Sika Solutions for Sustainable Concrete

Sika®

Concrete Concept

The Sika Life Cycle Approach

What is Life Cycle Assessmant (LCA) and why is it relevant?

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

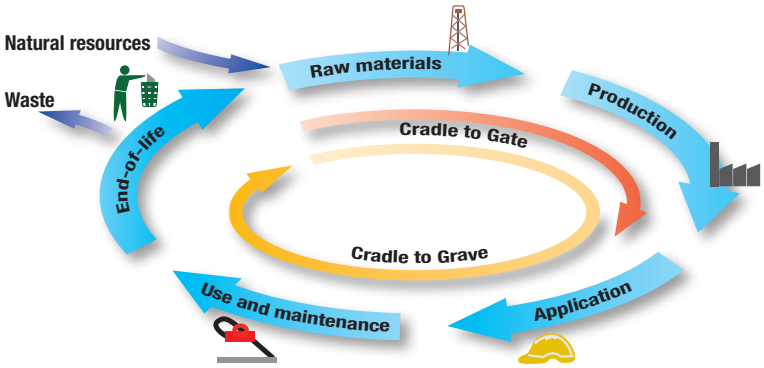
On what standards are Sika LCA's based?

Sika carries out LCA's according to the ISO 14040 series and the Standard EN 15804.

Where does the Sika LCA data come from?

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.

Which life cycle phases are included in these Sika LCA's?



What does 'Cradle to Gate' mean?

In a 'Cradle to Gate' approach, the LCA investigates the potential environmental impact of a product from raw material extraction to finished production.

What does 'Cradle to Grave' mean?

In a 'Cradle to Grave' approach, the LCA investigates the potential environmental impact of a product from raw material extraction, production, application and use to final disposal at the end-of-life.

Project reference

Project:
Letzigrund Stadium, Zurich

Sika Admixtures for on-site recycled concrete aggregates
An exemplary implementation of on-site recycling was realized during the construction of the new Letzigrund Stadium in Zurich.
The big challenge was the production of concrete with a constant quality using aggregates produced from material excavated on the construction site. This was only possible with a continuous adjustment of the concrete formulation and **Sika's** admixture know-how. In addition to saving extraction of raw materials, more than 6,000 truck runs were avoided because fewer transports were necessary.

The Sika Contribution to Sustainable Construction

The LCA of Concrete Admixtures follows a "Cradle to Gate with option" approach, and its aim is to analyze the production of Concrete Admixtures and their application in concrete. The LCA model was reviewed by the leading independent research institute Swiss Federal Laboratories for Materials Science and Technology (EMPA).

Sika has identified trends that will change in our target markets the needs for concrete products. These selected challenges are:

Energy efficiency
Sika Concrete Admixtures and Systems which contribute to reduce the energy demand of the concrete mix design and its application.

Resource efficiency
Sika Concrete Admixtures and Systems which contribute to reduce the resource demand of the concrete mix design.

Climate protection
Sika Concrete Admixtures and Systems which contribute to reduce the carbon emissions of the concrete mix design.

Water efficiency
Sika Concrete Admixtures and Systems which contribute to reduce the water demand required to achieve the concrete quality and improve the durability of concrete.

Project reference

Project:
AlpTransit Gotthard Railway Tunnel

Sika Admixtures for the use of tunnel excavated concrete aggregates

In tunneling, shotcrete is used for immediate rock support and concrete is used for final lining. By using high-quality **Sika** admixtures it was possible to produce all concrete and sprayed concrete by the use of excavated rock material as aggregates with respect of 100 years durability requirements. Especially high temperatures, very long transport and workability time as well as significant high early strength requirements were the project challenges

Description of Exemplary Concrete Mixes

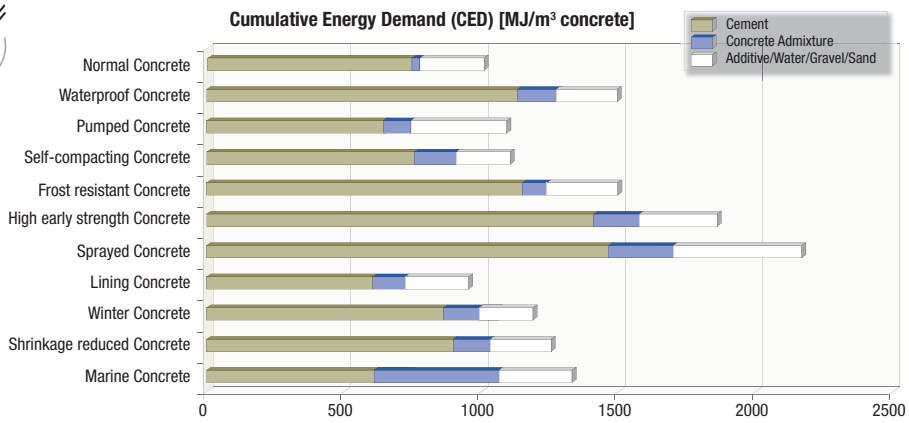
Concrete Systems	Components					
	Cement	Additive	Sand	Gravel	Water	Concrete Admixtures
Normal concrete	CEM II / A-L 32,5 280 kg/m³	–	800 kg/m³	1'200 kg/m³	w/c-ratio = 0.60 Recycled water	**Sika® Plastiment®** (0.6 %)
Waterproofing concrete	CEM I 42,5 320 kg/m³	–	900 kg/m³	1'000 kg/m³	w/c-ratio = 0.48	**Sika® ViscoCrete®** (1.0 %) **Sika® WT** (1.5 %)
Pumped concrete	CEM II / B-L 32,5 280 kg/m³	Flyash 50 kg/m³	1'000 kg/m³	1'000 kg/m³	w/c-ratio = 0.48 Recycled water	**Sikament®** (1.0 %) **SikaPump®** (0.5 %)
Self-compacting concrete	CEM II / A-L 32,5 280 kg/m³	Limestone 140 kg/m³	900 kg/m³	800 kg/m³	w/c-ratio = 0.42	**Sika® ViscoCrete®** (2.0 %) **Sika® Stabilizer** (0.3 %)
Frost resistant concrete	CEM I 42,5 325 kg/m³	Silicafume 15 kg/m³	800 kg/m³	900 kg/m³	w/c-ratio = 0.45	**Sika® ViscoCrete®** (1.2 %) **SikaFume®** (4.0 %) **Sika-Aer®** (0.1 %)
High early strength concrete	CEM I 52,5 350 kg/m³	–	900 kg/m³	1'000 kg/m³	w/c-ratio = 0.42	**Sika® ViscoCrete® HE** (1.4 %) **SikaRapid®** (0.8 %)
Sprayed concrete	CEM I 52,5 360 kg/m³	GGBFS 80 kg/m³	1'000 kg/m³	700 kg/m³	w/c-ratio = 0.46	**Sika® ViscoCrete® SC** (1.2 %) **SikaTard®** (0.8 %) **Sigunit® L AF** (6 %)
Lining concrete	CEM III / B 32,5 340 kg/m³	–	900 kg/m³	700 kg/m³	w/c-ratio = 0.48	**Sika® ViscoCrete®** (1.2 %) **SikaPump®** (0.5 %) **Sika® Retarder** (0.2 %)
Winter concrete	CEM II / A-L 32,5 310 kg/m³	–	800 kg/m³	1'150 kg/m³	w/c-ratio = 0.48 Recycled water	**Sika® ViscoCrete®** (1.0 %) **Sika® Antifreeze** (1.0 %)
Shrink reduced concrete	CEM II / A-L 32,5 325 kg/m³	–	800 kg/m³	1'150 kg/m³	w/c-ratio = 0.45	**Sika® ViscoCrete®** (1.2 %) **Sika® Control** (1.2 %)
Marine concrete	CEM III / B 32,5 340 kg/m³	–	900 kg/m³	1'000 kg/m³	w/c-ratio = 0.46	**Sika® ViscoCrete®** (1.0 %) **Sika® FerroGard®** (3.5 %)

Environmental Impacts and Resource Inputs

The LCA data refers to 1 m^3 of concrete

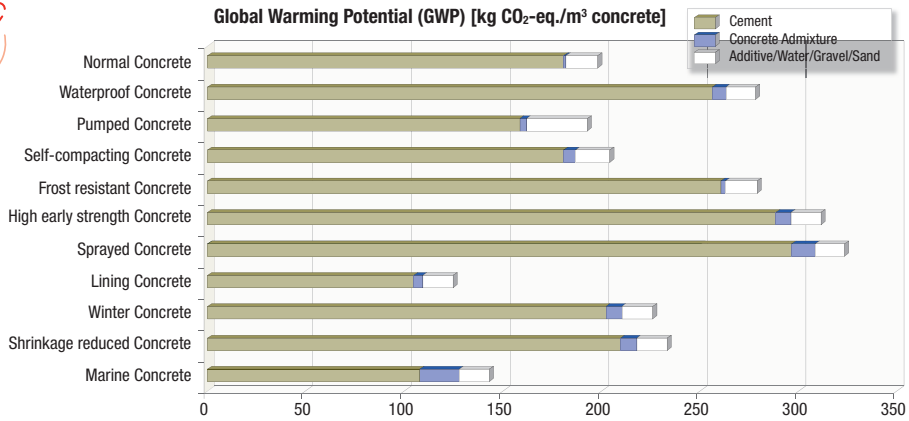
Cumulative Energy Demand [MJ]

Total amount of primary energy from renewable and non-renewable resources



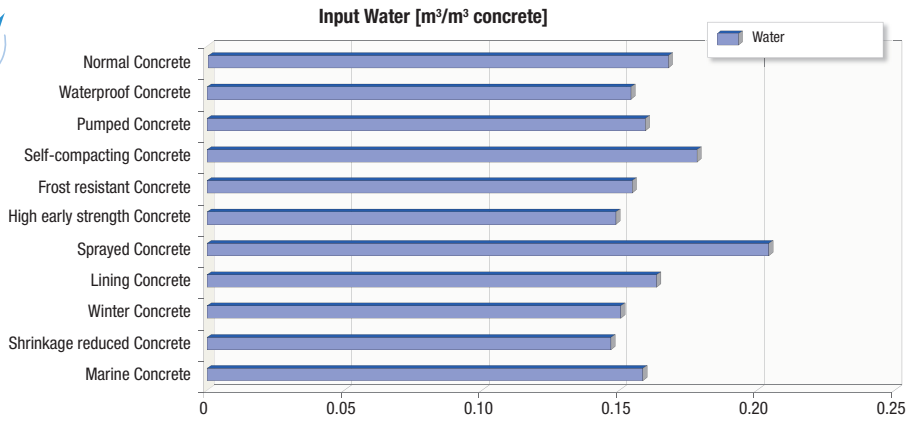
Global Warming Potential [kg CO_2-eq.], CML 2001

Potential contribution to climate change due to greenhouse gases emissions



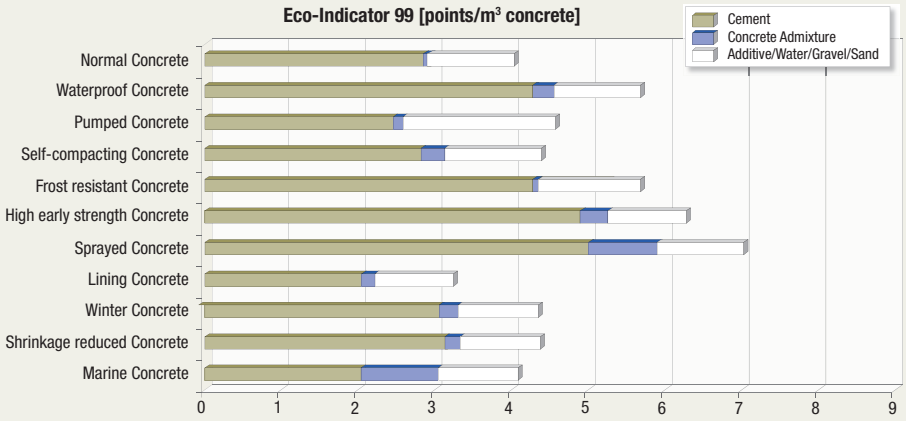
Input Water [m^3]

Consumption of water (for the concrete production)



Eco Indicator 99 [points]

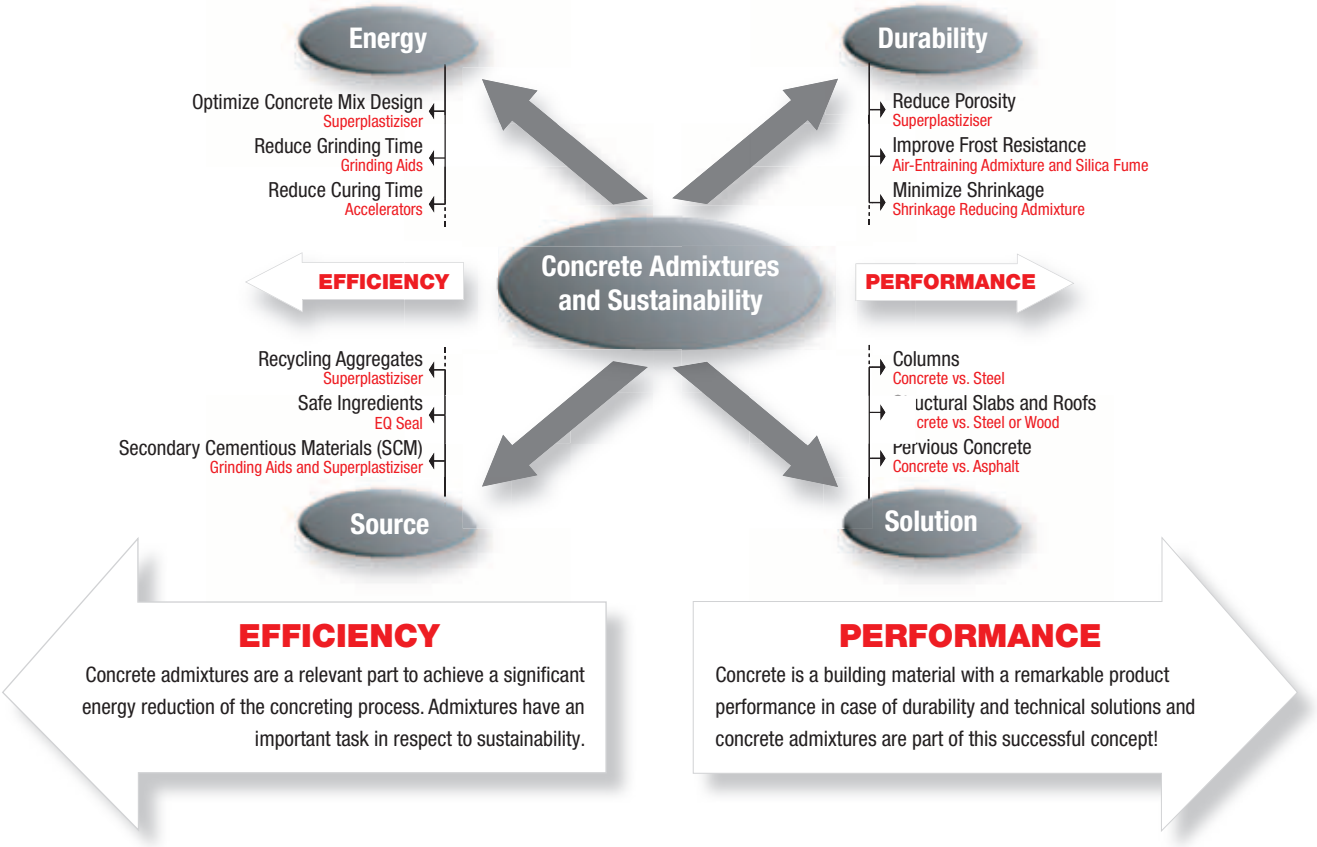
Impact score which takes into account several damage categories (to mineral and fossil resource, to ecosystem quality and to human health), which are then normalized and added to give a dimensionless result



How can Sika Concrete Concepts Contribute to Sustainable Constructions?

Concrete admixtures can improve the sustainability of concrete in many different ways. Firstly, admixtures can improve the quality and performance of concrete significantly, which in return extends its service life. In addition, thanks to the use of admixtures the application of concrete instead of other building materials can improve the life cycle of infrastructures, i.e. concrete roads greatly improve the quality and durability of highways for main traffic arteries compared with conventional road surfacing.
Further, the addition of special admixtures, such as stabilizing or water reducing admixtures also enables the use of alternative and recycled materials, such as recycled aggregates, for the production of good quality concrete. Finally, in many cases the energy required to produce certain cement or concrete mixes will be positively impacted with the use of admixtures. One example is the addition of water reducing and accelerating admixtures to obtain high early strengths in precast concrete to greatly reduced or even completely replaced external heating of elements.

Sika Sustainability Performance-Efficiency Approach



Project reference

Project:
INEOS Ethylene Concrete Buffer Tank

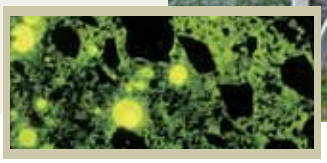
INEOS is building a 1 million tons ethylene concrete buffer tank in Belgium. The total concrete volume is about 3'500 m^3. Special concrete properties are required for the placement as slipped form concrete. To optimize that type of concrete recipe in respect to sustainability is a challenge.

Sika Sustainable Concrete System Components

Durability

Several admixtures will allow for the production of concrete with extended durability in regular circumstances or even in a severe environment.

- **Sika® ViscoCrete®**
  minimizes porosity in the cement matrix significantly
- **SikaAer®**
  improves freeze/thaw resistance of concrete
- **Sika® Control**
  reduces drying shrinkage of concrete



Solution

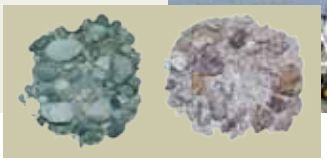
The use of the right admixtures allows for the production of specialty concrete, which offer environmentally friendly applications or can be used instead of other building materials (i.e. pervious concrete, insulating concrete).

- **Sika® ViscoCrete®**
  Self Compacting Concrete (SCC) enables the reduction of a structure's dimensions (wall thickness)
- **Sika® Stabilizer**
  generates a stable paste layer around the aggregates
- **SikaPlast®**
  ensures a high quality paste

Source

Using alternative of recycled materials in a concrete mix often has a negative impact on the concrete fresh or hardened properties. Admixtures can be used efficiently to counter such effects.

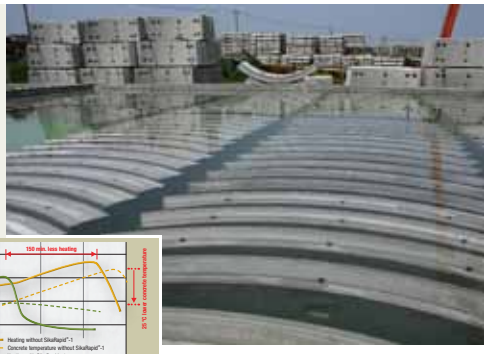
- **SikaPlast®** or **Sika®ViscoCrete®**
  ensure the use of concrete produced with recycled aggregates
- **SikaPump®**
  allows efficient concrete placing with the use of manufactured and recycled aggregates
- **SikaRapid®**
  compensates for the loss of early strength by using SCM

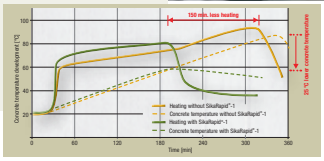


Energy

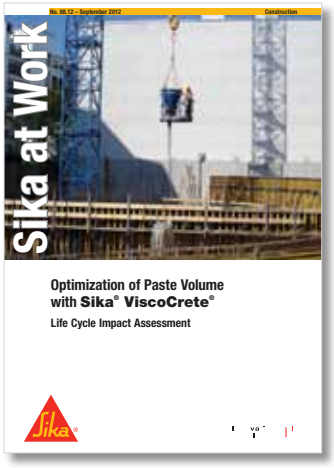
A lot of energy is used in the production, placement or curing of cement and concrete. Several admixture and additive solutions allow for a reduction of this process energy.

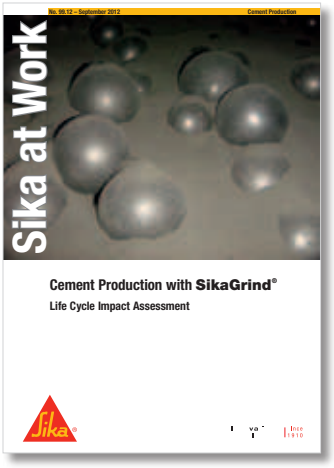
- **Sika® ViscoCrete®** or **SikaPlast®**
  offset the negative influence on final strength of the cement reduction through water reduction
- **SikaGrind®**
  reduces of time to grind cement of a specified fineness
- **SikaRapid®**
  allows for a reduction of steam curing in precast element production

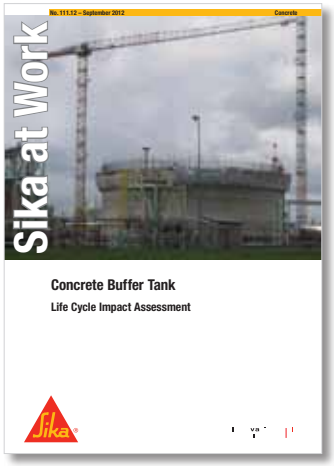




Project References







Further Information on Sustainability

This link opens the Sika Sustainability webpage. It provides access to more information on Sika and sustainability, our partnerships and initiatives, our environment & safety policies, plus much more.

www.sika.com/en/group/sustainability.html

Sika Services AG
Business Unit Concrete
Tüffenwies 16
CH-8048 Zürich
Switzerland
Phone +41 58 436 40 40
Fax +41 58 436 41 50
www.sika.com

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