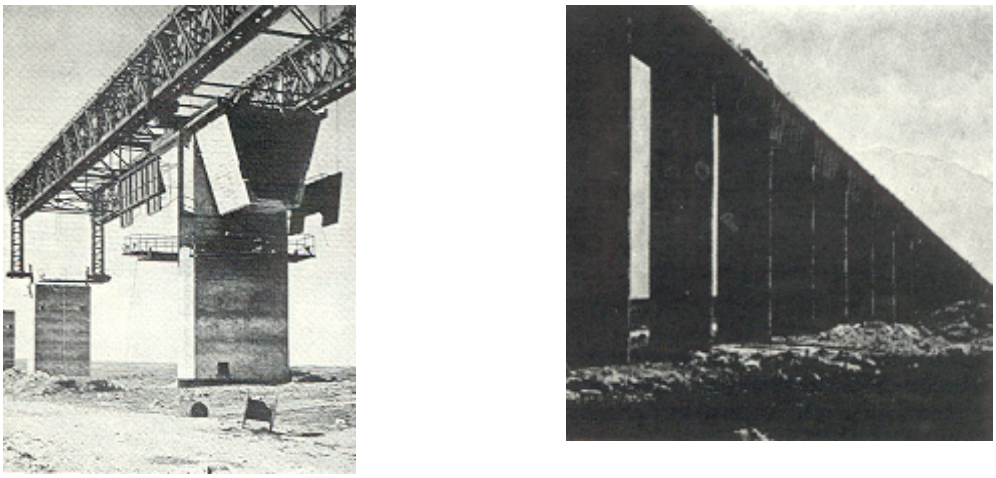
Construction of two Aqueducts near Valencia, SPAIN, according to the cementing procedure, using P.A. 103 epoxy adhesive paste.

To enable an area in the vicinity of Valencia to be irrigated the Spanish Ministry of Works has developed a hydraulic engineering project of some considerable size. The project provides for the digging of a canal and the construction of various tunnels and aqueducts. The intention is that water from the river Tagus will be conducted via these structures to the river Segura, from which the surrounding area of Valencia can be irrigated.
The two aqueducts, having a length of 1 and 7 kilometres respectively, span the rivers Riansaris and Ciguela. These structures of prestressed concrete are being constructed in accordance with the cementing procedure. The box-girders are assembled from prefabricated elements weighing 35 tons.
Similar elements were used for the construction of fly-overs at the Kleinpolderplein road junction in Rotterdam. The work comprises 209 piers, while 2277 elements must be manufactured and erected.
S.A. Trabajos y Obras (SATO) were awarded a contract by the Spanish government for the construction of the two aqueducts.



One of the two aqueducts under construction.

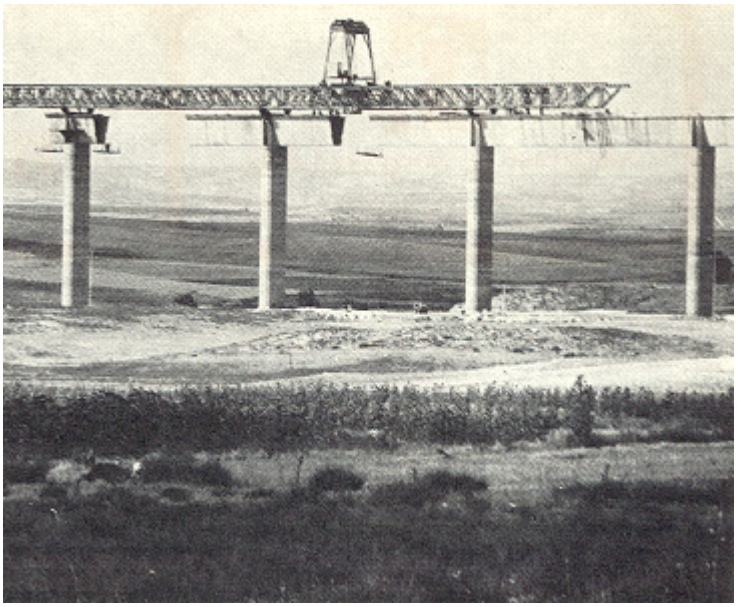
Construction

For the foundation of each pier it was necessary to drive nine steel piles having a length of 34 metres and a diameter of 100 cm. The base of the pier was placed on these piles.
The piers themselves were constructed with the aid of moving formwork. They measure 6.60 by 2 metres and vary in height from about 10 metres to 40 metres in the deepest part of the valley. The concrete elements are manufactured in a concrete works especially built for this project and subsequently transported to the erection site by means of a heavy truck and a deep loader.

The Cementing Operation

In the experimental stage SATO started off by cementing the elements with the aid of different kinds of epoxy adhesive and mortar on the abutment. The materials, however, did not meet the requirements imposed with respect to adhesion on moist subsoil, water tightness and curing.

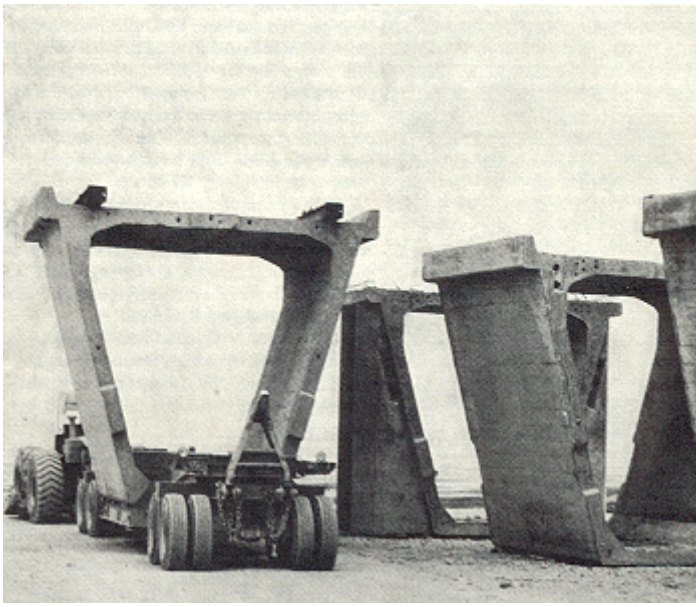
The principals specified that the supplier of the synthetic of the epoxy compound should have experience in the cementing of bridges.



Working from an erction girder on top of the piers, the elements are jointed together.

SATO contacted Sinmast Group has formulators and supplier of the P.A.103 epoxy adhesive utilized with their know-how for seven bridges in the Netherlands, constructed in accordance with the same procedure. In November 1971 Sinmast was awarded a contract for the supply of 50 tons of P.A.103 epoxy adhesive and 100 tons of embedding mortar based on E/2 epoxy binder.
In addiction, Sinmast made available to SATO in the initial erection stages the services of personnel familiar with the special cementing techniques.

For erection of the cemented elements SATO have designed a special erection girder. A traversing crane travels along this girder, lifts the elements brought up by deep-loader and takes them to their erection location.
In each erection cycle the first element forms the hammer-head. This element is placed on the pier at the correct height, whereupon a bed of synthetic resin mortar is applied underneath it.
After the mortar has cured the wire-ropes making the hammer-head and pier into an integral structure are inserted and stressed.



The crane then suspends an element at one end of the hammerhead. After the two faces to be jointed have been spreaded with P.A.103 adhesive paste the elements are drawn together with chair bolts. In order to allow the epoxy adhesive to cure under uniform pressure the element is temporarily clamped with four dywidag rods in a balcony structure on the deck at a pressure of 3-4 Kg/sq.cm.
The teeth present in the walls of the elements take up the lateral forces. The crane is then free to go and pick up a similar element and to place this at the other end of the hammer-head.

The cantilever structure is then in equilibrium. The wire-ropes are now inserted and stressed.
The erection of further pairs of elements is then continued until an extension of twenty metres has been attained on either side of the pier. When two extensions have been completed, the remaining gap of 20 cm is filled with concrete, after the concrete has acquired adequate compressive strength the continuity ropes are installed and stressed.
The erection girder is designed in such a way that erection operations can be performed simultaneously on three piers.
This prevents stagnation in the supply of elements while the wire-ropes are inserted and stressed. This method makes it possible to erect six elements per working day.

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