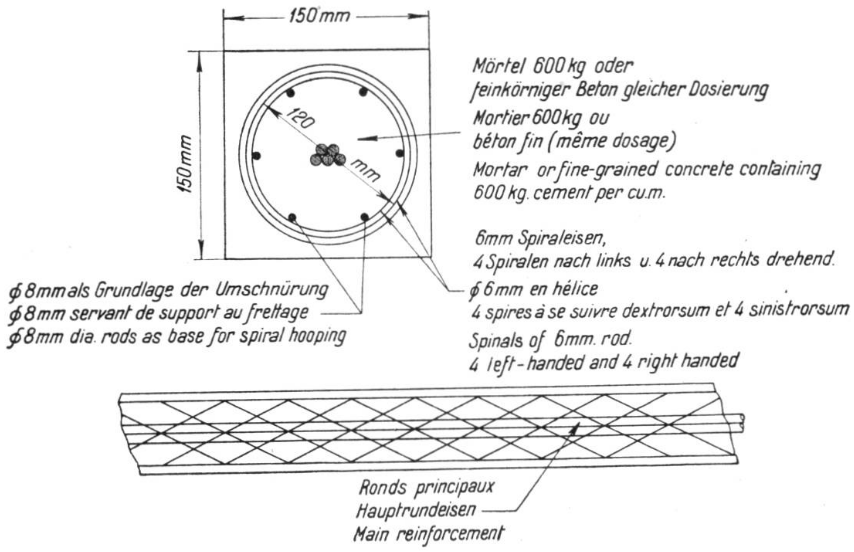

Fig. 6.

Tie bar with special hooping (of coarse pitch).

(Fig. 5). The turns must therefore be arranged in a spiral (Fig. 6) so that, firstly, the cracks are rendered discontinuous, and secondly, the longitudinal tension of the tie-bar is transformed by the agency of the spiral into a lateral

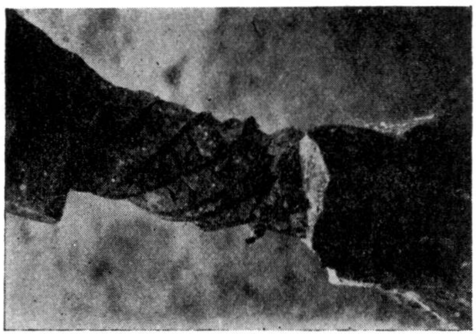

Fig. 7.

Tie bar with special hooping.

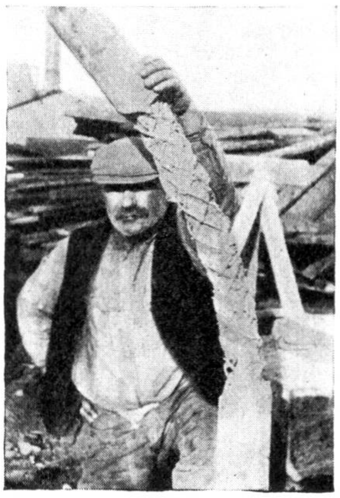

Fig. 8.

Tie bar with special hooping.

restraint. In this way tie-bars are formed which are capable of carrying very heavy bending moments without the concrete core suffering damage (Fig. 7 and 8).

This new method of forming *tensile* joints in reinforced concrete would doubtless be capable of many other applications also.