Durable Connections

Solutions for Construction & Rehabilitation of Bridges

BASF

The Chemical Company

Connecting Bridges and Highways

Bridges are more than engineering marvels and often become landmarks as they impact the skyline, the surrounding environment and everyday life. Imagine Sydney without the Harbour Bridge, Shanghai without the Nanpu or Shikoku without the Akashi Bridge.

Roads and bridges serve the basic function of allowing people, vehicles and goods to flow easier and faster across obstacles such as rivers or valleys. They aid commerce and tourism, and provide cultural and social links for society. Bridges and highways have been built to span valleys, roads, railway tracks, rivers, oceans and mountain ranges.

The construction of a bridge, highway or railroad track is a painstaking process which requires sophisticated architectural design, precise engineering, solid craftsmanship and the best quality building materials. While many bridges and highways are prominent structures and successful beacons of engineering brilliance, there are cases of fatal failures. Fatigue, structural deterioration, material fault, wrong selection of materials, corrosion and poor workmanship at time of construction are the most frequent reasons for premature deterioration.

The complexity of mega-structures requires appropriate materials to ensure state-of-the-art construction. BASF offers comprehensive and proven system solutions to facilitate highest reliability in construction.

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Linking Solutions

Concrete bridges and concrete roads need high performance concrete admixtures. Only products providing excellent resistance to cracking, shrinkage and steel corrosion should be considered. Bridges and highways are subjected to large cyclic strains from the fluctuations in the weather conditions. In their lifetime they are often exposed to chloride or sulphate attack, carbonation of the concrete as well as being subjected to dynamic loads. Choosing the right grade of concrete and admixture that provide the best balance of long-term durability of the concrete and the ease of placement is of paramount importance.

BASF offers a wide range of concrete admixture solutions as well as state-of-the-art remediation products to keep concrete bridges, highways and railroads strong and safe – for extended life cycles.

New Constructions

Increasingly sophisticated designs with longer spans and the need for faster construction create challenges for designers and builders of bridges and highways. The industry is demanding improved durability - the structures' ability to withstand traffic loads, environmental exposure such as chloride or sulphate attack and extreme weather. Our high performance admixtures enhance the concrete properties to achieve improved durability without compromising on its ease for placement and finishing.

Meeting Critical Specifications

In considering bridge and highways concrete applications, it is important that all criteria are fulfilled to improve hardened concrete properties, while at the same time reducing:

- water permeability
- rapid chloride permeability
- cracking
- chloride / sulphate / carbonation induced corrosion rates

High Early Strength Concrete

High early strength concrete has to withstand highway traffic 6 to 12 hours after placement. Excellent durability and workability for easy placement without loss of slump is an important requisite to avoid development of cold joints and is fittingly addressed by a combination of BASF's concrete admixtures used in a proprietary system like BASF's 4 x 4 system, (i.e. 400 psi flexural strength in 4 hours, i.e. 2.8 MPa in 4 hours) system.

High Performance Concrete

Offering latest polymer technology for versatile performance, these special concrete applications feature low permeability / low water absorption and low shrinkage. The formulations consist of state-of-the art polycarboxylate ether based admixtures. These admixtures are marketed under the **Glenium** and **Rheoplus** brands.

Glenium/**Rheoplus** formulations are available to create:

- High strength concrete
- Self consolidating concrete
- Concrete with specific pumpability requirements

sureTEC (Super Retention Technology) range of admixtures are designed to meet stringent requirements of higher and consistent slump retention for mixes with w/c ratios > 0.4. In such cases workability retention requirements of 2 hours or more is possible. In conjunction with the **Pozzolith** / **Polyheed** / **Rheoplus** formulations, the **sureTEC** can be added as an "on demand" system. The dosage can be controlled depending upon the requirement without affecting set times and early/late strengths; even in blended concrete mixes. Of course the versatile age-old RHEOBUILD range of admixtures is also available either for precast or general concrete applications.

Enduring Concrete

Post tension / pre-stressed cable duct durability…..

Pozzolith GF is an admixture for in-situ grout for post tension/ pre-stressed cable ducts, where bleeding must be avoided to ensure that the cables are completely encased in the grout without any shrinkage/ expansion. **Pozzolith GF** and the ready-to-use **Masterflow** 816 are formulated without hydrogen generation to avoid the possibility of hydrogen embrittlement of the cables.

Corrosion inhibition

Rheocrete CNI and **Rheocrete** 222+ are useful additives for concretes facing harsh environments such as coastal bridges or in highly reactive soils. These work through different mechanisms to either consume the ions that accelerate corrosion or to prevent them from entering the concrete through water penetration. The **Masterseal 360** silane based impregnator can also be used to restrict the passage of water and ions into concrete structures especially in highly contaminated areas.

Crack prevention

Rheoplus 800 series is a water reducer with integrated shrinkage reduction.

Durable Overlays for Bridge Decks

Advanced requirements for durable bridge deck overlays incorporating polymer modified concrete (PMC) are needed to protect the bridge-deck from water and chloride/ sulphate infiltration at the same time providing an abrasion resistant riding surface with excellent skid resistance. BASF offers modified styrene butadiene rubber (SBR modified) admixture for such systems.

Waterproofing Systems

The need to waterproof concrete decks to prevent corrosion in the reinforcing steel is essential particularly those subjected to high chloride loadings such as from de-icing salts or bridges in coastal areas. The PU (poly-urethane) **Conibridge** spray applied membrane system is proven for the application of asphalt with more than 20 years of service in harsh conditions. Alongside, **Masterpren** preformed modified bitumen sheets are an alternative.

Expansion Joints & Bearings

WABO® has designed expansion joint systems & bearings for a wide array of applications such as thermal and seismic movement requirements, high impact and load carrying ability, waterproofing and rehabilitation of existing joints. **WABO**® expansion control solutions are custom designed to meet specific and/ or complex project requirements. Our **WABO**® bearings are designed to meet the demands of today's complex bridge structures. The advent of longer span, continuous girder bridges coupled with compound curves and increased truck loads, have resulted in larger loads and movements concentrated on fewer piers.

Renovations

Structures such as bridges and highways undergo many changes over the years, resulting in damage and deterioration of the structure. Early preventive measures can extend the life and reduce the cost of repairs. Often, roads and bridges have to cope with increased loads (larger trucks or increased traffic movements), increased atmospheric contamination and change in use (extra lanes etc).

Quality materials make all the difference in durability and long-term savings in maintenance and repairs.

Crack Injection

Over time bridges may develop cracks due to higher than expected dynamic load, inadequate provision for joints and from settlement on the bridge structure. The **Concresive** range of injection systems can solve most cracking problems from structural reinstatement to sealing cracks that could lead to deterioration from ingress of contaminants. **Concresive** can also be used in specific pre-cast applications as a segmental bridge adhesive (SBA).

Strengthening

Sometimes bridges need to be upgraded to take on additional loads. The **MBrace** strengthening system can be used in place of conventional strengthening systems such as steel plate to improve the load bearing ability or simply to increase the stiffness of the structure. A selection of carbon fibre materials can be used in conjunction or individually to achieve this.

MBrace carbon fibre is available in fabric, laminate and bar forms to allow the strengthening of all sections of the structure. MBrace can increase the load carrying capcity of columns through confinement and reduce the flexing of beams and decks through the use of laminates. Bars are available to alllow embedment of the strenthening in the structure such as decks and sofits.

Other fabrics are available such as Aramid (Kevlar) and glass which can be used for impact mitigation or seismic reduction respectively. Simple installation, minimal increase of deadload and ability to deal with complex strengthening requirements make this a problem solver.

Repair Works

In many instances small sections of the concrete deck deteriorate and the need for fast repair is crucial. The **Emaco T** range of traffic area repair products allows fast return to service (within the hour) and provides long term wearing surfaces for roads and highways.

Many bridges will during their lifetime suffer deterioration of the concrete due to the corrosion of the reinforcing steel. It will need reparation to return to its original condition. The **Emaco Nanocrete** range of hand or machine applied repair products are the latest development providing ease of use and increased durability.

The **Emaco Nanocrete** range includes products to treat the corroded steel, reinstatement of concrete cover in either structural (load bearing) or non structural (cosmetic) parts and polymer modified coatings for finishings. Designed to minimize shrinkage and to improve durability, the **Emaco Nanocrete** range is the leading product in such remediation.

Cathodic Protection

Bridges in coastal areas need long term protection from the contaminants in the area and a cathodic protection system is required. The **Emaco CP** range is for use with passive and active cathodic protection systems. For large scale repairs the uniquely formulated Shotpatch series of dry spray applied mortars is suitable for impressed current cathodic protection systems. The range can be customized to meet the demands of almost any job.

Grouting

To allow for movement, many bridges are designed with a flexible bearing system. Like all dynamic load bearing equipment these need to be properly grouted to transfer the load from the bearing to the foundation. **Masterflow** grout range includes both cementitious and resin based grouts suitable for both initial installation or for remediation purposes. The grouts are also suitable for connecting the piers to the piles and for transfering the load from the bridge deck to the piles.

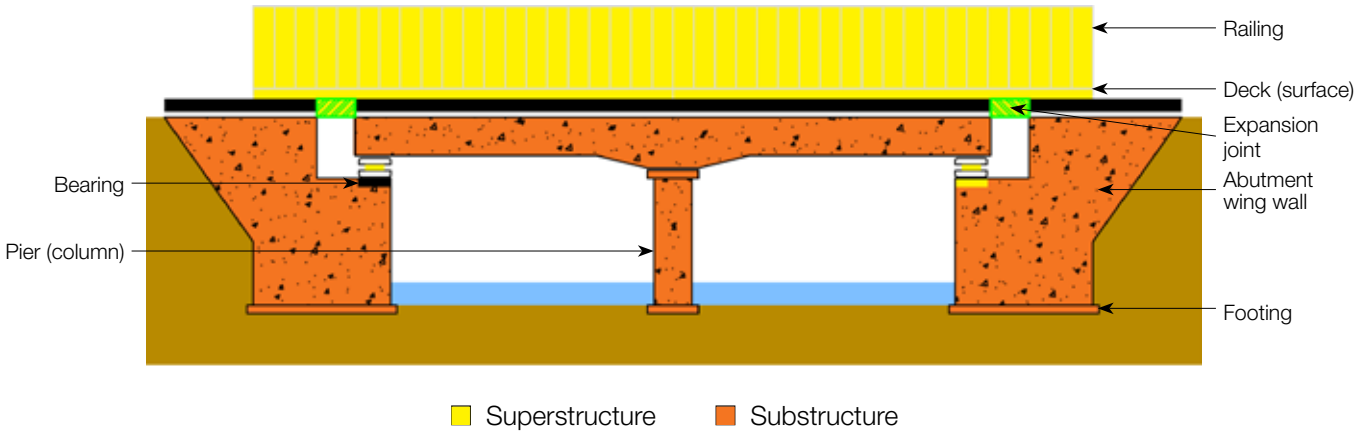
Making Great Business Connections

Ever since it started providing chemical solutions to its customers in the mid 1800s, BASF has steadily cemented its reputation and built solid business bridges with suppliers, customers and business associates.

With over 95,000 employees globally – out of which more than 8,000 work in R & D – BASF is committed to bring most innovative and most reliable products to customers.

The Construction Chemicals division is one of the pillars of the company's global expansion. Our skilled and highly trained technical and marketing support teams listen to clients' needs and customize solutions that work.

Typical Bridge Elements



Bridge Components

Position	Components	Products (Admixture Systems)	Products (Construction Systems)
Superstructure	Beams / Columns	Glenium sureTEC / Rheobuild / Rheoplus/ Polyheed	Emaco Nanocrete / MBrace / Masterseal
	Bridge decks	Glenium sureTEC / Rheobuild / Rheoplus/ Polyheed	Emaco T / Conibridge / Masterseal / MBrace
	Pylons	Glenium sureTEC / Rheobuild / Rheoplus/ Polyheed	Emaco CP / Conibridge / Masterseal
	Railings (parapets)		Masterseal
	Bridge expansion joints		WABO
	Bridge bearings		WABO / Masterflow
Substructure	Abutments	Glenium / Rheobuild / Pozzolith / Polyheed	Concresive / Emaco / Shotpatch
	Backwalls / Wingwalls	Glenium / Rheobuild / Pozzolith / Polyheed	Concresive / Emaco / Shotpatch
	Pile caps	Glenium / Rheobuild / Pozzolith / Polyheed	Masterflow
	Piers / Columns	Glenium / Rheobuild / Pozzolith / Polyheed	Emaco / Mbrace / Masterseal
	Footings	Glenium / Rheobuild / Pozzolith / Polyheed	Masterflow
	Piles	Glenium / Rheobuild / Pozzolith / Polyheed	Masterseal / Masterflow
General	For pre-stressed / post tensionsed cable ducts	Pozzolith GF	
	For corrosion protection of concrete	Rheocrete CNI / Rheocrete 222+	
	Admixture for shrinkage reduction	Rheoplus 800	

Bridging Success

Ibi River Bridge, Japan

Green Bridge, Australia

Bandra Worli Sea Link, India

Bay Chay Bridge, Vietnam

Hangzhou Bay Bridge, China

Suramadu Bridge, Indonesia

Intelligent Solutions from BASF Construction Chemicals

Concresive®	Resin Based Mortars, Adhesives and Injection Systems
Conibridge®	PU Based Membranes to protect Bridge Decks
Conideck®	Hand and Spray Applied Waterproof Membrane Systems
Coniroof®	PU Based Roofing Systems
Emaco®	Concrete Repair Systems
Finestone®	Exterior Insulation and Finishing Systems (EIFS)
Glenium®	For Hyperplasticizer Concrete
Masterflex®	Joint Sealants
Masterflow®	Precision and Structural Grouts
Masterpren®	Preformed Membrane Waterproofing Sheets
Masterseal®	Coating and Waterproofing
Mastertop®	Decorative and Industrial Flooring Solutions
Mbrace®	Composite Strengthening Systems
Meyco®	For Shotcrete and Spraying Equipment
PCI®	Tile Fixing and Cement Underlays
Pozzolith®	For Water-reduced Concrete
Rheobuild®	For Superplasticized Concrete
Rheomix®	For Improved Block Mortars
Rheoplus®	Cost-effective Products for Hyperplasticized Concrete
Ucrete®	Flooring Solutions for Harsh Environments
WABO®	Expansion Control Systems

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