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## 11. Precast Structures in Motorway Bridges — Tarragona—Valencia—Alicante Motorway (Spain)

Owner: Autopistas del Mare Nostrum (AUMAR)

Engineer: Intecsa (Internacional de Ingenieria y Estudios Tecnicos, S.A.)

Contractor: Dragados y Construcciones, S.A.

### Dimensions:

span length: from 15 to 27 m

bridge width: from 6.30 to 19.70 m

angle between axes highway/overcrossing: 37° to 90°

maximum grade: 7 o/o

### Quantities of materials used pro m<sup>2</sup> of bridge:

0.47 m<sup>3</sup> concrete for superstructure (span 21 m)

0.15 m<sup>3</sup> concrete for substructure (usual foundation conditions)

55 kg steel

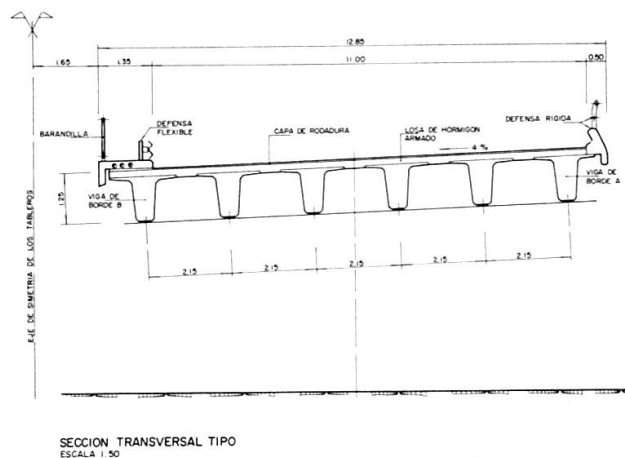
16 kg steel for prestressing

Work's duration: 5 years

Service date: 1977

The Tarragona—Valencia—Alicante Motorway, has an approximate total length of 385 km, of which, 270 km are in use at the present time, and the remaining 115 are in the course of construction. The total number of bridges along the entire Motorway are 300, of which 193 are Overpasses and 107 are Underpasses. Due to the large number of bridges which it was necessary to design and construct, it was considered of vital importance to plan and study a system, which would permit to the utmost, a standardization of the structures to be designed, an economy in the materials, a control of the quality, both in the design and in the execution, and a greater degree of rapidity in the same; all the aforementioned, therefore giving an economy in the realization of the works.

The only solution which would meet all the necessary requirements was the total precasting of the structures, both in the most important elements (bridges decks, sleepers, pier shafts, etc.) and in those of lesser importance (sidewalks, curbs, etc.), using the 'in situ' concrete only when absolutely essential. Once the system of precast structures was decided upon, it was necessary to define a standardization, both of the spans, and of typical sections for each one of the precast elements. The spans decided upon were of 15 m, 21 m and 27 m per element, with the cross section of each element being in the form of a T. Since the bridges did not have to be normal to the axis of the Motorway, in their intersection with the different obstacles, skews of 60°, 80°, 100° and 149° were studied, with all the possibilities covered. The transversal connection of all the beams, which constitute a deck, is made through the flanges of the T, with a separation between longitudinal axes



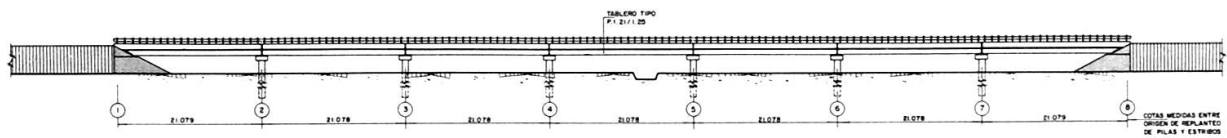
of beams varying from 2.15 m to 2.22 m, which left an 'in-situ' concreted joint of approximately 0.45 m. Both the sidewalks and the curbs which form part of the deck, are precast and modulated in accordance with the previously defined spans. The entire deck is simply supported through the supports on piers formed by precast elements. It is to be noted that the structural system as designed, never requires the placing of cross beams or stiffeners transversally to the deck, nor a pre-stressed element transversal to same. The precast beams are pre-stressed or post-stressed in the factory, using the most modern techniques in existence at the present time, as well as a rigorous control in the execution and handling of the same.

The piers are formed by precast reinforced concrete sleepers, with a section of 0.60 x 1.75 m and of variable length, which rest on precast circular shafts of pre-stressed concrete and of hollow section, which are used in same cases for deep foundation of the bridges; whilst in other cases they are on reinforced concrete footings, realized 'in situ'. When the foundation is deep, the shafts may be placed either by means of sinking, or by drilling, depending on the existing ground. The diameters normally used are of Ø 36" and 54", according to the height of piers, these varying from a free height of 7 m up to a height of 34 m, and varying the number of shafts in accordance with the deck heights and setions.

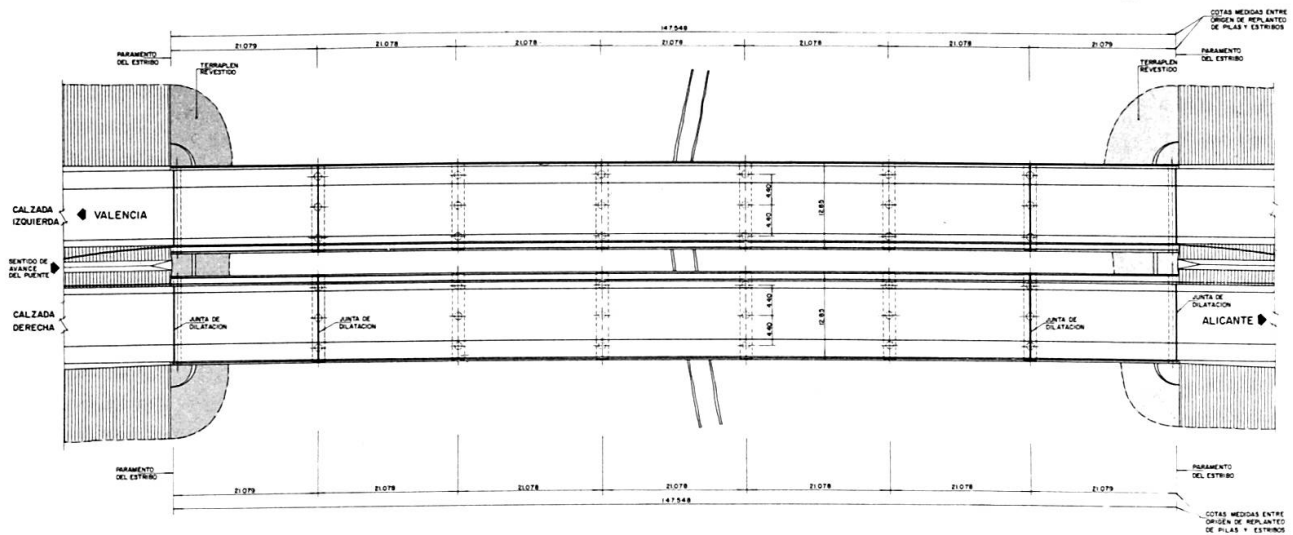
The abutments are of 'in situ' reinforced concrete, superficially founded on the duly compacted embankment; there existing in one case, due to the geotechnic conditions which so require it, abutment-piers whose compositions of precast elements is identical to that of the normal piers.

Different photographs relative to the bridges of the Motorway to which reference is made, are included further on.

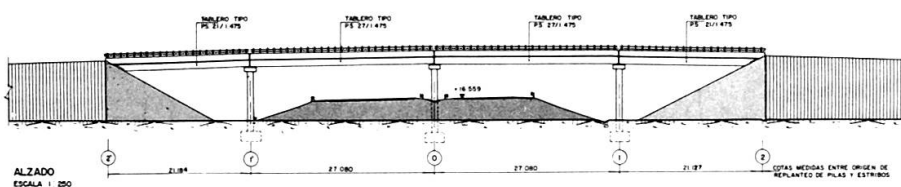
(Intecsa)



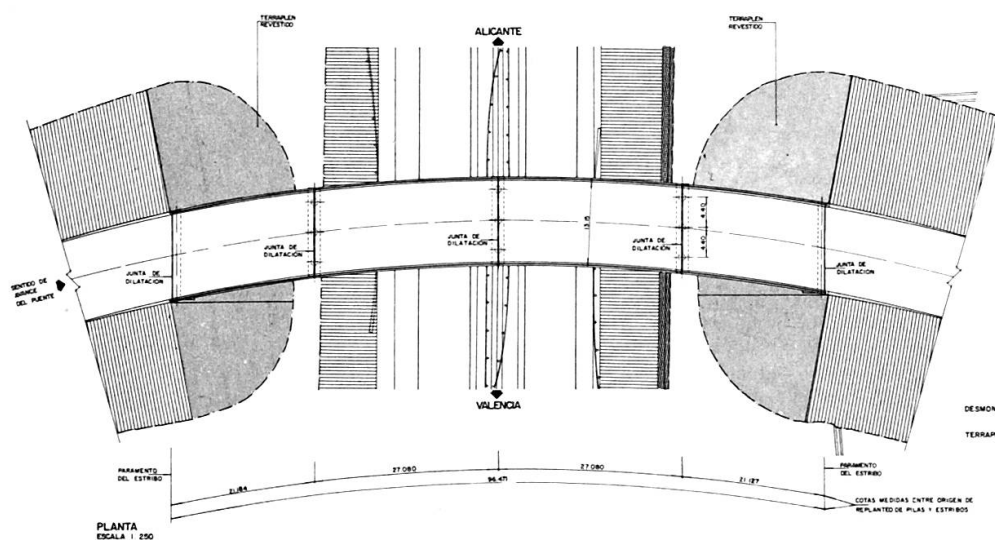
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