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4. Marão Viaducts, IP5 – Amarante (Portugal)

Owner: *Junta Autónoma de Estradas (Highway State Administration)*
Engineers: *ETECLDA – Escritório Técnico de Engenharia Civil Lda*
Contractors: *SEOP SA*
Works duration: *36 months*
Service date: *1988*

General

The plan of IP 4, the trunk road with a triple speed track that will connect Oporto to Bragança, includes the crossing of Marão mountain-range through a very rough and irregular land that imposed the construction of several structures.

Mainly between km 14 600 and 17 940 of the section that links Amarante to Campeã, the existence of steep ravines and the great slope of the ascents, that turned impossible local earth fillings, made it necessary to consider the construction of 6 main viaducts, with lengths that totalize 800 meters approximately.

These 6 viaducts constitute 2 groups of 3 viaducts each, in which the length of implantation is less than 1 km for the 3 viaducts. The adopted structural solution is mainly the result of the vicinity of the viaducts and of the roughness of the land. The so-called vicinity led to consider structural solutions similar in the six viaducts.

Foundations

The problems put by the foundations were basically problems of access to fulfil the works and of earth sliding prevention.

The schistons stone, of regular to fair quality, was showing up in almost all plantings of the columns footings, but the slope of the ascent and of the schists cleavage plans imposed serious precautions that were expressed, not only with a generous fixing of the footings in the schistons massif, but also with adequate nailwork.

In some places were also performed protection devices against earth slidings.

Structures

In all viaducts the longitudinal structure is a multiple continuous frame and is constituted with 2 margin spans of 27 m and 1, 2 or 3 intermediate spans of 36 m.

The cross section shows 3 longitudinal beams supporting the slab of the bridge deck. The structure is of reinforced concrete, the longitudinal being also prestressed.

During the construction, these beams were hinged on the tops of the columns; after the completion of the deck supporting structure, the columns were rigidly connected to the beams, thus performing the continuous frames as refered above.

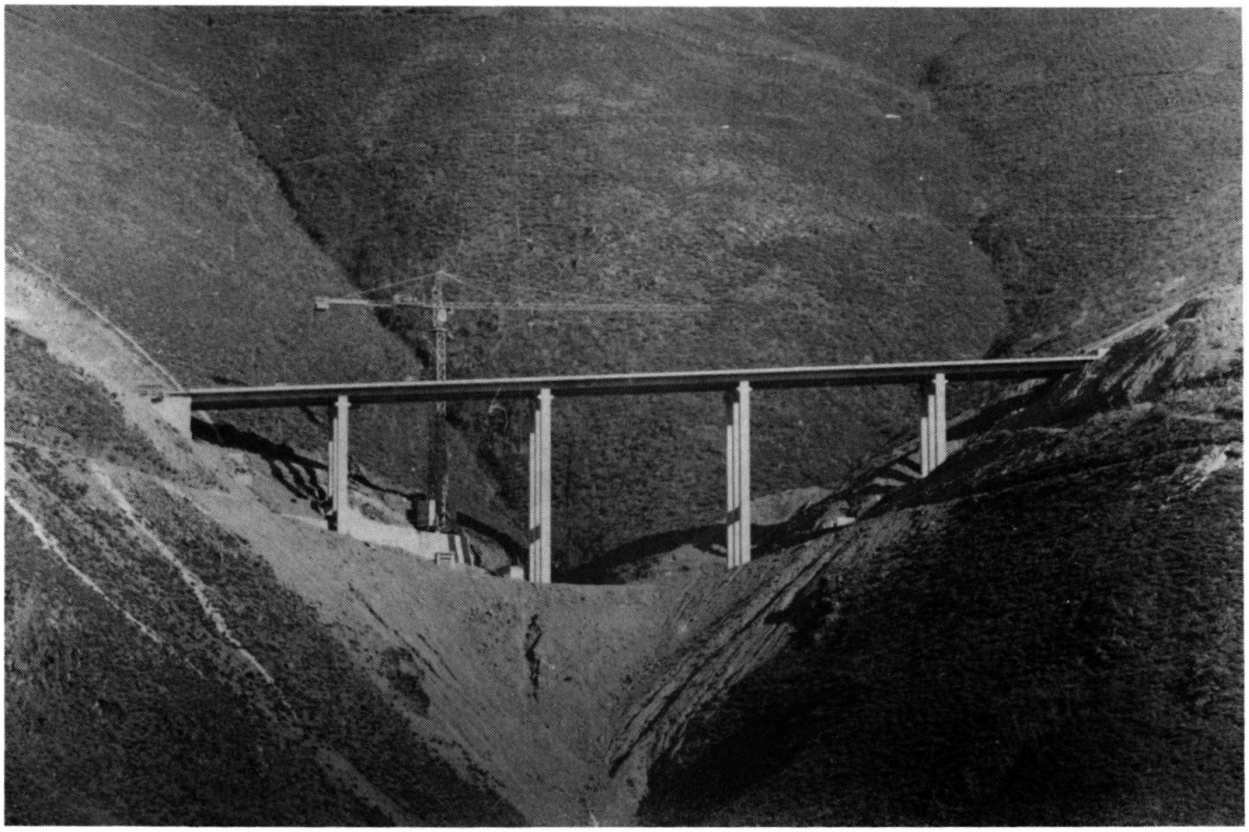

Fig. 2 View of one viaduct

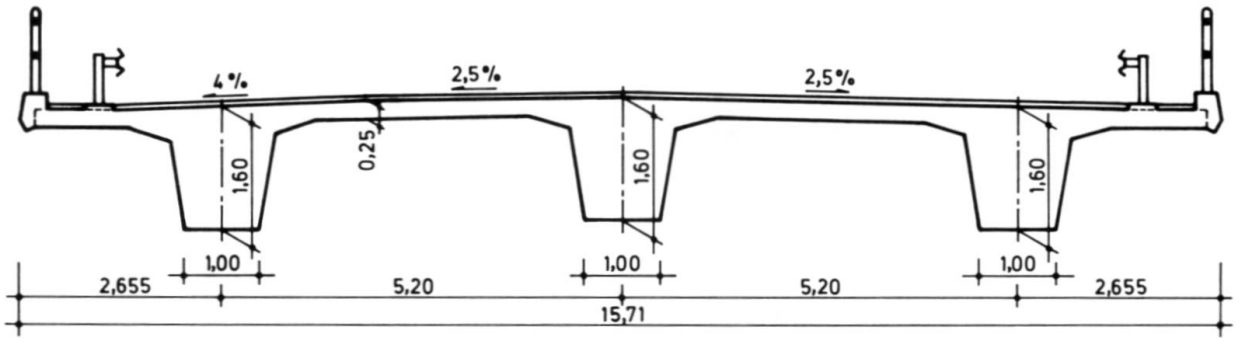

Fig. 1 Cross section type of the Bridges decks

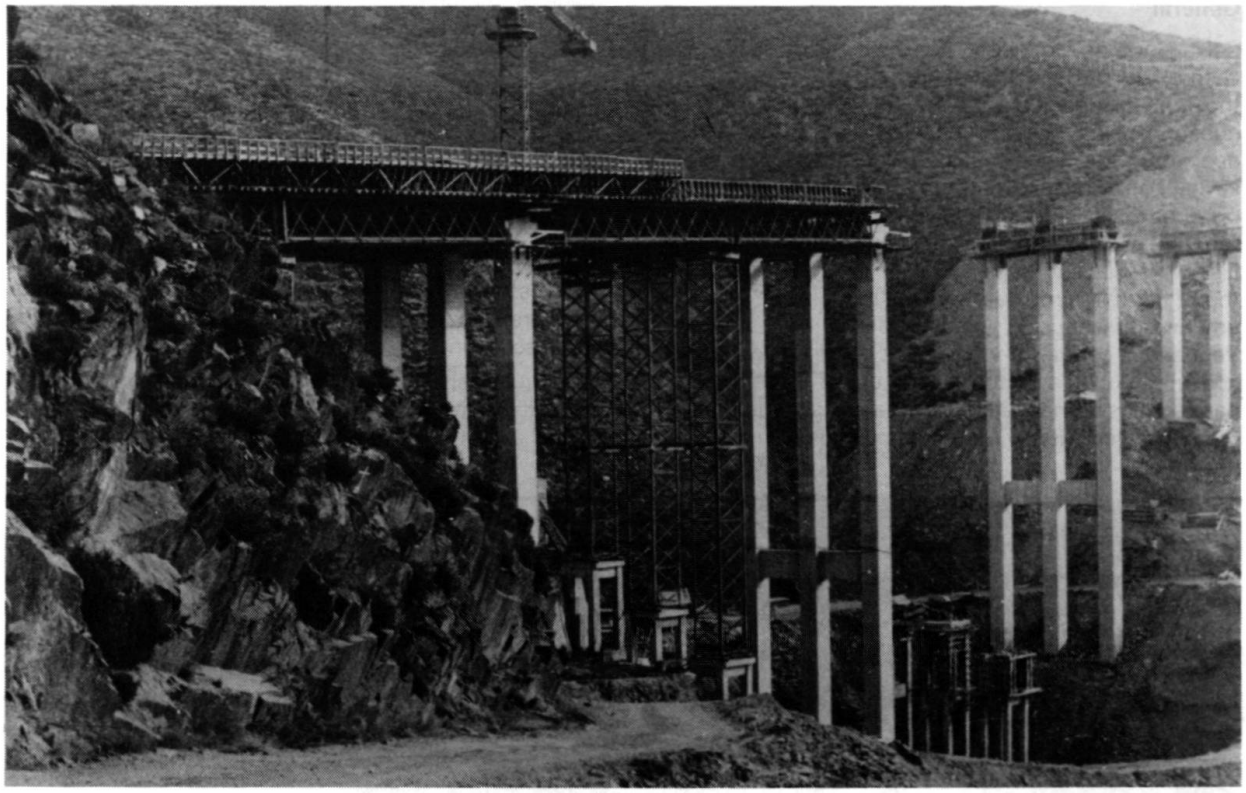

Fig. 3 Site construtions works

Construction

To the concrete setting, as otherwise to the moving and placing of all other materials and elements, the contractor has made use of huge cranes with large jibs for heavy loads. The applied falsework was formed with metal fabrications – beams and columns (easy to mount and dismount, that were able to numerous reapplications. The maximum span of the beams were of 36.5 m and the largest columns reached 40 m high.

(A. Campos e Matos)

Quantities of materials

Concrete	
Foundations	2 000 m^3
Columns and abutments	10 540 m^3
Decks	6 380 m^3
Reinforced steel	
Foundations	60 ton
Columns and abutments	500 ton
Decks	600 ton
Prestressed cables	14 460 m
Nailwork (Ø 32 mm)	9 320 m
Formwork	33 580 m