



# REFURBISHMENT SIKA SOLUTIONS FOR SEWERS AND WASTE WATER TREATMENT PLANTS

BUILDING TRUST





## SIKA – YOUR PARTNER

Since many decades Sika has been a reliable partner with waste water treatment plant contractors supplying products and systems on all continents. Sika has shown the industry we are a partner, they can trust. The products and systems used in new waste water treatment plants and retrofitted structures are thoroughly tested in Sika laboratories before being independently checked. Sika materials are further proven by long term site testing to withstand the harsh conditions in the real environment.

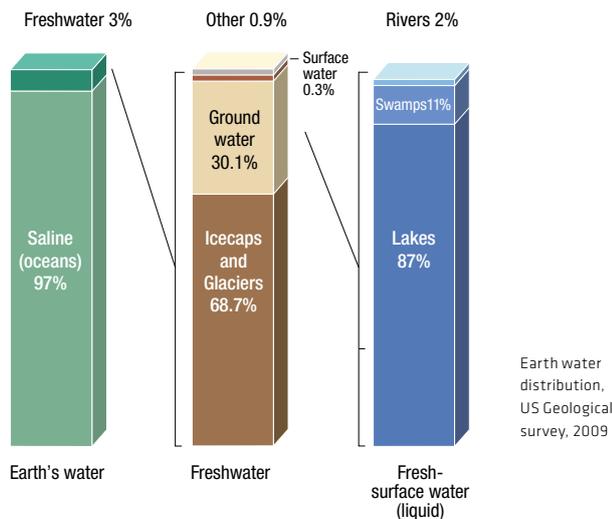
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# SIKA SOLUTIONS CONTRIBUTE TO A SUSTAINABLE FUTURE

“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



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<sub>2</sub> 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.



UNEP SBCI  
Sustainable Buildings & Climate Initiative

## THE SIKA LIFE CYCLE ASSESSMENT APPROACH

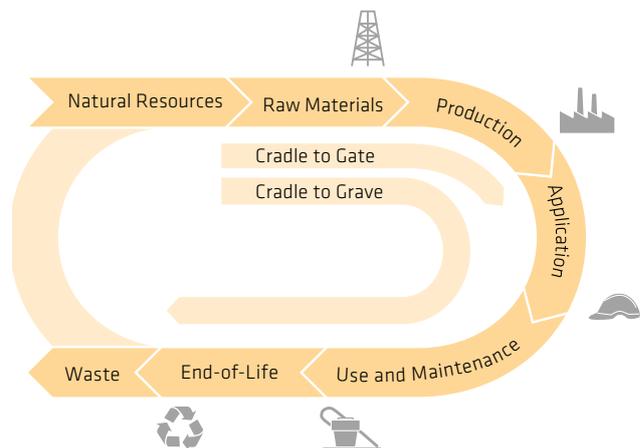
Life Cycle Assessment (LCA) is a standardized method to assess and compare the inputs, outputs and potential environmental impacts of products and services over their life cycle. LCA's are increasingly recognized as the best way to evaluate the sustainability of products and systems.

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).





# SUSTAINABLE REFURBISHMENT OF WASTE WATER TREATMENT PLANTS



Sika LCA's on refurbishment strategies for waste water treatment plants are based on a 'Cradle to Grave' approach. Potential environmental impact of products for concrete repair and protection is investigated from raw material extraction, production, application and use to final disposal at end of life. Construction and end-of-life scenario of the reinforced concrete structure itself is excluded.

The LCA analysis is based on the refurbishment of confined pits at the entrance of a waste water treatment suffering from severe biogenic corrosion less than 10 years after opening of the plant. The surface area is arbitrarily taken as 1000 m<sup>2</sup> and the life cycle over a 50 years period. The frequency of retrofitting are taken based on real project situation and relevant investigation reports. This LCA analysis has been presented at the Conference Concrete Solution in September 2019 in Romania.

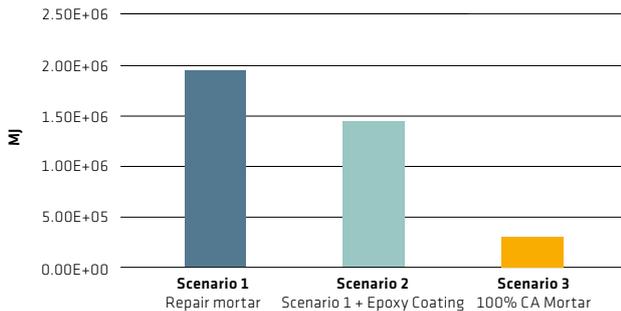
3 scenarios are investigated:

Scenario 1	Scenario 2	Scenario 3
Retrofitting every 7 years with repair mortar acting as sacrificial layer (50 mm)	Retrofitting every 10 years with repair mortar (25mm), resurfacing mortar and epoxy coating	Retrofitting once with 100% aluminate mortar (25 mm)

Refer to the article prepared for the above mentioned conference - available for free download at:  
[https://www.matec-conferences.org/articles/mateconf/abs/2019/38/mateconf\\_cs18\\_10005/mateconf\\_cs18\\_10005.html](https://www.matec-conferences.org/articles/mateconf/abs/2019/38/mateconf_cs18_10005/mateconf_cs18_10005.html)

### Cumulative Energy Demand

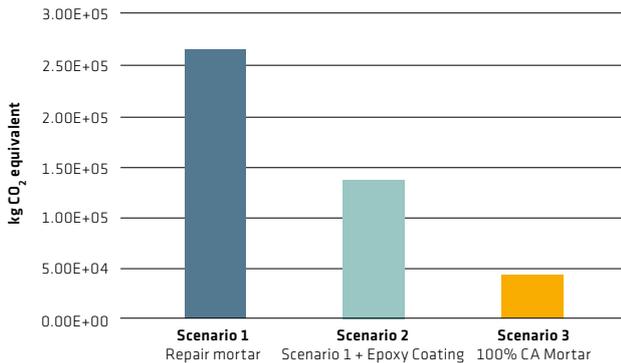
Waste Water Confined Tank Refurbishment (1000 m<sup>2</sup>)



When compared to scenario 1, the energy saving per year using the 100% calcium aluminate mortar is equivalent to the energy required to produce ~40 tons of oil (~28 tonnes of oil when compared to the system used in scenario 2).

### Global Warming Potential

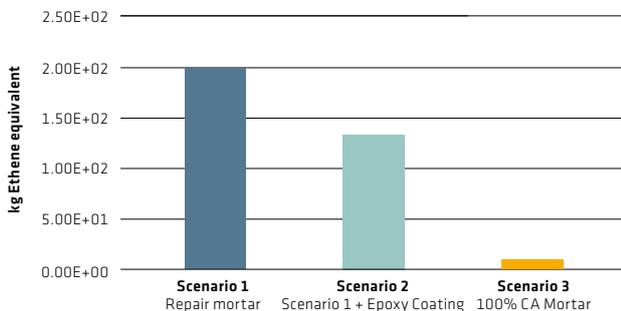
Waste Water Confined Tank Refurbishment (1000 m<sup>2</sup>)



When compared to scenario 2, the CO<sub>2</sub> saving per year with scenario 3 is equivalent to the CO<sub>2</sub> issued during the transport of 24.7 tonnes of product by truck for over ~150'000 km, which is equivalent to more than three times the world's circumference (this figure is still approx. half of the amount for scenario 2 at ~67'000 km).

### Photochemical Ozone Creation Potential

Waste Water Confined Tank Refurbishment (1000 m<sup>2</sup>)



When compared to scenario 1, the VOC saving per year using the 100% calcium aluminate mortar is equivalent to saving ~115 tonnes of solvent based coating (this figure is ~49 tonnes when compared to scenario 2).

### CONCLUSION

Overall saving for the plant owner with positive incidence on sustainability:

#### The appropriate strategy can have a beneficial impact:

- by reducing the frequency of refurbishment cycles,
- by improving the resource efficiency and the environmental performance of the refurbishment process,
- by providing a more sustainable solution.

# GENERAL PROCESS OF CLEANING WASTE WATER

The cleaning procedure of a modern waste water treatment plant can be summarized in 6 different steps:

## **SEWER SYSTEM** see pages 10 - 13

Generally, waste water is collected and transported via a network of pipes and pumped to the waste water treatment plant.

## **MECHANICAL TREATMENT** see pages 24 to 29 and 38/39

This includes the screening to remove large objects in the sewage water and the whole sedimentation procedure as well. Sand and grits, oil, grease, fat, floating and heavy solids will be separated from the waste water. The primary sludge after settlement will be skimmed off.

### **Construction elements:**

- 1 Screening channel
- 2 Grit removal chamber, combined with fat and grease removal
- 3 Primary sedimentation tanks
- 4 Secondary sedimentation plant

## **BIOLOGICAL TREATMENT** see pages 30/31

The pretreated waste water will be aerated in biological tanks. By adding oxygen, a special bacteria will be created to reduce the biodegradable soluble organic contaminants in the waste water.

### **Construction elements:**

- 5 Aerated and anoxic biological tanks



**CHEMICAL TREATMENT**  
see pages 30/31

The aim of the chemical treatment is to remove phosphorus by adding special chemicals as ferric chloride. This results in a chemical flocculation that will be removed further in the filtration process.

**Construction elements:**

5 Aerated and anoxic biological tanks

**FILTRATION**  
see pages 36/37

All the remaining particles after the biological and chemical treatment will be retained in special sand filter beds. The cleaned water is discharged to the receiving environment.

**Construction elements:**

6 Filtration beds

**SLUDGE TREATMENT**  
see pages 32 to 35 and 40/41

Sludge from the primary and secondary sedimentation will be digested to reduce the amount of organic matter. Within this process, biogas (methane, CO<sub>2</sub>) will be produced and stored in gasometers. Afterwards, the digested sludge will be dewatered first, before it will be disposed into an incinerator or landfill. In the energy building, methane gas will be used to produce electricity and heat.

**Construction elements:**

7 Digestion tanks

8 Gasometers

9 Energy building



# EXPOSURE FOR SEWERS

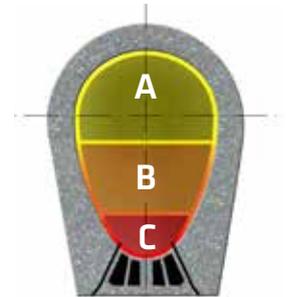
Most accessible sewers are more than 50 years old and in most cases are made of tamped or reinforced concrete in round, rectangular or ovoid shapes.

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.

In general rules, these elements shall be replaced and reassembled properly by bonding them in place with an epoxy adhesive. In case of concrete substrate, the erosion can be repaired with a high abrasion resistant mortar that will increase the service life of the substrate



## 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. After appropriate preparation, these defects can be repaired using sulfate resistant repair mortars.



## 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. It is recommended in these zones to proceed with a full resurfacing.



## 4 Cracks with water leaks:

Due to shrinkage or settlements, concrete in sewers often cracks. These cracks need to be filled in order to prevent leakage of pollutant to surrounding ground water. It is often necessary to use expanding materials to fill these 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. Therefore, these surfaces can be protected using EpoCem® technologies which are extremely resistant and watertight against urban waste water.



At the crown area, the structure can be protected against condensation water using a hydrophobic impregnation.

Additionally, the aerial part of the sewer can suffer from biogenic corrosion or microbial induced corrosion (MIC). To repair and protect these areas a 100% Calcium Aluminate Mortar must be used.



# SIKA SOLUTIONS FOR SEWERS

The products and systems to repair sewers will vary according to the extent of damages, performance requirements, expected durability and budget. Sika can answer all the needs by of-

fering products and system solutions to suit all requirements with the backup of worldwide references and experience.



## REPAIR WORK

### **Sika MonoTop®-1010/-910 Eco**

1-component anticorrosion slurry and bonding primer (when relevant)

### **SikaTop® Armatec 110 EpoCem**

3-component, epoxy modified corrosion protection and bonding primer (when relevant)

### **Sika MonoTop®-4012**

1-component, cementitious, sulfate resistant repair mortar

### **Sika MonoTop®-412 NFG**

1-component, polymer modified, sulphate resistant repair mortar

### **Sika MonoTop®-2400 Reseaux**

1-component, sulphate resistant hydraulic repair mortar

### **Sika MonoTop®-3400 Abraroc**

1-component, hydraulic abrasion resistant repair mortar, hand or dry spray applied

### **Sika MonoTop®-4400 MIC**

1-component, 100% calcium aluminate, biogenic corrosion resistant repair and protection mortar



## SURFACE PROTECTION

### **Sikagard®-720 EpoCem®**

Epoxy cement resurfacing mortar with high resistance against urban waste water

### **Sikagard®-740 W/-706 Thixo**

Hydrophobic impregnation to protect the concrete crown against condensed water

### **Sika MonoTop®-4400 MIC**

1-component, 100% calcium aluminate, biogenic corrosion resistant repair and protection mortar

### **Sikafloor®-390 N Thixo**

2-component, solvent free, thixotropic chemical and abrasion resistant epoxy coating

### **Sika® Permacor®-3326 EG H**

2-component, solvent free, chemical and abrasion resistant epoxy coating also against biogenic corrosion.



## ADHESIVE / ANCHORING / CRACK TREATMENT

### **Adhesive**

#### **Sikadur®-31**

Epoxy adhesive with high bonding on various substrate

### **Anchoring / Grouting**

#### **SikaGrout®-334**

Fluid mortar for grouting of elements

#### **Sika AnchorFix®S**

Styrenated polyester based 2-component universal anchoring adhesive  
Multipurpose use in concrete

#### **Sika AnchorFix®-1**

Solvent and styrene free based, two-component polyester anchoring adhesive  
Multipurpose use in solid and hollow masonry and concrete, also for regulated applications

#### **Sika AnchorFix®-2+ / -2002 / -2020**

Solvent and styrene free, epoxy acrylate based, 2-component high performance anchoring adhesive for different climate conditions  
Regulated / professional applications in concrete, fixing and post installed rebar applications in all classes of concrete; also in

cracked concrete  
Drinking Water certified

#### **Sika AnchorFix®-3+**

Solvent-free, thixotropic, 2-component, epoxy resin based, high performance anchoring adhesive  
Regulated applications in concrete, high chemical resistance, extended Potlife

#### **Sika AnchorFix®-3001 / -3030**

Solvent-free, thixotropic, 2-component, epoxy resin based, high performance anchoring adhesive  
Regulated / professional applications in concrete, fixing and post installed rebar applications in all classes of concrete also in cracked concrete  
High chemical resistance, extended Potlife. Can also be used in seismic zones, fire resistant tests available.  
Drinking Water certified

### **Crack treatment**

#### **Sikadur-Combiflex® SG System**

High performance joint and crack waterproofing system made of a FPO tape and epoxy adhesive



#### **INJECTIONS / FILLING**

##### **Sika® Injection-101 RC**

2-component expanding polyurethane foam to stop water leakage and temporary watertightness of cracks to allow further permanent injection

##### **Sika® Injection-201 CE**

2-component, elastic PUR resin for permanent and durable filling of the cracks, complying with EN 1504-5 as crack filling material for concrete (U(D1) W(2) (1/2/3) (9/30) )

##### **Sika® Injection-451**

2-component, fluid epoxy resin for structural injection of the cracks

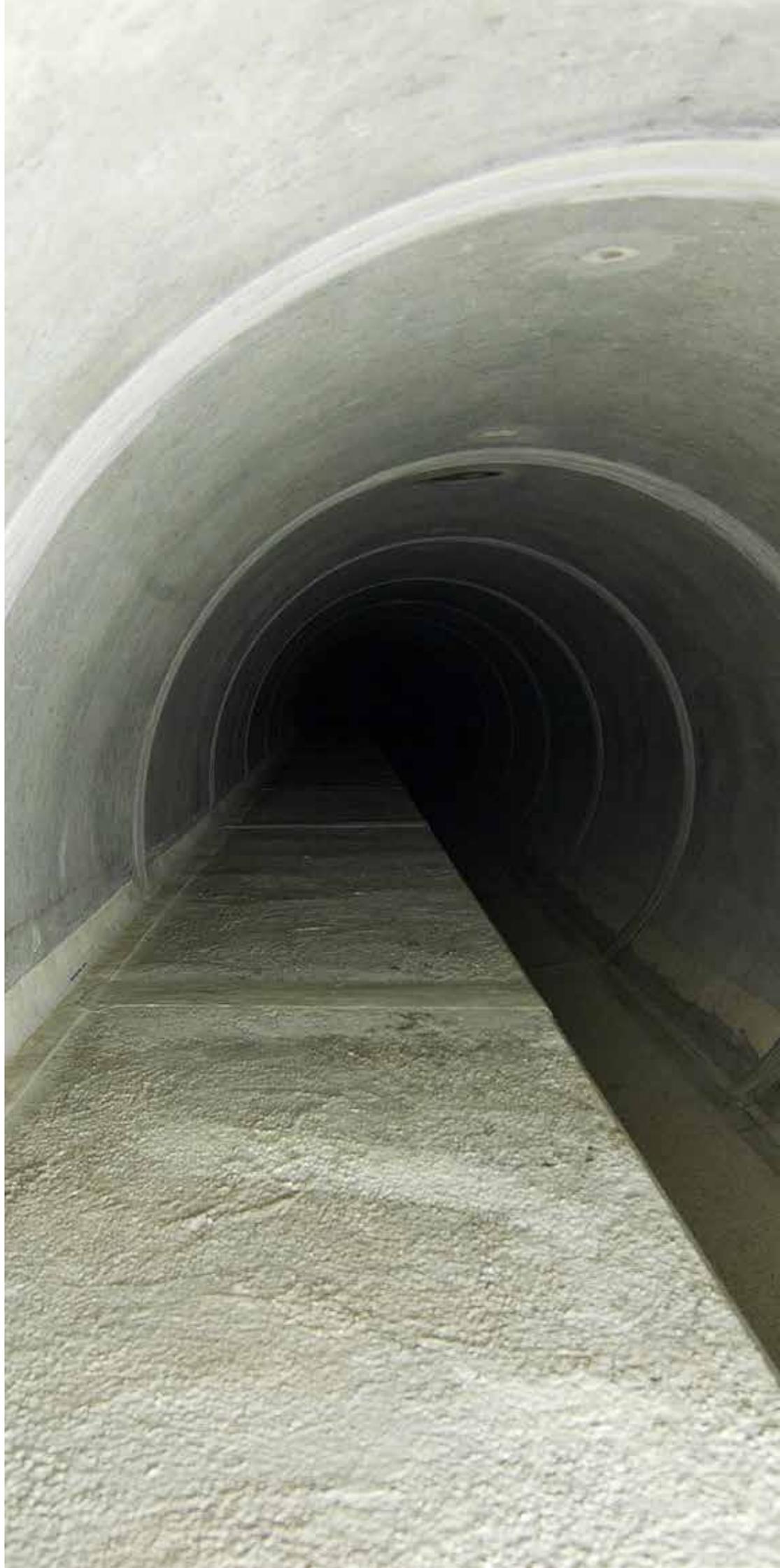
##### **Sika® InjectoCem-190**

2-component, micro-cement injection

#### **FILLING (FLOOR)**

##### **SikaFix®-501**

Fast reacting, 2-component hybrid (organic and mineral) resin to fill cavities



# PROBLEMS AND DAMAGES TO STRUCTURES

## SCREENING CHANNELS



- Abrasion and erosion due to sand, grit or other heavy particles
- Chemical attacks due to aggressive waste or industrial water
- Leakage due to cracks, untight joints or damaged concrete
- Biogenic corrosion in covered channels due to the action of bacteria contained in the sewage

## GRIT, FAT & GREASE CHAMBERS



- Abrasion and erosion due to sand, grit or other heavy particles
- Chemical attacks due to aggressive waste or industrial water
- Leakage due to cracks, untight joints or damaged concrete
- Biogenic corrosion in covered channels due to the action of bacteria contained in the sewage

## GASOMETERS



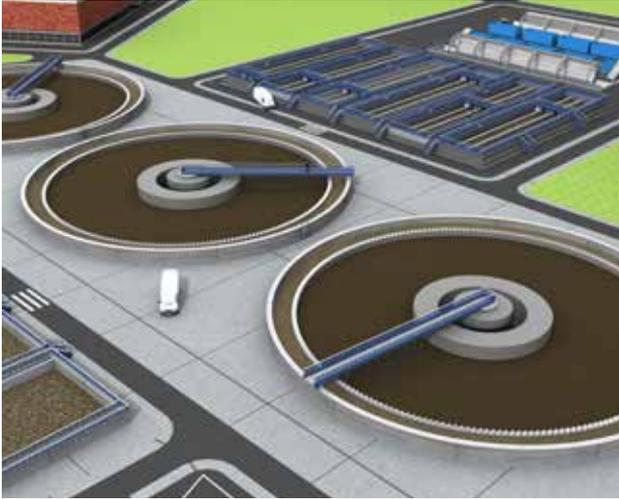
- Steel corrosion
- Untight joints
- Sulfuric acid damages

## DIGESTION TANKS



- Concrete damage due to sulfuric acid
- Leakage due to damaged waterproofing
- Cracks due to thermal expansion or shrinkage

### PRIMARY SEDIMENTATION TANKS



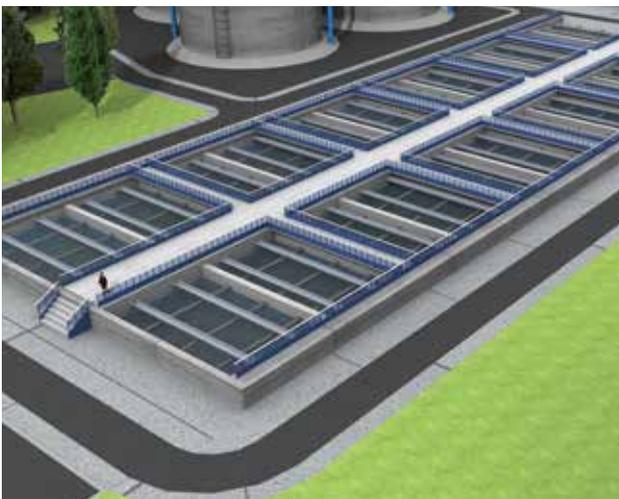
- Chemical attacks due to aggressive waste or industrial water
- Leakage due to improper waterproofing
- Cracks due to thermal expansion or shrinkage
- Steel reinforcement corrosion due to low concrete cover
- Mechanical abrasion at the rolling pad

### BIOLOGICAL TANKS



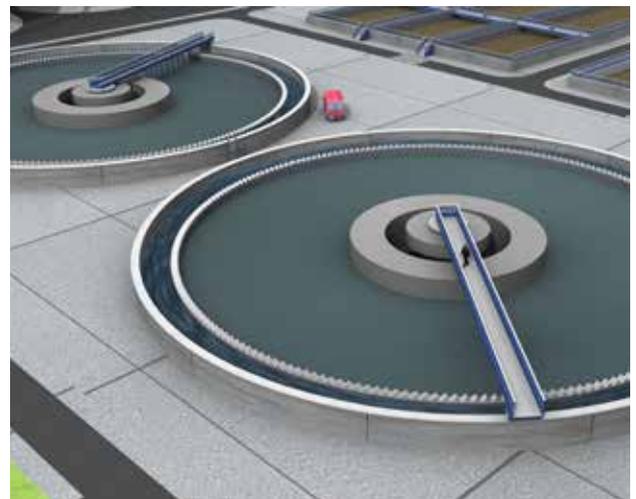
- Erosion due to water flow
- Chemical attacks due to aggressive waste or industrial water
- Leakage due to damaged waterproofing
- Cracks due to thermal expansion or shrinkage
- Steel reinforcement corrosion due to low concrete cover

### FILTRATION BEDS



- Abrasion due to sand
- Leakage due to damaged waterproofing
- Cracks due to thermal expansion or shrinkage

### SECONDARY SEDIMENTATION TANKS



- Leakage due to damaged waterproofing
- Cracks due to thermal expansion or shrinkage
- Mechanical abrasion at the rolling pad

# AGGRESSIVE SUBSTANCES IN SEWAGE – SUSTAINED ATTACK ON CONCRETE

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 corrosion



or microbial induced corrosion (MIC) is usually the most serious cause of damage in covered areas where 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.





## MICROBIAL INDUCED CORROSION (MIC)

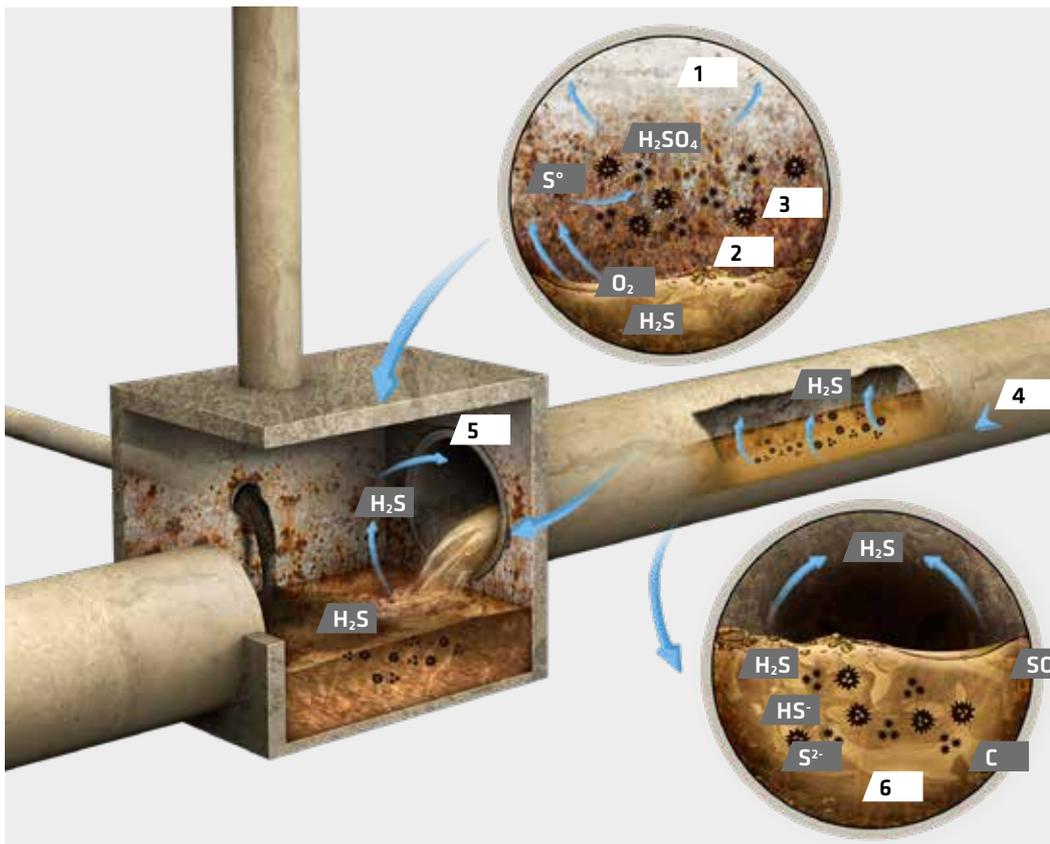
### Danger in delay – Microbial Induced Corrosion (MIC)

The chemical composition of biogas consists mainly of methane and variable concentrations of carbon dioxide, water vapour, hydrogen sulfide, nitrogen, oxygen and hydrogen.

Microbial induced corrosion happens when sulphates in biological waste are converted into sulphides through a bio-

logical process under the anaerobic conditions below the waste-water line in the sewers. Above the waste-water line, the hydrogen sulphide gas that is released in this process forms aggressive and corrosive condensates with water such as sulfurous and then sulphuric acid.

## MICROBIAL INDUCED CORROSION PRINCIPLES



- 1 Concrete wall
- 2 Thiobacillus
- 3 Wall moisture
- 4 Septic effluents
- 5 Acid
- 6 Sulfate-reducing bacteria

### SIKA SOLUTION

Sika MonoTop®-4400 MIC helps to increase the durability of structures in and along the sewerage system. Its key characteristics include:

- Acid neutralization, increasing durability of the concrete
- Promoting a bacterostatic environment, stopping the bacterial production of acids

Sika MonoTop®-4400 MIC is particularly suited to the repair and refurbishment of sewerage system structures, including manholes, inspection galleries, lifting pits and stations, the main trunk sewers and other steel and concrete structures and pipes, etc. Sika MonoTop®-4400 MIC is produced using the unique 100% Calcium Aluminate Technology that has been developed and used since 1940 for the protection of sewerage and waste water systems worldwide.

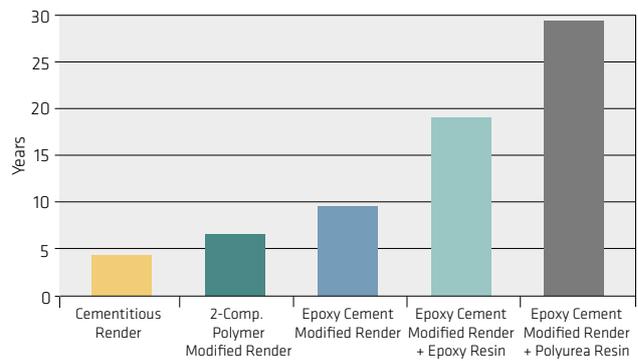
# SIKA'S FIELD EXPERIENCE SINCE 1991

## Results of Experimental Testing of Protection Systems in an Aeration Tank

In 1991, in one of the largest sewage treatment plants in Europe, different coating systems were applied in an aeration tank and left in real life exposure. Investigations were carried out at various time intervals to assess the longterm performances of the installed coating systems.

**Note:** Full article available upon request

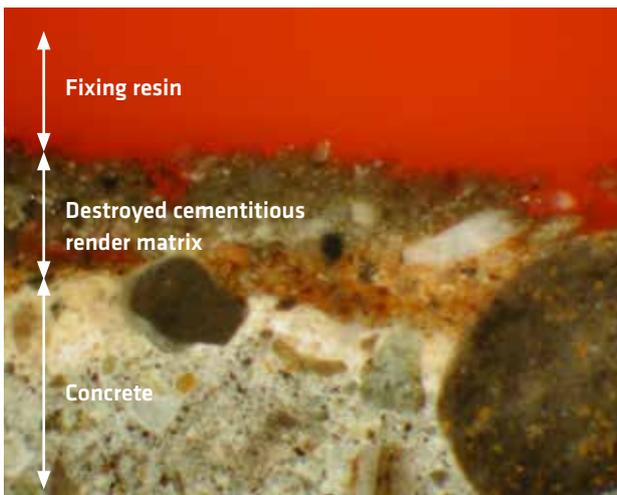
## LIFE EXPECTANCY IN AERATION TANKS



View of the various systems right after application in September 1991

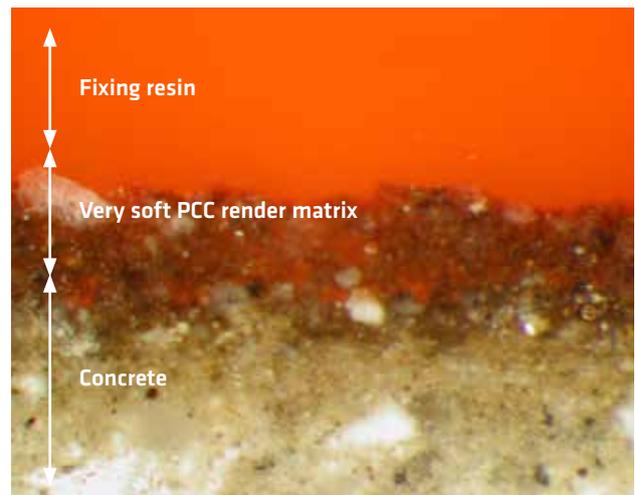


Overview of the test areas in 2008



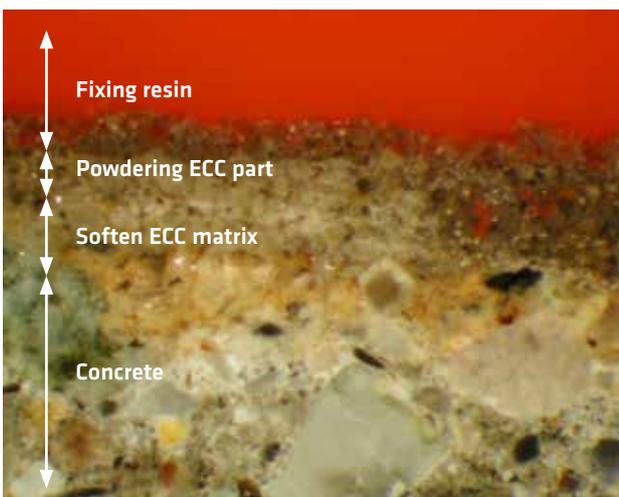
### Cementitious mortars:

Because the sewage dissolves the cement paste, continuous erosion begins within a short period of time. The binder matrix is weakened and the aggregates then break away.



### Polymer modified cementitious mortars:

They have a longer durability than normal cementitious mortars. However, when subject to aggressive chemical environments, their resistance is significantly reduced. When not over-coated, they can only provide protection for a short term.



**Epoxy cement mortar:**

The epoxy resin component improves the chemical resistance of the cement matrix. But due to the level of aggressiveness in waste treatment plant, they can only provide protection for a medium term.



**Resin coatings:**

According to their formulations, resin coatings (epoxy or polyurea) can bring long-term durability. However, particular attention must be paid to prevent osmotic blister by the use of EpoCem® levelling mortar as pre-treatment. Sikagard®-720 EpoCem® does not require curing and allows for a fast over-coating with a reactive resin. This allows a quicker and safer application process than normal cement render.

# 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.

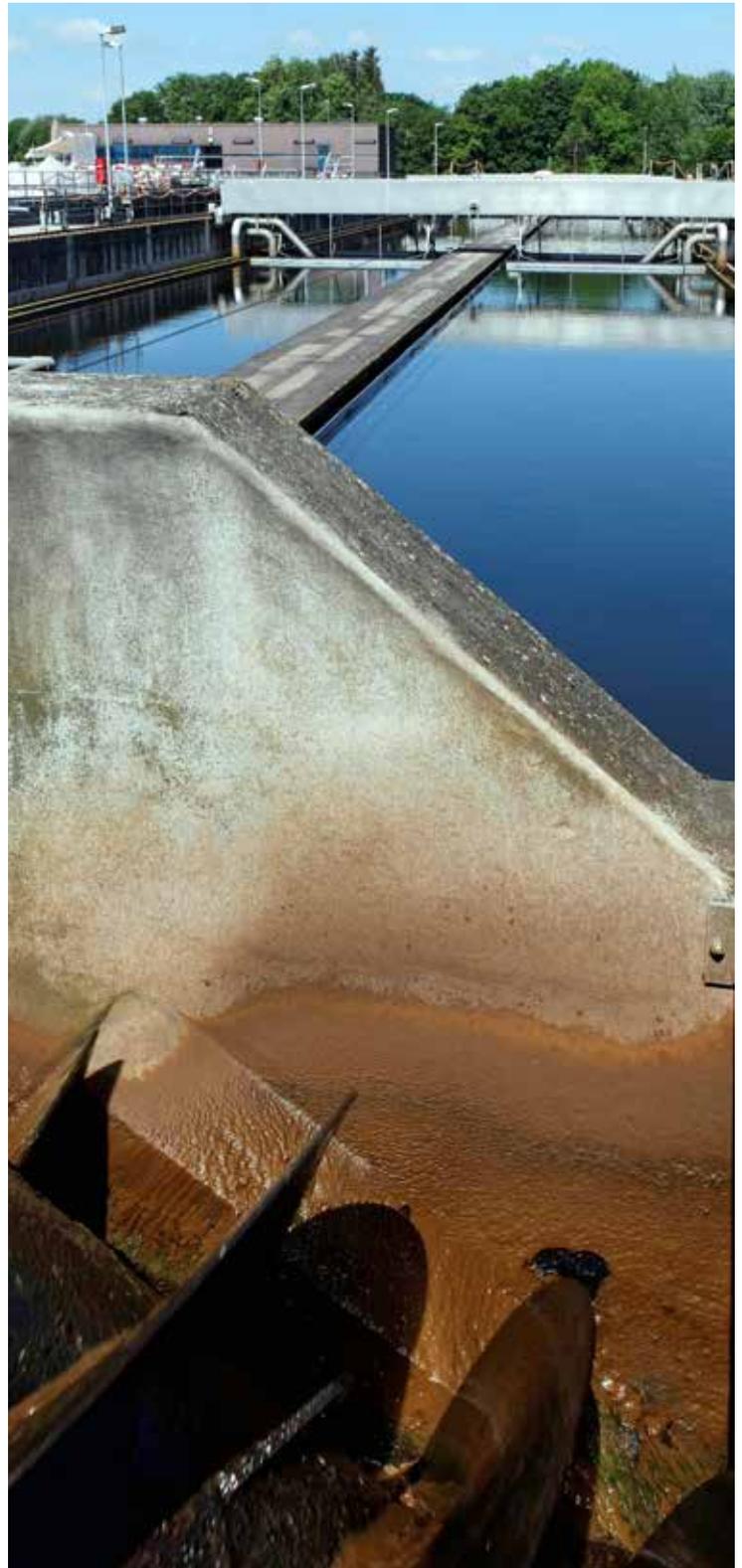
This significantly influences the selection of the appropriate refurbishment concept and the specific materials to be used.

## **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

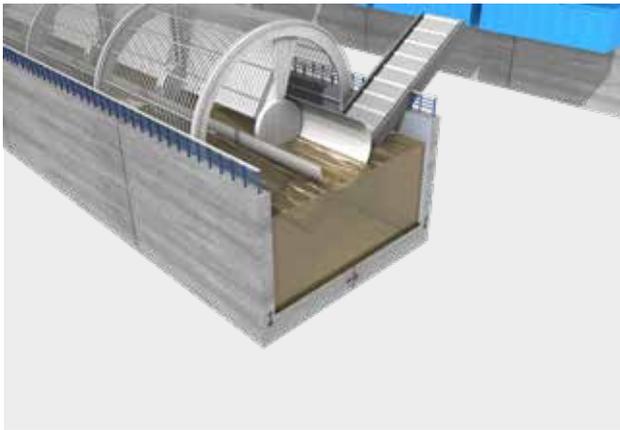
The repair and protection of sewage treatment plants must always be executed according to all relevant local standards and regulations. After a detailed condition survey and root cause analysis, the right procedures for successful refurbishment can be defined.

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)
Structural and non-structural steel corrosion		Not applicable	ISO 12944 Refers to the corrosion protection of steel structures

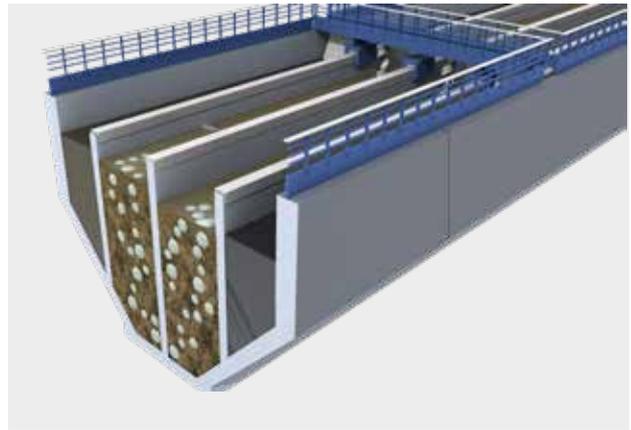
# OVERVIEW OF SIKA SOLUTIONS FOR EACH STRUCTURE

## SCREENING CHANNELS



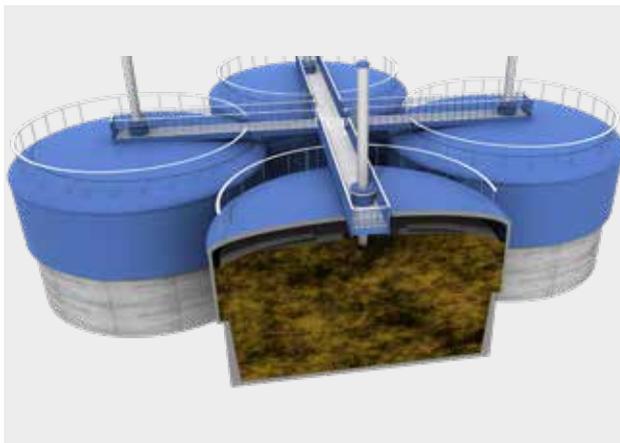
- Abrasion and erosion:  
Sika MonoTop®-3400 Abraroc
- Chemical attacks:  
Sikagard®-720 EpoCem® + Sikagard®-63 N/-62,  
SikaCor®-950 F
- Cracks, untight joints:  
Sikadur-Combiflex® SG, Sika® Injection-451 or  
Sikaflex® PRO-3
- Microbial induced corrosion (MIC) in covered areas:  
Sika MonoTop®-4400 MIC

## GRIT, FAT & GREASE CHAMBERS



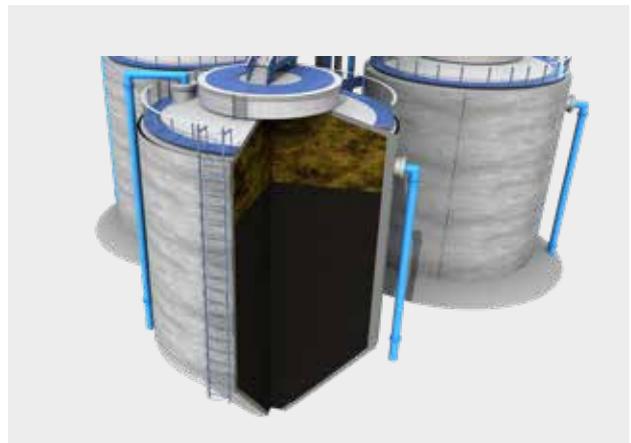
- Abrasion and erosion:  
Sika MonoTop®-3400 Abraroc
- Chemical attacks:  
Sikagard®-720 EpoCem® + Sikagard®-63 N/-62,  
SikaCor®-950 F
- Cracks, untight joints:  
Sikadur-Combiflex® SG, Sika® Injection-451 or  
Sikaflex® PRO-3
- Microbial induced corrosion (MIC) in covered areas:  
Sika MonoTop®-4400 MIC

## GASOMETERS



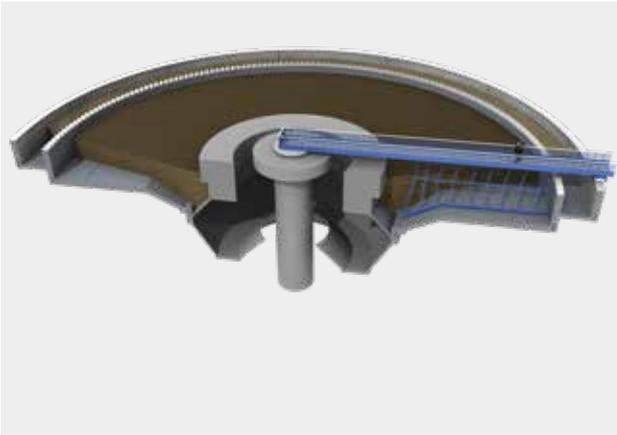
- Steel corrosion:  
Sika® Icosit® 6630 System or SikaCor® EG System
- Steel joint:  
Sikaflex® TS Plus
- Sulfuric acid attack:  
Sika® Permacor® 3326 EG H or Sikalastic®-8440

## DIGESTION TANKS



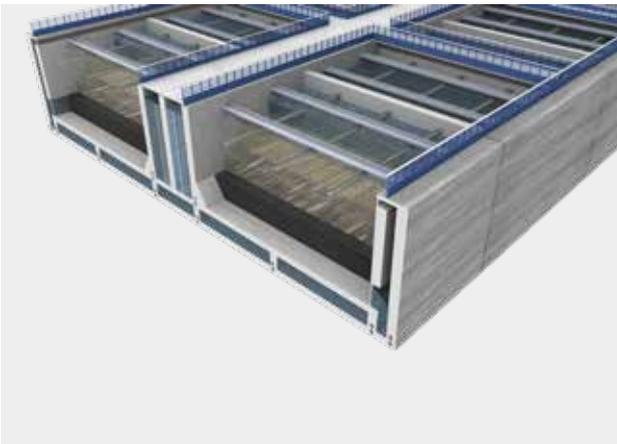
- Sulfuric acid attack and waterproofing:  
Sika® Permacor® 3326 EG H or Sikalastic®-8440
- Cracks:  
Sikadur-Combiflex® SG or Sika® Injection-451
- Chemical resistant joint:  
Sikaflex® TS Plus

## PRIMARY SEDIMENTATION TANKS



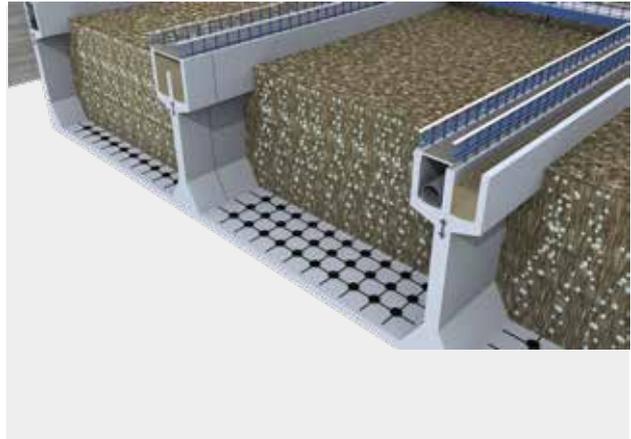
- Chemical attacks and damaged waterproofing: Sikagard®-720 EpoCem® + Sikagard®-63 N/-62, SikaCor®-950 F
- Cracks, untight joints: Sikadur-Combiflex® SG, Sika® Injection-451 or Sikaflex® PRO-3
- Damaged concrete and steel reinforcement corrosion: Sika MonoTop®-412 NFG, SikaTop® Armatec®-110 EpoCem®, Sika MonoTop®-2400 Reseaux
- Mechanical abrasion: Sikadur®-42 or Sika® Icosit®-KC 330 FK

## FILTRATION BEDS



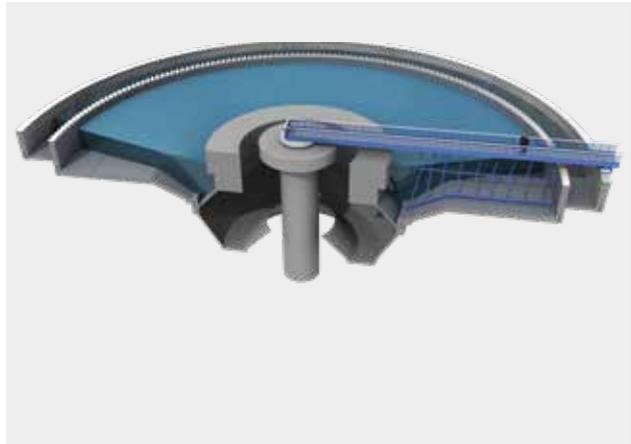
- Abrasion: Sika MonoTop®-3400 Abraroc
- Damaged waterproofing: Sikagard®-720 EpoCem®
- Cracks: Sikadur-Combiflex® SG or Sikaflex® PRO-3

## BIOLOGICAL TANKS



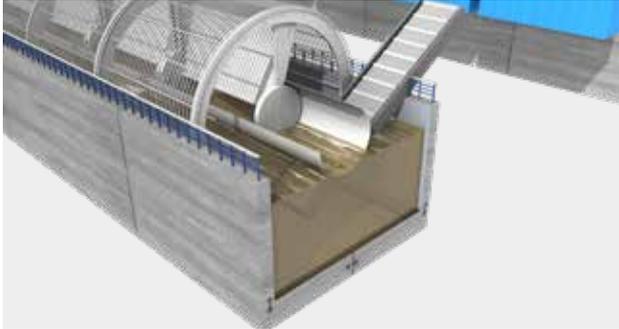
- Chemical attacks and damaged waterproofing: Sikagard®-720 EpoCem® + Sikagard®-63 N/-62, SikaCor®-950 F
- Cracks, untight joints: Sikadur-Combiflex® SG, Sika® Injection-451 or Sikaflex® PRO-3
- Damaged concrete and steel reinforcement corrosion: Sika MonoTop®-412 NFG, SikaTop® Armatec®-110 EpoCem®, Sika MonoTop®-2400 Reseaux

## SECONDARY SEDIMENTATION TANKS



- Damaged waterproofing: Sikagard®-720 EpoCem®
- Cracks: Sikadur-Combiflex® SG or Sikaflex® PRO-3

# 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

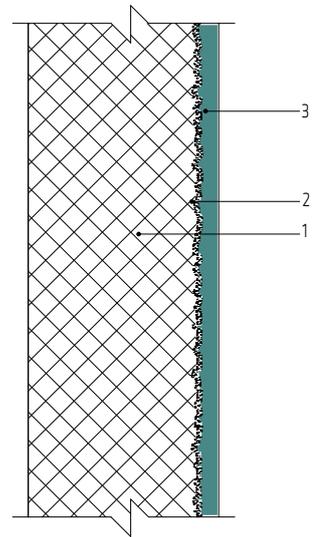
- Hydraulic abrasion resistant mortar
- Sulfate resistant
- Mild acid resistant
- Spray applied





### TYPICAL DETAIL

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

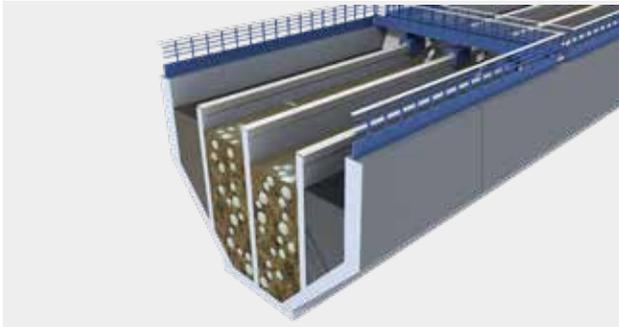


### OTHER TYPICAL PROBLEMS AND SIKA SOLUTIONS:

- Chemical attacks:  
Sikagard®-720 EpoCem® and Sikagard®-63 N/-62, SikaCor®-950 F
- Cracks, untight joints:  
Sikadur-Combiflex® SG, Sika® Injection-451 or Sikaflex® PRO-3 (or Sikaflex® TS Plus in zones of biogenic corrosion)
- Damaged concrete and steel reinforcement corrosion:  
Sika MonoTop®-412 NFG  
SikaTop® Armaterc®-110 EpoCem®  
Sika MonoTop®-2400 Reseaux
- Damages due to biogenic corrosion in confined areas:  
Sika MonoTop®-4400 MIC



# 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 corrosion (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.

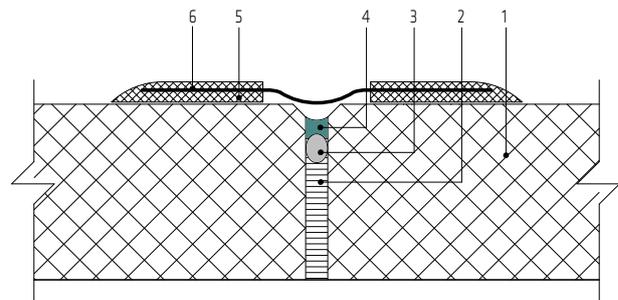
### Advantages:

- 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



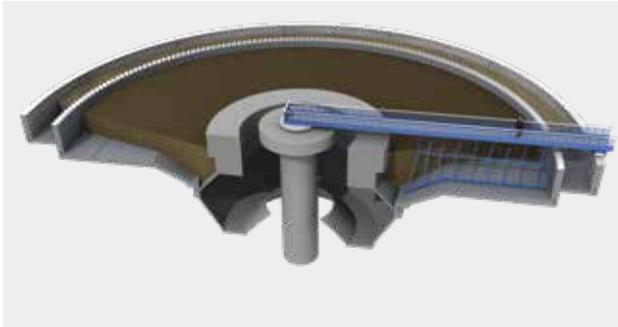
- 1 Substrate
- 2 Existing compression profile
- 3 Existing backing rod
- 4 Failed sealant
- 5 Sikadur® adhesive
- 6 Sikadur-Combiflex® SG Tape

## 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,  
SikaCor®-950 F
- Damaged concrete and steel reinforcement corrosion:  
Sika MonoTop®-412 NFG  
SikaTop® Armatec®-110 EpoCem®  
Sika MonoTop®-2400 Reseaux
- Microbial induced corrosion in covered areas with turbulent flow in the sewage:  
Sika MonoTop®-4400 MIC



# 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 scrapers 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 HE

- 3-pack epoxy grout
- High early strength and fast curing
- Stress and impact resistant
- High vibration resistance

#### Sika® Icosit® KC 330 FK

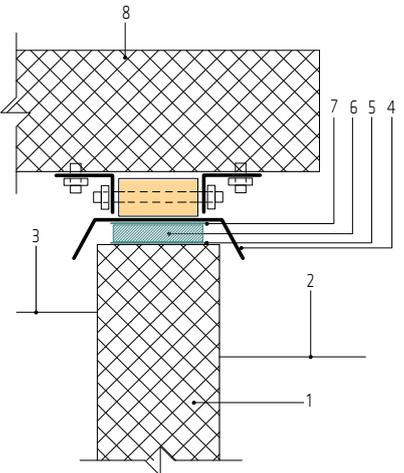
- 2-pack, solvent-free polyurethane adhesive
- High initial adhesion
- Vibration reducing
- Noise absorbing
- Not requiring temporary fixation





### 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

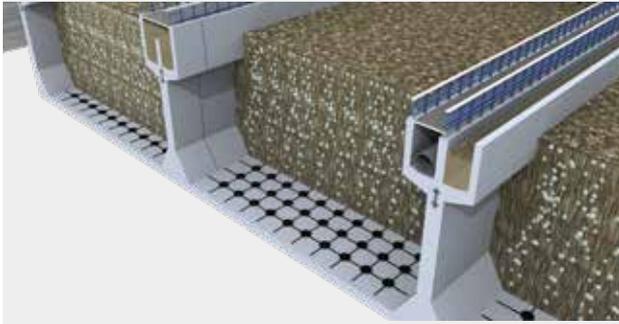


### OTHER TYPICAL PROBLEMS AND SIKA SOLUTIONS:

- Chemical attacks and improper waterproofing:  
Sikagard®-720 EpoCem® and or Sikagard®-63 N/-62, SikaCor®-950 F
- Cracks, untight joints:  
Sikadur-Combiflex® SG, Sika® Injection-451 or Sikaflex® PRO-3 (or Sikaflex® TS Plus in zones of biogenic corrosion)
- Damaged concrete and steel reinforcement corrosion:  
Sika MonoTop®-412 NFG  
SikaTop® Armatec®-110 EpoCem®  
Sika MonoTop®-2400 Reseaux
- Damages due to biogenic corrosion in confined areas:  
Sika MonoTop®-4400 MIC
- External concrete protection:  
Sikagard®-740 W hydrophobic impregnation  
Sikagard®-675 W ElastoColor protective coating  
Sikagard®-555 W 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® Armatex®-110 EpoCem®
- Reinforcement steel bar corrosion protection: SikaTop® Armatex®-110 EpoCem®
- Semi-fluid refilling mortars for large area repairs: Sika MonoTop®-452 N
- Thixotropic refilling mortars for local patch repairs: Sika MonoTop®-412 N/S/NFG/SFG/Eco, Sika MonoTop®-4012, Sika MonoTop®-2400 Reseaux
- Surface levelling and smoothing mortars: Sika MonoTop®-620 or



Sika MonoTop®-3012/-723 Eco (normal performance) 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

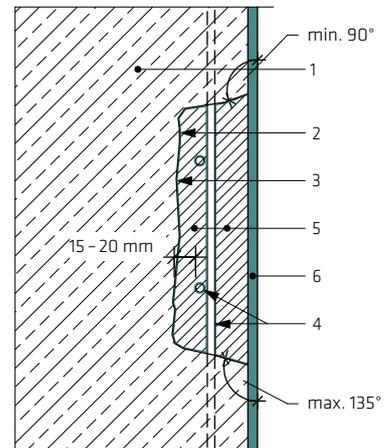
### Sika concrete repair expertise

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)

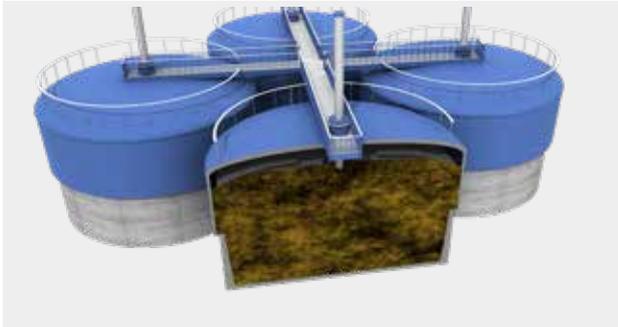


### OTHER TYPICAL PROBLEMS AND SIKA SOLUTIONS:

- Chemical attacks and damaged waterproofing: Sikagard®-720 EpoCem® and Sikagard®-63 N/-62, SikaCor®-950 F
- Cracks, untight joints: Sikadur-Combiflex® SG, Sika® Injection-451 or Sikaflex® PRO-3 (or Sikaflex® TS Plus in zones of biogenic corrosion)
- Damages due to biogenic corrosion in confined areas: Sika MonoTop®-4400 MIC
- External concrete protection: Sikagard®-740 W hydrophobic impregnation  
Sikagard®-675 W ElastoColor protective coating  
Sikagard®-555 W 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<sub>2</sub>) 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 sand-blasting 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, anthracene oil based, high solid SikaCor®-950 F



## SIKA SOLUTIONS FOR STRUCTURAL STEEL WORK

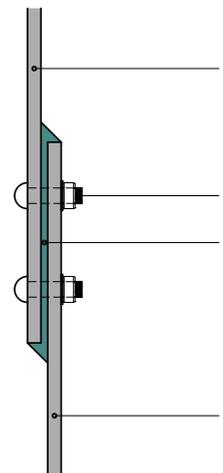
Coating systems for structural steel have to fulfil the requirements in accordance to EN ISO 12944:

- System build-up for corrosive industrial and maritime climate based on 2-comp. products SikaCor® EG-System
- System build-up for maintenance: Sika® Poicolor Primer HE



**TYPICAL DETAIL**

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

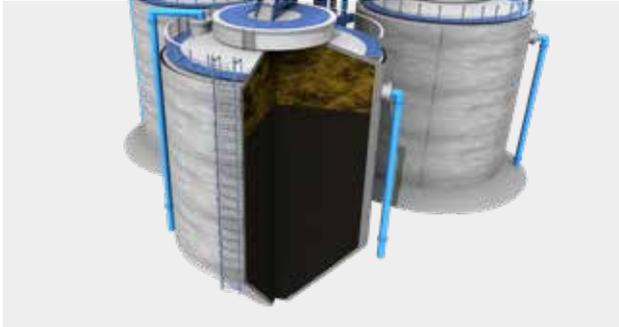


**OTHER TYPICAL PROBLEMS AND SIKA SOLUTIONS:**

- 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 or steel 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.

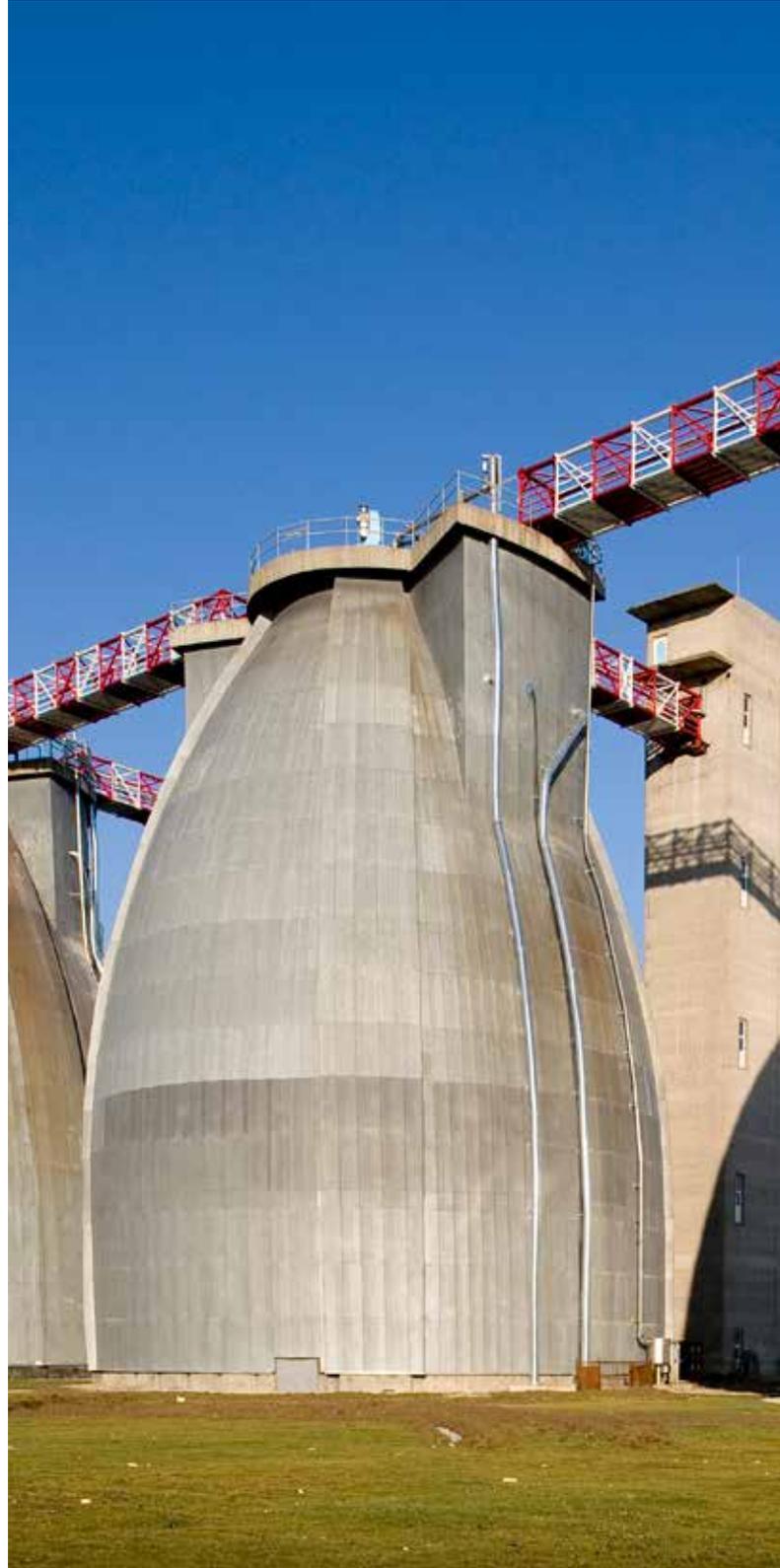
**Sikalastic®-8440** on primer

**Sikafloor®-156/-161** on concrete or **SikaCor® EG-1** on steel

- Hot spray Polyurea
- Solvent free
- Crack bridging
- Highest chemical resistance
- 1 layer application

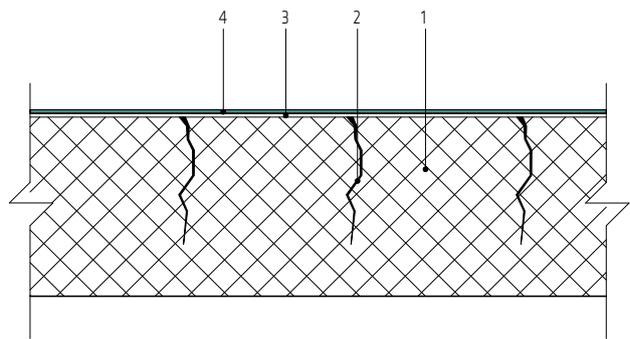
**Sika® Permacor®-3326 EG H**

- High performance epoxy resin
- Solvent based
- 3 layer application





#### TYPICAL DETAIL



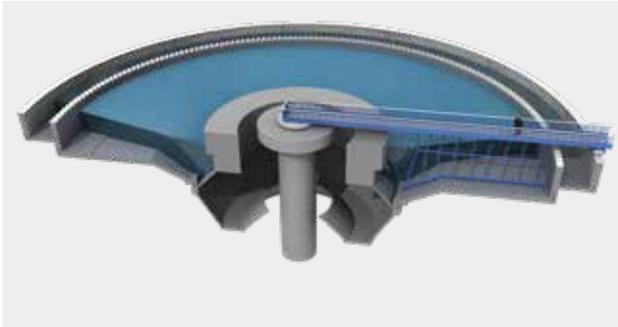
- 1 Concrete
- 2 Cracks
- 3 Primer Sikafloor®-156/-161 lightly broadcasted with quartz sand 0.3 - 0.8 mm
- 4 1 x Sikalastic®-844 XT

#### OTHER TYPICAL PROBLEMS AND SIKA SOLUTIONS:

- Cracks, untight joints:  
Sikadur-Combiflex® SG, Sikaflex® PRO-3, Sikaflex® TS Plus
- Damaged concrete and steel reinforcement corrosion:  
Sika MonoTop®-412 NFG, SikaTop® Armatec®-110 EpoCem®, Sika MonoTop®-2400 Reseaux
- External concrete protection:  
Sikagard®-740 W hydrophobic impregnation, Sikagard®-675 W ElastoColor protective coating



# 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

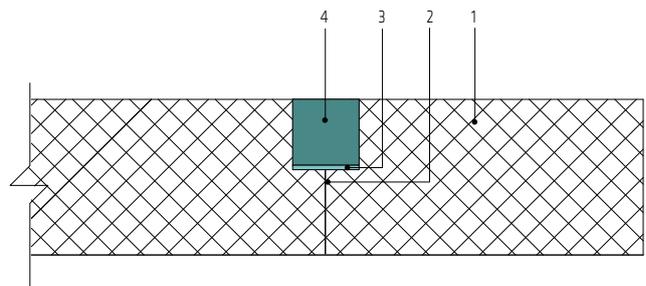
### Approvals & standards

- 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®, SikaCor®-950 F
- Cracks, untight joints:  
Sikadur-Combiflex®, Sika® Injection-451, Sikaflex® PRO-3,  
Sikaflex® TS Plus for Steel
- Damaged concrete and steel reinforcement corrosion:  
Sika MonoTop®-412 NFG  
SikaTop® Armatec®-110 EpoCem®  
Sika MonoTop®-2400 Reseaux
- External concrete protection:  
Sikagard®-740 W hydrophobic impregnation  
Sikagard®-675 W ElastoColor protective coating  
Sikagard®-555 W 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:

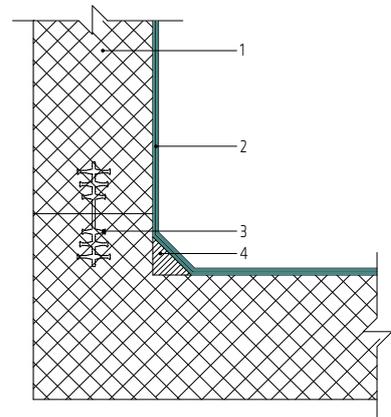
- Internal curing - no curing required
- Quick over-coating with resin coatings - either water or solvent based
- Increased chemical resistance (compared to polymer modified cement based product)





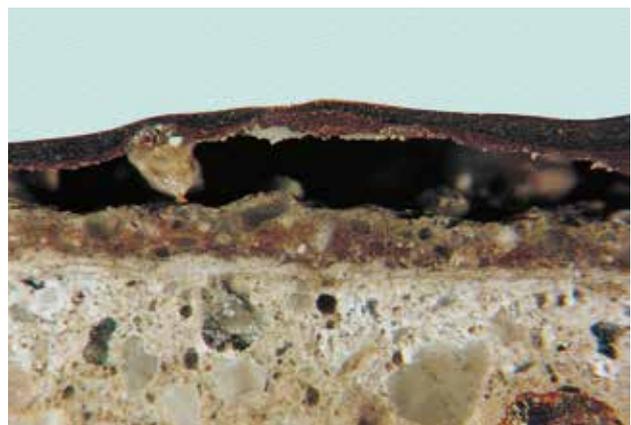
#### TYPICAL DETAIL

- 1 Concrete substrate
- 2 Sikagard®-720 EpoCem®
- 3 Construction joint Sika® Waterbar
- 4 Sika MonoTop®-412 NFG



#### 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:  
Sikafloor®-21 PurCem

## SIKA SOLUTIONS FOR EXTERNAL SURFACE PROTECTION

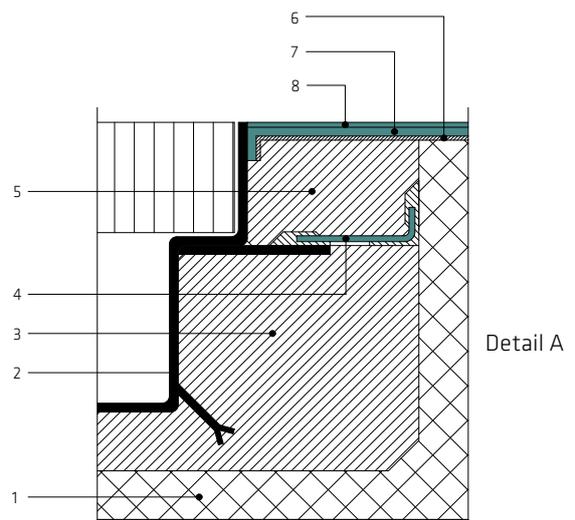
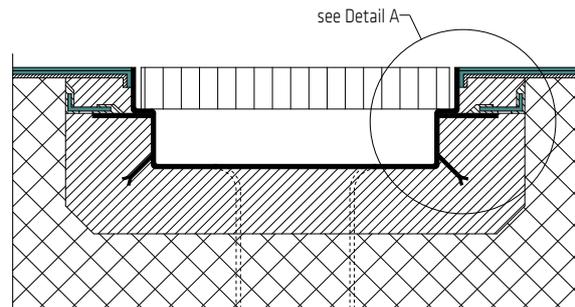
- Surface applied corrosion inhibitor:  
Sika® FerroGard®-903 Plus
- Thixotropic hydrophobic impregnation for concrete:  
Sikagard®-706 Thixo
- Hydrophobic impregnation for concrete:  
Sikagard®-740 W
- Hydrophobic impregnation for bricks and other mineral substrates:  
Sikagard®-703 W
- Concrete protective coating:  
Sikagard®-675 W ElastoColor
- Crack bridging concrete protective coating:  
Sikagard®-555 W Elastic





### 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).

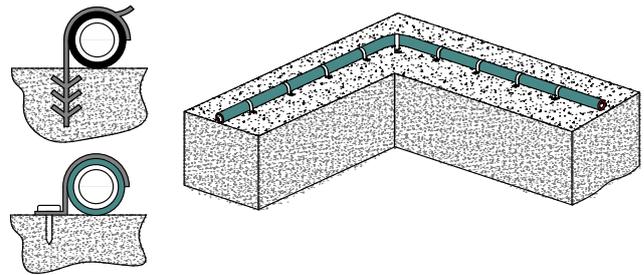


- Increased resistance to freeze-thaw action is obtained by adding air entraining agents.
- High resistance to mechanical impact and abrasion is achieved using a low water/cement ratio and added silica fume.

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

## SIKA SOLUTIONS FOR ANCHORING

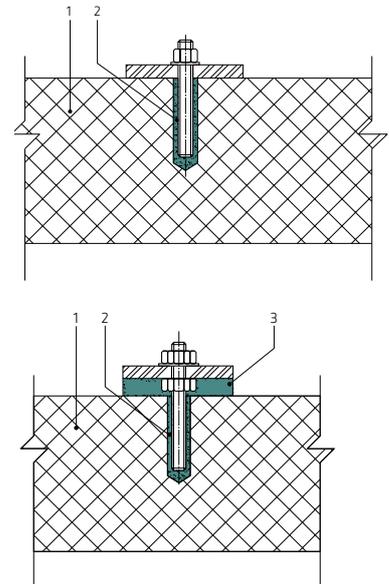
### Sika AnchorFix®S

- Styrenated polyester based 2-component universal anchoring adhesive
- Multipurpose use in concrete



#### TYPICAL DETAIL

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



#### Sika AnchorFix®-1

- Solvent and styrene free based, two-component polyester anchoring adhesive
- Multipurpose use in solid and hollow masonry and concrete, also for regulated applications

#### Sika AnchorFix®-2+ / -2002 / -2020

- Solvent and styrene free, epoxy acrylate based, 2-component high performance anchoring adhesive for different climate conditions
- Regulated / professional applications in concrete, fixing and post installed rebar applications in all classes of concrete; also in cracked concrete
- Drinking Water certified

#### Sika AnchorFix®-3+

- Solvent-free, thixotropic, 2-component, epoxy resin based, high performance anchoring adhesive
- Regulated applications in concrete, high chemical resistance, extended Potlife

#### Sika AnchorFix®-3001 / -3030

- Solvent-free, thixotropic, 2-component, epoxy resin based, high performance anchoring adhesive
- Regulated / professional applications in concrete, fixing and post installed rebar applications in all classes of concrete also in cracked concrete
- High chemical resistance, extended Potlife. Can also be used in seismic zones, fire resistant tests available.
- Drinking Water certified

# CASE STUDIES

## LA WANTZENAU WASTE WATER TREATMENT PLANT, STRASBOURG, FRANCE



### PROJECT DESCRIPTION

5<sup>th</sup> 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<sup>3</sup>/d and up to 380,000 m<sup>3</sup>/d in rainy weather. ~64 million m<sup>3</sup> 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<sup>®</sup>-4400 MIC 100% calcium aluminat mortar was applied using the dry spray technique.

Other Sika products used:

Surface hardener: Sikagard<sup>®</sup>-230 MIC

Surface retarder & mold released agent: Rugasol<sup>®</sup>-3W Paste

Repair mortar: Sika MonoTop<sup>®</sup>-410 R

PU Sealant resistant to biogenic corrosion: Sikaflex<sup>®</sup> TS Plus

## İSKİ İKİTELLİ 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<sup>3</sup> 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<sup>®</sup> polymer modified patch repair mortar.

Concrete was protected against chemical aggression with first a primary application of Sikagard<sup>®</sup>-720 EpoCem as temporary moisture barrier, followed by Sikagard<sup>®</sup>-2040 TR chemical resistant epoxy coating.

Jointing of concrete elements was done with the chemical resistant sealant Sikaflex<sup>®</sup> PRO-3.

## WROCLAW 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<sup>3</sup> 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 corroding.

### 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

Scrapper track refurbishment:

Sikafloor®-156 – Epoxy primer

Sika® Elastomastic® TF – wear resistant, crack bridging polyurethane epoxy resin

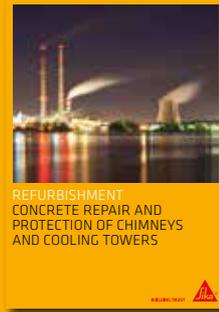
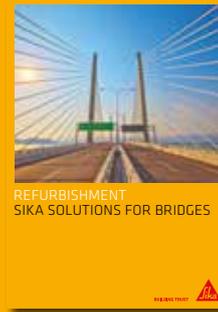
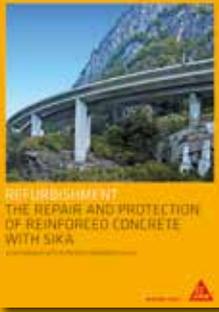
Sikafloor®-359 – abrasion resistance polyurethane sealer coat

Steel work:

SikaCor®-EG System – primer, epoxy intermediate coat and

polyurethane top coat

# ALSO AVAILABLE FROM SIKA



## FOR MORE REFURBISHMENT SOLUTION 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.

Our most current General Sales Conditions shall apply. Please consult the most current local Product Data Sheet prior to any use.



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**BUILDING TRUST**

