

The Bakun Hydroelectric Project



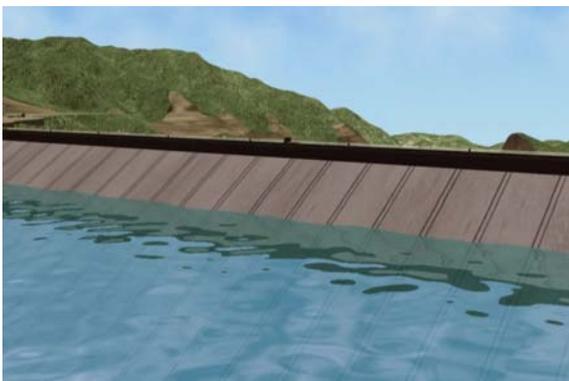
Original Physiognomy of the Bakun HEP

The Bakun Hydroelectric Project is situated on the Balui River, Sarawak, Malaysia. The project is comprised of the construction of a 2,400MW hydroelectric dam, the transmission of its electricity, and the building of related infrastructure including access roads. It is the largest project in Malaysia, and is known as the “Three Gorges Project in Southeast Asia”. Completion of the project is planned for 2006.



Airscape of the Bakun HEP

The powerhouse of Bakun HEP will accommodate eight turbine generator units, giving a total generating capacity of 240MW, which will meet the increasing demand for electricity. This project was first implemented in the beginning of 1990 but was shelved in 1997, due to the Asian Economic Crisis, and was resurrected in 2000.

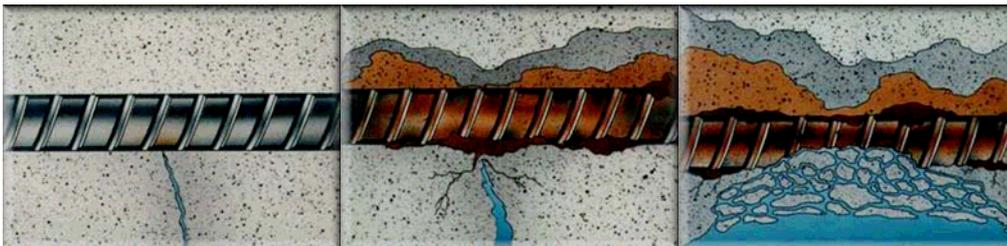


Bakun Dam

The Bakun Project includes a 205-high-meter Concrete Face Rockfill Dam (CFRD) with a crest length of 740 m, a crest width and base of 12 m and 573 m, a concrete open chute spillway of 15000m³/second capacity, power intakes, eight power tunnels with a length of 700 meters and a diameter of 8.5 meters, powerhouse, bottom outlets.

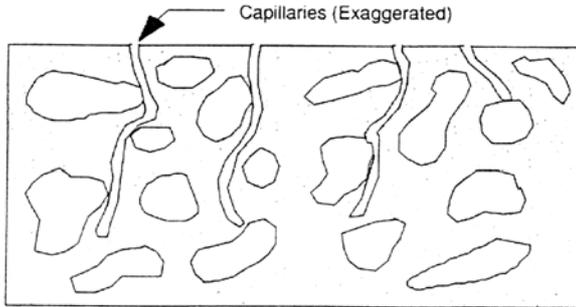
Water & Concrete Deterioration

- Even high quality concrete is a porous material
 - Excess water evaporation during hardening will leave millions of pores and capillaries in concrete
- Porosity of concrete
 - Allows water to move freely throughout the concrete
 - Increases absorption of harmful chemicals
- Moisture and water intrusion
 - Results in chemical corrosion due to the corrosive chemicals dissolved in them
 - Chlorine ion or concrete neutralization (carbonization) can accelerate corrosion of reinforcing steel
 - Freeze/thaw cycles can lead to concrete cracking and other damage
 - Causes alkali-aggregate reaction
 - Reduces structural property
- High speed water current
 - Results in concrete surface abrasion
 - Causes serious cavitations and concrete spalling due to partial low pressure
- Over time any untreated concrete structure will slowly succumb to damage due to the existence of water.



Corrosion of reinforcing steel in concrete

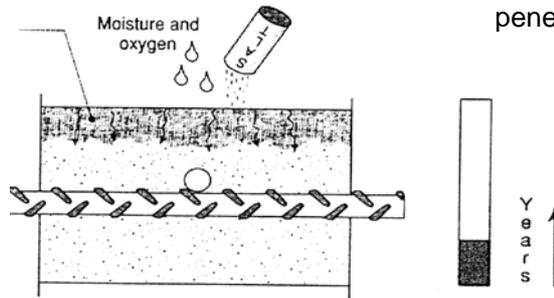
Water & Corrosion of Reinforcing Steel



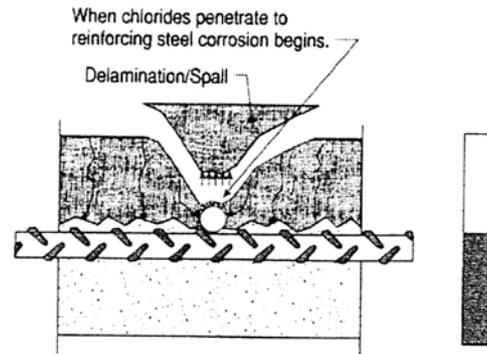
There are millions of pores and capillaries in untreated concrete.

Water and moisture can pass through them and into the concrete. The deleterious chemicals dissolved in them will also penetrate into the concrete.

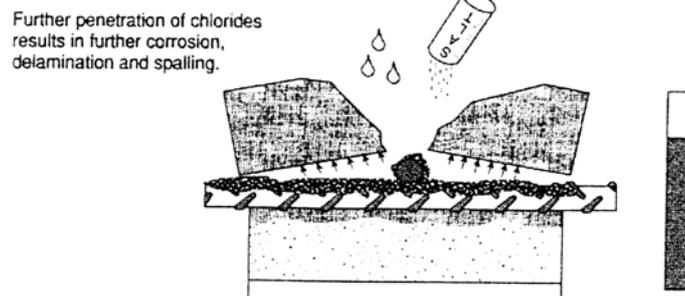
Chlorides penetrate into concrete with the help of surface moisture and water



The penetration of water and harmful chemicals, especially chlorides, results in the corrosion of reinforcing steel.



Concrete eventually fails due to further corrosion, delamination and spalling.



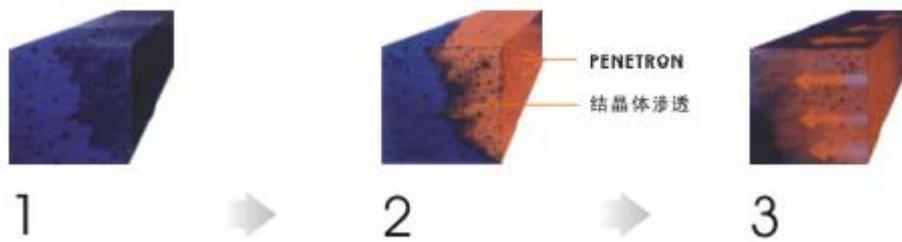
Solution

- Penetron products can effectively stop water and moisture penetration into concrete, and provide the best protection by providing a great improvement in pore structure and porosity reduction
 - Penetron Applied by brush or spray on hardened concrete surface
 - Penetron Plus Dry shake application on horizontal fresh concrete surface
 - Penetron Admix An additive mixed into new concrete at the time of batching for complete integral waterproofing
- Penetron products are cementitious capillary crystalline waterproofing materials
 - Powders consisting of Portland cement, quartz sand and multiple activating chemicals
- Properties meet the requirements of China National Standard GB18445-2001 “Cementitious Capillary Crystalline Waterproofing Materials”

	National requirement	testing results	
-- Initial setting time	≥20min	199min	
-- Final setting time	≤24hrs	5hrs	
-- Flexure strength, 7 days	≥2.8	5.8MPa	
-- Flexure strength, 28 days	≥3.5	6.3MPa	
-- Compressive strength, 7days	≥12.0	24.2MPa	
-- Compressive strength, 28 days	≥18.0	25.9MPa	
-- Adhesion strength, 28 day	≥1.0	1.2MPa	
		I type	II type
-- Impermeability pressure, 28 days	≥0.8	≥1.2	1.3MPa
-- Second impermeability pressure, 56 days	≥0.6	≥0.8	1.1MPa
-- Permeability pressure ratio, 28 days	≥200	≥300	325%

How Penetron products waterproof and protect concrete

- Penetron or Penetron Plus



1 Typical concrete structure with moisture

2 When mixed with water and applied as a coating, the active chemicals in Penetron cause a reaction leading to the formation of non-soluble crystals within the pores and capillary tracts of the concrete

3 The concrete becomes permanently sealed and neither water nor any other liquids are able to penetrate the concrete from any direction

Concrete was saturated with water so that there is an adequate amount of liquid water present to allow movement of chemicals into the concrete pores. The chemicals are pushed into the concrete through the action of diffusion. Under the right conditions, the chemicals can also move into the concrete by seeping water, or by the natural wicking action of the concrete.

Once into the concrete, the chemicals react with un-hydrated cement particles and by-products of cement hydration to form needle-like crystals, which fill and block the pores and capillaries in the concrete. As water can no longer pass through the concrete, the concrete becomes “waterproof”.

In absence of moisture, the activating chemicals remain dormant in concrete for years. If any minute cracks recur, any penetrating moisture will activate the dormant materials, and the chemical reaction and sealing process repeat itself automatically.

- Penetron Admix

Penetron Admix is a unique crystal-forming additive that provides permanent protection for buildings and other structures by waterproofing concrete from the inside out.



Penetron Admix is added to the concrete mix at the time of batching. The activating chemicals of the product react with water, unhydrated cement

particles and by-products of cement hydration in concrete to form needle-like crystals. These crystals grow and migrate through the concrete to fill in hairline cracks and microscopic voids that would otherwise serve as passages for harmful moisture.

Penetron Admix enhances the natural hydration process in concrete by intensifying hydration crystal growth, increasing compressive strength and reducing cracking caused by shrinkage.

In absence of moisture, the activating chemicals remain dormant in concrete for years. Should cracks recur at any time, these dormant materials are activated by any penetrating moisture, and the chemical action and sealing process repeats itself automatically.

Features, Advantages & Benefits of Penetron Technology

- Features and Advantages

-- Penetron Admix

Permanent waterproofing admixture

- Impermeability lasts as long as the concrete
- System becomes an integral part of the concrete
- Does not require re-application

Resists high hydrostatic pressure from either positive or negative surface

- Ideal for below grade application
- Does not need any other form of waterproofing
- Protects against water-borne ground contaminants

Protects reinforcing steel from corrosion

- Highly resistant to water-borne aggressive chemicals
- Stops ingress of water required for AAR
- Allows concrete to breathe, eliminating vapor build-up and leaving the concrete completely dry

Will grow crystals years after initial application

- Will re-activate in the presence of moisture
- Self-heals hairline cracks of up to 0.4mm and stop water ingress that may occur from subsequent damage to the structure
- Continually improves with time

Multi-functional admixture

- Does not contain stearates, sodium or silicates
- Not a hydrophobic type product
- Not a surface densification product
- Assists concrete in the hydration process, acting as a catalyst to un-hydrated cement particles already existing in the concrete
- Water-reducing, increasing workability of fresh concrete
- Increases compressive strength of hardened concrete
- Non-toxic, approved for potable water use

- Penetron or Penetron Plus

In-depth waterproofing property

- Penetrates deeply, and impermeability lasts as long as the concrete
- System becomes an integral part of the concrete, forming a complete body of strength and durability
- Waterproofing and chemical resistance properties remain intact even if the surface is damaged

Completely effective against high hydrostatic pressure

- Ideal for below grade application, reservoirs and pipelines
- Does not require protection during backfilling, placement of steel or wire mesh and other common procedures
- Protects against water-borne ground contaminants

Protects reinforcing steel from corrosion

- Resists chemical attack (PH3-11 constant contact; PH2-12 periodic contact) and provides a wide range of protection from freeze/thaw cycles, aggressive waters, sea water, carbonates, chlorides, sulfates and nitrates
- Stops ingress of water required for AAR
- Allows concrete to breathe, eliminating vapor buildup and leaving the concrete completely dry

Will grow crystals years after initial application

- Will re-activate in the presence of moisture
- Self-heals hairline cracks of up to 0.4mm and stops water ingress that may occur from subsequent damage to the structure
- Continually improves with time

Efficient and simple application method

- Can be applied from either the positive or negative side
- Can be applied to moist or green concrete
- Can be used for new or existing concrete
- Compatible with water-based glues and surface coatings

High-growth technology

- Zero VOC
 - Does not contain stearates, sodium or silicates
 - Not a hydrophobic type product
 - Not a surface densification product
 - Non-toxic
 - Approved for portable water use
- Benefits of Penetron Technology

-- Penetron Admix

Benefits to Property Owners

- Cost effective
- Lowers overall project costs
- Permanent waterproofing system
- Requires no maintenance
- Increases the quality of the concrete for structural performance and integrity
- Increases usage of infrastructure
- Eliminates down-time and costs associated with maintenance and repairs
- Reduces project time requirements
- Long-term manufacturer's warranty
- Manufacturer's history of international success in varying climatic & environmental conditions

Benefits to Contractors

- Unmatched technical support
 - Reduces application errors associated with installation of other systems
 - Improves pouring and placement of concrete
 - Eliminates construction delays due to elimination of traditional waiting period to install membranes on cured concrete
- Penetron or Penetron Plus

Benefits to Property Owners

- Cost effective
- Lowers overall project costs

Integral Capillary System Concrete Waterproofing

- Permanent waterproofing system
- Requires no maintenance
- Long-term manufacturer's warranty
- Manufacturer's history of international success in various climatic & environmental conditions

Benefits to Contractors

- Unmatched technical support
- Reduces application errors associated with installation of other systems
- Eliminates risk associated with membrane failure
- Requires no protective cement mortar in comparison with other systems

Comparison of Penetron Products to Other Waterproofing Systems

	Penetron Penetron Plus	Penetron Admix	Membranes (Positive Side)	Other Surface Applied Products
Description	Cementitious material applied on concrete surface to transfer needle-like crystals to infiltrate the concrete mass	Cementitious material added into fresh concrete to form needle-like crystals within the concrete mass	Liquid and sheet applied bitumens and polymers affixed to the concrete surface	Materials applied to concrete surface containing mainly water repellents and sealants
Resistance to hydrostatic water pressure	<ul style="list-style-type: none"> Improves with time Resistance to exceeding 150m head pressure Withstands 3Mpa in permeability test 	<ul style="list-style-type: none"> Improves with time Continuous self-healing ability Initiates full hydration 	<ul style="list-style-type: none"> Protection breached by any pinhole or seam Once leaking, will require replacement 	<ul style="list-style-type: none"> Reduces initial absorption but will deteriorate with time Limited penetration leads to poor resistance to hydrostatic pressure
Protection of reinforcing steel	<ul style="list-style-type: none"> Prevents corrosion of reinforcing steel by stopping passage of water and chlorides 	<ul style="list-style-type: none"> Permanent protection Prevents any permeation of water and chlorides 	<ul style="list-style-type: none"> No negative side protection Easily leaks at the joints and seams 	<ul style="list-style-type: none"> No negative side protection Limited protection as it slows the water ingress in uncracked areas
Crack self-healing ability	<ul style="list-style-type: none"> Will re-activate in the presence of moisture to seal new cracks even years later 	<ul style="list-style-type: none"> Will re-activate in the presence of moisture to seal new cracks even years later 	<ul style="list-style-type: none"> No self-healing ability 	<ul style="list-style-type: none"> No self-healing ability
Crack resistance	<ul style="list-style-type: none"> Rigid material, can not bear excessive transformation, but self heals minor cracks of up to 0.4mm 	<ul style="list-style-type: none"> Reduces cracking in plastic and curing stage Self heals minor cracks of up to 0.4mm in the presence of moisture 	<ul style="list-style-type: none"> Can bear excessive transformation Limited time protection at existing cracks locations 	<ul style="list-style-type: none"> No crack resistance Temporarily fills existing cracks
Freeze/thaw durability	<ul style="list-style-type: none"> Improves durability by removing water within concrete Eliminates water penetration at cracks 	<ul style="list-style-type: none"> Improves durability by removing water within concrete Eliminates water penetration at cracks 	<ul style="list-style-type: none"> Slow deteriorating factors initially 	<ul style="list-style-type: none"> Slow deteriorating factors initially No durability at crack locations
Repair requirement	<ul style="list-style-type: none"> Permanent waterproofing protection, does not need repair 	<ul style="list-style-type: none"> Easily repaired from positive or negative side Wide range of options are available Repairs are cost effective 	<ul style="list-style-type: none"> Difficult to repair Difficult to locate pinholes and poor joints May require total removal & repair Expensive and sometimes impossible due to accessibility 	<ul style="list-style-type: none"> Repairs may require removal of previous materials

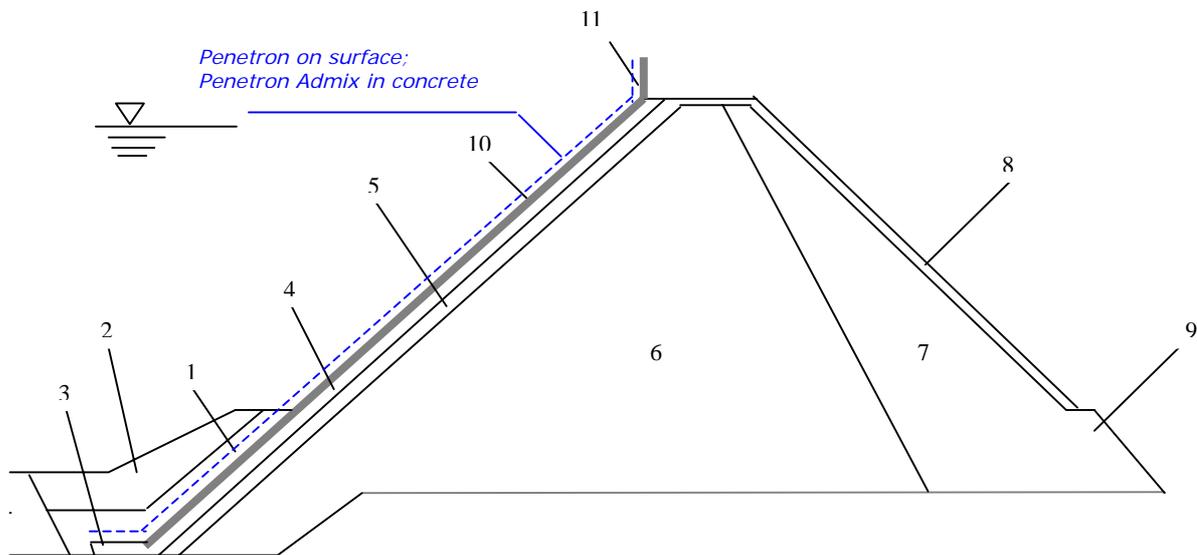
Integral Capillary System Concrete Waterproofing

	Penetrone Penetrone Plus	Penetrone Admix	Membranes (Positive Side)	Other Surface Applied Products
Application	<ul style="list-style-type: none"> Applied by brush/ spray to positive or negative side of old/new concrete Or, dry shake application on horizontal fresh concrete surface 	<ul style="list-style-type: none"> Mixed at batch plant or on-site No additional applications required 	<ul style="list-style-type: none"> Liquids: brush application Sheets: glued or welded to the concrete surface Correct joints and seams critical to performance 	<ul style="list-style-type: none"> Only applied to positive side Substrate profile critical to performance
Surface preparation	<ul style="list-style-type: none"> Needs coarse, water saturated, clean surface for brush or spray No surface prep for dry shake 	<ul style="list-style-type: none"> No surface preparation 	<ul style="list-style-type: none"> Clean surface Dry surface Smooth surface 	<ul style="list-style-type: none"> Needs surface prep depending on products requirements
Construction schedule	<ul style="list-style-type: none"> Can be applied during concrete finishing or anytime following 	<ul style="list-style-type: none"> Added into fresh concrete at the time of batching Saves 10-50% time and construction costs 	<ul style="list-style-type: none"> Must be applied at completion of structural work Require protective cement mortar 	<ul style="list-style-type: none"> Some require 28 days cured concrete Similar scheduling as membranes
Effective land usage	<ul style="list-style-type: none"> Can be applied to the negative side of concrete allowing construction tight to property lines 	<ul style="list-style-type: none"> Can build tight with property lines 	<ul style="list-style-type: none"> Spaces required between property line and concrete for membrane installation 	<ul style="list-style-type: none"> Spaces required between property line and concrete for surface application
Sub-surface drainage system	<ul style="list-style-type: none"> Not required 	<ul style="list-style-type: none"> Not required 	<ul style="list-style-type: none"> Require drainage under high hydrostatic pressures 	<ul style="list-style-type: none"> Require drainage under high hydrostatic pressures
Additional coatings	<ul style="list-style-type: none"> Can be finished with coatings, tiles, etc. 	<ul style="list-style-type: none"> Does not affect coatings Adhesion excellent for coatings or tiles 	<ul style="list-style-type: none"> Require protective mortar prior to surface finishes 	<ul style="list-style-type: none"> May require special preparation prior to surface finishes
Maintenance	<ul style="list-style-type: none"> Not only as a surface coating Maintenance not required 	<ul style="list-style-type: none"> Maintenance not required for the life of the concrete 	<ul style="list-style-type: none"> Costly replacement generally required 	<ul style="list-style-type: none"> Re-application required under hydrostatic conditions
Service life	<ul style="list-style-type: none"> Permanent and improves with time 	<ul style="list-style-type: none"> Life time of concrete 	<ul style="list-style-type: none"> Become brittle with age resulting in cracks and openings Surface damage will eliminate protection 	<ul style="list-style-type: none"> Best when first applied Deteriorate with time Vulnerable to surface damage

Proposal for Waterproofing of Concrete by Application of Penetrator Products for the Bakun Hydroelectric Project

- Proposal for Bakun CFRD

Concrete self-waterproofing treatment + Concrete surface waterproofing treatment



Waterproofing treatment for CFRD

- | | | |
|----------------------------|---------------------------|---------------------------------|
| 1 Upstream Blanket Area | 2 Repetition Blanket Area | 3 Upstream Toe Slab |
| 4 Cushion Layer | 5 Transition Zone | 6 Main Rockfill Area |
| 7 Downstream Rockfill Area | 8 Downstream Slope | 9 Downstream Toe of Filter Zone |
| 10 Concrete Face Slab | 11 Upstream Wave Wall | |

-- Concrete self-waterproofing treatment

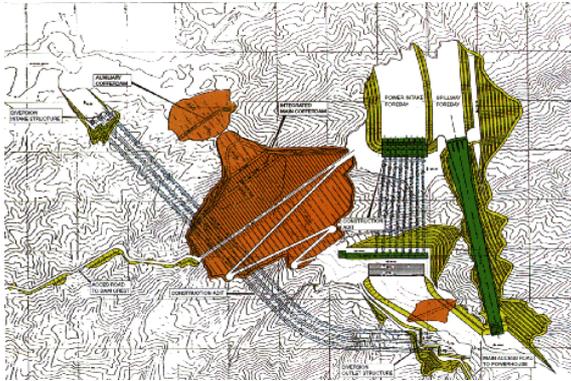
Penetrator Admix is added into all upstream concrete at the time of batching for complete integral waterproofing.

-- Concrete surface waterproofing treatment

Penetrator is applied on the surface of concrete face slab, toe slab and upstream wave wall by brush or spray.

- Proposal for other auxiliary structure

- Spillway



The spillway is composed of a gated ogee, an open concrete chute, a flip bucket and a plunge pool. The ogee, with crest elevation of 209 meters, is divided into four 15-meter-wide bays separated by 6.5-meter-wide piers.

The flip bucket and plunge pool are designed to safely discharge the floodwater away from the toe of the dam and the powerhouse. The flip bucket is designed to be stable under the hydrodynamic forces applied to it by the discharge flows, and the plunge pool is designed to control the erosive forces of the discharged waters. Its sides will be protected with a concrete slab anchored in the rock.

All concrete structures of the spillway contacting with water are recommended:

Concrete self-waterproofing treatment: Penetrator Admix is added into the fresh concrete at the time of batching for complete integral waterproofing.

- Water Conductors

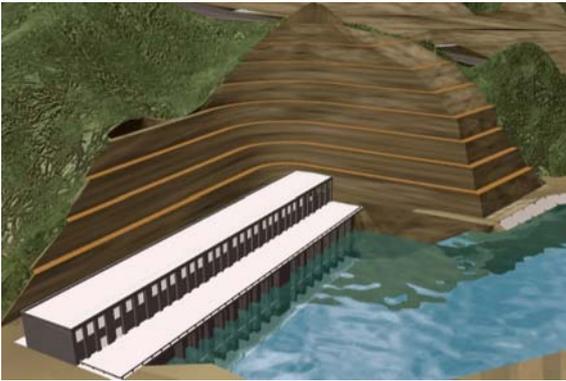


The water conductors include the power intakes, the pressure shafts and tunnels. The eight power intakes are joined together and located in an excavation next to the spillway, in the left abutment of the dam. The eight pressure shafts and tunnels convey the water from the intake to the turbines in the powerhouse.

All concrete structures of the water conductor contacting with water, or below grade, are recommended:

Concrete self-waterproofing treatment: Penetrator Admix is added into the fresh concrete at the time of batching for complete integral waterproofing.

-- Powerhouse

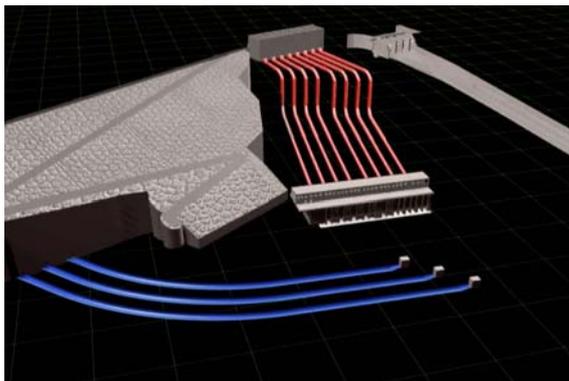


The powerhouse will be of the surface type, located on the left bank of the river, near the toe of the dam but separate from it. The powerhouse will provide enough space to install and later operate all the equipment necessary to generate energy using an installed capacity of 2,400 MW. The substructure of the powerhouse will be founded on sound rock.

Waterproofing of concrete slab of the powerhouse is recommended:

Concrete self-waterproofing treatment: Penetron Admix is added into the fresh concrete at the time of batching for complete integral waterproofing.

-- River Diversion Works



The diversion will consist of upstream and downstream cofferdams, three river diversion tunnels and other ancillary structures.

Three 12-metre internal diameter diversion tunnels, approximately 1400 metres long, will be used to evacuate the floodwater during construction. The tunnels will be stabilized using rock bolts and drain holes as well as through a process of consolidation grouting and concrete lining. The concrete lining will also contribute to the safety of the tunnels, protecting the rock excavation against erosion due to the high flow velocities. One of the tunnels will be converted to a bottom outlet after construction of the project. The outlet structures are designed to protect the tunnels from retrogressing erosion.

We recommend that Penetron Admix be added to the concrete lining at the time of batching:

Concrete self-waterproofing treatment: Penetron Admix is added into the fresh concrete at the time of batching for complete integral waterproofing.

- Application of Penetron

- Surface Preparation

The concrete surface must be structurally sound and free of dirt, soil, oil, release agents, laitance or any other foreign materials which may impair the bond, penetration and/or overall performance of Penetron materials.

Extremely smooth concrete surface must be water-blasted or sandblasted to make sure the concrete surface has an open capillary system.

Rout out visible cracks exceeding 0.4mm in size to a depth of 20mm to 25mm. Also rout out honeycombed pockets and faulty construction joints to sound concrete. Construction joints are routed or provided with a formed 20mm*20mm reglet.

Wet down dry surfaces prior to the application of Penetron materials. Moisture must be present in the concrete strata to ensure maximum chemical penetration. Surfaces must be damp when Penetron products are applied.

- Mixing

Brush application: 0.8-1.5kg/m², 5 parts Penetron to 2 parts water

Spray application: 0.8-1.5kg/m², 5 parts Penetron to 2.75-to-3.25 parts water (varies with climate and spray equipment)

Penetron should be mixed to the consistency of thick latex paint. Stir the slurry mixture frequently during the application and prepare only as much as can be applied within a 30-minute period.

- Application

Apply Penetron coating by masonry-type brush (artificial fibers, if available). For spray application, drop hopper or piston pump type equipment is recommended.

Prior to application of Penetron coatings, fill form tie holes, rout out cracks, honey bombs, reglets and seal strips at construction joints with Penecrete Mortar in laminating layer of 2.5cm to 3cm. Prime concrete surface of these areas with one slurry coat of Penetron prior to applying Penecrete Mortar.

Penetron slurry must be applied to damp concrete surface. Second coat should be applied when first coat is dry to the touch. A light misting of water may be required between coats in hot/dry climates.

Horizontal concrete surfaces: Apply Penetron slurry in one coat with stiff bristle brush/broom or squeegee.

Dry sprinkle Penetron or Penetron Plus on "still plastic" concrete by broadcasting or with a fine mesh sieve in the specified quantities. Work the slab surface with wood flat or power trowel until required finish has been achieved.

-- Coverage

Horizontal concrete surface: Penetron at 1.4 to 1.6kg/m². Apply in one slurry coat or powder application when concrete reaches initial set. Trowel or float to specified finish. Penetron Plus powder application at 0.5kg/m² when concrete reaches initial set. Trowel or float to specified finish.

Vertical concrete surfaces: Penetron at 1.4 to 1.6kg/m². Apply in two coats (0.8kg.per coat).

-- Curing

Except for extremely hot weather and very low humidity, curing of the Penetron system is not required. In these extreme conditions curing, using a light water misting, must begin as soon as the Penetron coating has hardened sufficiently. Under most conditions it is sufficient to mist the areas treated with Penetron three times a day for the first day. In extremely hot climates spraying may be required more frequently and for several days.

Penetron Plus (trowel applied): Follow concrete specifications for curing procedures.

-- Temperature requirement

Penetron system can be applied in coating or in mortar form when the temperature is above 32 degrees Fahrenheit or 0 degrees Centigrade.

Penetron Plus (trowel applied) can be applied in temperatures where concrete can be placed. Follow concrete specifications for protection requirements according to standard concrete procedures.

- Application of Penetron Admix

- Dosage rate

Penetron Admix: 0.8%-1% by weight of the cementitious materials, including fly ash, silica fume, etc.

Note: Under certain conditions the dosage rate may have to be increased to 2%-3%, depending on the quantity and type of total cementitious materials.

- Application

Ready Mix Plant-Dry Batch Operation: Add Penetron Admix in powder form to the drum of the ready-mix truck. Drive the truck under the batch plant and add 60%-70% of the required water along with 136-227kg of aggregate. Mix the materials for 2-3 minutes to ensure the Admix is distributed evenly throughout the mix water. Add the balance of materials to the ready-mix truck in accordance with standard batch practices.

Ready Mix Plant- Central Mix Operation: Mix Penetron Admix with water to form a very thin slurry (e.g., 18kg of powder mixed with 22.7 liters of water). Pour the required amount of material into the drum of the ready-mix truck. The aggregate, cement and water should be batched and mixed in the plant in accordance with standard practices (taking into account the quantity of water that has already been placed in the ready-mix truck). Pour the concrete into the truck and mix for at least 5 minutes to ensure even distribution of Penetron Admix throughout the concrete.

Precast Batch Plant: Add Penetron Admix to the rock and sand, and mix thoroughly for 2-3 minutes before adding cement and water. The total concrete mass should be blended using standard practices.

- Note

Penetron Admix is compatible with other water-reducing admixtures and superplasticizers.

Retardation of set may occur when using Penetron Admix. Trial mixes should be carried out under project conditions to determine setting time. Once the concrete mix design is determined, without testing any adjustment of the dosage rate is prohibited.

Project Case History

	<p>Glen Canyon Dam in Arizona, U.S.A.</p> <p>Shotcrete containing Penetron Admix was applied to the utility tunnels to stop infiltration of ground waters and slow the aging process of this structure.</p>
	<p>Kiambere Hydroelectric Generation Project, Kenya</p> <p>Walls of the Power Generation House continued to leak at 137 meters below ground level. Leaks sealed with Penetron.</p>
 <p>Dam Skalka APP PATCHING MATL APP MAINT OF DAM INT & EXT PROJ DAM SKALKA</p>	<p>Skalka Dam Project,</p>
	<p>Daugava Dam, Latvia</p>

Pre Casting Inspection Report

Project: _____

Type of Structure: _____

Section Identification: _____

Date of Inspection: _____

Date of Proposed Casting: _____

Curing Proposed? Yes/No Curing Period _____ Days

Curing Type: Water Burlap (Wetted) Plastic

 Sand/Water Chemical (Note Brand or Type)

Site Condition Report:

Construction Debris Removed Yes/No

Formwork Clean and Sound Yes/No

Rebar Clean, Secure (well tied) Yes/No

Construction Joints Prepared Yes/No

General Site Conditions: _____

Casting Surface- Construction Joint/ Lean Concrete/ Plastic Sheeting/Packed Earth/ Formwork/ Other _____

Evidence of Ground Water Flow or Seepage? _____

Surface Water Runoff or Drainage Points Created? _____

Waterbar Installed Yes/No Type _____

Condition of Waterbar Installation: _____

Nature and location of all defects to be described in detail

Inspected by: _____

Witnessed by: _____

Post Casting Inspection Report

Project: _____

Type of Structure: _____ Volume of Concrete: _____

Cast Section Identification: _____

Date of Inspection: _____

Date of Casting: _____

Date of Formwork Removed: _____

Curing Applied? Yes/No Curing Period _____ Days

Curing Type:	Water	Burlap (Wetted)	Plastic
	Sand/Water	Chemical	Formwork

Condition Report:

Evidence of Honeycombing? Yes/No/Photo

Evidence of Cracking? Yes/No/Photo

Evidence of water leakage? Yes/No/Photo

Exposed rebar Yes/No/Photo Tie Bolt Holes Yes/No/Photo

Finish Surface Condition: _____

Waterbar Installed Yes/No

Condition of Waterbar Installation: _____

Is it continuous? _____

Re-welding required? _____ Cleaning required? _____

All defects to be described in detail, including location, extent, apparent depth, etc.

Inspected by: _____

Witnessed by: _____

Inspection Report of Penetron Application

Project: _____

Application Section: _____

Client: _____

Contractor: _____

Date of Inspection: _____

Before-Application Inspection:

Surface Repair:	Crack repair	[]
	Spalling repair	[]
	Void repair	[]
	Construction debris removed	[]
Smooth Surface Treatment:	Sandblast	[]
	Acid Etch	[]
	Waterblast	[]
	Scabbling	[]
Final Wash-down (High pressure water)		[]

Comments on surface preparation: _____

During-Application Inspection:

Mixing Product:	Mix water quality	[]
	Mix rater	[/]
	Application rate	[kg/m ²]
	Number of coats	1[] or 2 []
	Application by brush	[]
	Or spray	[]

After-Application Inspection:

Observe and comment on consistency of application:

Thickness: _____

Coverage: _____

Joints: _____

Overlap: _____

Penetration: _____

Curing Program:

Water fogging [] times per day, for [] days

Volume of product used in this section: [] kgs]

Surface area treated [] m²]

Comments: _____

Inspected by:

Date: