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New Opportunities with Arapree Prestressed Concrete

Béton d'arapree précontraint

Arapree-Spannbeton

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1 Introduction

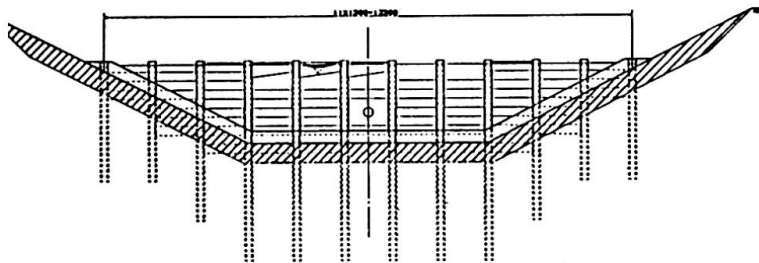
In recent years extensive research has been carried out into the behaviour of man-made high strength fibres, aiming for structural application in concrete. This paper describes some recent designs and applications of Arapree (ARAmid PREstressing Element) in concrete.

ARAPREE prestressing elements are composed of aramid fibres, embedded in a polymeric matrix, with the following main characteristics: high strength (3000 N/mm²), non-corrosive, resistant to aggressive environments, excellent fatigue behaviour and insensitive to electro-magnetic currents. The durability of Arapree is even guaranteed in cracked cross-section. For more detailed information, see [1].

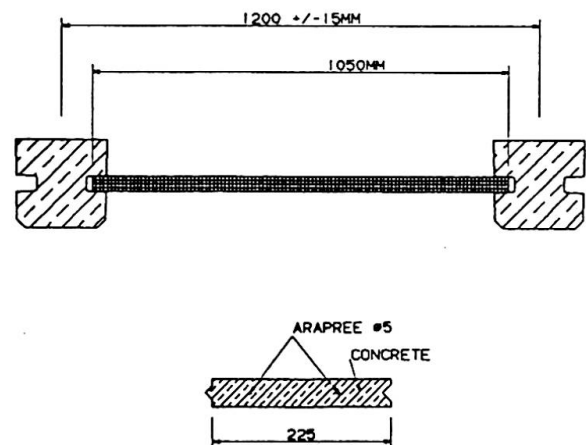
2 Applications

2.1 Fish ladder

In The Netherlands a hydro-electro power station has recently been built in the river Meuse. To enable fish to pass the 4,5 m head (difference in water level) a fish ladder was constructed consisting of 24 small weirs. Each weir is composed of vertical driven piles with shutters in between. To allow for optimisation of the water stream over the weirs, the shutters have to be adjustable by hand. They are 35 mm thick and weigh 19 kg. In addition to these elements, the slide near the entrance and the walkway to the control winch are also made of concrete prestressed with Arapree.



Typical cross-section fish ladder

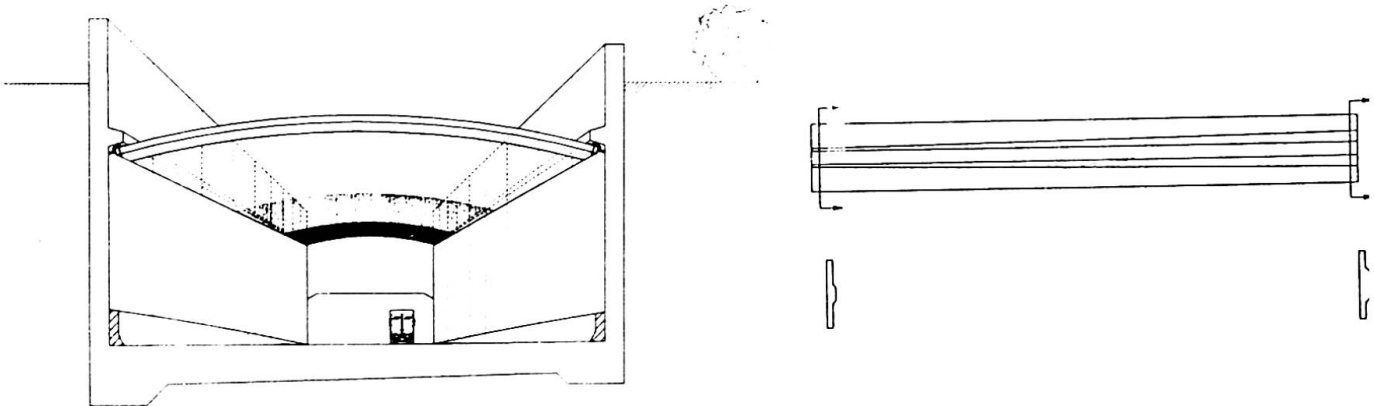


Details

A construction comparable to the weirs is the bank protection. A feasibility study showed that the use of Arapree prestressed concrete elements can be economically more attractive than traditional concepts in steel or wood for a retaining height of 3 m.

2.2 Sun screen

The possibilities of Arapree prestressed concrete require a new way of thinking to utilize the material at its best. A typical example of this is the design of a sun screen for tunnel entrances. Traditionally, these screens are made of aluminum lamellae which are supported by a steel structure. An alternative construction in concrete is not possible due to the large concrete cover. The slightly curved Arapree elements with a rise of 1 m span 12,8 m have a cross-section of 250 mm wide and 90 mm high.



Tunnel entrance

Wall elements

2.3 Wall elements

The eastern entrance of the new tunnel under the river de Noord in the Netherlands is a trough-like structure, founded on concrete foundation piles up to 6.5 m above ground level. To hide these piles from view, a wall of concrete elements along both sides of the entrance is currently under construction. The non-corrosive Arapree made it possible to construct attractive prestressed, light weight elements, in an aggressive environment. The wall elements have a T-shaped cross-section with a width of 500 mm, a flange thickness of 45 mm and a total thickness varying from 125 mm to 65 mm.

2.4 Structural building elements

The demand for handy, slender and durable structural elements is in contradiction with the increasing concrete cover necessary to protect normal reinforcing and prestressing steel in aggressive environments. In this field Arapree solves the problem. For instance prestressed concrete lintels and floor elements with minimal dimensions are architecturally attractive and easy to handle.

3 Conclusion

New prestressing materials like Arapree make it possible to widen the horizon of prestressed concrete. The examples discussed make it clear that by using Arapree, concrete can now economically replace traditional materials such as steel, aluminum and wood. Structures that were not possible before in concrete, now are!

4 References

- [1] Gerritse, A et.al.:
New horizons with Arapree prestressed concrete.
Conference papers: IABSE Congress, New Delhi, March 1-6 1992