

Canal Lining with **Incomat**[®]

CUSSET HYDROELECTRIC SCHEME, JONAGE CANAL,
LYON, FRANCE EMBANKMENT RENOVATION

The Cusset hydro-electric scheme was brought into operation in 1899. Its turbines are driven by the waters of the Rhone emanating from the JONS dam and discharged downstream of the Croix Luizet bridge, just outside Lyon.

This diversion follows through the 19 km long Jonage canal from the dam, situated at a height of 5,575 m. The CUSSET power station, at a distance of 15.8 km from the dam, is designed to handle a flow of 600 m³/s.

The scheme is operated by EDF, Energie Rhone-Auvergne, which has its head office in Lyon.

The Jonage canal is bounded on its left bank by a natural slope and on the right by an embankment, which on its canal side has an impermeable barrier of clay and concrete slabs at the water level zone.

In Autumn 1993 a considerable damp area was noticed on the outer slope of the embankment, which prompted the operator to carry out a further investigation. Bathymetric measurements of the canal profile indicated that the clay layer had severely eroded at several points, the concrete slabs were worn



Captions: *Placing a panel on the barge*

and the canal bed had deepened.

This damage had led to a loss of embankment impermeability. It provided an explanation for the leakage and posed a danger to the embankment stability. EDF's Rhône-Alpes Engineering Department (SIRA) at St. Etienne was charged with identifying technical solutions for the reinstatement, which would provide erosion protection for the higher slope of the bank and restore the impermeability of the

embankment.

The difficulty was to undertake the repair work while keeping the power station in operation with the canal flowing at a high rate.

From the various renovation proposals **Incomat**[®] Standard, the geosynthetic sealing system, was chosen. The **Incomat**[®] concrete mattress offered several advantages. It provided under-water execution, rapid installation and uncomplicated



Placing a panel on the barge for installation

Bringing a panel onto site



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HUESKER
REPORT



Filling the mattress using a concrete pump



The restored canal access after the mattress installation

concrete filling. By covering the embankment with **Incomat®** the impermeability required by the operator was achieved. At the same time the embankment was protected from severe erosion effects.

The **Incomat®** mattress, manufactured and made up into panels by HUESKER Synthetic, comprises two layers of high strength UV stabilised polyamide / polyethylene fabric held together by binder threads and interwoven areas. The length of the binder determines the thickness of the mattress when filled with concrete.

Tournaud, a firm specialising in hydraulic engineering for more than fifty years, were contracted to complete this work.

In the first phase Tournaud undertook a reprofiling of the

embankment to eliminate the uneven features. The contractor then installed a series of piles both to position the **Incomat®** panels and to keep them secure during construction.

The **Incomat®** factory-prepared panels, 33 m wide and 36 m long, were brought into position by barge and then placed over the area to be treated. The contractor filled the mattress with a specially prepared foamed concrete. The injection was pumped into the mattress using hose pipes, withdrawn after filling.

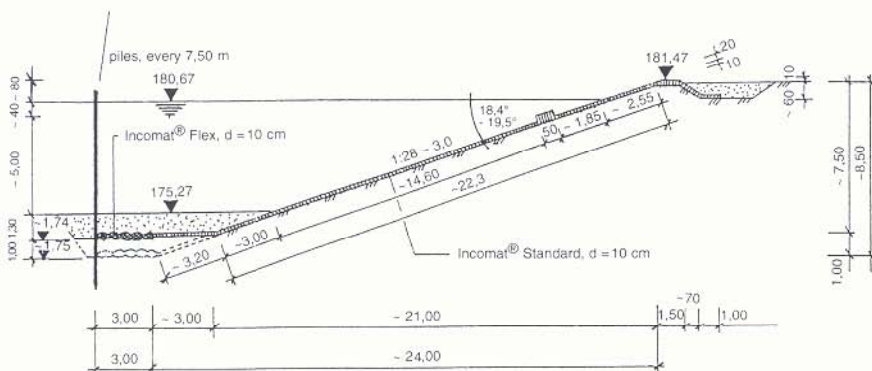
The individual panels were connected under water by means of zip fasteners. The **Incomat®** installation was continuously supported by a team of divers.

The **Incomat® Standard** mattress was finished off at the foot of the

slope throughout the section under repair with **Incomat® Flex**. This product has the capability of conforming with the surface formation. By this means the toe of the embankment and the untreated transition zone were protected from wash-out. Using this method the long term safety of the embankment has been assured.

During the construction work certain difficulties due to the strong current were quickly resolved.

All work, including the installation of 12,000 m² of **Incomat®** concrete mattress, was finished in fifteen weeks without disruption to the power station. This contract was successfully completed in September 1994.



Incomat® is a registered trademark of HUESKER Synthetic GmbH.

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