



# SIKA AT WORK

## Rrapun Hydro Power Plant (HPP), Librazhd, Albania

CONCRETE PRODUCTION: Sika® ViscoCrete®, Sika® Separol®, Sika® Sigunit®  
WATERPROOFING: Sika® Waterbars®, Sikadur®-Combiflex® SG, SikaSwell®  
SEALING: Sikaflex®  
REFURBISHMENT: Sika® MonoTop, SikaGrout®, Sikadur®

BUILDING TRUST



# RRAPUN HYDRO POWER PLANT (HPP), LIBRAZHID, ALBANIA



## PROJECT DESCRIPTION

The Rrapun Hydro Power Plant (HPP) is a 9.0MWe D&B small hydro scheme built along the river Rrapun near the town of Librazhd in Albania. This project consists inter alia of a hybrid dam (earth dam 246m long, 10m high plus 4 arch weir gates), a 2.3km long hydraulic tunnel, a power station and extensive electromechanical installations (including 3 Francis turbines (3MW each) with their generators and control valves). The project's budget was 25,250,000 € and its construction was completed in 3 years (August 2013 – August 2016).



## PROJECT TECHNICAL CHARACTERISTICS

- **Design Discharge:** (17+10=) 27 m<sup>3</sup>/s from two water intakes (Rrapunit & Qarrishte respectively)

- **Installed Capacity:** 9.0 MW

- **Average Production:** 43.83 GWh/year

The project includes:

### Rrapunit Water Intake (17 m<sup>3</sup>/s):

- Water dam 246.0m long in Rrapuni village consisting of:
  - Three (12 x 8) m radial gates and one (12 x 8) radial gate with an (8 x 2) flap gate (total length 65m – height 10m)
  - Earth dam 177m long, 8.70m high above the river bed with a 2.50m foundation
  - Diaphragm walls of ~ 1.300 m<sup>2</sup>

### Qarrishte Water Intake (10 m<sup>3</sup>/s):

- Water transfer projects:
  - A shaft receives the outflow from HPP Rrapun 2 and leads them to a concrete pipe through a siphon under the river bed of Qarrishte.
  - Concrete dam with two (12x6) m radial gates, one of with with an (8x1.60) m flap gate for the reception of the flow in Qarrishte.

### Electro mechanical equipment for flow from intakes to the plant:

- 3 x Francis type turbines with a maximum rated power 3.114MW
- 3 x Power Generators 3.780KVA-6.3KV-429rpm each
- 3 x Inlet Valves DN1800 / PN6bar
- 3 x Hydraulic Power Units
- Voltage increase transformer 6.3 / 115KV power 12MVA
- External High Voltage Substation (115KV)

- Medium Voltage General Tables (6.3KV-16KA / 1sec)
- General Low Voltage and Automation Boards

#### Tunnel

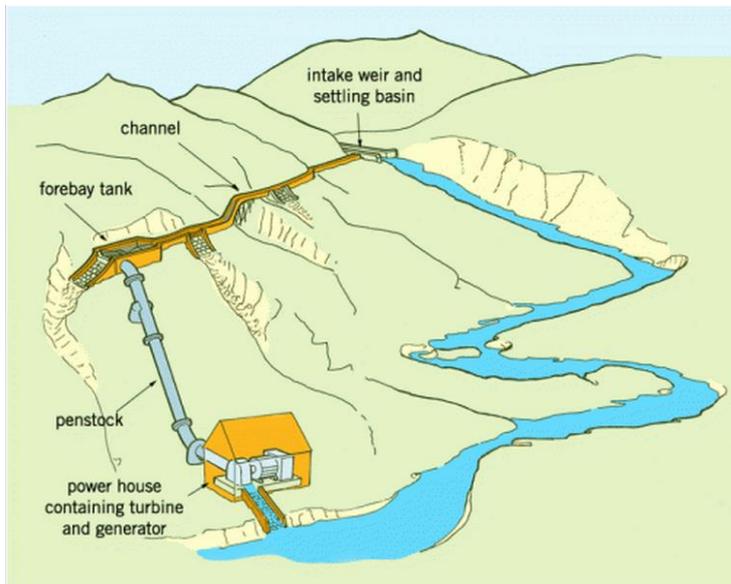
- Arc type tunnel (5x5.15)m and 2.3km long, constructed with drill and blast method
- Construction of adit, 300m long

#### Surge shaft

- 18mØ, 9m high circular tank
- Steel pipe D1800mm and 30m long from the bottom of the tank to the top of the tunnel

#### Power Plant Building

- 830m<sup>2</sup> area
- Equipped with 3 turbines, an erection bay, a control room and electrical panels
- Tower crane with a 30tn lifting capacity and 11.0m span for installation and maintenance
- Erected electricity transformers



#### PROJECT DEMANDS

The construction of such a project required technical support and specialized products through all its phases until completion. High performance site batched concrete types were demanded, with use of natural (river) aggregates – a condition that was difficult to manage and maintain stable in terms of properties. Concrete types included casting fro technical projects, but also shotcrete and concrete for the final lining of the tunnel. Also, such a project posted high watertightness demands and therefore all joints (movement & connection) had to be tightly watertight and sealed.

#### SIKA SOLUTION

In this project, Sika supplied various products for concrete production, joint sealing, watertight joints and concrete repair (refurbishment):

#### CONCRETE & SHOTCRETE PRODUCTION

For all concrete types, natural (river) aggregates were used. Since natural aggregates featured a hard-to-work-with granulometry, achieving mixes pumpable, easy to work with and cast while maintaining their plasticity and workability over time was a major issue. For all concrete & shotcrete mixes, the High Range Water Reducer **Sika® ViscoCrete®-400** was used. **Sika® ViscoCrete®-400** is a 3<sup>rd</sup> generation superplasticizer with high range

water reducing properties that also offers prolonged slump maintenance. **Sika® ViscoCrete®-400** was used for concrete types C30/37 & C35/45 (technical projects), for the concrete of the final lining of the tunnel and for shotcrete production.



For the shotcrete in the tunnel also the alkali accelerator **Sika® Sigunit® L-22 E** was used. **Sika® Sigunit® L-22 E** offers exceptional early strength development, improves adhesion to substrate, reduces rebound and allows for high output.

For the concrete elements of the final lining the demoulding agent **Sika® Separol® N** was used, in order to contribute to easy demoulding, faster cleaning-up process and re-usage of moulds, but also to produce exceptional concrete surface of elements.

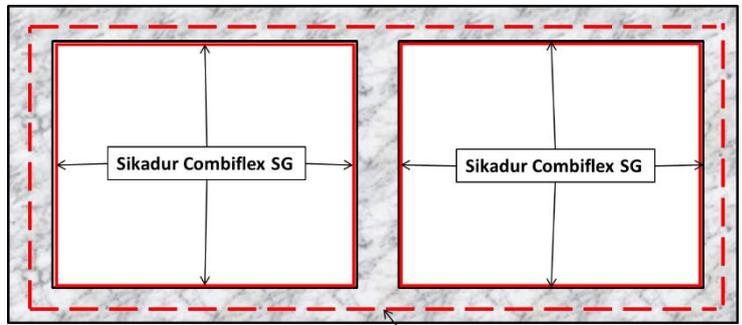


**JOINT WATERPROOFING**

All construction joints of the dam blocks, but also the construction joints of the inlet duct (from the dam to the tunnel) were waterproofed with the hydrophilic sealants and profiles **SikaSwell® S-2 & A** respectively.



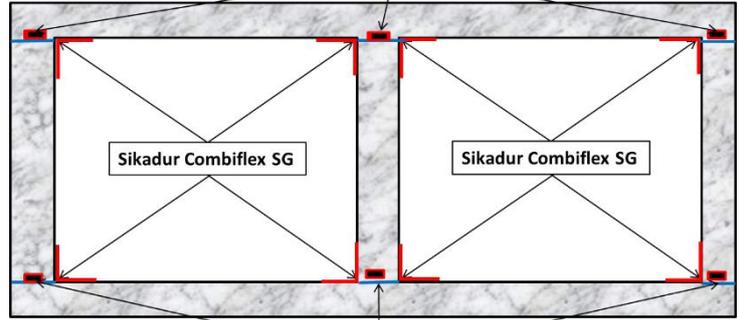
From the specification phase, Sika Albania had a close collaboration with the specifier and supplied designs and details for the waterproofing of all construction and expansion joints. One major issue during the sealing of expansion joints, was the creation of a surface completely smooth, without bumps and protrusions to prevent turbulent flow of water. The demand was to increase the waterproofing properties of the sealed joints, so that the transferred water does not pass and appears under pressure on the surface (the pipeline is buried under the river's floating materials). Therefore, for expansion joints the triple system **Sika® Waterbars (for expansion joints) – Sikaflex®-11 FC+ (polyurethane sealant)- Sikadur-Combiflex® SG System (FPO tape & epoxy resin Sikadur®-31 EF)** was used.



Sika Waterbar O32L

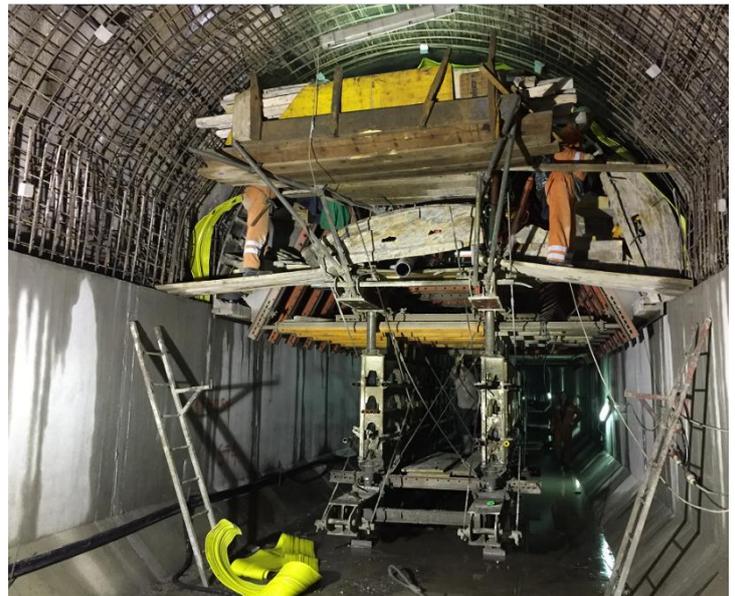
*Sealing of expansion joints, using internally placed Waterbar with valve*

SikaSwell® A-2010



SikaSwell® A-2010

*Sealing of construction joints, using Sikadur-Combiflex SG system and SikaSwell A-2010 profiles*



For the waterproofing of the junction point of the tunnel inlet with the metal pipe ending at the energy generating turbines station the products **Sika® Injection-105-RC** & **Sika® Injection-201-CE**.



**REPAIRS & RIGID BONDING**

**Sikadur®-32 EF** was mainly used in grouting and concreting application to ensure monolithic constructions in the dam (spillway) and in the substation for the placement of the turbines.

**Sika MonoTop® Dynamic HP** (1-component, cementitious mortar, R4 Class acc. to EN 1504-3) was used for general surface repairs along with the 2-component epoxy resin **Sikadur®-31 EF**.



**SIKA PRODUCTS IN VOLUMES:**

- **Concrete & shotcrete production:**

Superplasticizers: Sika® ViscoCrete®-400: **324 tns**

Demoulding agent: Sika® Separol® N: **4,000 lt**

Liquid shotcrete accelerator: Sika® Sigunit® L-22 E: **203 tns**

- **Joint waterproofing:**

Waterbars: Sika® Waterbar®: **15 km**

Clips for Waterbars: **6,750 pcs**

Heating irons for welding of waterbars: **2 pcs**

Swellable sealant: SikaSwell® S-2: **3550 sausages**

Swellable profiles: SikaSwell® A 2010: **19.32 km**

Joint sealing system: Sikadur-Combiflex® SG system (Sikadur-Combiflex® SG tape: **2.75 km** & Sikadur®-31 EF epoxy resin: **3.9 tns**)

Injections: Sika® Injection-105-RC & Sika Injection-201-CE: **250 kg**

- **Elastic joint sealing:**

Polyurethane sealants: Sikaflex®-11 FC+: **1700 sausages**

Primer for PU sealants: Sika Primer®-3 N: **31 lts (7,750 m³)**

- **Refurbishment:**

Cementitious repair mortar: Sika® MonoTop Dynamic: **2 tns**

Resin adhesive: Sikadur®-32 EF: **266 kg**

**PROJECT PARTICIPANTS:**

Owner: **Orthodox Autocephalous Church of Albania**

Main contractor: **C & S ENERGY Sh.p.k.**

Sub-contractor: **Aktor Sh. A.**

EM Equipment: **KOESSLER GmbH**

Hydro technical Equipment: **POSEIDON S.A.**





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