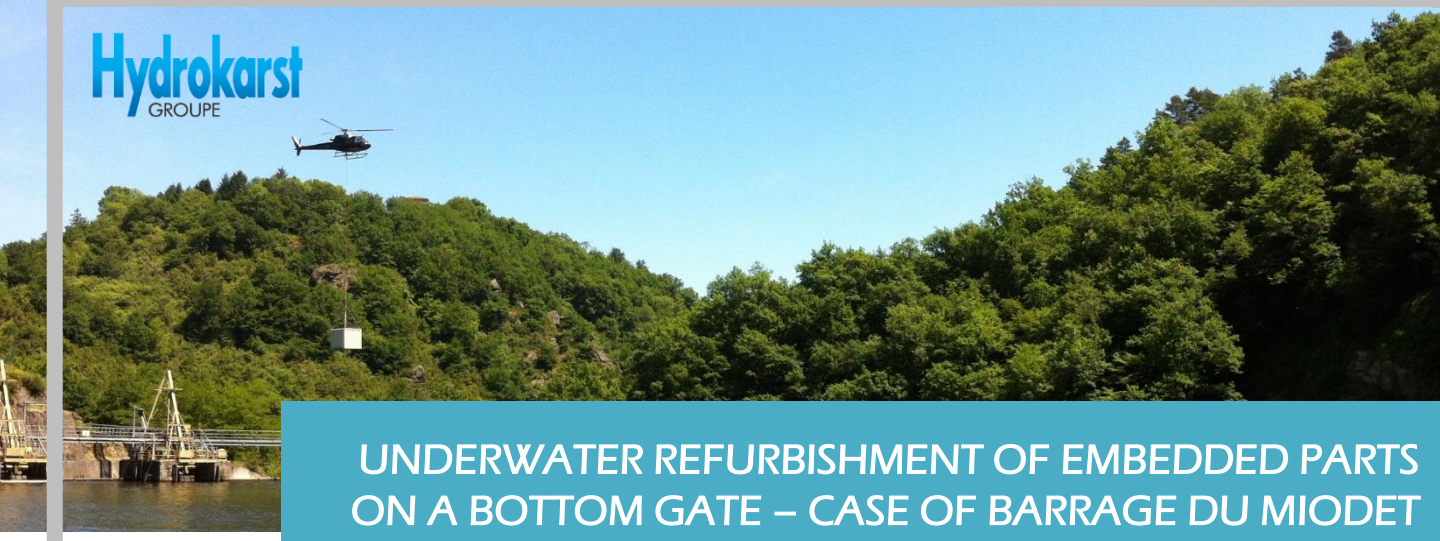
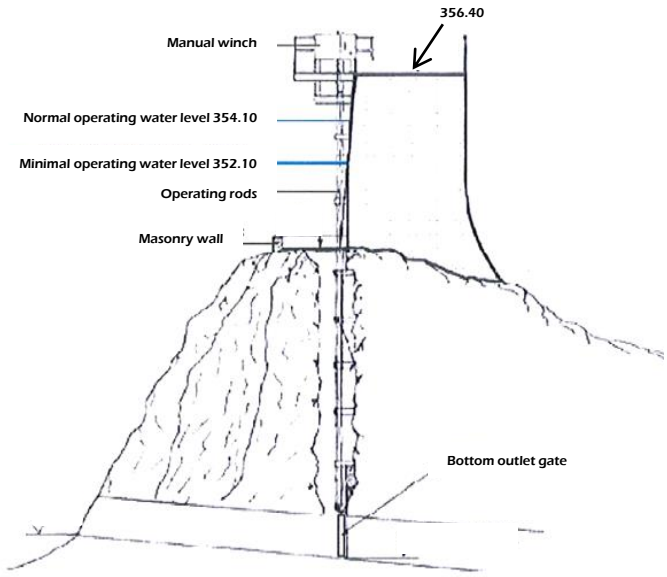


UNDERWATER REFURBISHMENT OF EMBEDDED PARTS ON A BOTTOM GATE – CASE OF BARRAGE DU MIODET

INTRODUCTION

In order to complete refurbishment of bottom outlet gates, it is usually possible to do refurbishment of the mobile part on surface and in dry conditions. When it comes to rehabilitation of embedded parts, such as bottom sill, frontal plate or lateral guide rails, it is commonly admitted that it has to be done on dry, either by lowering reservoir level or by adding upstream cofferdams.
In order to minimize loss of generation and to avoid environmental consequences, bottom gate refurbishment was implemented, in our case, completely underwater.



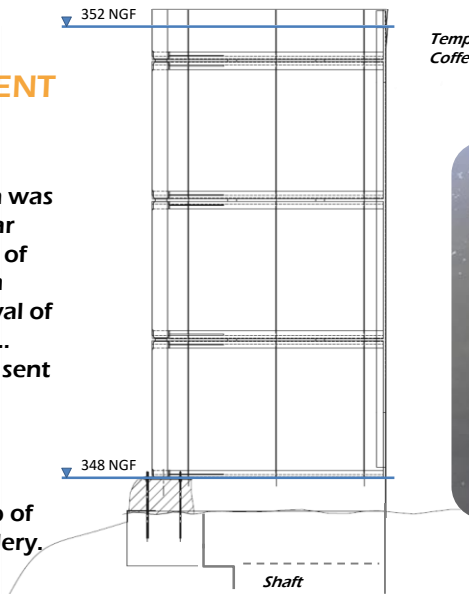
WORKING CONDITIONS

- Working depth : - 20 m
- Water temperature range : 4° C to 18° C
- Visibility range : 5 cm to 40 cm

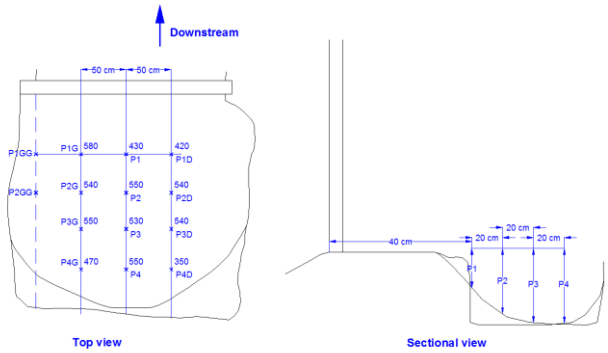
PHASES OF REFURBISHMENT

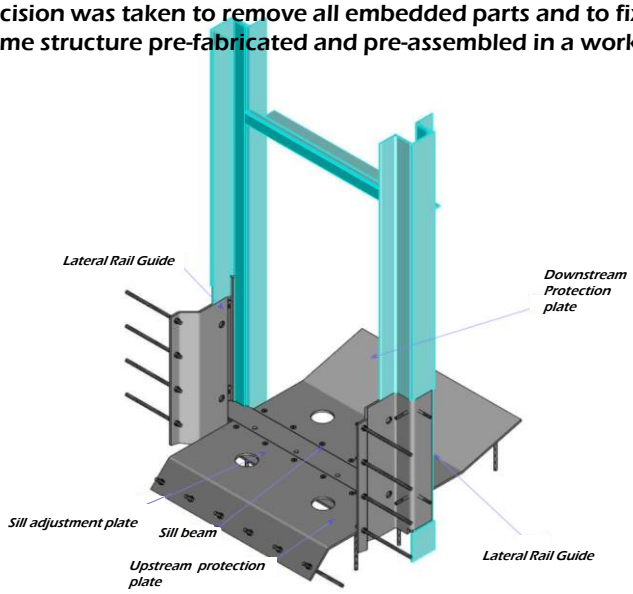
Step 1 : The gate was blocked in a closed position at the bottom of the well, which was full of sediment. The first task was to clear the shaft and the bottom gallery in front of the gate. Clearing was implemented by a combination of air lift and manual removal of steal debris, wood, blocks, sand, gravels...
The bottom gate was then removed and sent for rehabilitation within a workshop.

Step 2 : In order to protect divers from incoming flood debris when working, a temporary cofferdam was erected on top of the shaft and another one inside the gallery.

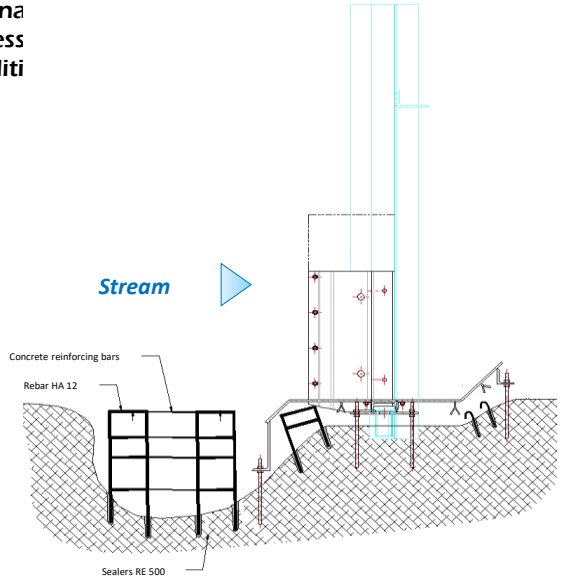


Step 3 : A prior cleaning by high pressure jetting was necessary in order to assess properly extension of erosion and corrosion on embedded parts. Inspection of all components was then implemented by divers equipped with video cameras linked to surface monitors. Thickness measurements of residual steel beams were made by divers and a complete assessment of necessary remedial work was undertaken. Sill beam was completely destroyed and lateral guides were partially missing plus a cavity has formed on the concrete sill upstream of the gate.
Decision was taken to remove all embedded parts and to fix a new frame structure pre-fabricated and pre-assembled in a workshop.





Step 4 : Demolition of embedded parts, second stage concrete, residual steel beams and plates was done using a combina
high press
and additi



Step 5 : Positioning and adjustment of the frame structure was a challenging task, especially for sill beam and plates which has to be adjusted and fixed in a very precise position before concreting phase. Due to limitation of lifting capacity, sill beam and lateral rail guides were not lifted down in one piece and adjustment underwater was a time consuming phase.
Once adjusted, wet welding of lateral rail guides, sill beam and frontal plate was done.
A special welding procedure qualification was designed for this contract according to the ISO 15618 - 1

Step 6 : Underwater concreting was done with a premixed mortar and was completed by a grouting phase to make sure that all embedded parts and operating rods were completely filled up and fixed.

Protection plate

Lateral guide rail

Diver checking

FINAL COMMISSIONING

The refurbished gate was then put back in its rail guides, new operating rods were assembled and the gate went through successful commissioning tests.

CONCLUSIONS

Underwater refurbishment of embedded parts of bottom/flood/intake gates is possible
if following conditions are all favorable :

- Appropriate design for such rehabilitation work
- Appropriate concreting and wet welding procedures
- Sheltering of divers against current, debris, sediment flows
- Use of dams technicians/divers with similar experiences and corresponding qualifications