REHABILITATION WORKS FOR ISALNITA GATED DAM

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ABSTRACT

Isalnita intake on Jiu River provides cooling water for large thermo power plant. The local head for the intake is provided by a gated dam with a maximum height of 18 m and a crest length of 129 m. The gated dam structure is divided into 6 flood - passing equipped with radial gates. The rehabilitation works were mainly imposed by two significant deficiencies: - The impossibility to provide regular maintenance of gates due to lack of means to put the gates on dry since the floating cofferdam system never worked; - The significant damages of the energy dissipation system due to regressive erosion and the general river bed lowering. The aging phenomena (quite normal after 55 years of operation) have also imposed rehabilitation works. The works are partly completed. A new system of stoplogs was placed on pier inner faces, upstream off gates. The installation is done under water, by using divers. The old energy dissipation system was supplemented by a new stilling basin and a new rear apron ended by a rockfill blanket. Extensive foundation treatment (piles and jet grouting) was provided to avoid further regressive erosion and construction settlements.

1. BRIEF DESCRIPTION OF THE DAM

Isalnita intake on Jiu River, provides cooling water for Isalnita and Simnic thermo power plants and water supply for Chemical plant Craiova and for the warm water treatment station for city of Craiova.

The local head for the intake is provided by a gated dam with a maximum height of 18 m and a crest length of 129 m. Lateral dikes create the storage contour. The hydrotechnical system includes:

- gated dam;
- water intake;
- settling basins;
- headrace channel.

The main characteristics of the development are:

- normal operation level 85,50 mASL
- crest level 89,38 mASL
- overflowing sill elevation 80,30 mASL
- stilling basin slab elevation 78,00 mASL
- hydraulic head 6,50 m
- dam maximum height 18,00 m
- intake sill elevation 83,00 mASL
- Year of commissioning 1964

The gated dam structure is divided into 6 flood - passing bays by contraction joints (each bay has a slab and one semi – pier on each side of it). The bays are equipped with radial gates of 16 x 5 m^2 (bays 1.3 and 5) and with combined radial and flap gates of 16 x (3.8 + 1.2) m^2 (bays 2.4 and 6). One additional bay of 10 m wide, equipped with a combined radial and flap gate of 10 x (4,3 + 1,2) m^2 is used for regular flushing of sediments in front of the intake.

The intake consists in a pocket 10 x 4.6 m^2 created by the divider wall, closed upstream by the entry weir and the vertical lift gate and the lateral entrance - 21 x 1.80 m^2 - protected by the trash rack. The intake capacity is 39 m^3/s.

Figure 1 : Downstream view of Isalnita Dam

The settling basin is divided into 12 chambers provided with entrance gates and exit valves. One additional channel, used during winter, bypasses the settling basins.

The dam and all the appurtenance structures are founded on sand and gravel deposits. The concrete weir has upstream and downstream cutoff walls that are clamped in the marle bedrock and provide the foundation watertightening.

The energy dissipation was provided by a stilling basin with dental sill and a rear apron ended by a massive concrete beam closed into foundation by steel sheet piles. The final river bed protection was done by the rockfill apron.

2. REHABILITATION WORKS

2.1 The need for rehabilitation

The rehabilitation works were mainly imposed by two significant deficiencies:

- The impossibility to provide regular maintenance of gates due to lack of means to put the gates on dry. Mention should be made that according to the original design concept each bay can be put on dry by a floating cofferdam fitted on its adjacent piers. The system never worked;
- The significant damages of the energy dissipation system; the rear apron was completely destroyed by regressive erosion and the concrete blocks placed in order to protect the end of the stilling basin were moved and washed away. Deep erosion and a general river bed lowering was also present.

The aging phenomena (quite normal after more than 50 years of operation) have also imposed rehabilitation works: - reconditioning or refurbishing the mechanical and electrical equipment; - repairing and protecting of exposed concrete surfaces; - consolidation of downstream guide walls foundation.

Finally, the almost total siltation of the reservoir has asked for a sediment removal and installation of a permanent dredging activity. Figure 2 presents in brief the damages recorded at Isalnita Dam.

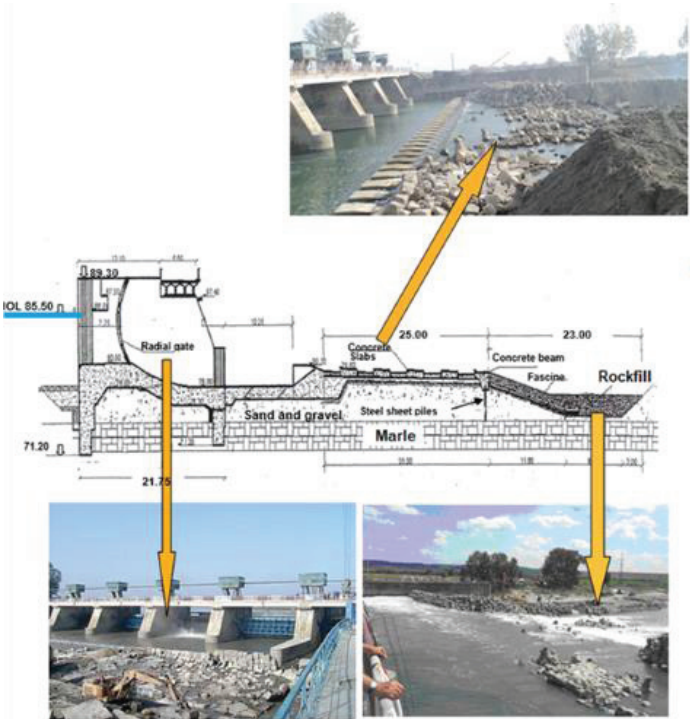

Figure 2 : Deficiencies

2.2 Rehabilitation project

The rehabilitation project has dealt with the correction of deficiencies and aging consequences presented above:

(a) The dam was equipped with a new system of stoplogs that allows for putting on dry the gates for maintenance and eventual repairing. The new system is based on the current practice, with stoplogs. Steel stoplog guidance is placed on pier inner faces, upstream off gates. The installation was done under water, by using divers. Stoplogs will be launched into guidance by means of a special new crane. Existing reinforced concrete beams did not have the required bearing capacity for the new crane and, consequently, new beams were also provided.

(b) The old energy dissipation system will be supplemented by a new stilling basin, some 4 m lower than the old rear apron and a new rear apron ended by a rockfill blanket.

(c) Extensive foundation treatment (piles and jet grouting) is provided to avoid further regressive erosion and construction settlements.

(d) Works needed to overcome the aging effects - reconditioning or refurbishing the mechanical and electrical equipment; - repairing and protecting of exposed concrete surfaces; - consolidation of downstream guide walls foundation.

(e) Sediment removal from the reservoir and installation of permanent dredging equipment.

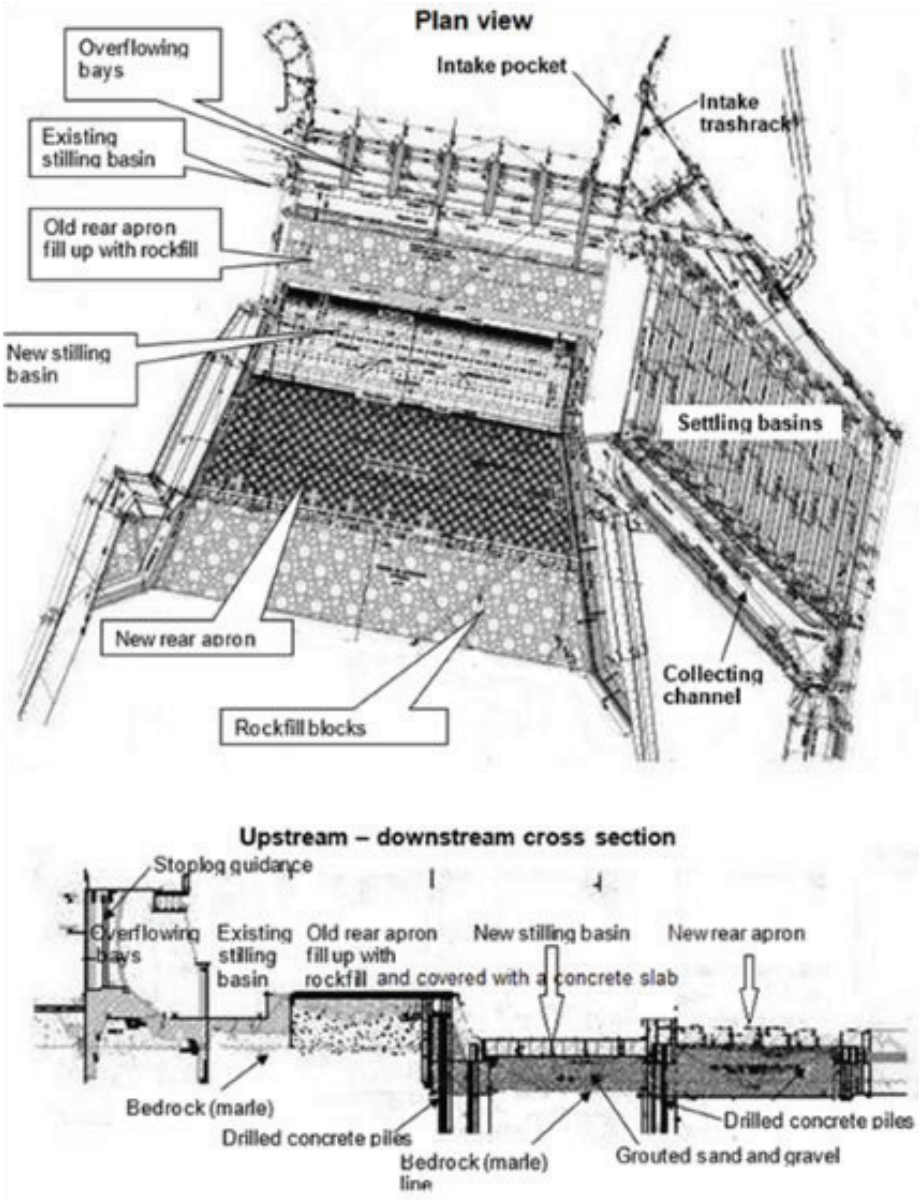

Figure 3 : Rehabilitation works

3. WORK PERFORMANCE

The project includes a large variety of works with significant complexity. Special remark has to be made concerning the steel stoplog guidance placement on piers. Working under water has avoided difficult water diversion and saved funds.

Figure 4 : New stoplog guidance

Two problems were encountered during the project implementation. The first one was induced by the actual conditions of the side walls foundation. The lowering of the river has uncovered the previous foundation and the walls were practically suspended. The design technical solutions were modified during the work implementation in order to cope with the actual site conditions. However, some of the changes have improved the foundation conditions of the new works but affected the hydraulics of the downstream flow. Concrete blocks resting on drilled pipes were provided inside the flowing area in order to support the side walls structures but they do not preserve the downstream flowing area. The concrete blocks along the side walls partly obturate the water flow released by the spillway bay near the right bank. A similar hydraulic blocking could happen to the water flow released by the washing bay of the intake pocket.

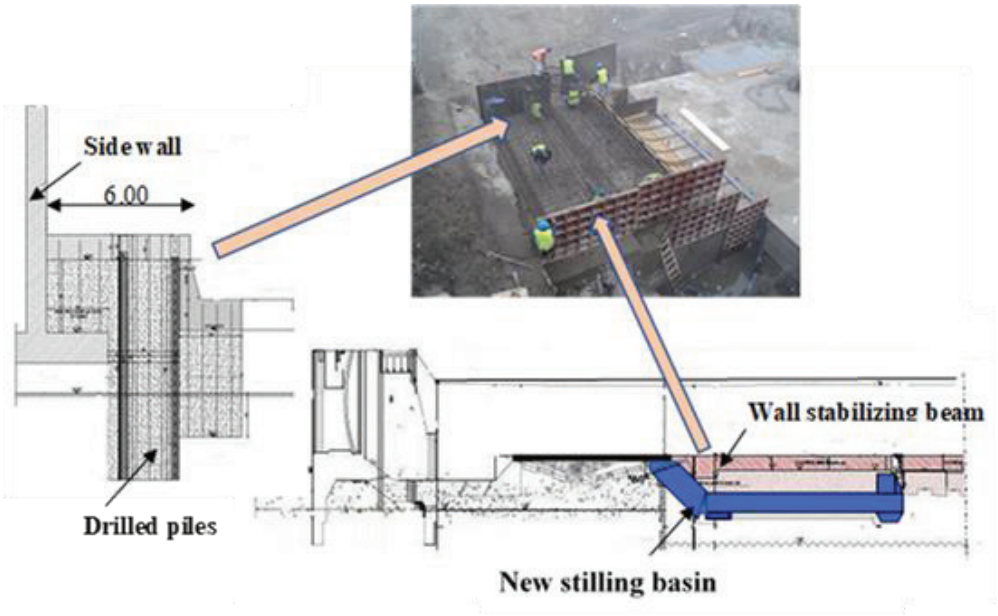

Figure 5 : Concrete blocks along the side walls.

The hydraulics of the flow downstream of the right bank bay and downstream of the flushing bay were partly solved by adding guide wings.

The second problem was generated by the unexpected duration of the works, mainly due to lack of funds. Several floods were routed through the reservoir affecting the construction site. The most severe one happened on 4 April 2013 when a flow of 1028 m3/s was passing the dam. The actual river bed downstream of the dam was partly closed by a diversion cofferdam. The water overflowed the cofferdam crest, the rockfill of the rear apron was washed away and at the end a large amount of debris covered the downstream area. Mention should be made that the new structures (stilling basin, concrete blocks along the side walls, the new dental sill), even still under construction, were not damaged.

Figure 6 : Construction site after the flood in April 2013.

The main rehabilitation works are finished. The performance of the new crane supporting beams for stoplogs maneuvering is still under construction. The demolition of the existing reinforced beams and cast in place of the new ones is quite difficult since implies risks to gates integrity during demolition and is very time consuming.

The past behavior of the radial gates and their actual condition do not support the design provision to replace the gates. A thorough investigation when the gates will be on dry by using the new stoplogs may be the basis of such decision.

4. CONCLUDING REMARKS

The project concerning the dam rehabilitation is justified since the Isalnita development provides cooling water for thermal plants and industrial water supply. Additionally, the same facility provides dilution water for the treatment station of Craiova Water Company.

The project has included a large variety of works with significant complexity. The quality of civil works performed. The implementation overpassed the frame of the project time schedule.

The adjustment of the design imposed by unexpected foundation damages of the side walls induced some changes in the hydraulics of the development that were promptly corrected. corrected.

The decision concerning the main gates replacement was postponed since it has to be based on a thorough investigation when the gates will be on dry by using the new stoplogs.