



## **The Design and Construction of the huge cavern for dissipation in Zengwen reservoir sediment sluicing tunnel outlet**

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### **Abstract**

The Zengwen Reservoir is the largest reservoir in Taiwan and also the most significant water resource in Chia-nan plain area. However, its capability keeps decreasing by the increasing of sediment deposition since operating in 1974. Due to the lack of sediment sluicing facilities, a new sediment bypass tunnel is planned on the left side of the dam with a discharge capacity of 1,075 cms base to extend the service life of the reservoir.

As being short of the area to allow energy dissipation completely at the outlet into the Zengwen river. An underground energy dissipation facility is to be built in the cavern with 90m long, 18m wide and 41.69m at the highest section.

In this case, we discuss the engineering challenges in the design and construction of the huge cavern. The most significant difficulty comes from topography and geological factors. Because the energy dissipation pool is located at the outlet of the tunnel, adjacent to the surface of river bank slope, the overburden depth of the cavern is insufficient, which is unfavorable for the excavation stability of the cavern. In addition, the alignment of the tunnel is not orthogonal to the slope of the river bank, therefore, underground caverns will face unsymmetrical stress during excavation.

To solve these problems, the designer moved the underground cavern forward to the mountain to obtain a thicker overburden depth and divided the end of the underground cavern into two smaller sections of the outlet tunnel. Despite this, these two outlet tunnel are still have section of 10 meters wide and nearly 30 meters high in the slope surface of river bank.

Therefore, the designers use a 3-D numerical model analysis to check the design and stability to ensure the safety of underground excavation. The design issue includes: rock mass bearing capacity at the top of the tunnel arch, stability of rock wall between two outlet tunnels, and tunneling unsymmetrical stress of slope treatment measures, etc.

The constructor excavate the underground caverns step by step within four years, and closely monitored the displacement of the rock mass during the process. In the flood season, it overcomes the displacement of rock mass caused by groundwater and withstands the impact of reservoir spillway flood discharge on construction. The

challenge of excavating this huge underground cavern and achieving difficult goals was finally completed.

keyword : Zengwen reservoir 、 desiltation of reservoir 、 huge carven excavation 、 unsymmetrical stress

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