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Modern Equipment for Precast Bridge Construction

Nouveaux équipements pour la construction de ponts préfabriqués

Moderne Montageeinrichtungen für Fertigbrücken

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The use of prestressing enabled the development of new methods of construction which more and more replace the traditionals methods of construction "in-situ".
From a well known method, the "in-situ" concreting of complete span on truss, and by applying to it the recent developpments of external prestressing, engineers have developed innovations in construction methods particularly in the field of the progressive building method with precasted segments. The time of construction has been reduced considerably.
The balanced cantilever method with launching girder is being developed for long bridges.
For reducing the time of construction, we are brought to handle precast components which are heavier and heavier, that has induced an important development of handling engineering that enables the engineers to conceive new forms.

1 - PROGRESSIVE BUILDING METHOD

1.1 - The construction on self launching truss.

The principle is to built the deck span by span on a steel frame truss self moving from one span to the other. The truss is supported by 2 pier brackets placed on the piers. All the segments of the span are simultaneously assembled by the tensionning of the prestressing cables.
The segments can be supplied from the deck previously placed. For the designer, the cables are continuous from pier segment to pier segment on each span.

(Fig.1) Romulo Betancourt

Some realizations :

- Metropolitain Atlanta viaduc ,United States,
- San antonio viaduc, United States,
- Romulo Betancourt, Venezuela (Fig.1)
- Métro Nuevo Leon, Mexico.

The association of the 2 techniques : external prestressing and self launching truss has resulted in better productivity in the segment precasting and placing on the deck, particularly by savings in material and erection time on which the economic aspect of the project is based.
For bridges with spans between 40 and 50 metres, erection speeds of 2 spans per week are currently achieved. On the Metropolitain Atlanta viaduc, up to four spans have been completed per week.

1.2 - The construction with temporary mast and cable stays

Instead of being placed on a stell truss, the precast segments of the complete span are temporary supported by a mast and temporary cable stays.
The last developments of this process have been applied on the Frebuge viaduc in French Alps. During the construction, the 50m spans were built in cantilever and supported by a cable stayed mast which was moved from span to span.
The prestressing was achieved on a complete span. So, a 50m span was completed in 6 days.
In conjonction with its rapidity, this method enables to build bridges with spans between 35 and 50 m the space geometry complexity of wich does not allow to use other construction methods : in particularly the incremental launching, ground scafolding.

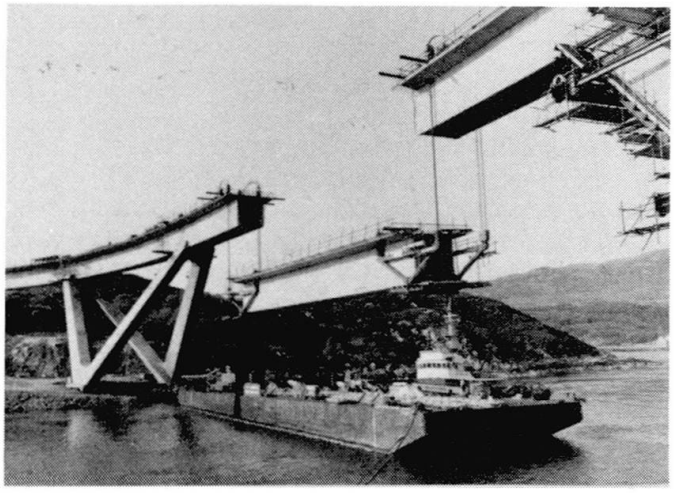
2 - CONSTRUCTION BY BALANCED CANTILEVER

This is the most widespead method and the oldest. The first technique used mobile travellers to build the deck symmetrically on both sides of the pier by concreting in place.
Then, the invention of precast segment enabled to develop new methods of construction.
The geometry of the bridge may be in any proportions but the best outputs are with long bridges.
Contrary to the progressive building method where the design and arrangement of prestressing cables have a tight connection to the method of construction, the balanced cantilever construction has not this strong interaction.
The construction of F9 Melbourne viaduc in Australia has shown all the possibilities of this method by using a launching girder.
The main characteristics of this bridge are :
- The 121 spans from 27 à 55 m, composed with precasted segments of 68 T maximum
- The plan radius of 114 m , with 6 % slope, for some ramps.

The stabilization of the cantilever during construction was achieved by the launching gantry.
This technique will be used to build the Baldwin bridge, in United States, where a launching gantry will place the 14O tons segments and will stabilize the 84 m spans.
The placing with this equipment is principaly used for long bridges because of the rapidity of erection and cost of equipment.

3 - LIFTING ENGINEERING

Lifting equipments for heavy loads have been studied to answer to the design of new bridges with shorter time of construction which necessitate to handle heavier and heavier precast elements.



(Fig.2) Kylesku bridge

The new lifting equipements are made up by hydraulic jacks and strands which are derived from prestressing engineering. The enables to handle loads of several thousands tons with important heights. So the designers can conceive new geometry of bridges.
For example, this type of equipment has been used successfully :

- To lift up the central span of CHEVIRE bridge in France. This central span of 162 m in length and 2,400 tons has been lifted on a height of 50 m.
- To lift up a concrete span of 600 tons on the Kylesku bridge in Scotland (fig.2).

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