FUSEGATE NEWS
Issue 12 - November 2007

ALLAN RIVER – FRANCE

Fusegates on a flood retention basin

In June 2007, Hydroplus was awarded a contract for the design and installation of 10 fusegates, 1.10 m high and 5.60 m wide, at a retention basin on the Allan River in eastern France. The first unit is designed to tip off for floods with a probability of occurrence in excess of 1 in 70 years. This is the first river-based dam safety upgrade carried out by Hydroplus in France. Work was completed at the end of October 2007.

Close-up view on the Allan fusegates and their special well structure preventing vandalism.

The retention basin consists of a dyke, built across a valley, with a free overflow weir limiting river flow. Floodwaters are thus stored behind the dyke, resulting in reduced downstream flow. A 56-m-long emergency spillway ensures the safety of the dyke against overtopping.

Given their reliability and safety features, fusegates were favoured as the spillway control system over fuse plugs. Fusegates were also preferred to flap gates due to their low-maintenance requirements and cost-effectiveness. An innovative design protecting fusegates against vandalism was also implemented as part of this project. This new feature testifies to the Hydroplus technical team's continuous efforts to enhance their ability to respond to new challenges.

CANTON DAM – USA

Reaching new heights

Completed in 1951, Canton dam near Oklahoma City consists of a 23-m-high, 4,600-m-long earthfill embankment. Following a study that revealed the dam's insufficient flood-discharge capacity, plans were made to build a new emergency spillway to provide adequate flood protection.

To that end, 9 fusegates – at 9.14 m, the tallest ever built – will be installed on the existing dam, increasing its total discharge capacity from 9,900 to 18,000 m^3 per second. The first stage of the Hydroplus design and engineering contract is related to model tests designed to optimize the emergency spillway channel configuration.

This $1.8-million engineering contract is the fifth mandate for Hydroplus in the United States and the third in partnership with the U.S. Army Corps of Engineers.

The Ghrib dam: a success story

The recent rehabilitation of the Ghrib dam, which was equipped with 20 fusegates 4.50 m high, provides an opportunity to compare labyrinth weirs and fusegated spillways.

The Ghrib dam, operated by the National Agency of Dams and Transfers (ANBT), is the second most important dam under operation in the western part of Algeria. Built in the 1940s, the structure was designed to irrigate the Mitidja valley and High and Low Cheliff regions and to provide water supply for the capital, Algiers.

Two solutions were compared in 2004 to increase the reservoir storage capacity by 70 millions m^3 while keeping the same discharge capacity at Maximum Water Level: a fixed labyrinth weir and a fusegated spillway.

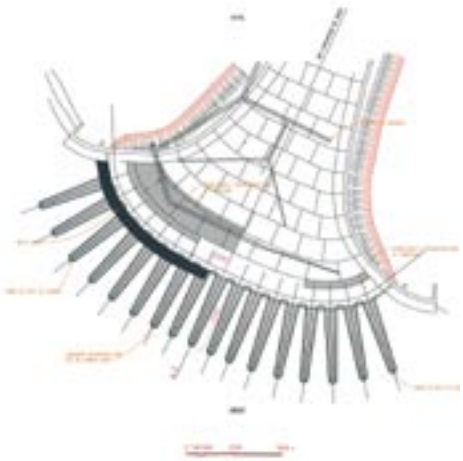
The labyrinth weir alternative

From a structural and construction point of view, this option would have consisted in building a fixed labyrinth made of reinforced concrete with 17 waves, each 40 m long and 10 m wide. The fixed labyrinth would have been erected on the upstream side of the existing ogee sill.

The construction would have required 22,000 m^3 of excavation work and 23,400 m^3 of concrete casting. Furthermore, the fixed labyrinth would have involved the erection of a major cofferdam, or a significant lowering of the reservoir level during the construction phase, which would have led to significant water loss.

From a hydraulic point of view, the fixed labyrinth would have required 2 classic gates, each 4.50 m high by 10 m wide, in order to retain rapid drawdown capacity in case of problems. According to model tests performed by Algeria's CTH Laboratory, despite the magnitude of the labyrinth waves, this solution would have limited the maximum discharge capacity of the spillway to 4,500 m^3 per second, which was well below the existing spillway discharge capacity of 7,000 m^3 per second when the water level reaches the dam crest.

Therefore, this solution was acceptable to pass the Design Flood but not the PMF, which according to ICOLD recommendations should be passed below the dam crest for high dams such as the Ghrib.



Fixed labyrinth : spillway plan view

The fusegate alternative

This solution involved the installation of 20 labyrinth fusegates, 4.50 m high and 6.75 m wide, made of 30 m^3 of reinforced concrete. They were cast on site and associated with 2 flap gates, 4 m high by 15 m wide, made from 22 tonnes of steel. This configuration required 10,000 m^3 of excavation work and 1,200 m^3 of concrete casting.

Modifications to the existing ogee were also involved, as follows:

- Installation of 50 dynamic anchors, 30 m long to stabilize the ogee sill against the foundation; and
- Flattening of the existing ogee sill and construction of a reinforced concrete platform 185 m long and 5 m wide on top.

From a hydraulic point of view, this solution did not limit the maximum discharge capacity of the spillway in case of PMF, the fusegates being washed away in case of extreme floods.

The preferred solution

The fusegate alternative was chosen because it:

- Did not jeopardize the dam safety's with regard to the PMF;
- Respected ICOLD recommendations with regard to the PMF; and
- Was 30% more cost-effective and could be implemented in a much shorter time than the fixed labyrinth solution.

Fusegated spillway : plan view

RENEWABLE ENERGY

Hydroplus in Armenia

Following a project to promote renewable energy sources in Armenia, supported by the KfW Development Bank of Germany, Hydroplus is participating in the rehabilitation of the currently disused Vorotna dam located in the southern part of Armenia. Seven fusegates, each 1.50 m high and 2.70 m wide, will be installed on a new weir downstream of the existing dam.

In efforts to carry out the project in as cost-effective a manner as possible, fusegates were selected as a spillway control system to minimize the difference between the dam crest and the permanent pool level. Reliability was also a key factor in the selection of the fusegate system.

This new contract reinforces the fusegate system's reputation as a robust solution for optimizing existing and new dams. Other similar projects are under consideration in Armenia.

The Vorotna dam will be upgraded with seven fusegates.

MOROCCO

Optimization studies

In April 2007, Hydroplus was awarded a contract sponsored by the government of France to study the optimization of dams owned and operated by the Hydraulic Works Directorate in Morocco.

During Phase 1, engineers visited thirteen dams to determine the potential for installing fusegates; they also collected valuable data about hydrology and water demand. Following analysis of this information, Hydroplus selected the five most promising dams, whose upgrade would provide additional storage of 70 million m^3.

The Hydraulic Works Directorate approved this selection and launched Phase 2 of the project. Currently under way are feasibility studies of the selected dams, which include a hydrology study, the design of the fusegate system, and a cost-benefit estimate for the project.

This is the first fusegate project for Hydroplus in Morocco and should open the doors to a very promising market in that country.

Hydroplus, faithful to its creative spirit and its permanent search for innovation, is in the process of filing a new patent related to fusegates wells safety. This innovation will be developped in the next Fusegate News issue.

Events

ANCOLD 2007

QUEENSTOWN, NEW ZELAND
November 17 to 21, 2007

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