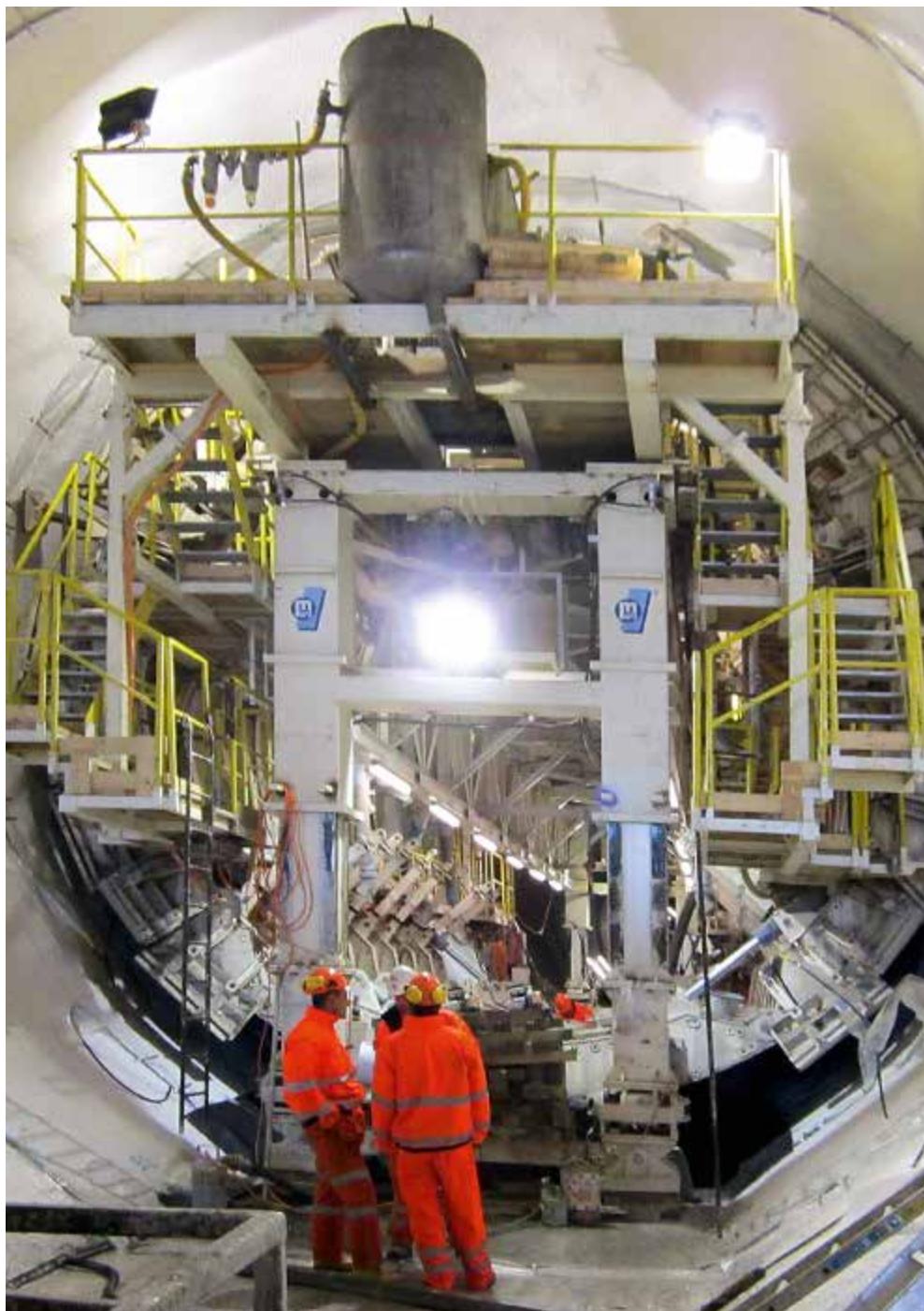


## Hydro-power plant Limmern

# Full-round tunnel formwork with max. gradient 22 %



Linth Limmern Power Stations are building the largest hydroelectric power plant in Switzerland to be operational by the end of 2015. Currently, the internal work is in full swing. Marti Technik AG began submitting their offers for the formwork of the pressure water caverns in mid-2011. They were able to schedule the first full-round formwork for the Muttsee intake structure section up to the surge chamber in autumn 2011. The formwork was operational as of mid-July 2012, the last ring was concreted after 550 m at the end of November 2012. Marti Technik AG received a follow-up order in mid-2012 for the full-round formwork at the tailrace tunnel with a start-up date of late 2012.

### Overview

#### Full-round formwork headrace pressure galleries

Formwork weight: approx 120 t

Diameter: 8.03 m

Stage lengths: 10 m

Advancing mechanism length: 23 m

Concrete / stage: approx. 85 m<sup>3</sup>

Concreting period: July – November 2012

Concreting section: 550 m

Maximum gradient in the tunnel: 15 %



## Hydro-power plant Limmern



### Full-round formworks tailrace tunnels

Formwork weight: 70 t  
 Diameter: 5.58 m  
 Stage length: 6 m  
 Advancing mechanism length: 12 m  
 Gripper function for advancing operation  
 Concrete / stage: approx. 35 m<sup>3</sup>  
 Concreting period: December 2012 – autumn 2014  
 Concreting section: 600 m  
 Maximum gradient in the tunnel: 22 %  
 Minimum curve radius: 50 m



Full-round formworks are expensive to design and manufacture. The geometry and ring connector must be precisely adapted to the deformations of the concreting stage, otherwise it is impossible to strip the formwork later on. With the full-round formwork of the new pumped storage power plant in Limmern, there was also the additional difficulty of gradients measuring up to 22 % and exceptionally tight spaces.

### Full-round formwork in the headwater pressure galleries

The section of the Muttsee intake structure section up to the surge chamber runs at a gradient of up to 15 %. The weight of the complete formwork is 125 t. We tested different solutions to deal with the stepped difference of 10 m with an alternating maximum traction of 20 tonnes. In the end, Marti Technik AG's workshop in Moosseedorf converted two chain hoists of 25 t from compressed air to hydraulics, and with their help we were able to overcome the problems posed by the gradient.

### Bottleneck Y-tube (branch structure)

As our assembly area, the Y-tube is hardly any bigger than the formwork itself. At the site, over 50 rock anchors were drilled into the dome in advance for our installations. The wooden elements, longitudinal trusses, formwork and the advancing mechanism were then attached to this. Only once this work was completed could we install the full-round formwork.

### Full-round formworks in the tailrace tunnel

The formwork for the tailrace tunnels are a complex challenge. The diameter is only 5.58 m. In addition to the gradient of up to 22 %, the formworks must cover 50 m radii. A gripper prevented the slabs from sliding on the formwork by bracing them against the tunnel wall.



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