

SIKA WATERTIGHT CONCRETE CONSTRUCTION

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SIKA SERVICES AG / TARGET MARKET CONCRETE

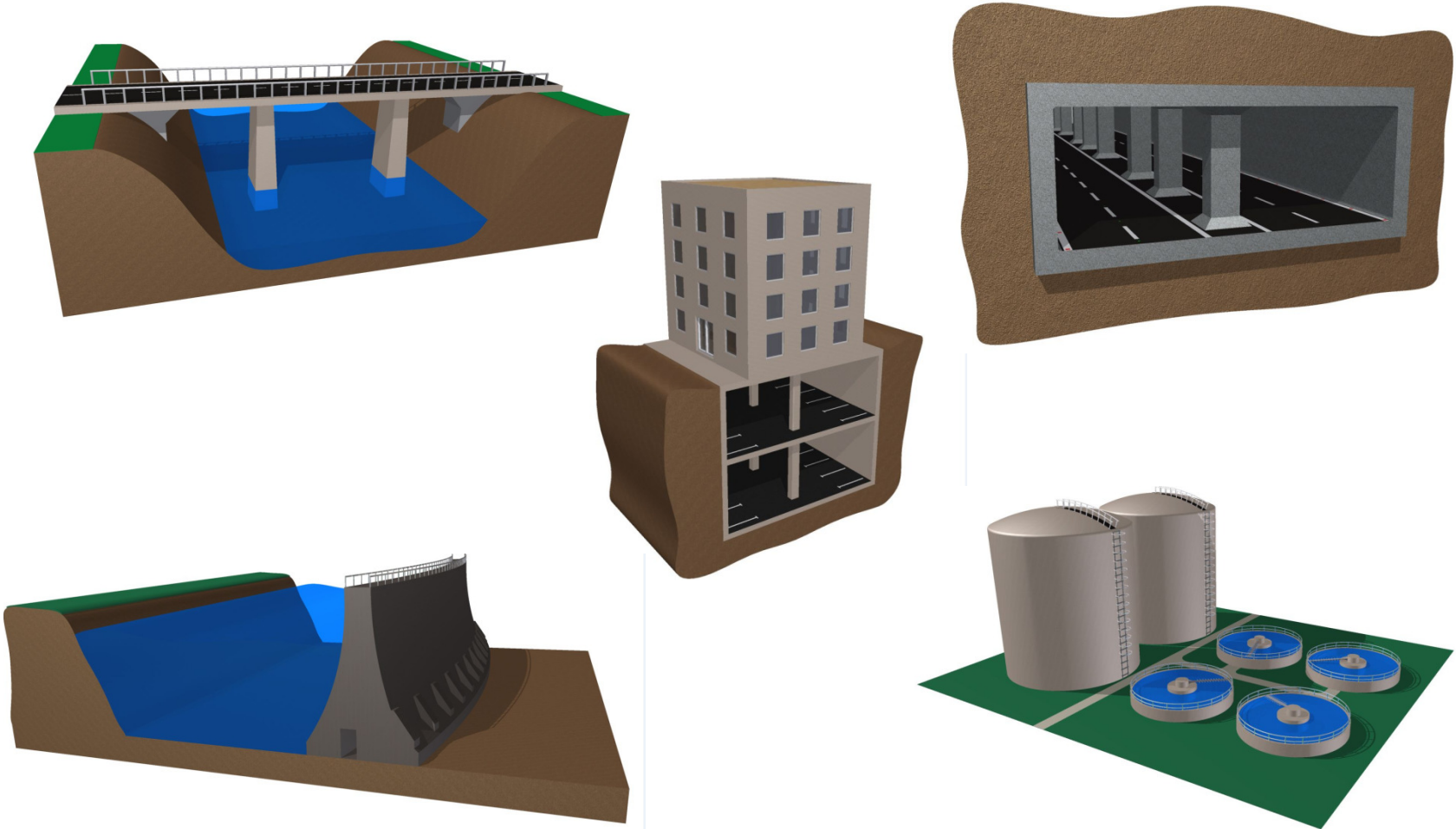
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WATERTIGHT BUILDINGS AND STRUCTURES ARE NEEDED TO.....

- Keep water in or out or both
- Protect the concrete structure from aggressive environments such as chlorides, freeze thaw, sulfates, sea water or other chemicals
- Prevent freeze-thaw attack and damage
- Prevent contamination or pollution of the environment
- Store clean or dirty water

TYPES OF CONCRETE BUILDINGS AND STRUCTURES THAT ARE DESIGNED AND BUILT TO BE WATERTIGHT.....



WATERTIGHT STRUCTURES BELOW GROUND STRUCTURES



General Categorization

- Parking garages
- Equipment / Plant Rooms
- Habitable environments
- Archives

MONTEVETRO, GOOGLE EUROPEAN HQ, DUBLIN, IRELAND

SIKA WATERTIGHT CONCRETE



Project Description

Montevetro is one of the tallest commercial buildings in Dublin. It comprises 19,500 square metres of prime office space spread over 15 floors, and is located on the water's edge on the Grand Canal Basin in Dublin. The development is owned by Google and is part of its European headquarters.

Sika Solution

To ensure a dry environment in the basement car park, consulting engineers Arup specified the Sika® Watertight Concrete.

UNDERGROUND MANSION, LONDON, UK

SIKA WATERTIGHT CONCRETE



Project Description

A P Arcon Construction Limited constructed an exciting new, partly subterranean mansion, on a strip of previously vacant land between two existing buildings in Kensington, London. The main bedrooms, entrance and garage space are built above ground, but the main living, entertainment and swimming pool areas are underground.

Requirements

It was essential to construct a watertight structure that provided a habitable environment. It was also essential to make maximum use of the limited space available between the existing buildings on either side.

UNDERGROUND MANSION, LONDON, UK

SIKA WATERTIGHT CONCRETE



Sika Solution

For these reasons, A P Arcon chose the Sika Watertight Concrete System to construct the below ground shell of the building. Close to 1,000 cubic meters of Sika Watertight Concrete were supplied by Heidelberg Cement - Hanson Concrete. Around 1,200 skips of soil weighing around 10 tons each had to be excavated to create the working space.

Project Participants

Owner: A P Arcon Construction Limited

Architect: Jones Lambell Architects

Contractor: A P Arcon Construction Limited

Concrete Supplier: Heidelberg Cement - Hanson Concrete

WATERPROOFING MATERIALS AND TYPES

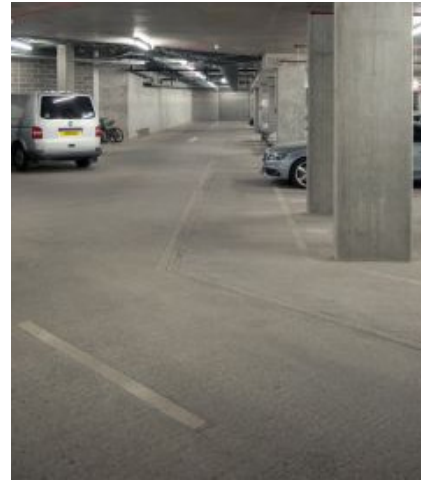
MODERN WATERPROOFING MATERIALS



Synthetic Sheet Membrane



Liquid Applied Membrane



Watertight Concrete



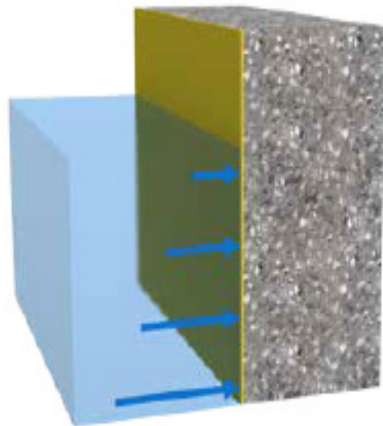
Cavity Drain

WATERPROOFING MATERIALS AND TYPES

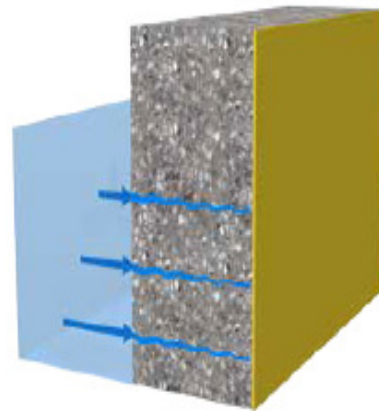
WATERPROOFING TYPES

Different waterproofing concepts for reinforced concrete structures are designed to function in different ways:

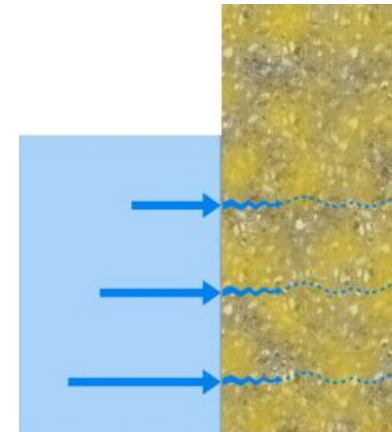
External barriers



Internal barriers



Integral barriers





SIKA WATERTIGHT CONCRETE CONSTRUCTION CONCRETE TECHNOLOGY



- Cement
 - Minimum Binder Content:
350 kg/m³
 - Maximum SCM:
40% (GGBS & Fly Ash)



- Water
 - Maximum water cement ratio:
0.45

SIKA WATERTIGHT CONCRETE CONSTRUCTION CONCRETE TECHNOLOGY



- Aggregates
 - Use concrete mix designs with maximum size of approximately 32mm
 - Select a balanced particle-size distribution curve
 - Recycled aggregate should not be used



- Additions
 - Use specific additions for systematic improvement of the concrete properties as required

SIKA WATERTIGHT CONCRETE CONSTRUCTION CONCRETE TECHNOLOGY



- Fresh concrete properties
 - Easy to pour
 - Save to compact
 - Easy to finish



SIKA WATERTIGHT CONCRETE CONSTRUCTION CONCRETE TECHNOLOGY



- Admixtures
 - A superplasticiser is required to ensure water cement ratio and initial flow and workability over time
 - Sika® WT to ensure watertightness

SIKA WATERTIGHT CONCRETE CONSTRUCTION

SUMMARY OF TEST METHODS

Required test method and limits for Sika® Watertight Concrete

Test Method	Standard	Sika® Limit
Water penetration depth	EN12390-8	< 30 mm
Water conductivity	SIA 262/1 Annex A	< 6 g/m ² x hour
Drying shrinkage	SIA 262/1 Annex F	< 0.05%

SIKA WATERTIGHT CONCRETE CONSTRUCTION TESTING METHODS



Water Penetration

- Water penetration under hydrostatic pressure the water permeability limit for watertightness is defined as a maximum water penetration into the concrete under a specific pressure over a defined period
- Water penetration under hydrostatic pressure (according to EN 12390 – 8: **72 hours with 5 bar**)

SIKA WATERTIGHT CONCRETE CONSTRUCTION TESTING METHODS



Control / Blank

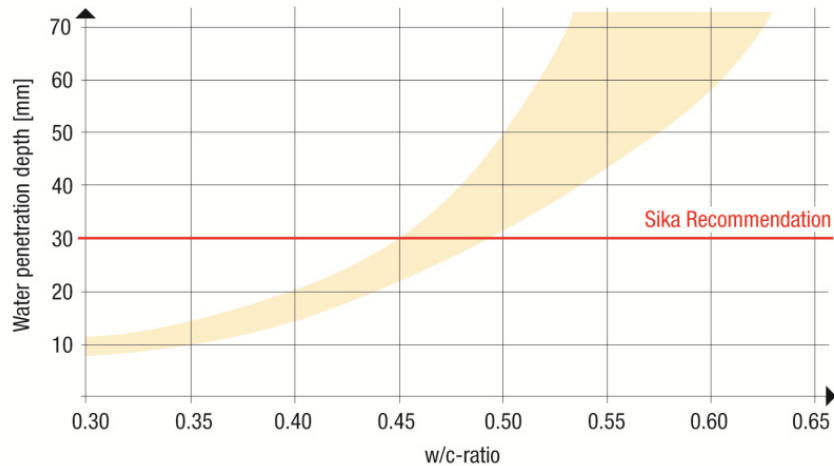
Water penetration under hydrostatic pressure (according to EN 12390 – 8: 72 hours with 5 bar



Sika® WT

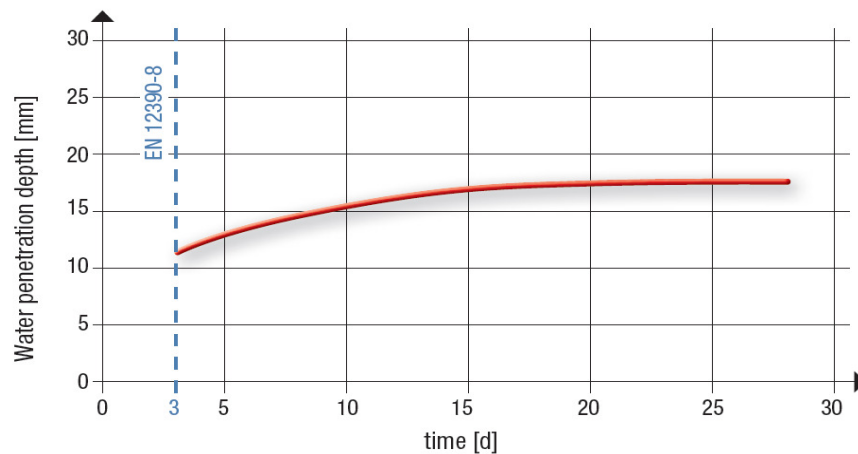
Water penetration under hydrostatic pressure (according to EN 12390 – 8: 72 hours with 5 bar

SIKA WATERTIGHT CONCRETE CONSTRUCTION TESTING METHODS



Water Penetration – Sika Defined Limit

- Water penetration under hydrostatic pressure (according to EN 12390 – 8: 72 hours with 5 bar)
- **Maximum 30mm**
(Limit shown by red line)



Water Penetration – 28 Days

- Water penetration under hydrostatic pressure (according to EN 12390 – 8: 28 days with 5 bar)
- Penetration stabilises over time
(Shown by red line)

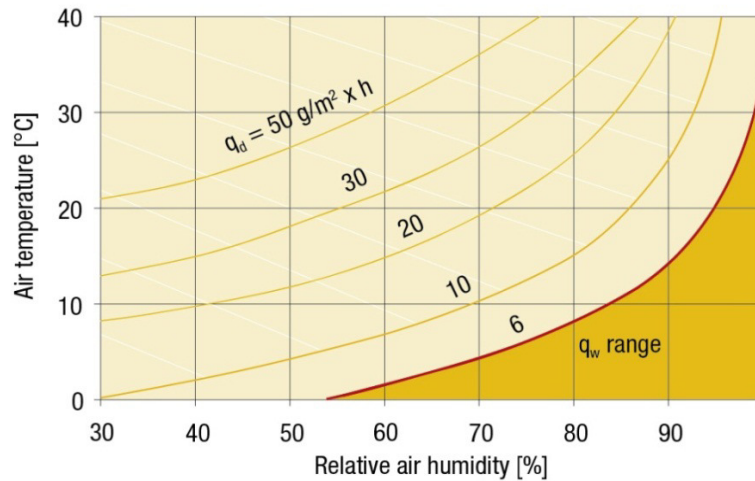
SIKA WATERTIGHT CONCRETE CONSTRUCTION TESTING METHODS



Water Conductivity

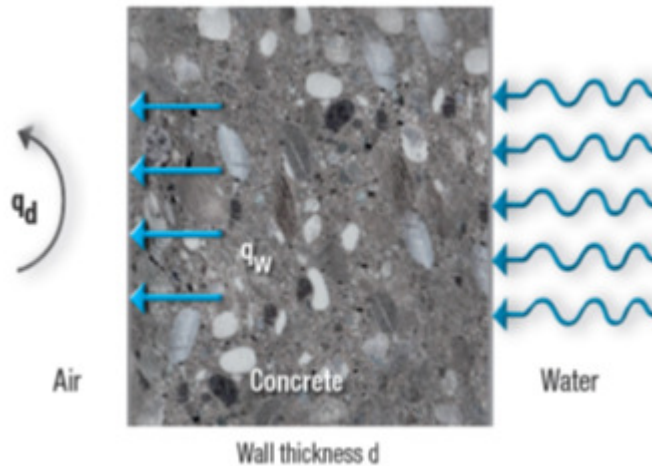
- Water conductivity of wet concrete surfaces the water permeability limit for watertightness is defined as $g/m^2 \times h$, where water permeability is smaller than vapour volume of water without pressure over a defined period
- Water conductivity (SIA 262/1)

SIKA WATERTIGHT CONCRETE CONSTRUCTION TESTING METHODS

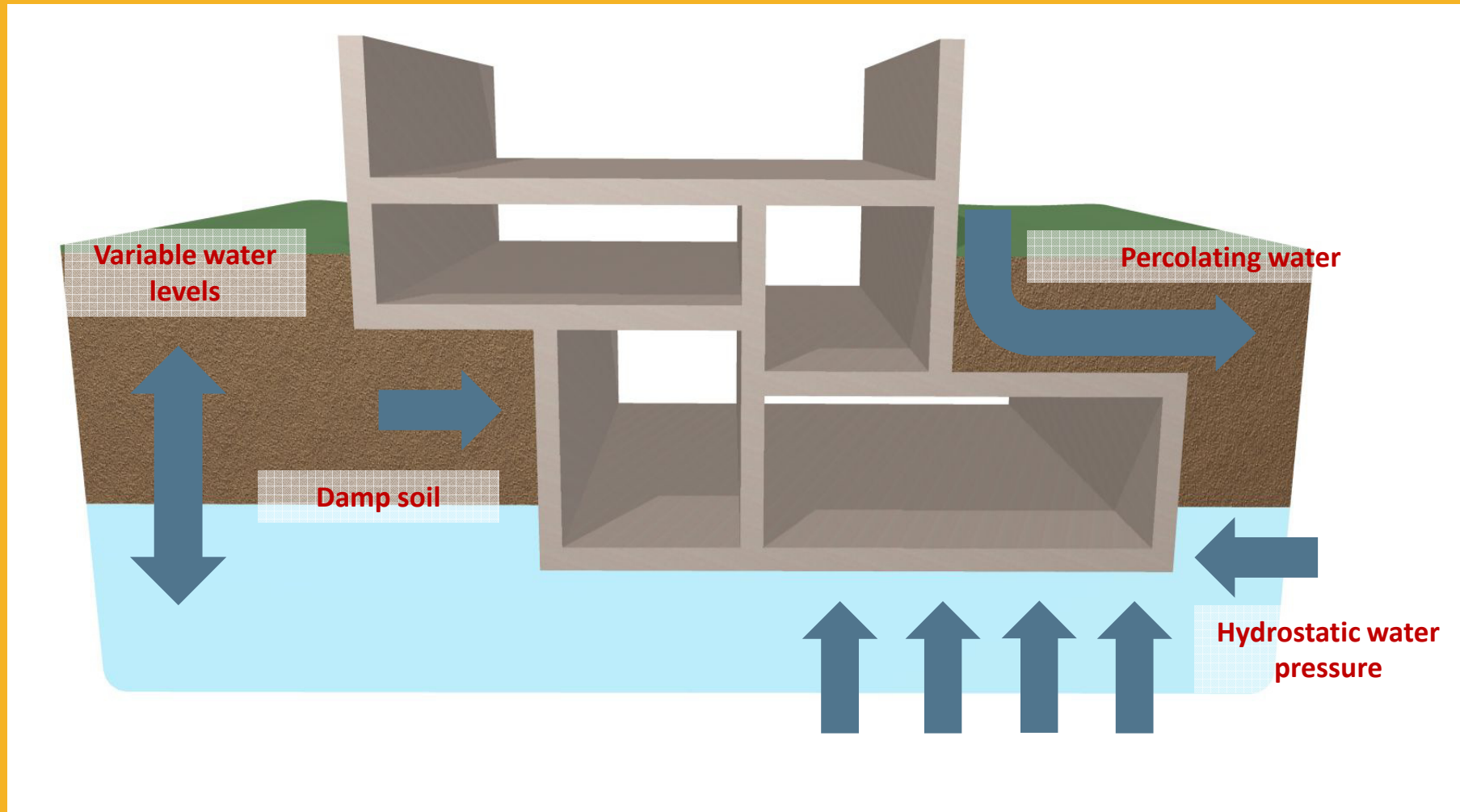


Water Conductivity – Sika Defined Limit

- Water conductivity (SIA 262/1)
- **Maximum $6\text{g/m}^2 \times \text{hour}$**
(Limit shown by red line)

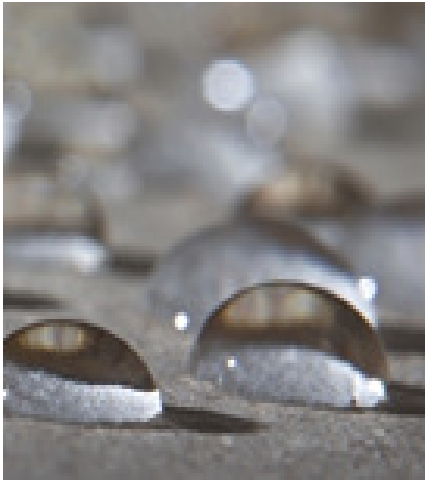


SIKA WATERTIGHT CONCRETE SATISFIES ALL CONDITIONS



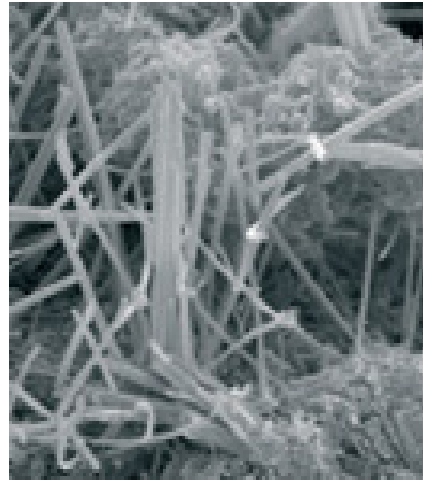
SIKA WATERTIGHT CONCRETE CONSTRUCTION

SIKA SOLUTIONS FOR WATERTIGHT CONCRETE



Sika® WT-100 Series

- Based on hydrophobic and pore blocking technology
- Develops polymer barriers inside pores during the hydration process



Sika® WT-200 Series

- Based on crystalline technology (self healing)
- Non-soluble crystalline structure formation in the capillaries

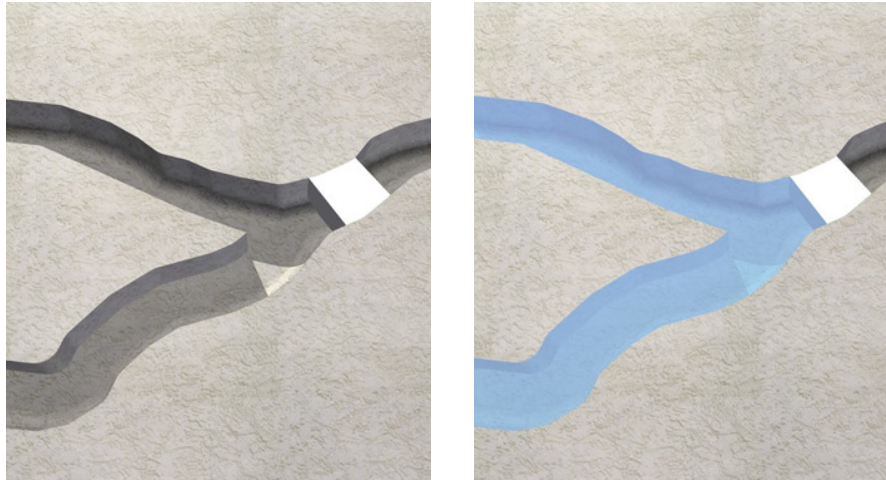


Sikament® Sika® ViscoCrete®

- Effective water reduction- production of high quality durable concrete
- Ensured workability on construction site

SIKA WATERTIGHT CONCRETE CONSTRUCTION

SIKA SOLUTIONS FOR WATERTIGHT CONCRETE

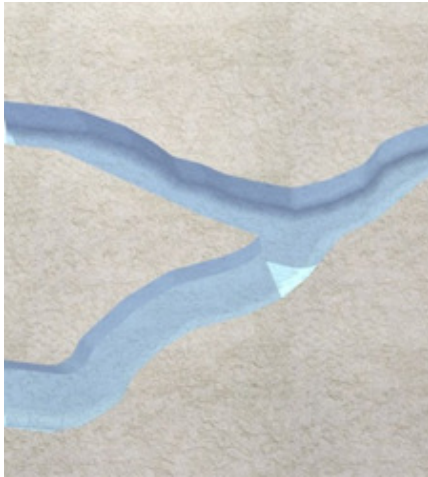


Sika® WT-100 Series

- Hydrophobic pore blocker
- Consists of long chained fatty acids such as stearates and oleates
- Chemicals react when in the presence of calcium hydroxide CaOH in the fresh concrete
- Changes the surface tension of the capillary surfaces
- Hydrophobic layer repels water
- Polymer globules collect in the capillaries forming a physical "plug", blocking the capillary system
- High performance when water exposure is inconsistently

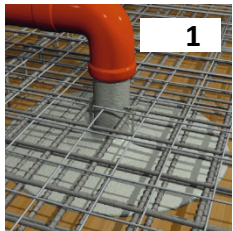
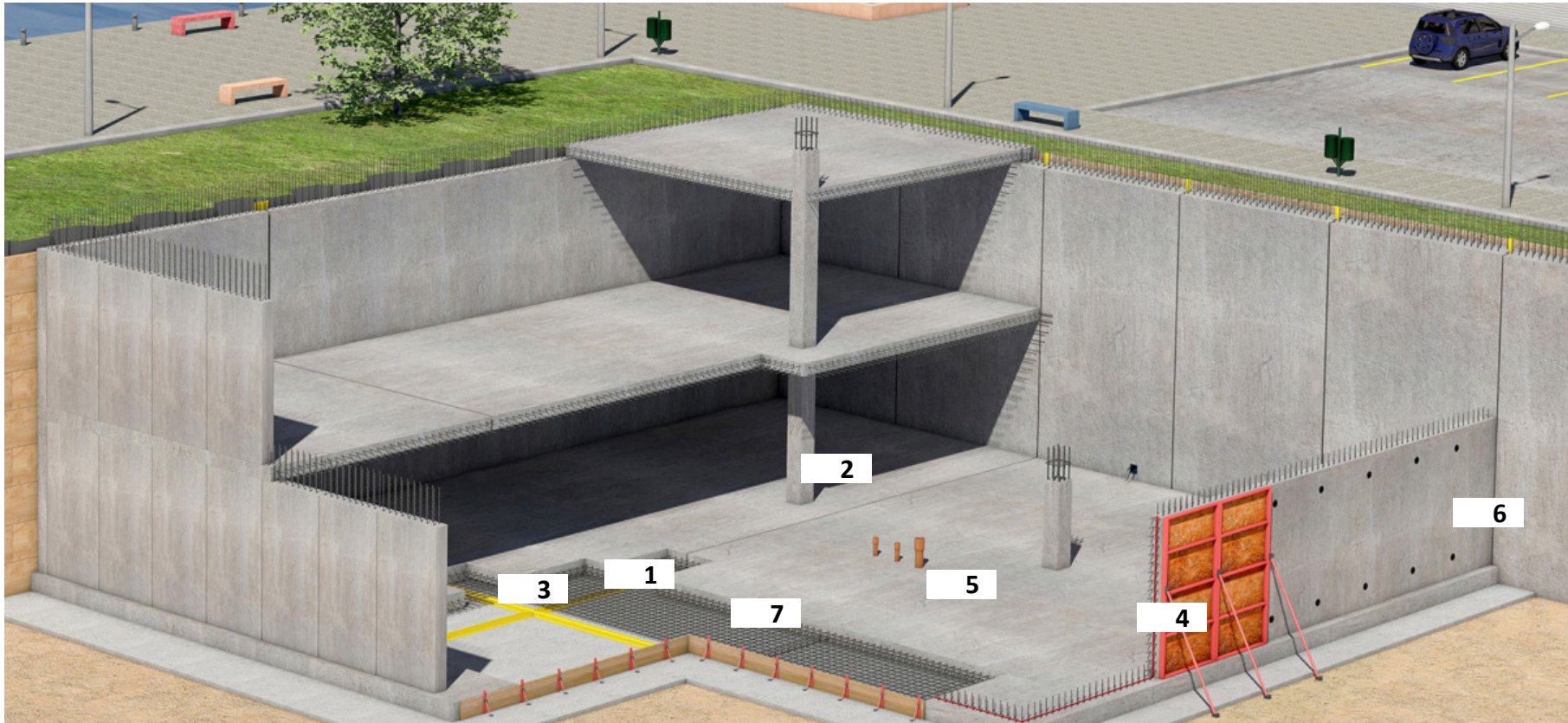
SIKA WATERTIGHT CONCRETE CONSTRUCTION

SIKA SOLUTIONS FOR WATERTIGHT CONCRETE



Sika® WT-200 Series

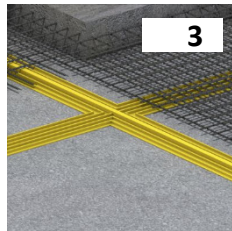
- Crystalline pore blocker
- Based on crystalline technology (self healing)
- Consists of specially selected chemicals and silica sand
- Crystalline chemicals react when in the presence of calcium hydroxide CaOH (and other hydration by-products) and **moisture**
- Crystalline structure forms and fills and blocks the capillary structure, small voids and micro-cracks
- Lack of **moisture** will stop the reaction (reactivation if re-wetted)
- High performance when water exposure is consistent



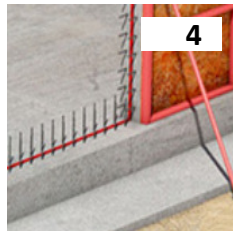
Sika®WT
Watertight Concrete
Minimum thickness ≥ 200mm
Pour dimensions to not exceed guidance



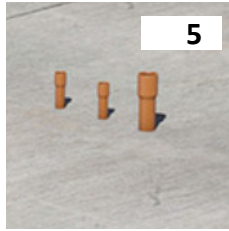
Sika® ViscoCrete®
Water reduction and improved durability



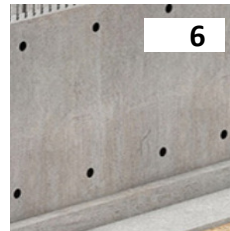
Sika®Waterbar
Movement and construction joints



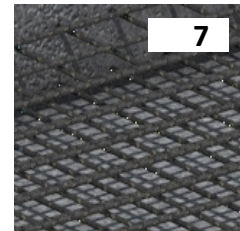
SikaSwell®
Construction joints



SikaSwell®
Sealing services and penetrations



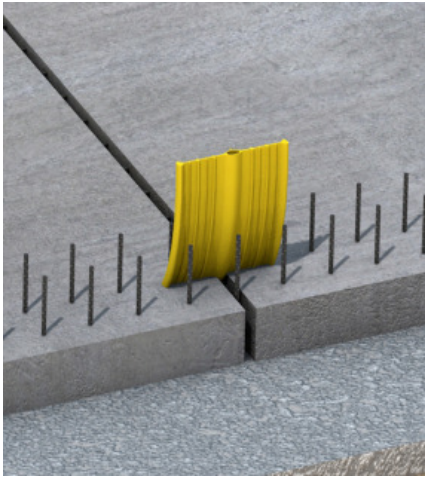
SikaSwell® A-Rings and Plugs
Sikadur®31
Sealing tie bar holes



Design
Maximum single crack width design ≤ 0.3mm

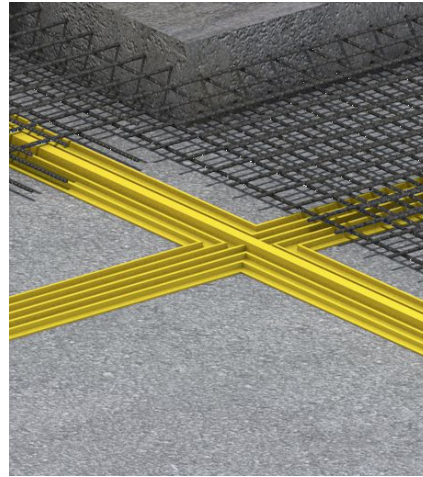
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SIKA WATERSTOP SOLUTIONS



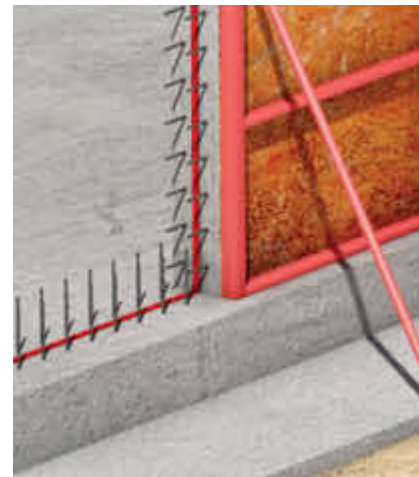
Sika® Waterbar A-19
Sika® Waterbar A-24
Sika® Waterbar D-19
Sika® Waterbar D-24

- Internally placed PVC waterstops



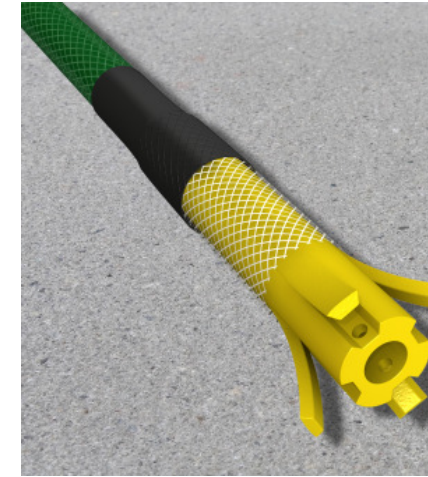
Sika® Waterbar AF-24
Sika® Waterbar DF-24

- Externally placed PVC waterstop



SikaSwell® A 2010
SikaSwell® A 2005
SikaSwell® S2

- Internally placed hydrophilic waterstop
- Construction joints
- Service penetrations



SikaFuko® Eco-1
SikaFuko® VT-1

- Internally placed injection hoses waterstop
- Injectable and re-injectable
- Optional for Basic Range

LINCOLN MEMORIAL POOL, WASHINGTON D.C. USA

SIKA WATERTIGHT CONCRETE



Sika Solution

To stabilize the pool, 2,133 timber piles were driven into the bedrock to provide more stable support. Sika Corporation. Aggregate Industries supplied 15,500 cubic yards of Sika Watertight Concrete. This high-performance concrete mix also included Sika® Control 40 shrinkage reducing admixture, and polypropylene fibers to minimize shrinkage potential.

Project Participants

Owner: National Park Service U.S.

Department of the Interior

Engineer: KCE Engineers, CO

General Contractor: Corman Construction

Concrete Supplier: Aggregate Industries