Warta River crossing 130 m of ready construction per week with a crowing achievement – extradosed bridge

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1. Description of the river crossing. Construction and the main assumptions

The Warta is a medium size river in central Poland. The project of the Warta river crossing was connected with the project of the town ring road of Konin. The crossing was divided into four independent structures: three flyovers E5, E7, E8 and the main bridge. All structures were designed for two roads. Fig. 1. presents division of the crossing into particular engineering objects with their lengths and spans.

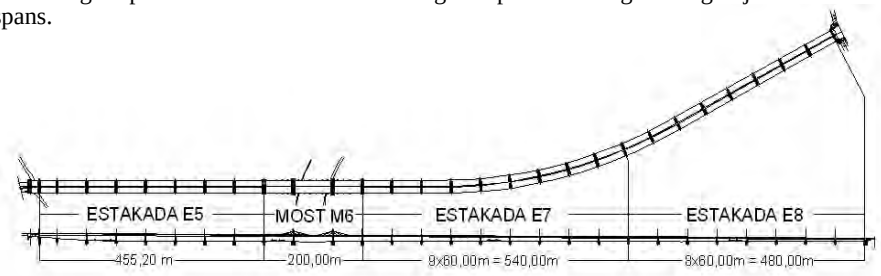


Fig. 1. Division of the Warta crossing into particular engineering objects.

The flyovers E5, E7, E8 running over floodplains were designed as multi-span, prestressed concrete box structures. Each flyover consists of two boxes of geometric section and parameters. The differences between particular flyovers resulted mainly from how they go in the plan and their total lengths. The main bridge over the river was designed as an extradosed structure of three prestressed concrete girder spans and steal transoms. The strands 42 and 47 make up the external prestressing. Their angles of inclination are 15, 21 and 40 degrees. The external prestressing takes place on three planes: over the external girders and in the zone of the median stripe over the internal girder. Passive anchorages are placed in pylons and the active ones by external surface of the outer girders and on the bottom surface of the middle girder. The bridge has both roads of the town ring road (unlike the flyovers). The consortium of three firms: Hydrobudowa-6 S.A. – PPRM S.A. – WPRD S.A. won a tender made in 2006 for the works execution which began in april 2006.

2. Technology of building

The Contracting Consortium was faced with difficult task to accomplish the works in short period of time (20 months) and not to exceed the costs offered in the tender. The spans were decided to be built

https://doi.org/10.2749/222137908796294199

in the longitudinal launching technology for the sake of their length and section standardization. Therefore the Consortium commissioned specialized company to prepare an appropriate technology of execution. The company has gained essential experience in building of large flyovers in Poland by means of the launching method (e.g. the flyovers in Wrocław, 400m long, and in Warsaw, 600m long; the launched constructions of approximately 13,000 tons).

A specially developed technological project and a schedule for launching of the flyovers structures optimized the technological cycle in this way that it was possible to lay the reinforcement, place the concrete, provide time for the concrete to cure and prestress centrical cables and launch three 30 meters long segments of flyovers E5, E7, E8 and 40 meters long segments of bridge M6 girders.

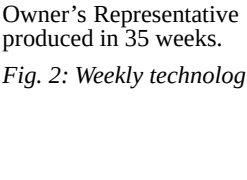
This way 130 meters of structure was produced every week. Fig. 2. presents symbolically a cycle of producing one flyover segment. Launching of the flyovers structure took place in the first days of every week.

To launch the segments of the flyovers there were used two jacks supplied with hydraulic pump which enabled to launch the structure at a speed of 10 km/h. The traction force was transmitted from the jacks to the structure by means of traction strands.

Each of the launched, 30 meters long segments weighed 600 tons. This way the flyover E7 segment of 495 meters weighed in the last stage of launching almost 10,000 tons. In order to move such a heavy structure by overcoming static friction at the supports, it was necessary to apply a horizontal force of 7,500 kN. Obviously it was harder to launch the segments of the flyovers which were shaped along its entire length on a circular arc of a radius of 1000 meters.

3. Load tests

Technology and organization enabled a realization of a big bridge crossing containing non-conventional construction solutions (extradosed) in a very short period of time.Dynamic and static tests were performed on the flyovers and extradosed bridge, comparison with theoretical results was done. Research showed that in spite of high pace of the works there occured no failures and the object behaves according to the conditions definied in the project.



4. Summary

Thanks to the successful cooperation between all the entities involved in the investment: the Investor, the Design Office, the Contracting Consortium, the Owner's Representative Services and Freyssinet Polska, this impressive bridge superstructure could be produced in 35 weeks.

Fig. 2: Weekly technological cycle of producing one flyover segment: