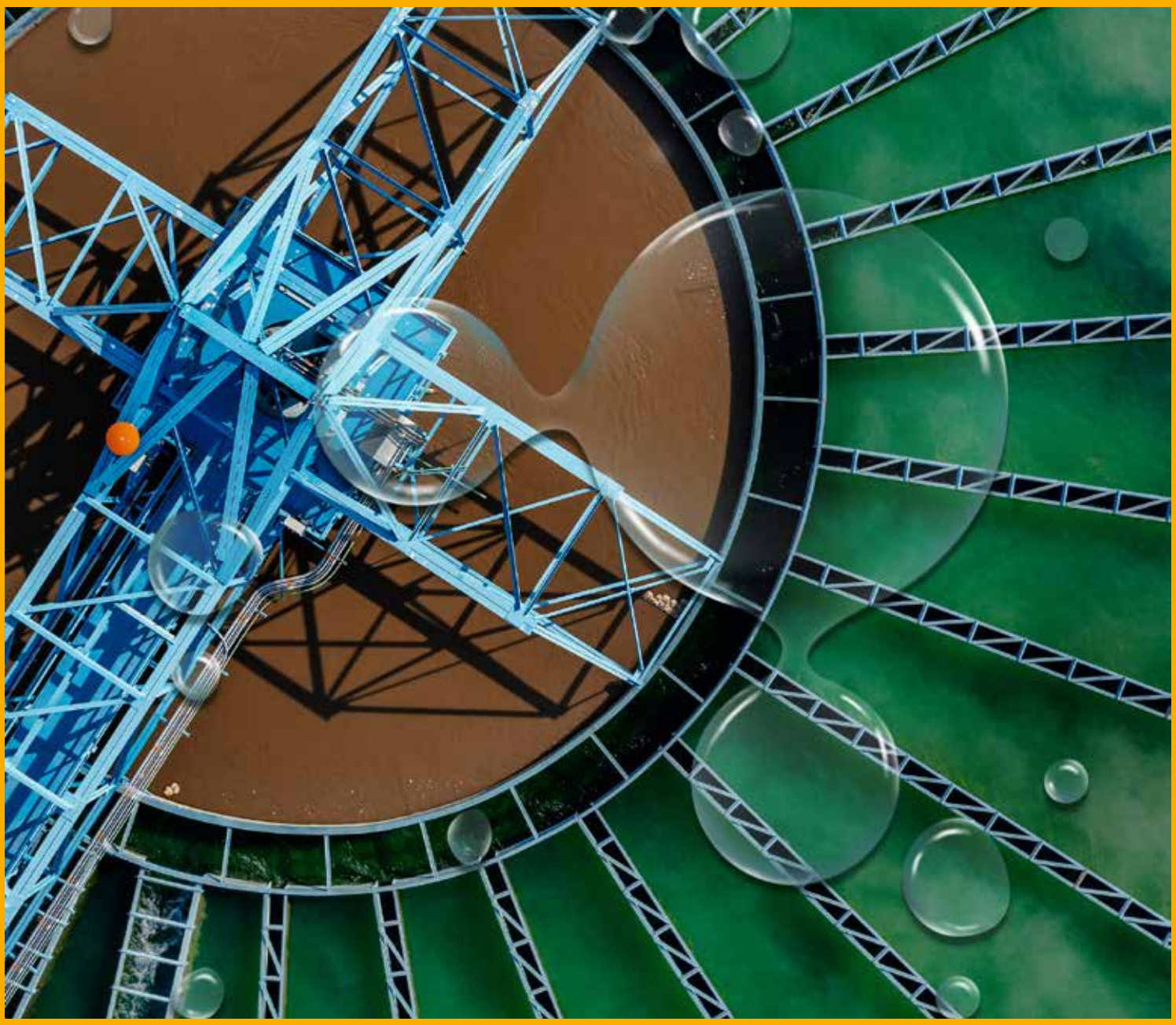


YOUR TRUSTED PARTNER IN SOLUTIONS FOR DURABLE SEWER NETWORKS AND WASTE-WATER TREATMENT PLANTS

BUILDING TRUST

SIKA – YOUR PARTNER

Water is an essential resource on our planet.

With climate change, population growth and urbanization, the water supply faces increasing challenges, making it more critical than ever.

We provide solutions that stop leakages, protect the infrastructure and conserve water throughout the entire water cycle, ensuring full water availability with efficiency, environmental and economical benefits.
This brochure focuses on our solutions in sewers and in wastewater treatment plants, following the different stages of the water treatment process.

Water is not only essential for human needs, but is also used in various activities and industries, such as agriculture, the food and beverage industry, the paper industry, and power and energy production. These industries often rely on the strict public water regulations and sometimes require specific additional measures, such as long-term resistance to chemicals used in their process. They can rely on the high performance of Sika protection and waterproofing systems.
As the global leader in providing protection and waterproofing solutions, Sika offers the most complete and comprehensive range of products and systems. These are designed and adaptable to meet the specific needs and requirements of owners, operators, architects, engineers, and contractors on site. Because every drop counts!

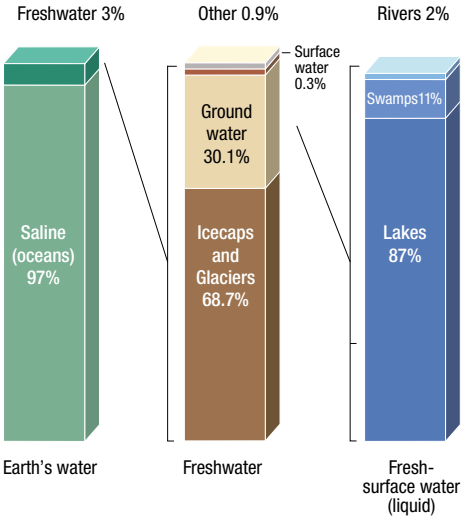
CONTENTS

SIKA SOLUTIONS CONTRIBUTE TO A SUSTAINABLE FUTURE

SIKA SOLUTIONS CONTRIBUTE TO A SUSTAINABLE FUTURE

"SIKA IS COMMITTED TO PUTTING HIGH-PERFORMANCE SOLUTIONS into practice – to the benefit of our customers and for a sustainable development."

Distribution of earth's water



Earth water distribution, US Geological survey, 2009

The fresh water available on the earth amounts to only 3% of the total water – the balance being saline water from seas and oceans. Rivers and lakes that supply most of the water for the human uses only constitute 0.007% of the total water (source: US geological survey, 2009). From these figures alone, it is clear that we should do the maximum to minimize pollution of our rivers and lakes. Waste water from urban and agricultural areas is one of the most significant sources of pollution.
There is a wide diversity in the world regarding access to waste water treatment. While 90% of the waste water produced globally remains untreated, this situation is reversed in developed countries – for example, around the Lake Geneva, more than 95% of the population is connected to a sewage treatment plant.
Sika contributes to saving water in the planet by providing sustainable construction and refurbishment solutions to extend the functional service life of waste water treatment plants.

SIKA SOLUTIONS TO REDUCE WASTE!

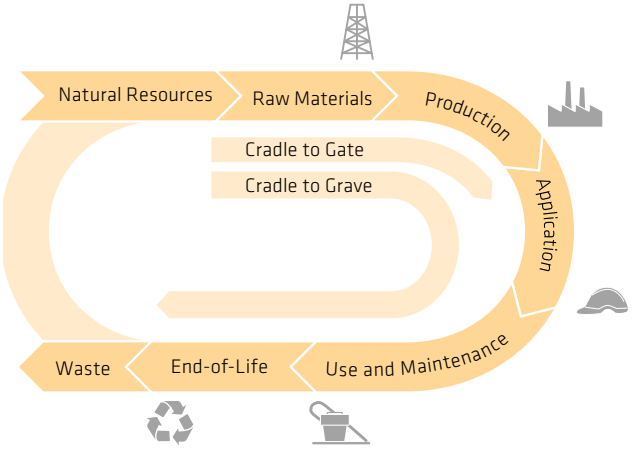
In a remedial work, significant amount of waste is generated: polluted concrete, chemical residue of old coatings, pails and bags. These wastes need to be disposed off in specific areas and contribute to CO_2 emission. Sika provides long-lasting repair and protection systems that help to extend the interval between maintenance and remedial work. Thanks to this, the quantity of waste is significantly reduced.

THE SIKA LIFE CYCLE ASSESSMENT APPROACH

Life Cycle Assessment (LCA) is a standardized method to assess and compare the inputs, outputs and potential environmental impacts of products and services over their life cycle. LCA's are increasingly recognized as the best way to evaluate the sustainability of products and systems.
Sika carries out LCA's according to the ISO 14040 series and the Standard EN 15804. The impact assessment methodology used is CML 2001. The data for the Sika LCA is based on public databases, such as those from ecoinvent, the European Reference Life Cycle Database (ELCD) and PE-GaBi, plus the specific data from Sika production plants and products.

Cumulative Energy Demand (CED), Global Warming Potential (GWP) and Photochemical Ozone Creation Potential (POCP) are considered to be the most relevant for concrete repair and protection:

- Cumulative Energy Demand (CED) is the total amount of primary energy from renewable and non-renewable resources.
- Global Warming Potential (GWP) is the potential contribution to climate change due to greenhouse gases emissions.
- Photochemical Ozone Creation Potential (POCP) is the potential contribution to summer smog, related to ozone induced by sunlight on volatile organic compounds (VOC) and nitrous oxides (NOx).



GENERAL PROCESS OF CLEANING WASTEWATER

WASTEWATER TREATMENT PLANTS clean dirty water using physical, chemical, and biological processes to remove pollutants. Key steps include screening out large objects, settling solids, breaking down organic matter by bacteria, and disinfecting to kill germs. Treated water is safe to return to nature, be reused or go through additional disinfecting process for drinking water supply.

PRIMARY TREATMENT

The first step in wastewater cleaning happens here. It involves removing large objects like sticks and grit, followed by allowing heavier solids settle to the bottom. This process creates sludge, which is removed, while cleaner water moves on to the next treatment stage.

1. Screening channels

This stage removes large objects like rags, plastics, and debris that could damage equipment later in the process.

2. Grit, fat & grease removal

Next, the water flows through a grit chamber where heavy, inorganic materials like sand and gravel settle out.

3. Primary sedimentation tanks

Heavier organic matter sinks to the bottom as sludge, while lighter materials like oils and fats float to the surface and are skimmed off.

SECONDARY TREATMENT
This stage relies on biological processes to break down organic matter and remove suspended solids, often using activated sludge or trickling filters.

4. Biological treatment

This is the heart of secondary treatment. Microorganisms like bacteria and protozoa consume and break down the organic matter left in the wastewater after primary treatment. While there are different types of biological treatment systems, all utilize these hardworking microbes.

5. Secondary sedimentation/ clarification tanks

After the biological breakdown, the water enters a settling tank again, allowing the microorganisms and any remaining solids to separate from the treated wastewater. It's like letting the water settle after the microscopic cleaning bacteria have done their job.

TERTIARY TREATMENT
This optional stage is used to further treat wastewater for specific purposes, such as reducing nutrients for environmental protection or removing specific contaminants for reuse.

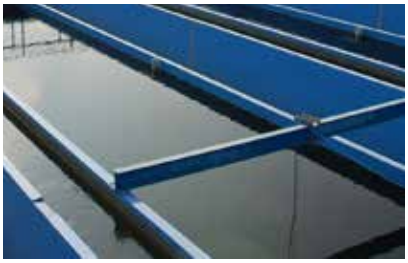
6. Filtration beds

Treated water may pass through filters, such as sand filters or membrane filters, to remove any remaining particles.

Disinfection

While primary disinfection often occurs after secondary treatment, some facilities may add another disinfection step, using processes like chlorine or ultraviolet light, to ensure even stricter removal of bacteria.

Nutrient removal



In some cases, additional treatment may be required to remove specific nutrients like nitrogen and phosphorus. This can be important for preventing excessive algae growth in the environment.

SLUDGE TREATMENT
This stage handles the solid waste produced during wastewater cleaning. It involves thickening, stabilizing (often through digestion), and dewatering the sludge to reduce its volume and harmful content. The treated sludge can then be disposed or reused as fertilizer, depending on regulations and quality. Methan produced in the digestion phase is often stored for electricity generation.

7. Filtration beds

Sealed vessels allow organic waste break down through a process called anaerobic digestion. Microorganisms, like bacteria, break down the waste in an oxygen-free environment, producing biogas (mainly methane) as a byproduct.

8. Disinfection

The biogas produced in digestion tanks is stored and can be used for various purposes, such as generating electricity, providing heat, or as transportation fuel.

PROBLEMS AND DAMAGES TO STRUCTURES

SEWER NETWORKS

Most accessible sewers are more than 50 years old and in most cases are made of tamped or reinforced concrete in round, rectangular or ovoid shapes.
Generally, sewers present three different zones of stresses with specific issues:

A: Biogenic aggression, runoff, storm water, waste water or condensation
B: Runoff, storm and waste water, erosion and corrosion defects
C: Waste water, erosion and abrasion

1 Damages at the bottom:
Heavy abrasion and erosion of the concrete and prefabricated elements are often found at the bottom of the sewers.

2 Localized defects of the concrete:
Lateral walls and the crown often show localized defects of the concrete and sometimes defects due to the corrosion of the reinforcement.

3 Full degradation of the concrete surface:
The resistance of tamped concrete against a strong water current is generally not enough and often the full surface of the concrete is eroded.

4 Cracks with water leaks:
Due to shrinkage or settlements, concrete in sewers often cracks.

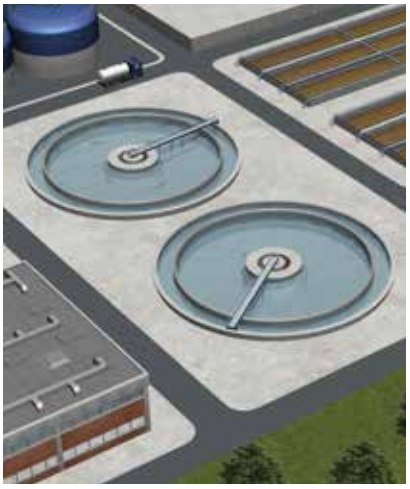
5 Damages at the crown:
Exposed tamped concrete surfaces show very low resistance against carbonation and the aggressive substances contained in the waste water. The aerial part of the sewer can suffer from biogenic corrosion or microbial induced corrosion (MIC).

PROBLEMS AND DAMAGES TO STRUCTURES

PRIMARY TREATMENT

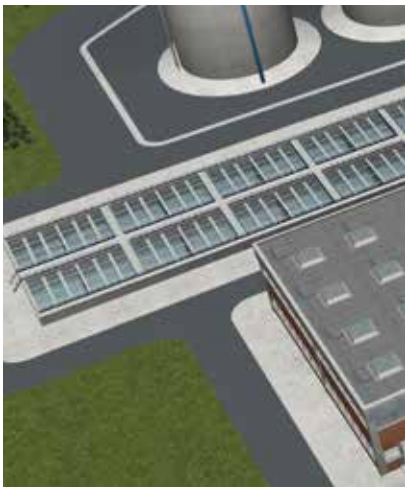
Screening channels	Grit, fat & grease removal	Primary sedimentation tanks
Abrasion and erosion due to sand, grit or other heavy particles		
Chemical attacks due to aggressive waste or industrial water		
Leakage and risk of pollution due to cracks, untight joints or poor concrete quality		
Damage in concrete due to Biogenic Sulfuric Acid attack in closed areas where the sewage is in turbulent flow		
		Heavy abrasion on the rolling pad of the scraper

SECONDARY TREATMENT



Biological treatment	Secondary sedimentation/ clarification tanks
Abrasion and erosion due to sand, grid or other particles	Erosion due to water flow, cavitation
Abrasion due to cavitation	Chemical attacks depending on the aggressiveness of the waste or industrial water
Chemical attacks depending on the aggressiveness of the waste or industrial water	Heavy abrasion on the rolling pad of the scraper
Leakage and risk of pollution due to cracks, untight joints or bad quality concrete	Leakage and risk of pollution due to cracks, untight joints or bad quality concrete
	Steel reinforcement corrosion due to less concrete cover

TERTIARY TREATMENT



Filtration beds	Disinfection	Nutrient removal
Abrasion		
Improper waterproofing		
Leakage and risk of pollution due to cracks and untight joints		

SLUDGE TREATMENT

Digestion tanks	Biogas tanks
Heavy chemical attacks above the anaerobic zones (BSA attack)	
Leakage and risk of pollution due to cracks, untight joints or bad quality concrete	

AGGRESSIVE SUBSTANCES IN SEWAGE

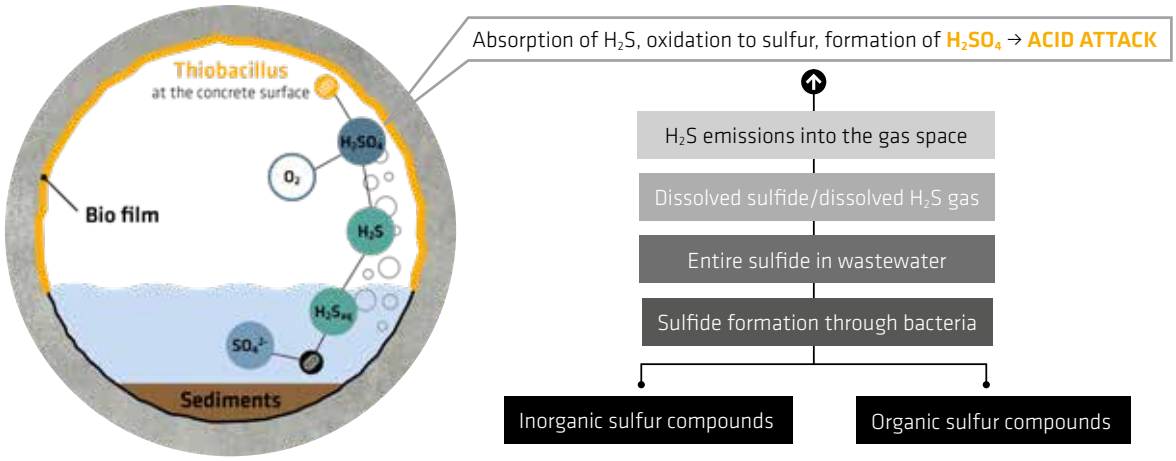
The type and extent of concrete damage to be expected in all areas of sewerage systems, is determined by the corrosiveness of the substances present, by the quality of the existing concrete and by the quality of any protective treatments. The level of concrete corrosiveness in the different parts of the sewerage system exposed to waste water can be assessed on the basis of EN 206: 2013. This European standard defines three levels of chemical attack (XA1, XA2 and XA3 – low, severe and very severe respectively) on concrete. The status of the water quality under this standard is however still an essential basis for selecting and applying suitable repair systems, all other relevant factors provided, such as MIC (microbial induced corrosion) are also carefully considered.

The repair system selection is of course also made on the basis of the concrete quality and in terms of the depth of damage, chloride levels and substrate strength etc. For very serious chemical attack, additional treatment in the form of a surface protection system is required, over and above the concrete repair and replacement. This so-called biogenic sulfuric acid attack (BSA) or microbial induced corrosion (MIC) is usually the most serious cause of damage in covered areas were there is turbulent sewage. Sulfuric acid can cause concrete erosion rates of 0.5 – 10.00 mm per annum; in extreme cases erosion of up to 20 mm has been measured.

BIOGENIC SULFURIC ACID ATTACK

Biogenic sulfuric acid attack is the destruction of materials, often concrete or steel, caused by bacteria that produce sulfuric acid. These bacteria thrive in the areal part of structures in damp environments like sewers, primary treatment of wastewater treatment plants or in digestion tanks leading to significant infrastructure damages.

DEVELOPMENT OF BIOGENIC SULPHURIC ACID ATTACK IN SEWAGE ENVIRONMENT



The intricate nature of wastewater treatment and its degradation processes pose significant challenges to the surrounding infrastructure. The rate of chemical attack is determined by a range of factors related to both the wastewater and its environmental conditions. These factors can even lower the pH level below 1 in extreme cases. Uncoated concrete is particularly susceptible to so-called biogenic sulfuric acid attack (BSA). BSA attack is caused by bacteria present in wastewater. These bacteria metabolize hydrogen sulfide (H_2S) into sulfuric acid. The sulfuric acid then deposits directly onto the concrete, causing chemical attack. This attack is particularly aggressive because the sulfuric acid lowers the pH of the concrete, making it more susceptible to corrosion. The resulting erosion of the concrete surface can be rapid and damaging.

BIOGENIC SULFURIC ACID ATTACK CAN LEAD TO SEVERE STRUCTURAL DAMAGE TO CONCRETE COMPONENT STRUCTURES.

AGGRESSIVE SUBSTANCES IN SEWAGE

MAIN CHEMICALS DAMAGING STRUCTURES IN WASTEWATER TREATMENT PLANTS

1. **Sulphates:** Present in wastewater and sometimes introduced through treatment chemicals like sulfuric acid (for pH adjustment). Sulphates react with calcium hydroxide (a component of concrete) to form gypsum, which can lead to cracking and expansion of the concrete.

2. **Acids:** Acids like sulfuric acid (for pH adjustment) can directly attack the calcium hydroxide in concrete, weakening it and increasing its porosity.

3. **Chlorides:** Chlorine (often used as sodium hypochlorite for disinfection) can react with calcium hydroxide in concrete to form calcium chloride. While not as detrimental as sulphates, calcium chloride can increase the permeability of concrete, making it more susceptible to further degradation.

4. **Hydrogen Sulphide (H_2S):** in the presence of moisture and specific bacteria, it reacts to form sulfuric acid, which is highly corrosive and attacks concrete, causing it to weaken and deteriorate.

5. **Residual Chemicals:** Improper handling or spills of various treatment chemicals, such as coagulants (e.g., ferric chloride) or flocculants (e.g., some polymers), can also have localized aggressive effects on concrete depending on their specific properties.

Sulphates attack

Biogenic sulfuric acid attack

GENERAL SEWAGE TREATMENT PLANT REFURBISHMENT CONSIDERATIONS

Before defining the repair and protection strategy, the specific sewage treatment plant requirements on refurbishment must be considered. These requirements can have an important influence in determining the correct design, planning and construction procedures, together with the future maintenance works necessary for the sewage treatment plant.
Examples of these project related requirements are outlined below.

DURABILITY
Remedial works on a sewage water treatment plant can cause substantial costs; hence the frequency of remediation work should be as low as possible. Therefore, products used in these remedial works must provide adequate durability to extend the defined functional service life.

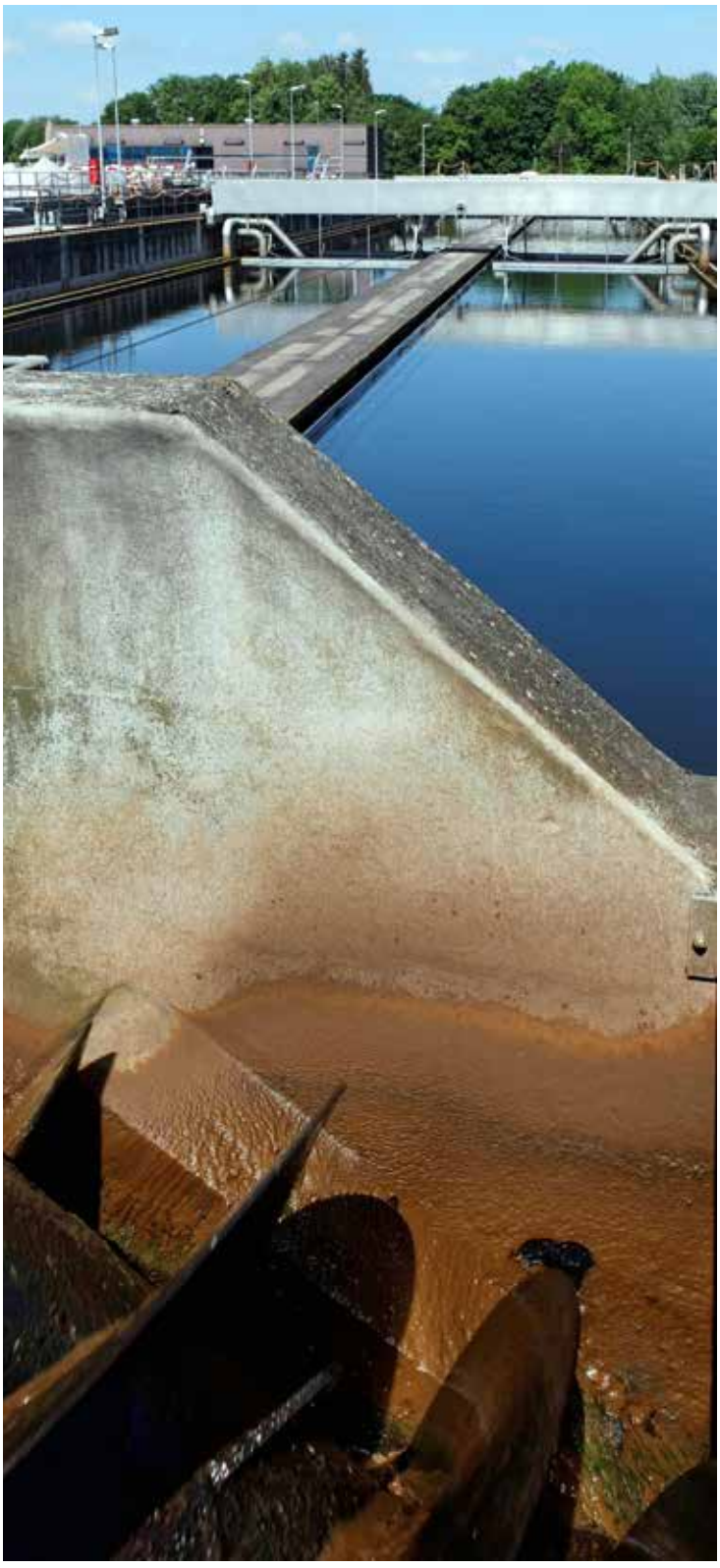
DURATION OF CLOSURE / DOWN TIME
During the time of remedial works, either the plant is completely or partly shut down leading to extra demand on neighboring plants. The remedial works selected shall minimize this duration of closure.

SYSTEM COMPATIBILITY
Remedial works on complex large sewage water treatment plants often demand a complete and integrated system build-up.
The compatibility of products and system is very important.
The use of one full range system supplier with proven compatible products and systems ensures this is achieved.

TOTAL LIFE CYCLE COSTING
The total costs must take into account the actual costs of the remedial works plus the maintenance costs of the defined functional service life.
This significantly influences the selection of the appropriate refurbishment concept and the specific materials to be used.

EXPOSURES / SITE CONDITIONS
The specific site exposure and environmental conditions, such as the climate, access and space for material application, also significantly influences the selection of the refurbishment concept, the appropriate materials and application techniques.

ECOLOGY
Environmental friendly and sustainable materials such as solvent free products help to safeguard the environment. These are increasingly an important requirement. In some countries, some financial penalties are being imposed to contractors that use products that release Volatile Organic Compounds (VOC's).



GENERAL SEWAGE TREATMENT PLANT REFURBISHMENT PROCEDURES

The repair and protection of sewage treatment plants must always be executed according to all relevant local standards and regulations.

After a detailed condition survey and root cause analysis, the right procedures for successful refurbishment can be defined.

Standards (such as European Standard EN 1504-9) define principles and methods to refurbish damaged concrete. Please refer to our Brochure "The Repair and Protection of Reinforced Concrete with Sika" for more information relating to repair and protection according to EN 1504-9.

Types of Damage/Defects (Examples)		Possible Principles/Methods EN 1504-9	
		For the Repair	For the Protection
Concrete spalling/ scaling of concrete surface		Principle 3: Concrete restoration (Method 3.1/3.2/3.3)	Principle 1: Protection against ingress (Methods 1.1/1.2/1.3) Principle 5: Physical resistance (Method 5.1/5.2/5.3)
Steel reinforcement corrosion		Principle 7: Restoring passivity (Method 7.1/7.2)	Principle 8: Increasing resistivity (Method 8.1/8.2/8.3) Principle 9: Cathodic control (Method 9.1) Principle 10: Cathodic protection (Method 10.1) Control of anodic areas (Methods 11.1/11.2/11.3)
Structural cracks		Principle 4: Crack injection (Method 4.5/4.6)	Principle 4: Structural strengthening (Methods 4.1/4.3/4.4/4.7)
Non-structural cracks		Principle 1: Filling of cracks (Method 1.5)	Principle 1: Protection against ingress (Method 1.1/1.2/1.3) Principle 2: Moisture control (Method 2.1/2.2/2.3) Principle 5: Physical resistance (Methods 5.1/5.2/5.3)
Chemical attacks		Principle 6: Adding mortar or concrete (Method 6.3)	Principle 6: Resistance to chemicals with coating (Method 6.1)

SIKA SOLUTIONS FOR WASTE-WATER TREATMENT PLANTS

Overview of main products and systems for wastewater treatment plants

		Sewer networks	Primary treatment
Systems & Products	Description		Screening channels
Rebar protection			
Sika Armatec® 110 Epocem®	Cementitious epoxy slurry	■	■
Sika MonoTop®-1010	Polymer modified slurry	■	■
Concrete repair			
Sika MonoTop®-4012	Fibre reinforced repair mortar, class R4 according to EN 1504-3 with reduced carbon foot print compared to a standard cementitious repair mortar	■	■
SikaEmaco® S 5440 RS	Rapid setting, high-strength, fibre reinforced, tixotropic concrete repair mortar with integrated corrosion inhibitor, class R4 according to EN 1504-3	■	■
Concrete injection			
Sikadur®-52 / SikaInject®-1360	Epoxy injection resin for concrete cracks	■	■
Concrete repair witth high abrasion resistance			
Sika MonoTop®-3400 Abraroc	Cementitious hand or machine applied structural concrete repair mortar with very high resistance to hydraulic abrasion	■	
Concrete repair witth high BSA resistance			
Sika MonoTop®-4400 MIC	Repair and protection mortar resistant to BSA attack. Ideal for fast refurbishment: Application on humid surface and fast curing	■	□
Cocnrete Structural reinforcement			
Sika Carbodur® Grid	Carbon fiber FRCM system for concrete and masonry structures	■	□
Concrete reprofiling			
Sikagard®-720 Epocem® / Sikagard®-385 Epocem®	Epoxy modified, cementitious, fine textured mortar for levelling and finishing concrete		
Concrete protection			
Sikagard®-62/63 N	Epoxy resin based chemical resistant protective coating. Can be reinforced with a mesh		□
Concrete protection with high BSA resistance			
Sikagard®-7000 CR	High chemical resistant coating based on Xolutec technology for harsh waste water environement	■	■
Sikalastic®-8440 / Sikalastic® M 689	Spray applied polyurea membrane for water installations, biogas and digestion tanks		□
Rolling wheel pad fixing			
Sika® Icosit® KC 340	Flexible polyurethane polymer resin grout designed as a vibration absorbing and load bearing		
Sikadur®-42+ HE Cold Climate / LE Warm Climate / VLE Hot Climate	3-part, high-performance, moisture-tolerant epoxy grout which develops high early strength. It is suitable for many static or dynamic precision grouting applications. Layer thickness of 10 mm to 150 mm / 25 mm to 300 mm / 25 mm to 300 mm and an application temperature range of +5°C to +30°C / +15°C to +40°C / +25°C to +45°C .		

			Secondary treatment		Tertiary treatment			Sludge treatment	
	Grit, fat & grease removal	Primary sedimentation tanks	Biological treatment	Secondary sedimentation tanks	Filtration beds	Disinfection	Nutrient removal	Digestion tanks	Biogas tanks
	■	■	■	■	■	■	■	■	■
	■	■	■	■	■	■	■	■	■
	■	■	■	■	■	■	■	■	■
	■	■	■	■	■	■	■	■	■
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SIKA SOLUTIONS FOR WASTE-WATER TREATMENT PLANTS

		Sewer networks	Primary treatment
Systems & Products	Description		Screening channels
Anchoring			
Sika AnchorFix®-1	Solvent and styrene free based, two component polyester anchoring adhesive for medium to high loads	■	■
Sika AnchorFix®-2+ (Arctic, Tropical) / Sika Anchorfix® 2020	Solvent and styrene free, epoxy acrylate based, 2-component high performance anchoring adhesive for different climate conditions	■	■
Sika AnchorFix®-2002	Solvent- and styrene free, acrylate-cement hybrid based, 2-component anchoring adhesive for high loads	■	■
Sika AnchorFix®-3030	Solvent-free, thixotropic, 2-component, epoxy resin based high performance anchoring adhesives	■	■
Grouting			
Sikagrout®-800	Cementitious, high performance grout with reduced carbon foot print compared to a standard cementitious grout.	■	■
Joint and crack sealing – external			
Sikadur-Combiflex® SG system	High performance joint sealing system for construction, expansion and connection joints as well as for cracks. Wehn fixed to the joint, allows irregular and high movement in more than one direction	■	■
Sikaflex® Pro-3 Purform	Polyurethane, tough, coloured, elastic joint sealant for sealing joints in civil engineering strucutres	□	□
Sikaflex®-403 Tank & Silo	Moisture curing, elastic sealant for sealing steel continers built in sections. Resistant to liquid manure, silage liquids and is suitable for sealing domestic and municipal sewage systems	■	■
Waterbars			
Sika Waterbar® FB 125	Hybrid waterstop	■	■
Swelling profiles			
Sikaswell® A/S	Hydrophilic profiles and sealants	■	■
Concrete admixtures			
Sika WT 200 P	Concrete admixtrue waterproofer	■	■

Sika offers a full range of concrete admixtures: Contact the Concrete Sika services for any request.

			Secondary treatment		Tertiary treatment			Sludge treatment	
	Grit, fat & grease removal	Primary sedimentation tanks	Biological treatment	Secondary sedimentation tanks	Filtration beds	Disinfection	Nutrient removal	Digestion tanks	Biogas tanks
	■	■	■	■	■	■	■	■	■
	■	■	■	■	■	■	■	■	■
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SIKA SOLUTIONS FOR WASTE-WATER TREATMENT PLANTS

Selection guide for selecting the concrete protection solution according to the project requirements

<table>
<tr><td rowspan="2">Urban W.W.T.P.</td><td colspan="3">Resin Based</td></tr>
<tr><td colspan="2">Epoxy</td><td>PUA</td></tr>
<tr><td>SYSTEM</td><td>Sikagard®-63 N/62</td><td>Sikagard®-63 N/62 + mesh</td><td>Sikalastic® M 689/8440</td></tr>
<tr><td>BSA resistant</td><td>NO</td><td>NO</td><td>YES</td></tr>
<tr><td>Surface preparation</td><td colspan="3">Sika MonoTop®-3020
SikaTop®-500
Sikagard®-720 EpoCem®
Sikagard® P 770 + Sand + Thickener</td></tr>
<tr><td>SYSTEM 1
(Humidity < 4%)</td><td>Sikafloor®-161/160
Sikagard®-63 N</td><td>Sikafloor®-161/160
Sikafloor®-161+mesh+Extender
Sikagard®-63 N</td><td>Sikafloor®-161/160
Sikalastic® M 689/8440</td></tr>
<tr><td>SYSTEM 2
(No limit of humidity)</td><td>Sikagard® P 770*
Sikagard®-63 N</td><td>Sikagard® P 770*
Sikafloor®-161+mesh+Extender T
Sikagard®-63 N</td><td>Sikagard® P 770*
Sikalatic® M 689/8440</td></tr>
<tr><td>Inflow, primary treatment</td><td rowspan="3">No crack bridging</td><td rowspan="3"></td><td rowspan="4">High crack bridging and very fast return to service</td></tr>
<tr><td>Secondary treatment</td></tr>
<tr><td>Third treatment</td></tr>
<tr><td>Biogas tanks, sludge treatment, bio reactors</td><td>NO</td><td>NO</td></tr>
</table>

*Surface visibly dry during application
Biogenic Sulfuric Acid Corrosion occurs mainly in inflow, primary treatment and sometimes in secondary treatment in case of confined areas and covered tanks.

	Hybrid		Cement based
	Xolutec®	EpoCem®	Calcium aluminate
	Sikagard®-7000 CR	**Sikagard®-720 EpoCem®**	**Sika MonoTop®-4400 MIC**
	YES	NO	YES
	Sika MonoTop®-3020 SikaTop®-500 Sikagard®-720 EpoCem® Sikagard® P 770 + Sand + Extender T	Sikagard®-720 EpoCem®	Not needed
	Sikagard® P 770* Sikagard® M 790	Sikagard®-720 EpoCem®	Sika MonoTop® 4400 MIC
	Innovative and unique technology	NO	**Only when BSA corrosion occurs** Application on damp surface Fast re-opening
		Reprofiling + protection in one step (limited durability)	
		Reprofiling + protection in one step	NO
		As reprofiling below coating	If damp substate in refurbishment of sludge treatment Fast re-opening **Not for biogas or bio reactors**

SIKA SOLUTIONS FOR SEWER NETWORKS

GENERAL DESCRIPTION AND MAIN REQUIREMENTS
Sewers are underground pipes that transport wastewater from homes, businesses, and industries to treatment plants. They are essential for public health and sanitation. The diameters of these pipes depend on the required flow and population density. They can be up to several meters wide in large cities. The main material used is concrete, and the wastewater flows through the pipes by gravity.

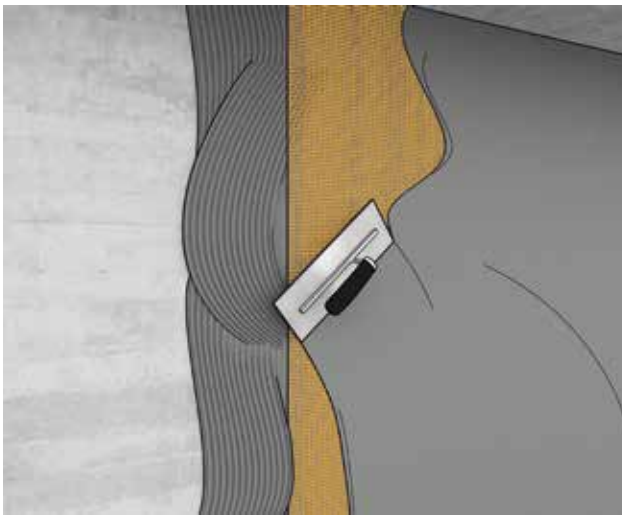
Typical problems encountered are:
- Water and debris abrasion from sand, grit and other particles
- Concrete damage due to biogenic sulfuric acid attack in the upper part of the sewers (gas phase)
- Leakages and risk of pollution due to cracks
- Structural damage caused by aging and earth movement

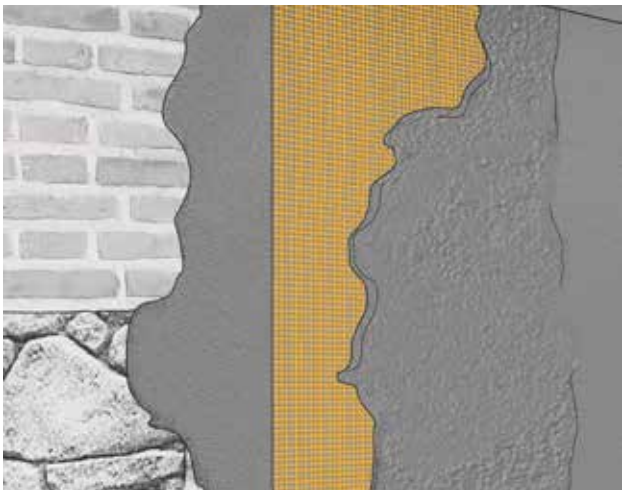
SIKA SOLUTION FOR STRUCTURAL DAMAGE
Sika Carbodur® Grid is a structural reinforcement system consisting of a carbon grid embedded in a cementitious matrix.

APPLICATION
1. The substrate is repaired, if needed
2. A first layer of Sika MonoTop®-3200 for concrete and 3260 for masonry is applied
3. The Sika Carbodur® Grid is embedded in the fresh mortar
4. A final layer of Sika MonoTop®-3200 for concrete and 3260 for masonry is applied
5. The system can be protected against chemical attack with a Sika coating. e.g. Sikagard®-7000 CR

Sika CarboDur® Grid
- Fast application
- Application on humid substrates
- No significant reduction of the diameter
- Safe manipulation and application vs standard solution with a steel mesh

The system can be protected against chemical attack with a Sika protective system, e.g. Sikagard®-7000 CR or Sika MonoTop®-4400 MIC.

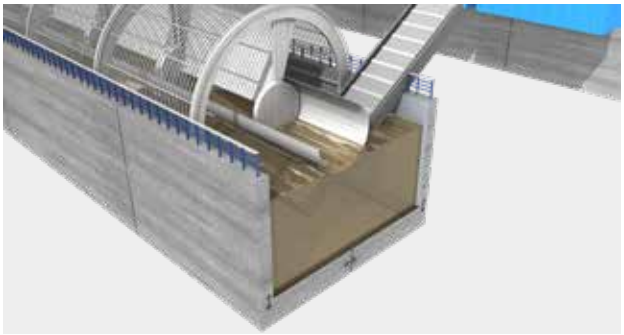




OTHER TYPICAL PROBLEMS AND SIKA SOLUTIONS:

- Biogenic sulfuric acid attacks:
  Sikagard®-7000 CR
  Sika MonoTop®-4400 MIC
- Abrasion**:**
  Sika MonoTop® 3400 Abraroc
- Concrete cracks:
  Sikadur-Combiflex® SG
  Sikadur®-52

SIKA SOLUTIONS FOR SCREENING CHANNELS



GENERAL DESCRIPTION & MAIN REQUIREMENTS
In a large treatment plant, the removal of large objects is automatically performed in the screening channel.

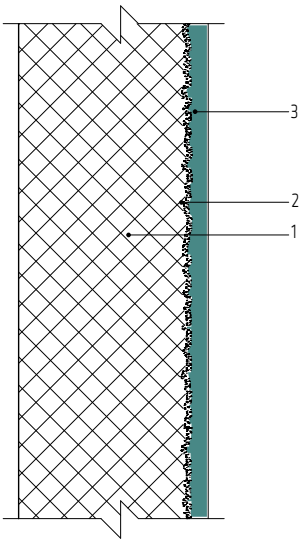
Typical problems encountered are:
- Abrasion and erosion due to sand, grit or other particles.
- Chemical attacks, depending on the aggressiveness of the waste or industrial water.
- Leakage and risk of pollution due to cracks, untight joints or damaged concrete.
- Damage in concrete due to microbial induced corrosion (MIC) in covered areas where the sewage is in turbulent flow.

SIKA SOLUTIONS FOR HYDRAULIC ABRASION
In waste water treatment plants, erosion is mainly due to abrasion or by chemical attack.
Erosion damage results from the abrasive effect of water-borne silt, sand, gravel, and other debris being circulated over a concrete surface during operation.
The compounds present in hardened Portland cement are attacked by the aggressiveness (low pH) of the waste water.
Sika is specialized in this field since decades and, together with major partners, has developed products that address the issues above:

Sika MonoTop®-3400 Abraroc
- Hydraulic abrasion resistant mortar
- Sulfate resistant
- Mild acid resistant
- Spray applied

TYPICAL DETAIL

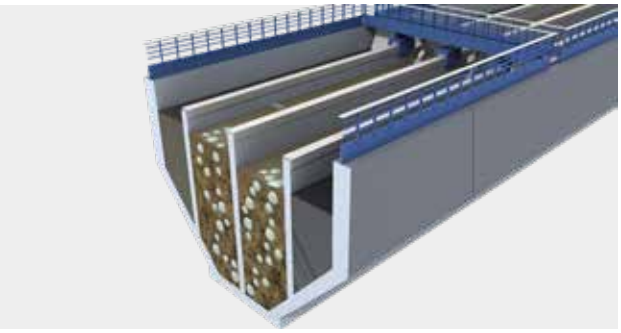
1 Host concrete
2 Abraded surface
3 Over laying with
Sika MonoTop®-3400 Abraroc



OTHER TYPICAL PROBLEMS AND SIKA SOLUTIONS:

- Chemical attacks:
  Sikagard®-720 EpoCem® and Sikagard®-63 N/-62,
  Sikagard®-7000 CR
- Cracks, untight joints:
  Sikadur-Combiflex® SG, Sikadur®-52 or Sikaflex® PRO-3 (or
  Sikaflex®-403 Tank and Silo in zones of biogenic corrosion)
- Damaged concrete and steel reinforcement corrosion:
  Sika MonoTop®-4012
  SikaTop® Armatec®-110 EpoCem®
  SikaEmaco® S 5400
- Damages due to biogenic corrosion in confined areas:
  Sika MonoTop®-4400 MIC
  Sikagard®-7000 CR

SIKA SOLUTIONS FOR GRIT, FAT AND GREASE CHAMBERS



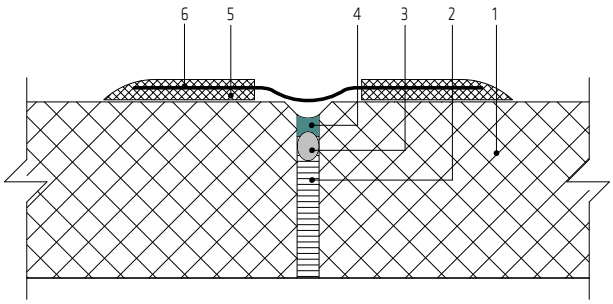
GENERAL DESCRIPTION & MAIN REQUIREMENTS
In some plants, pre-treatment may include a grit channel where the waste water velocity is adjusted to allow settlement of the sands/grits or other hard particles. Sands/grits must be removed as they may damage pumps or other equipments.
Fat and grease removal is generally done in large plant in the primary settlement tank using mechanical surface skimmers.

Typical problems encountered are:
- Abrasion and erosion due to sand, grit or other particles.
- Chemical attacks depending on the aggressiveness of the waste or industrial water.
- Leakage and risk of pollution due to cracks, untight joints or damaged concrete.
- Microbial induced acid attack (MIC) in covered areas where the sewage is in turbulent flow

SIKA SOLUTIONS FOR UNTIGHT JOINTS
Very often in waste water treatment, joints sealed with average sealant fail due to the lack of chemical resistance of these products. Instead of proceeding to the full removal of the failed joint, Sika has developed joint system that can be applied over the original failed material.
The Sikadur-Combiflex® SG system is the second generation development of the globally proven Sikadur-Combiflex® with even improved performance such as advanced adhesion properties. The unique system consists of the Sikadur-Combiflex® SG tape and the Sikadur® adhesives. It is widely used as joint waterproofing in watertight concrete structures.

Advantages:
- Repair of failed joint
- Blocking the path of water penetration
- Increased length of water penetration
- Fully bonded to the concrete preventing underflow
- Waterproofing of joints with extreme movements
- Easy to install and adjust to complicated construction details
- Excellent adhesion to different substrates
- Resistant to high water pressure
- Crack sealing system
- Easy to control and repair

TYPICAL DETAIL

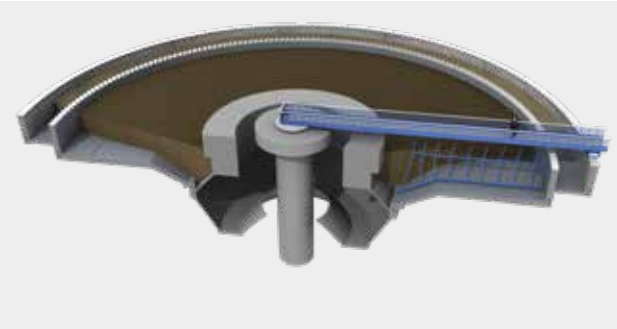


1 Substrate
2 Existing compression profile
3 Existing backing rod
4 Failed sealant
5 Sikadur® adhesive
6 Sikadur-Combiflex® SG Tape

OTHER TYPICAL PROBLEMS AND SIKA SOLUTIONS:

- Abrasion and erosion:
  Sika MonoTop®-3400 Abraroc
- Chemical attacks (fatty acid):
  Sikagard®-720 EpoCem® and Sikagard®-63 N/-62,
  Sikagard®-7000 CR
- Damaged concrete and steel reinforcement corrosion:
  Sika MonoTop®-4012
  SikaTop® Armatec®-110 EpoCem®
  SikaEmaco® S 5400
- Microbial induced corrosion in covered areas with turbulent flow in the sewage:
  Sika MonoTop®-4400 MIC
  Sikagard®-7000 CR

SIKA SOLUTIONS FOR SCREENING PRIMARY SEDIMENTATION TANKS



GENERAL DESCRIPTION & MAIN REQUIREMENTS
In the primary sedimentation tank, sewage flows through large tanks, commonly named “primary clarifiers” or “primary sedimentation tanks”. These tanks are equipped with mechanically driven scrappers that drive the collected sludge towards a hopper.

Typical problems encountered in these tanks are:
- Abrasion and erosion due to sand, grit or other particles.
- Heavy abrasion on the rolling pad of the scrapper.
- Chemical attacks depending on the aggressiveness of the waste or industrial water.
- Leakage and risk of pollution due to cracks, untight joints or damaged concrete.

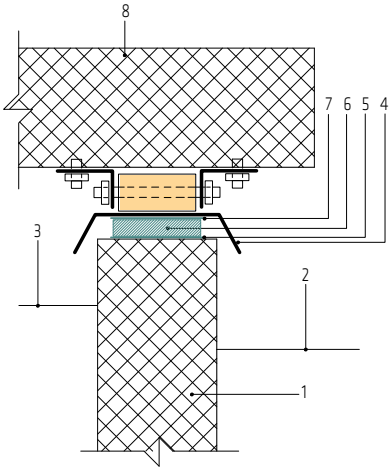
SIKA SOLUTIONS FOR ABRASION RESISTANT GROUT
Mechanical scrapper movement yields to heavy stress combining vibration and abrasion.
Although cost effective, cement based products do not resist much against stress from vibration of the scrapper and therefore do not last long.
Sika proposes for this usage either epoxy or PU based grout / adhesive to fix the metallic rolling cladding on the running surface of the scrapper

Sikadur®-42+ cold climate
- 3-pack epoxy grout
- High early strength and fast curing
- Stress and impact resistant
- High vibration resistance

Sika® Icosit® KC 330 FK or Sika® Icosit® KC 340/65
- 2-pack, solvent-free polyurethane adhesive
- High initial adhesion
- Vibration reducing
- Noise absorbing
- Not requiring temporary fixation

TYPICAL DETAIL

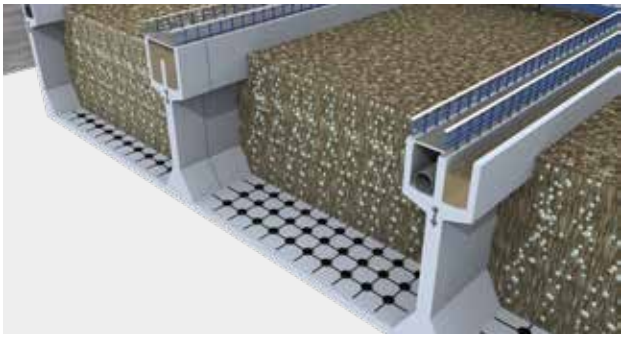
1 Concrete wall of clarifier
2 Ground level
3 Water level within the clarifier
4 V2A Stainless steel plate
5 Priming of concrete surface with Primer such as Sika® Icosit® KC 330 Primer or equivalent
6 Shock absorbing, vibration damping & bonding material such as Sika® Icosit® KC 330 FK
7 Priming after grinding the under side of the stainless steel plate with primer such as Sika® Icosit® KC Primer or equivalent
8 Scraper bridge



OTHER TYPICAL PROBLEMS AND SIKA SOLUTIONS:

- Chemical attacks and improper waterproofing:
  Sikagard®-720 EpoCem® and or Sikagard®-63 N/-62,
  Sikagard®-7000 CR
- Cracks, untight joints:
  Sikadur-Combiflex® SG, Sika® Injection-451
  or Sikaflex® PRO-3 (or Sikaflex®-403 tank and silo in zones of biogenic corrosion)
- Damaged concrete and steel reinforcement corrosion:
  Sika MonoTop®-4012
  SikaTop® Armatec®-110 EpoCem®
  Sika Emaco® S 5400
- Damages due to biogenic corrosion in confined areas:
  Sika MonoTop®-4400 MIC
  Sikagard®-7000 CR
- External concrete protection:
  Sikagard® H 303 hydrophobic impregnation
  Sikagard®-675 W ElastoColor protective coating
  Sikagard®-5500 Elastic protective coating

SIKA SOLUTIONS FOR BIOLOGICAL TANKS



GENERAL DESCRIPTION & MAIN REQUIREMENTS
Primary sedimentation tanks are designed to substantially degrade the biological content of the sewage. These biological contents are originated from human waste, soap and detergents.

Typical problems encountered in these tanks are:
- Chemical attacks depending on the aggressiveness of the waste or industrial water.
- Leakage and risk of pollution due to cracks, untight joints or bad quality concrete.
- Concrete spalling due to reinforcement steel corrosion.

SIKA SOLUTIONS FOR CONCRETE REPAIR
Overview
Repairing damaged concrete is one of the primary requirements in the maintenance of sewage treatment plants.
A sound and correctly repaired concrete substrate is also the basic requirement for any additional waterproofing, protection or strengthening systems to be applied.

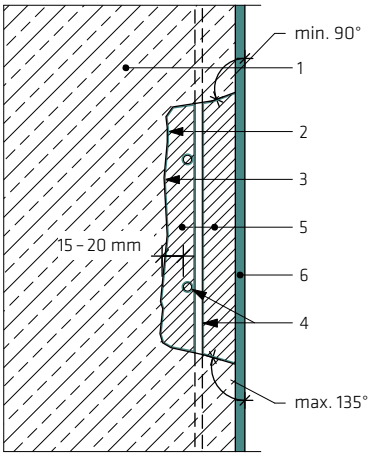
Requirements
- Full system compatibility (bonding primer, repair mortar, levelling mortar)
- Approved for structural repairs where required (e.g. class R3 or R4 according to EN 1504-3)
- Low crack sensitivity
- Fast and easy application

SIKA SOLUTIONS
- Bonding primer for large area repairs (where relevant): SikaTop® Armatec®-110 EpoCem®
- Reinforcement steel bar corrosion protection: SikaTop® Armatec®-110 EpoCem®
- Semi-fluid reprofilling mortars for large area repairs: Sika MonoTop®-452 N
- Thixotropic reprofilling mortars for loca patch repairs: Sika MonoTop®-4012, SikaEmaco® S 5400
- Surface levelling and smoothing mortars: Sika MonoTop®-620 or Sika MonoTop®-3020 or Sikagard®-720 EpoCem® (high performance)
- Self-levelling, epoxy modified, cement based levelling mortars: Sikafloor®-81/-82 EpoCem®
- Highly resistant to hydraulic abrasion cement based mortar: Sika MonoTop®-3400 Abraroc

Sika concrete repair expertise
Sika provides an extensive range of thoroughly tested and proven repair materials and systems based on different technologies for each specific requirement and situation.

TYPICAL DETAIL

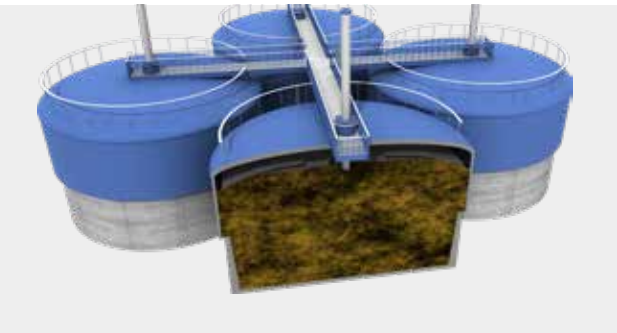
1 Host sound concrete
2 Cutting line of damaged concrete, cleaned and prepared substrate
3 Bonding primer (if relevant/required: e.g. SikaTop® Armatec®-110 EpoCem®)
4 Corrosion protective coat (e.g. SikaTop® Armatec®-110 EpoCem®)
5 Repair mortar (e.g. Sika MonoTop®-412 NFG)
6 Smoothing coat (e.g. Sika MonoTop®-3012/-723 Eco)



OTHER TYPICAL PROBLEMS AND SIKA SOLUTIONS:

- Chemical attacks and damaged waterproofing:
  Sikagard®-720 EpoCem® and Sikagard®-63 N/-62
- Cracks, untight joints:
  Sikadur-Combiflex® SG, Sikadur®-52 or Sikaflex® PRO-3
  (or Sikaflex®-403 tank and silo in zones of biogenic corrosion)
- Damages due to biogenic areas:
  Sika MonoTop®-4400 MIC
  Sikagard®-7000 CR
- External concrete protection:
  Sikagard® H 303 hydrophobic impregnation
  Sikagard®-675 W ElastoColor protective coating
  Sikagard®-5500 Elastic protective coating

SIKA SOLUTIONS FOR GASOMETER



GENERAL DESCRIPTION & MAIN REQUIREMENTS
Within the process of biological deterioration in the biological tank or the digestion tank, biogas (methane, CO_2) will be produced and be stored in gasometers. These gasometers are generally built in steel. Biogenic sulfuric acid is highly aggressive to steel. Additional stresses are caused by the elevated temperature.

Typical problems encountered are:
- Steel corrosion
- Leakage and risk of pollution due to untight joints

SIKA SOLUTIONS FOR STEEL CORROSION
Sika provides a large range of extensively tested products in the field of corrosion protection. Sika offers products for the protection of new structures on site or for shop application. For maintenance works, Sika offers a surface tolerant primer allowing application of the corrosion protection without sandblasting the surface, meaning no plant shut down is necessary. UV-resistant top coats, available in almost all RAL color shades, give the possibility for aesthetic designs.

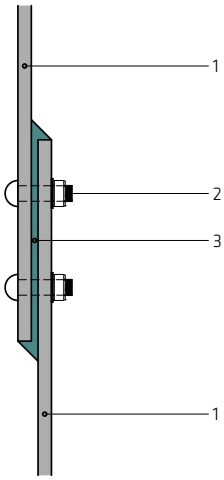
SIKA SOLUTIONS FOR DIGESTERS, GASOMETER AND MIC (MICROBIAL INDUCED CORROSION) OF STEEL STRUCTURES IN ANAEROBIC CONDITIONS
- Hot spray Polyurea, solvent free, crack bridging, highest chemical resistance, 1 layer application:
  Sikalastic®-8440, on primer SikaCor® EG 1 (on steel)
- High performance epoxy resin, solvent based,
  3 layer application:
  Sika® Permacor®-3326 EG H, directly applied on blasted steel

SIKA SOLUTIONS FOR STEEL COMPONENTS
Steel, not subject to microbial induced corrosion:
- Standard epoxy, solvent free, high chemical resistance,
  3 layer application Sikagard®-63 N/-62
- Epoxy based, high solid SikaCor®-950 F

SIKA SOLUTIONS FOR STRUCTURAL STEEL WORK
Coating systems for structural steel have to fulfil the requirements in accordance to EN ISO 12944:
- System build-up for corrosive industrial and maritime climate based on 2-comp. products SikaCor® EG-System
- System build-up for maintenance: Sika® Poxicolor Primer HE

TYPICAL DETAIL

1 Steel plates
2 Bolt with protection
3 Sikaflex® TS Plus

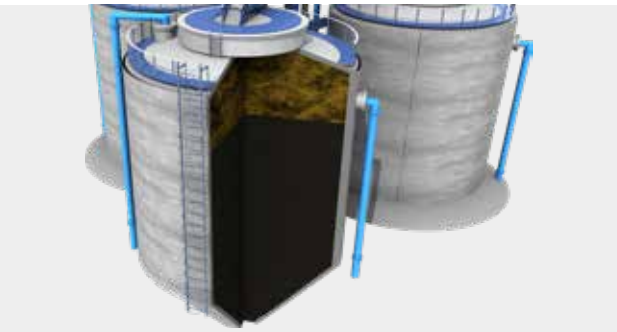


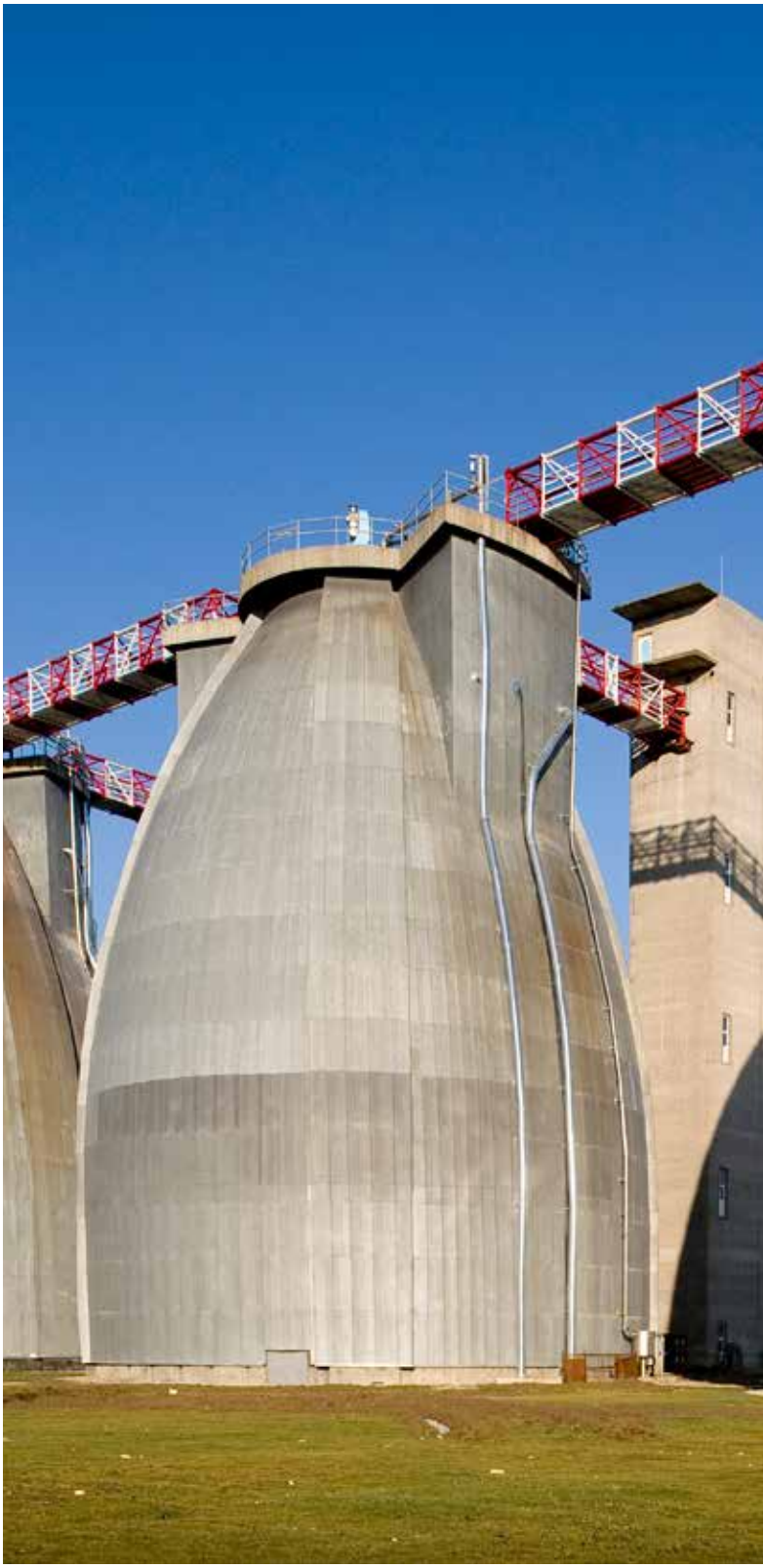
OTHER TYPICAL PROBLEMS AND SIKA SOLUTIONS:

- Steel plate joint:
  Sikaflex® TS Plus

- External weathering protection:
  Concrete structures:
  Sikagard®-740 W, Sikagard®-675 W ElastoColor,
  Sikagard®-555 W Elastic
  Brick structures:
  Sikagard®-703 W

SIKA SOLUTIONS FOR DIGESTION TANKS





GENERAL DESCRIPTION & MAIN REQUIREMENTS
The sewage sludge digestion tank is where the sludge is stabilized, reduced in volume, made innocuous through the process of dissolving organic substance with the help of anaerobic bacteria and finally, where energy is recovered.

Typical problems encountered are:
- Heavy chemical attacks above the anaerobic zones
- Leakage and risk of pollution due to cracks, untight joints or damaged concrete.

SIKA SOLUTIONS FOR HEAVY CHEMICAL PROTECTION
Concrete above the sludge may suffer heavy attack due to the formation of the sulfuric acid (refer to page 16 for more details). Additional stress is caused by the elevated temperature originating from the biological process.
Down times always create problems and difficulties for the owners, as well as loss of money. Sika offers solvent free, high build coating systems which can be applied in one layer on a good prepared surface. Therefore, down times can be minimized without the reduction of the protective properties.

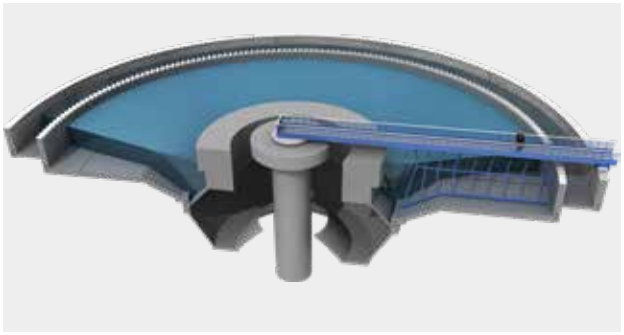
Sikalastic®-8440 on primer
Sikafloor®-156/-161 on concrete
- Hot spray Polyurea
- Solvent free
- Crack bridging
- High chemical resistance
- 1 layer application

Sikagard®-7000 CR – Primer Sikagard® P 770
overcoated with Sikagard® M 790
- Solvent free
- Application on humid conditions
- Hand or spray application
- High chemical resistance including BSA
- Crack bridging
- Application in three layers of coating

OTHER TYPICAL PROBLEMS AND SIKA SOLUTIONS:

- Cracks, untight joints:
  Sikadur-Combiflex® SG
  Sikaflex® PRO-3
  Sikaflex®-403 tank and silo
- Damaged concrete and steel reinforcement corrosion:
  Sika MonoTop®-4012
  SikaTop® Armatec®-110 EpoCem®,
  Sika SikaEmaco® S 5400
- External concrete protection:
  Sikagard® H 303 hydrophobic impregnation
  Sikagard®-675 W ElastoColor protective coating
  Sikagard®-5500

SIKA SOLUTIONS FOR SECONDARY SEDIMENTATION TANKS



GENERAL DESCRIPTION & MAIN REQUIREMENTS
Secondary treatment is intended to degrade further the organic content of sewage water originating from human waste, soap, detergent, etc. Most of the plants treat the sewage using aerobic biological processes.

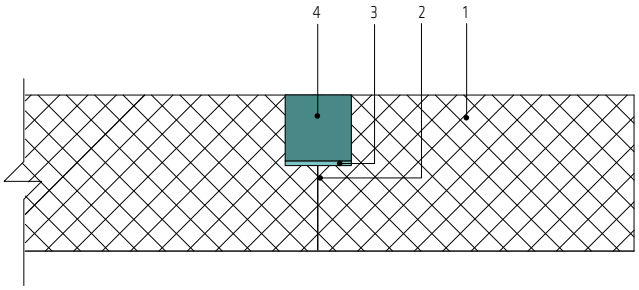
Typical problems encountered are:
- Erosion due to water flow
- Chemical attacks, depending on the aggressiveness of the waste water
- Leakage and risk of pollution due to cracks, untight joints or damaged concrete
- Steel reinforcement corrosion due to reduced concrete cover

SIKA SOLUTIONS FOR DURABLE JOINT SEALANTS
Sealants used in sewage treatment plants have to survive extremely harsh conditions and thus must meet very demanding requirements.

Sikaflex® PRO-3
- 1-component non-sag sealant
- High resistance against waste water and waste water treatment chemicals
- Excellent adhesion under permanent water immersion
- Resistance against microbiological attack
- Resistance against continuous high water pressure

Approvals & standards
- ISO 11600 25 HM, EN 15651, part 4 25 HM CC
- CSM: Very good resistance against mould and bacteria growth according to IPA (ISO 846)
- Waste water resistance according to the DIBt guidelines (German approval body for construction products and types of construction)

TYPICAL DETAIL

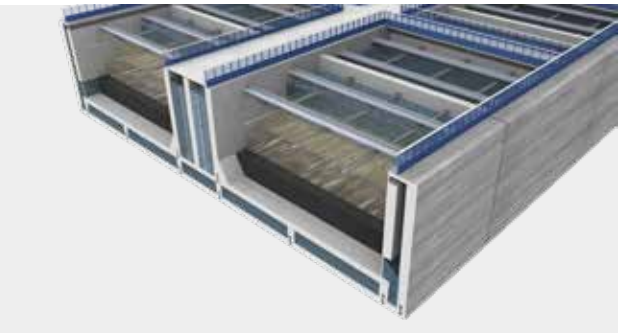


1 Substrate
2 Construction joint
3 Bond breaking
4 Sikaflex® PRO-3

OTHER TYPICAL PROBLEMS AND SIKA SOLUTIONS:

- Chemical attacks and improper waterproofing:
  Sikagard®-720 EpoCem®
- Cracks, untight joints:
  Sikadur-Combiflex®, Sika® Injection-451, Sikaflex® PRO-3,
  Sikaflex®-403 tank and silo
- Damaged concrete and steel reinforcement corrosion:
  Sika MonoTop®-4012
  SikaTop® Armatec®-110 EpoCem®
  SikaEmaco® S 5400
- External concrete protection:
  Sikagard® H 303 hydrophobic impregnation
  Sikagard®-675 W ElastoColor protective coating
  Sikagard®-5500 Elastic protective coating

SIKA SOLUTIONS FOR FILTRATION BEDS



GENERAL DESCRIPTION & MAIN REQUIREMENTS
In the filtration bed, the treated water flows through various layers of sand beds for final filtration before being discharged in the environment.
Filters are periodically cleaned using air and clean water at counter stream. The cleansing water is then pumped back to the aeration basin for retreatment.

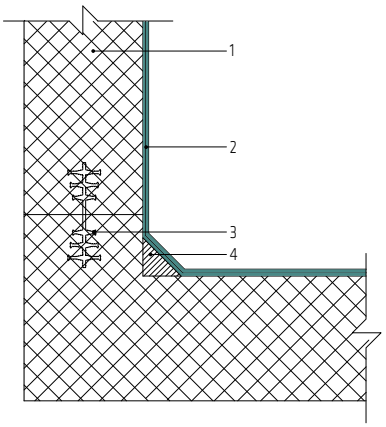
Typical problems encountered are:
- Abrasion
- Damaged waterproofing
- Leakage and risk of pollution due to cracks and untight joints

SIKA SOLUTIONS FOR BLISTERING
Typical problems occurring in sewage treatment plants are the formation of blisters (see picture on page 37) when semi-permeable coatings are applied in water saturated concrete.
This can be avoided using a layer of 3 mm of Sikagard®-720 EpoCem® during the repair works.
This specially developed product acts as temporary moisture barrier allowing the application of a coating or flooring to a green or damp concrete. The advantage for the owner is reduced completion time and eliminated risk of blistering.

Other characteristics of Sikagard®-720 EpoCem® are:
- Internal curing – no curing required
- Quick over-coating with resin coatings – either water or solvent based
- Increased chemical resistance (compared to polymer modified cement based product)

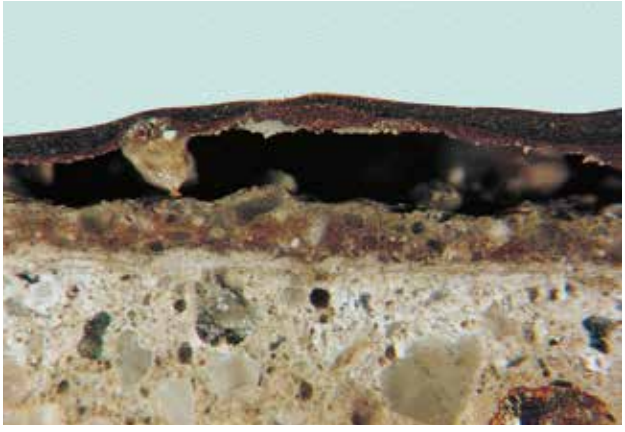
TYPICAL DETAIL

1 Concrete substrate
2 Sikagard®-720 EpoCem®
3 Construction joint Sika® Waterbar
4 Sika MonoTop®-4012



OTHER TYPICAL PROBLEMS AND SIKA SOLUTIONS:

- Damaged waterproofing: Sikagard®-720 EpoCem®
- Abrasion: MonoTop®-3400 Abraroc
- Cracks, untight joints: Sikadur-Combiflex® SG, Sikaflex® PRO-3



SIKA SOLUTIONS FOR TECHNICAL SERVICE BUILDINGS AND WEATHERING PROTECTION

GENERAL DESCRIPTION & MAIN REQUIREMENTS

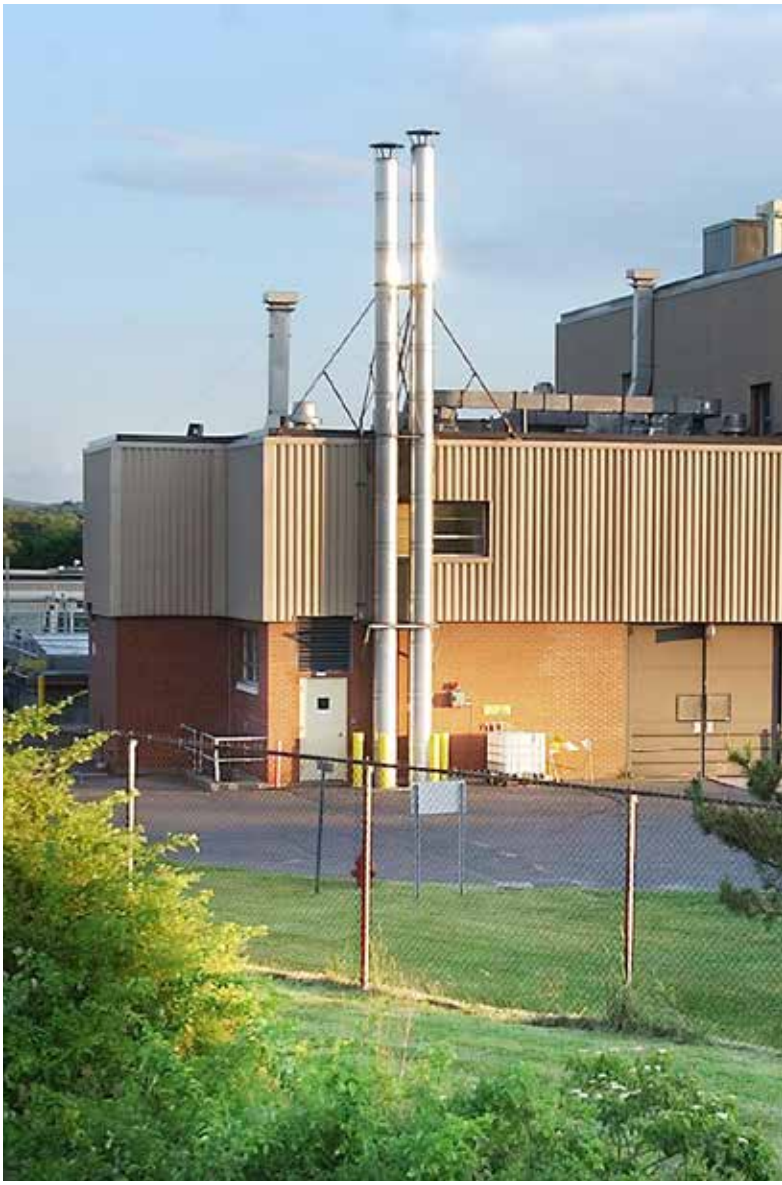
Most waste water treatment plants have a technical service building. External surfaces of the building as well as of the above ground tanks are exposed to weathering and therefore often need protection.
In these technical buildings, chemicals are handled. Therefore, the floors in the chemical storage area also need protection.

SIKA SOLUTION FOR FLOORS

- Epoxy flooring, self levelling, solvent free, high chemical resistance:
  Sikafloor®-381
- PU-modified cementitious flooring, solvent free, excellent chemical resistance, lightly slip resistant:
  Sika® Ucrete® MF or Sika® Ucrete® DP 10

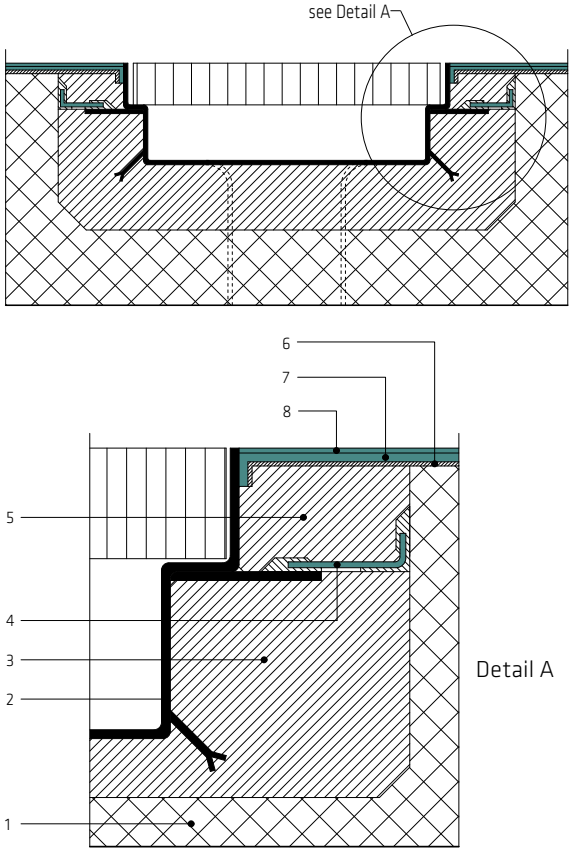
SIKA SOLUTIONS FOR EXTERNAL SURFACE PROTECTION

- Surface applied corrosion inhibitor:
  Sika® FerroGard®-903 Plus
  Sikagard®-706 Thixo
- Hydrophobic impregnation for concrete:
  Sikagard® H 303
- Hydrophobic impregnation for bricks and other mineral substrates:
  Sikagard®-703 W
- Concrete protective coating:
  Sikagard®-675 W ElastoColor
- Crack bridging concrete protective coating:
  Sikagard®-5500



TYPICAL DETAIL

Sikafloor® coating
Connection on drainage channel or outlet



1 Concrete slab
2 Drainage channel or outlet with adhesive steel flange
3 SikaGrout®-314
4 Sealing adhesive steel flange with Sikadur-Combiflex® SG System
5 SikaGrout® anchorage mortar
6 Sikafloor® primer (epoxy) thickness ca. 0.1 mm
7 Sikafloor® coating in epoxy or PUR thickness ca. 2.0 – 4.0 mm
8 Sikafloor® finishing thickness ca. 0.1 – 0.4 mm according to the selected coating system and the mechanical load anticipated in service

OTHER TYPICAL PROBLEMS AND SIKA SOLUTIONS:

Roofs in the buildings (technical and office) of the sewage treatment plants may require waterproofing. Sika offers full range of roof waterproofing that fits the different needs of owner:

- SikaPlan® PVC or FPO membrane
- Sikalastic® liquid applied membrane

SIKA SOLUTIONS FOR NEW CONSTRUCTIONS

CONCRETE FOR SEWAGE AND WASTE WATER TREATMENT PLANTS

Reinforced concrete forms the load-bearing framework, floors and walls for practically all of the specialist structures in sewage and waste water treatment plants. These include all of the drainage channels and pipework into the plant and between the different processes including initial mechanical screening and separation, primary sedimentation tanks, secondary treatment including clarification in aeration / biological digestion tanks, and finally any tertiary specialist chemical treatments and purification that are required.

High performance durable concretes must be used for these structures, particularly for direct contact with the sewage and waste water. However, it should be clearly understood that concrete alone cannot withstand all of the different types and degrees of mechanical and chemical attack that can be imposed in a waste water treatment plant. The correct design and construction of these structures, together with the additional surface protection systems required, are therefore all essential for long-term durability. Timely scheduled and correct maintenance are essential.

The main technical challenge for concrete is to resist in this harsh physical and chemical environment.

Concrete Corrosion & Erosion:

- Mechanical abrasion & erosion
- Freeze-thaw attack, with or without de-icing salts
- Chemical attack (acid and sulfate attack)
- Alkali-aggregate reaction (ASR)
- Microbial Induced Corrosion (MIC) in closed areas

Depending on the degree of exposure, the concrete can be designed and placed to provide increased levels of resistance, or this level can be further increased by the application of a suitable protective surface treatment. The so-called 'tidal zones' of tanks and structures which are areas continuously alternating between dry and wet exposure due to variations in water levels, are particularly at risk. In these zones, the damage processes can be accelerated by the alternating high oxygen and high water / chemical exposure. Over time, in some structures an organic "protective barrier layer" is formed on the concrete surfaces; however, each time this layer is removed by the cleaning scrapers, the concrete surface can also be abraded and is gradually eroded. The operation of the plant must therefore be optimized to minimize damage from this process.

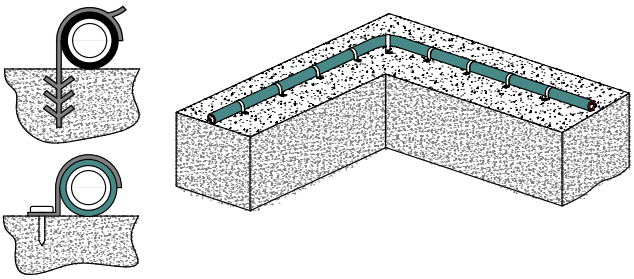
Where the concrete surfaces are to be exposed, it is always important to pour and place the concrete as dense as possible, with minimal voids or surface cracking, plus:

- High ASR resistance is achieved through modifying the cement binder by adding suitable quantities of pulverized fly ash (PFA), or ground-granulated-blast-furnace-slag (GGBFS).

- Increased resistance to freeze-thaw action is obtained by adding air entraining agents.
- High resistance to mechanical impact and abrasion is achieved using a low water/cement ratio and added silica fume.

Chemical resistance is related to the impermeability and density of the surface and the cement matrix, so a low w/c ratio and closed finish is necessary. However, against aggressive chemicals, particularly strong acid attack, the resistance of concrete alone is limited. Therefore, an additional protective surface treatment must be applied.

TYPICAL DETAIL



No matter how good a concrete is, the failure will occur at points of weakness: construction joints, cold joints and expansion joints, pipe penetrations, fixing, etc.
Since decades, Sika provides a wide range of solutions to cater for all types of detailing: Sika® Waterbar for construction and expansion joints; Sikaflex® PRO-3, a chemical resistant joint sealant; SikaFuko® Hose, re-injectable hoses for construction joints; Sikadur-Combiflex® SG System, for sealing construction joints, failed sealants, cracks etc.

Sulfate driven attack is primarily caused by sulfates dissolved in water. By reacting with the hardened cement matrix, an increase in volume is induced, which damages the structure. (Picture: BetonSuisse, Merkblatt 01)

Acidic attacks which dissolve calcium compounds out of the hardened cement matrix can be caused by acids, exchangeable salts, vegetable and animal fats or oils. Degradation of the concrete usually occurs very slowly. (Picture: BetonSuisse, Merkblatt 01)

MORE SIKA SOLUTIONS

GENERAL DESCRIPTION & MAIN REQUIREMENTS
Additionally to the different problems exposed in the previous pages, sometimes special issues are raised such as strengthening of a basin, anchoring some ladders in a tank, making an opening for a new pipe, waterproofing the flat roof of a new building, etc. Sika provides fully compatible products and integrated systems to suit almost every refurbishment project and site requirement.

SIKA SOLUTIONS FOR STRUCTURAL STRENGTHENING
Due to design errors, upgrading of a structure or damage of the concrete substrate, structural strengthening may be necessary. Bonding of strengthening products to an existing structure can extend its lifetime significantly avoiding demolition and rebuilding. Structural strengthening by bonding of external plates or lamination of fabrics is carried out in accordance with relevant design codes.
The surfaces where the externally bonded reinforcement will be installed must be prepared and cleaned thoroughly. Any damages or deteriorated concrete must be removed and repaired to comply with EN 1504 part 10 section 7.2.4 and section 8. Depending on the project, different solutions are available:

Sika CarboDur® plates
- Pre-cured CFRP plates
- Bonded with Sikadur®-30 adhesive
- Light weight and easy to install, especially overhead
- Very high strength
- Excellent durability and fatigue resistance
- Minimal preparation, applicable in several layers
- Can alternatively be embedded into the substrate

SikaWrap® Fabrics
Dry fibre fabrics, saturated on site
Laminated with Sikadur®-330 or Sikadur®-300 resin
- Available in different weights and widths
- Flexible and accommodating of different surface planes and geometry
- Multifunctional material for use in different strengthening applications

Sika CarboStress® System
- Unique pre-stressed strengthening system
- Advantages of Sika CarboDur® CFRP plates
- Advantages of post tensioning
- StressHead anchorage system

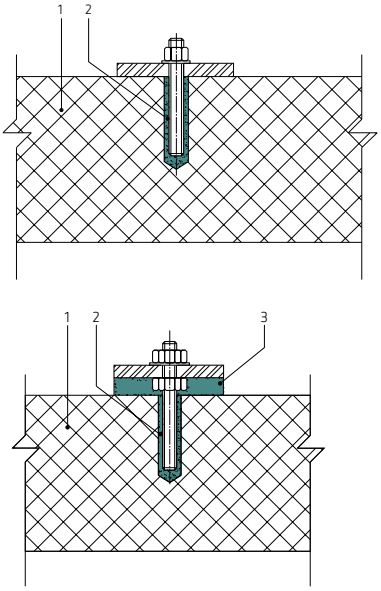
Others:
CarboShear L: Profiles for shear strengthening of beams
CarboHeater: Accelerated curing of Sikadur®-30 adhesive

SIKA SOLUTIONS FOR GROUTING
SikaGrout®-334
- High performance shrinkage compensated cementitious grout
- CE marked as EN 1504-6, anchoring of reinforcement bars
- Low shrinkage, high mechanical strength
- Grouting under base plates, machine bases etc.
- Fast strength development
- Possible to reach up to 125 mm thickness per layer
- Sulphate resistant

For grouting of special equipment with dynamic loads and vibrations:
Sikadur®-42+ HE/LE/VLE:
- 3-part, high-performance epoxy resin based grouts, suitable for various static or dynamic precision grouting applications.
- CE-marked according to EN 1504-6 for anchoring reinforcement bars
- High mechanical strengths
- Good resistance to vibration and chemical exposures

TYPICAL DETAIL

1 Concrete substrate
2 Sika® AnchorFix-1, 2 or 3
3 Leveling mortar Sikadur®-41



CHEMICAL ANCHORING / FIXATIONS
GENERAL DESCRIPTION AND MAIN REQUIREMENTS

Fixing any sort of equipment can be particularly challenging within a WWTP. Installations are often required on various substrates, often under different temperature conditions, and almost in all cases, fast curing is necessary to return to service quickly.
Frequently, installations need to be carried out in humid or wet concrete, and the environment of a WWTP is in general chemically quite aggressive.

Typical problems encountered:

- Various substrates for all sorts of fixings are present in a WWTP
- For short interruptions and quick service / maintenance work, fast curing is required
- Applications must be carried out under different temperature conditions; both indoor and outdoor
- Concrete is often wet or has high humidity during installation
- Fixings are unstable due to chemical attack / aggressive environment

SIKA SOLUTIONS FOR CHEMICAL ANCHORING / FIXATIONS

- Products for fixing in various concrete classes and masonry
- Fast curing, even under different temperatures (-25° to +40°C)
- No expansion of the anchor in certain substrates (no cracking of substrate)
- Application possible in wet concrete or high humidity conditions
- Resistant and durable in chemically aggressive environment
- Also suitable for use in drinking water areas (NF certified)
- Wide service temperature range (-40°C to 100°C)
- Chemical anchors provide a sealed borehole, preventing corrosion of fixed steel parts
- Approvals for all steel classes, including stainless steel and HCR (high corrosion resistant), which are common in such environments

SIKA PRODUCTS FOR CHEMICAL ANCHORS

AnchorFix®-2+ / AnchorFix®-2020

- Solvent and styrene free, epoxy acrylate based, 2-component high performance anchoring adhesive for different climate conditions
- Regulated / professional applications in concrete, fixings and post installed rebar applications in all classes of concrete, also in cracked concrete and seismic zones
- Drinking water certified
- High durability

AnchorFix®-2002:

- Solvent- and styrene free, acrylate-cement hybrid based, 2-component anchoring adhesive for high loads
- Regulated / professional applications in concrete, fixings and post installed rebar application in all classes of concrete, also in cracked concrete and seismic zones
- Also suitable for high service temperatures

AnchorFix®-3030

- Solvent-free, thixotropic, 2-component, epoxy resin based high performance anchoring adhesives
- Regulated / professional applications in concrete, fixings and post installed rebar application in all classes of concrete, also in cracked concrete and seismic zones
- High chemical resistance, extended pot-life, fire resistant tests available
- Drinking water certified
- High durability

CASE STUDIES

LA WANTZENAU WASTE WATER TREATMENT PLANT, STRASBOURG, FRANCE

PROJECT DESCRIPTION
5th largest wastewater treatment plant in France, with a capacity of 1,000,000 population equivalent, e.g. 61t of BOD5/day and a hydraulic capacity of 240,000 m^3/d and up to 380,000 m^3/d in rainy weather. ~64 million m^3 of water treated in 2019. Commissioning in 1988, work to bring it up to standard between 2005 and 2007.

PROJECT REQUIREMENTS
Due to severe biogenic corrosion, large part of various confined elements had damages over 20 cm. Retrofitting was required to resist long term to this biogenic corrosion.

SIKA SOLUTION
In some parts, reprofiling was done with dry shotcrete and other parts, more damaged, with new poured formwork concrete.
And to provide the long term durability against biogenic corrosion, Sika MonoTop®-4400 MIC 100% calcium aluminate mortar was applied using the dry spray technique.
Other Sika products used:
Surface hardener: Sikagard®-230 MIC
Surface retarder & mold released agent: Rugasol ®-3W Paste
Repair mortar: Sika MonoTop®-410 R
PU Sealant resistant to biogenic corrosion: Sikaflex® TS Plus

İSKI İKITELLI WASTE WATER TREATMENT PLANT, ISTANBUL, TURKEY

PROJECT DESCRIPTION
This is a large sewage water treatment plant with capacity to provide water to 5.2 million people, 40% of the population in Istanbul. It has 2 separate water treatment systems, which provide 840,000 m^3 of clean water a day. System 1 was completed in 1998 and system 2 in 2003.

PROJECT REQUIREMENTS
The sewage treatment plant treats waste water containing the biological contamination and eutrophication. It needs to use various procedures and chemicals to make the water finally clean before going back to the city's water supply system. The water containing structures have to survive under extremely severe conditions and resist against microbiological and chemical attack.

SIKA SOLUTION
Concrete spallings were repaired using Sika MonoTop® polymer modified patch repair mortar.
Concrete was protected against chemical agression with first a primary application of Sikagard®-720 EpoCem® as temporary moisture barrier, followed by Sikagard®-2040 TR chemical resistant epoxy coating.
Jointing of concrete elements was done with the chemical resistant sealant Sikaflex® PRO-3.

WROCŁAW WASTE WATER TREATMENT PLANT, POLAND

PROJECT DESCRIPTION
The sewage treatment plant in Wroclaw is a mechanical-biological sewage treatment plant with chemical-assisted removal of phosphorus and full sludge processing.
The goal of the third phase of development and modernization of the sewage treatment plant was to increase the capacity from an average of 70,000 to 140,000 m^3 per day, and to fulfill more stringent standards of water leaving the plant and entering the river stream.

PROJECT REQUIREMENTS
Settlement tanks and sludge pump stations needed to be rehabilitated.
New structures needed to be built like grit chambers, primary and secondary settlement tanks, digestion chambers, sludge dehydration buildings and biomass tanks.

SIKA SOLUTION
Sika could provide a technical solution for the following applications:
Preliminary and secondary settlement tank walls:
Sika® Repair-30 F – repair mortar and Sika® Poxitar F – epoxy coating (3 layers)
Preliminary and secondary settlement tank floor:
Sikafloor® 156 – epoxy levelling mortar and Sika® Poxitar F – epoxy coating (3 layers)
Top of tanks and driving range:
Sika® Elastomastic TF – 3 mm highly mechanical and chemical resistant epoxy polyurethane hybrid and Sikaflex® PRO-3 – chemical resistant polyurethane sealant
Pumping Station:
Sika® Repair-30 F – as levelling mortar and Sika® Poxitar F – epoxy coating (3 layers)
Digestion chambers:
Sika® Repair-30 F – as levelling mortar and Sika® Poxitar F – epoxy coating (3 layers – laminated)

SINDELFINGEN-BÖBLINGEN WASTE WATER TREATMENT PLANT, GERMANY

PROJECT DESCRIPTION
This plant belongs to the community towns of Sindelfingen and Böblingen. This WWTP alone treats over 15 million cubic meter of waste water annually.
The plant boasts efficient treatment of the waste water. For organic pollutants a purification rate of over 90% is achieved and at the same time more than 70% of dissolved nutrients including phosphorus and nitrates are removed from the water.

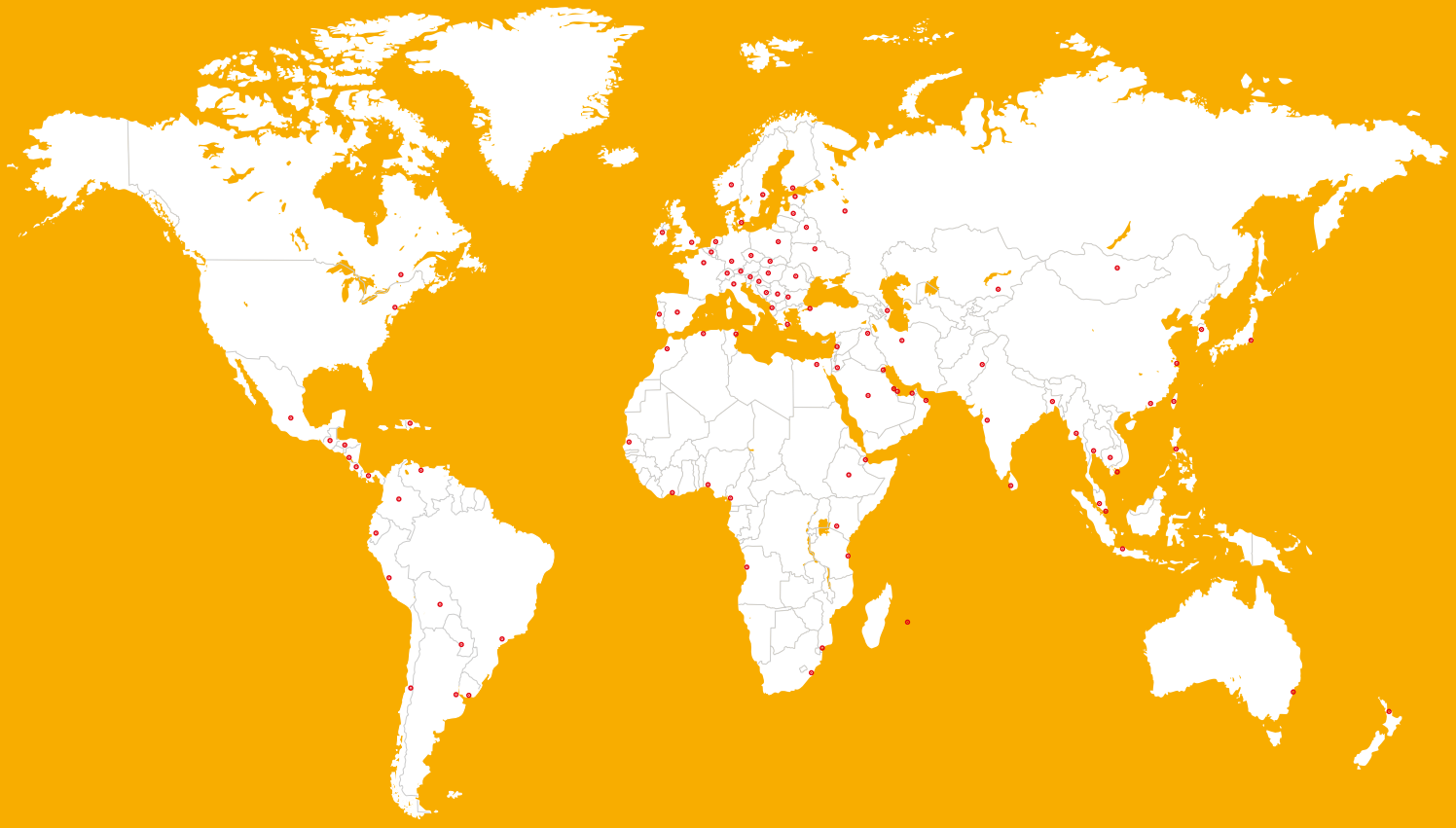
PROJECT REQUIREMENTS
The two primary settlement tanks and the mechanical scrapper tracks were in need of immediate refurbishment.
Concrete under the settlement tanks was suffering from decays. The mechanical scrapper tracks were subjected to heavy abrasion. Exposed steel structures were coroding.

SIKA SOLUTION
Sika could provide a technical solution for each application:
Settlement tanks:
Concrete repair:
Sika MonoTop®-601 Neu – exposed steel protection
Sika MonoTop®-602 / 603 Neu – Polymer modifier repair mortar
Sika® Icoment®-520 – Resurfacing mortar
Sika® Poxitar® F – Chemical protection

Scraper track refurbishment:
Sikafloor®-156 – Epoxy primer
Sika® Elastomastic® TF – wear resistant, crack bridging polyurethane epoxy resin
Sikafloor®-359 – abrasion resistance polyurethane sealer coat

Steel work:
SikaCor®-EG System – primer, epoxy intermediate coat and polyurethane top coat

GLOBAL BUT LOCAL PARTNERSHIP



FOR MORE INFORMATION:

WE ARE SIKA
Sika is a specialty chemicals company with a leading position in the development and production of systems and products for bonding, sealing, damping, reinforcing and protecting in the building sector and the motor vehicle industry. Sika's product lines feature concrete admixtures, mortars, sealants and adhesives, structural strengthening systems, industrial flooring as well as roofing and waterproofing systems.

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