Fosroc Solutions for
Bridge and Viaduct Construction

FOSROC

constructive solutions

www.fosroc.com

ABOUT FOSROC INTERNATIONAL

Since the company's beginnings over 80 years ago, Fosroc has developed into an International leader in delivering Constructive Solutions for projects across a broad range of market segments including transport, utilities, industrial and general buildings.

Fosroc's commitment to customer service and technical support is second to none. We work closely with architects, structural engineers, contractors and owners to best understand their requirements. Together we can develop a bespoke solution for a construction project, adding value and becoming more than just a materials supplier, but a solution provider.

Fosroc has an extensive network of offices and manufacturing locations across Europe, the Middle East, Africa, India, North, South and East Asia, and is further represented in other regions across the world by distributor and licensee partners.

Selecting from the full portfolio of Fosroc products and services and integrating expert technical support, world class customer service and innovation, Fosroc goes beyond just product selling to ensure that we partner with our customers to deliver complete constructive solutions.

- Admixtures
- Adhesives
- Protective Coatings
- Concrete Repairs
- Industrial Flooring
- Grouts & Anchors
- Joint Sealants
- Surface Treatments
- Grinding Aids
- Waterproofing

FOSROC DELIVER SOLUTIONS NOT JUST PRODUCTS

CAD Details	Project Specifications	Site Support	Seminar & Training
A library of standard CAD details are available, bespoke CAD details can be created for your specific project	Dedicated specification managers on hand to assist with correct system choices and tailored solutions	Expert product and application support made available from our specialist teams.	Comprehensive programme of seminars and training courses designed to expand and reinforce your knowledge.

Leader in delivering
Constructive Solutions
Worldwide!

BRIDGES & ELEVATED SECTIONS

Bridges are important and economically valuable structures that should be constructed with maximum durability and minimum requirements for maintenance.

Fosroc has been involved in bridge construction since it's earliest days. Customers turn to Fosroc because of a tradition of producing strong and reliable products that are made to last.

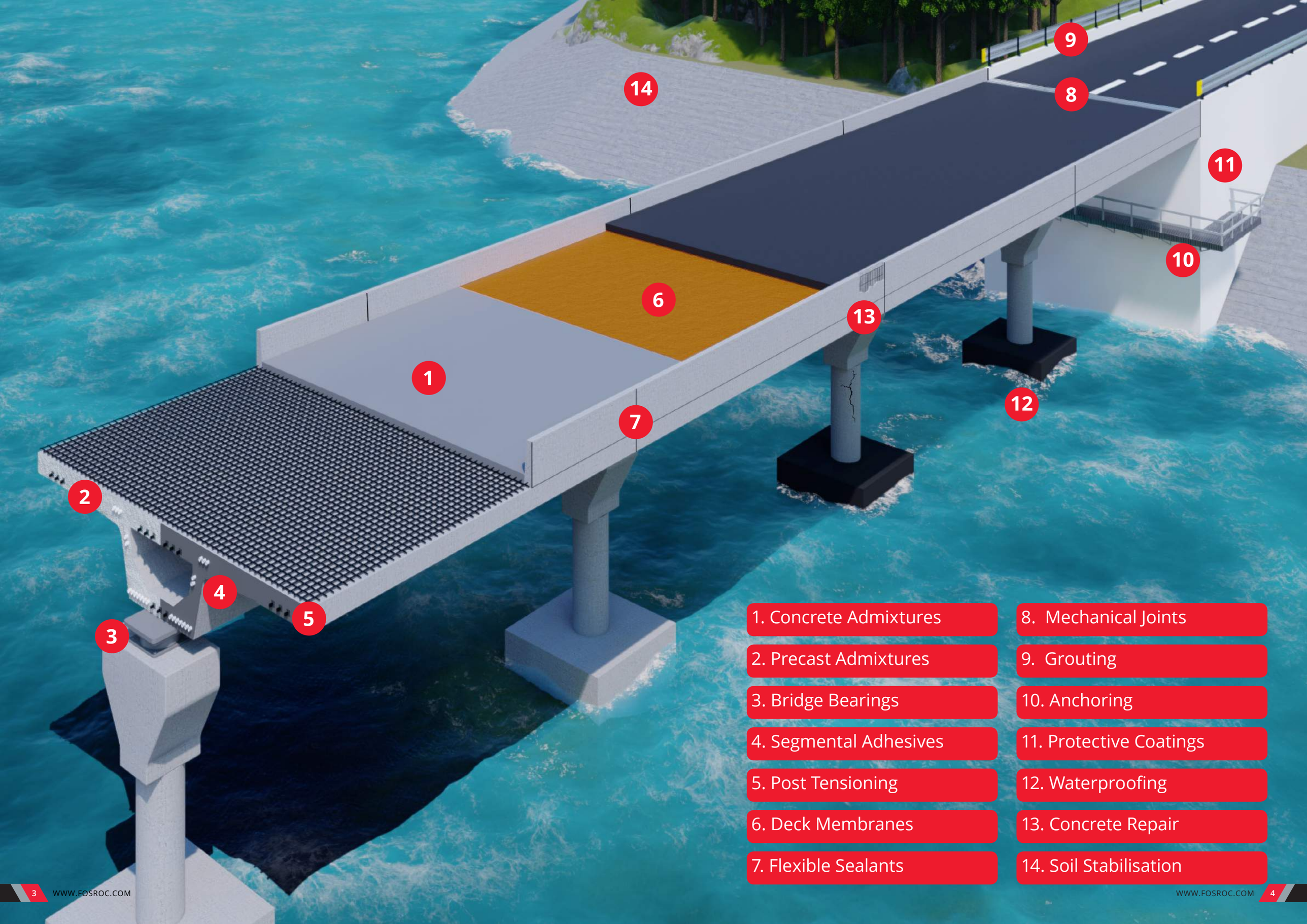
Solutions are diverse and cover many of the most challenging aspects of construction from foundation to finish. The range of products is constantly developing to find better, more effective and greener construction specialities.

With an unrivaled array of product solutions, global know-how and local techical support, Fosroc leads the industry with it's problem solving approach.

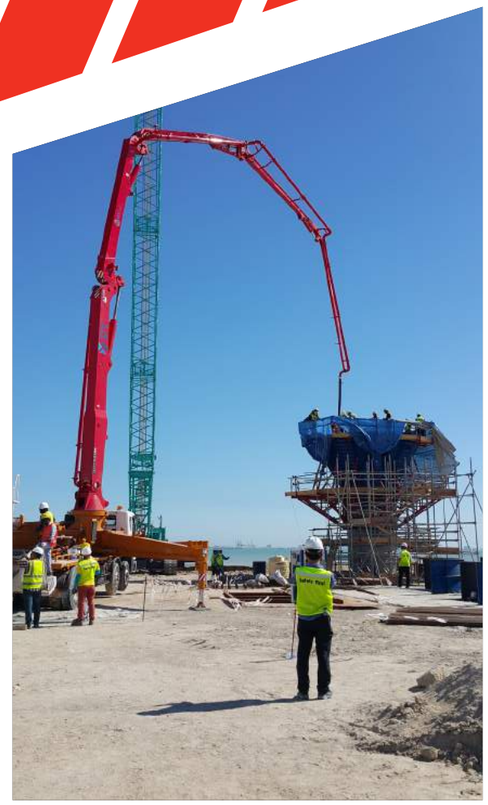
Fosroc works extensively in the repair and refurbishment sector around the world. This provides a special insight into some of the problems that bridges face and what the consequences of failure can be. This experience helps create solutions for the new construction market.

Fosroc has a reputation for durability, reliability and its people have a culture of proactive problem solving. This means that Fosroc people and products contribute to the successful construction, maintenance and repair of bridge structures all across the globe.

FOSROC constructive solutions



1. Concrete Admixtures
2. Precast Admixtures
3. Bridge Bearings
4. Segmental Adhesives
5. Post Tensioning
6. Deck Membranes
7. Flexible Sealants
8. Mechanical Joints
9. Grouting
10. Anchoring
11. Protective Coatings
12. Waterproofing
13. Concrete Repair
14. Soil Stabilisation



CONCRETE

Ensuring concrete has sufficient strength and workability is critical to the construction of dense and durable structures. Fosroc admixtures are formulated by its technical teams to match the cements, aggregates and conditions encountered at site. They are blended and trialled to suit the specific project needs, helping to ensure that the concrete is cast to the client's satisfaction. Fosroc provides value at every stage of concrete design, casting and finishing

Each project presents it's own challenges and unique needs. Bridges are build to last and a major part of the durability comes from the quality of placement and compaction. Challenges include:

- Congested reinforcement
- Large pours
- Difficult to access locations
- Clay-bearing aggregates
- Extremes of climte
- concrete segregation
- labour access challenges

Creating concrete that can flow as required, and finish to a high standard is part of Fosroc's brief on every project. By bringing the benefit of global technical teams to the local support, Fosroc has access to industry leading know-how and experience to create optimized mix design. This ensures the best possible product placement, product finish and durability.

CONCRETE ADMIXTURES

Fosroc has an extensive range of solutions for casting concrete

- High & Ultra-high strength concrete
- Self-compacting concrete
- Low permeability concrete
- Retained workability & slump
- Corrosion inhibitors
- Underwater concreting
- Hydration controllers
- Mould release agents
- Curing compounds
- Fibres
- Shotcrete Acclerators

Our knowledge extends beyond cast-in-situ admixtures, covering all elements of concrete. This includes shotcretes that are frequently used in foundation and embankment stabilisation, grout admixtures for ground filling and specialist precast admixtures.

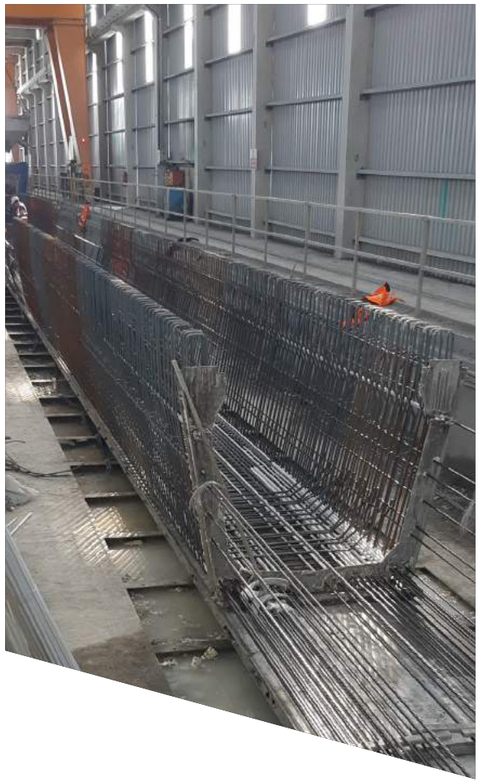
PRECAST CONCRETE

Precast admixture solutions have been tailor made and benefit from shared global experience. Customers turn to Fosroc looking for cutting-edge solutions and advice.

- Wide range of solutions for different casting techniques
- Latest global technologies
- Adaptable solutions

Fosroc's comprehensive range of products for precasting include:

- Admixtures
- Accelerators
- Corrosion inhibitors
- Mould release agents
- Surface treatments
- Curing agents
- Repair materials



PRECAST CONCRETE

Precasting bridge sections allows for greater efficiencies in production and superior control of quality. To optimise production Fosroc will formulate mix designs to meet the needs of the production process and blended to the specifics of the raw materials in use.

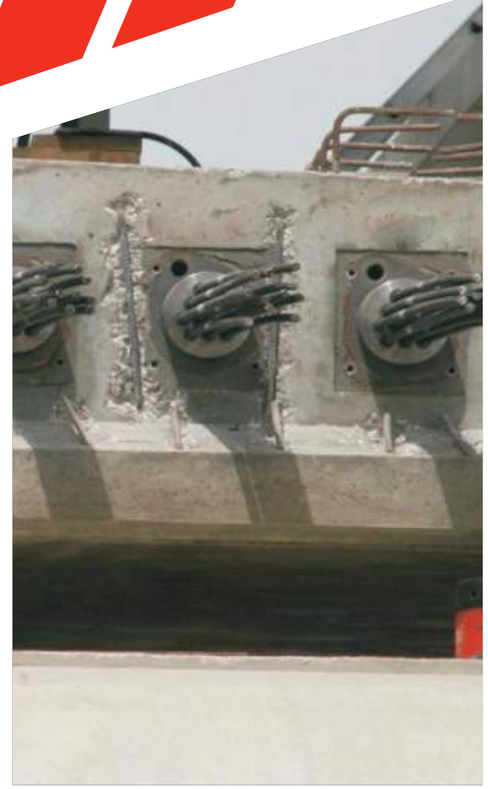
For bridges, durability and quality must be high. Therefore the concrete consistency must be equally high, with a dense and resistant surface finish. Auracast admixtures and surface treatments will create an high spec solution while maximising plant efficiency.

The fast and efficient production of quality precast elements is vital to the construction of bridges. Fosroc work hand-in-hand with precast facilities around the world, be they permanent facilities or project bespoke set-ups.

Each production line has it's own set of objectives and challenges:

- High quality finishes
- High Early Strengths
- Rapid demoulding
- Achieving highly consistent concrete
- Durable concrete
- Improving daily productivity
- Cost optimisation in materials and production
- CO2 reduction
- Aesthetics

POST TENSIONING DURABILITY



Due to the stressed nature of the post tensioned tendons, when damage occurs to bridges the results can be catastrophic.

One significant reason for failure of PT tendons is poor grouting. The occurrence of voids in the grout allows moisture, oxygen and sometimes chlorides to form corrosion cells on the steel. This weakens the tendons and ultimately can lead to breakage.

Voids in grouting can be caused by poor materials, often site batched grouts which lack stability and when pumped are prone to bleeding or blockages. Small changes in raw materials or temperature can alter the consistency of the material. Raw materials must be checked for contaminants such as chlorides.

Fosroc can supply admixtures for cable grouting but believe that the best solution is to create grouts in a factory where variables are monitored and controlled. Fosroc's cable grouts formulated to meet the highest industry standards. Tests undertaken on cable grouts include:

- Fluidity & fluidity retention
- Expansion & shrinkage
- Bleeding, product stability and foaming
- Compressive strengths
- Setting times
- Raw material analysis

POST TENSIONING

Fosroc Conbextra Cable Grouts are tested to high industry standards, meaning that this element of work and risk is managed for the contractor. All parties can have peace of mind knowing that factory production has ensured product quality and made time on site more efficient. This benefits work on site in the following ways:

- No formulation trials
- Few or no additional tests
- Reliable, repeatable performance
- Rapid installation
- Excellent steel protection
- Risk management

Fosroc supplied the following products to post tensioning projects around the world:

- Conbextra Cable Grout
- Cebex Cable Grout (powdered admixture)
- Other liquid admixtures and stabilizers
- Repair materials for damaged end blocks.

SEGMENTAL ADHESIVES

Segmental adhesive is an important material for the structural integrity of precast bridges, forming an integral role in the long term durability of the structure.

Selecting the correct product will ensure that working time is appropriate for the climatic conditions and techniques being used. The robust nature of the product will ensure the joint remains watertight. Fosroc's segmental adhesives are viscous, meaning that several millimetres of adhesive can be applied to account for surface deviations and minor miss-alignments.

There are numerous advantages in using Fosroc's structural adhesives:

- Different open times to suit climatic conditions
- Applicator friendly
- High product build-up to adjust for imperfections.
- Resistance to water & chemicals
- Tested to FIP & EN standards

Durable products in the range include:

- Nitobond SBA
- Nitobond PC20
- Nitobond EP (wet to dry casting)

GROUTING & ANCHORING

Whether bridges are constructed using precast segments or cast insitu sections, they invariably use grouts and fixings. Fosroc is a industry leader in grouting and offers numerous bespoke solutions that facilitate construction, achieving dependable outcomes.

Our systems are designed to meet the needs of the project and are manufactured with high performance, ease of use and durability in mind. Systems are extensively tested to prevailing industry standards and the comprehensive solutions are unrivaled in the industry.

- Bridge bearing grouts
- Cable grouts
- Pile capping grouts
- Rapid strength grouts
- Ultra-high strength grouts
- High flow grouts
- Accredited anchoring resins for reinforcement
- Accredited anchoring resins for fixings
- Underwater grouts
- Rail fixing grouts
- High early strength grouts

BRIDGE BEARINGS

Selecting the correct bearings for bridges is an important decision. Designers must consider the roles played by dead and dynamic loads, vibration, movements in different planes caused by wind loading, tensioning and thermal differentials as well as numerous other factors.

Importantly, high quality bearings should be designed to be durable and resist corrosion. Bearings placed near joints and half joints can be exposed to leakages which can cause bearing seizure if they have insufficient resistance. Damage caused by bearing failures can be considerable. Replacement of bearings and the damage caused by their failure is technically challenging, highly costly and disruptive.

Designers selecting bearings must carefully consider the following items:

- Durability & service life
- Planes of movement
- Practicalities of installation
- Merits of bespoke manufacture
- Whole life costing
- Compatable grouting & fixing products

Fosroc can assist with the technical specification of bearings and arrange for bespoke design accompanied by method statements, drawings and installation assistance.

BRIDGE BEARINGS

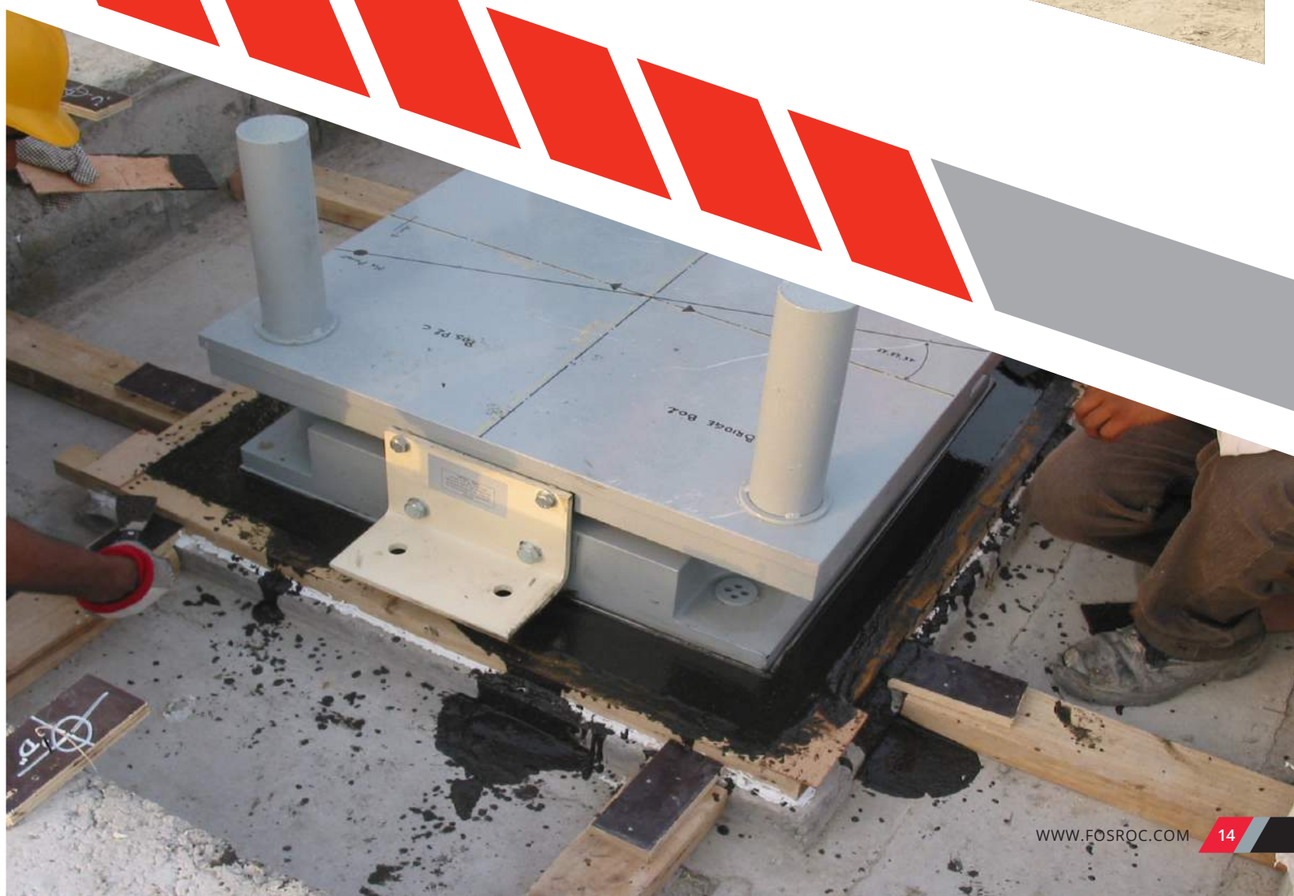
Fosroc ETIC ETIBLOC bearing pads consist of an elastomeric block composed of either modified neoprene or natural rubber in which parallel and plane steel reinforcement plates are totally embedded before vulcanization. Full protection of the steel reinforcement from corrosion is assured.

Fosroc ETIC POTETIC pot bearings, although relatively small in size can transmit considerable loads from the bridge structure, absorb rotations and accommodate horizontal movements. Fosroc ETIC POTETIC pot bearings are bespoke designed and manufactured for each project ensuring maximum durability for each project.

Conbextra grouts offer full load support, in connecting the bearing with the structure. High early strengths can allow loading within just days.

Fosroc can supply the following product olutions, individually or as part of a comprehensive package:

- Elastomeric bearing pads
- Bespoke manufactured pot bearings
- Cementitious bearing grouts
- Epoxy bearing grouts
- Resin anchors



JOINTS

The balance between flexibility and robustness required of bridge joints can be hard to find. With incorrect specification, movement joints rapidly become weak points of a bridge, allowing water ingress or causing mechanical damage. At important intersections this can substantially reduce the structures service life and lead to costly repairs of elements such as concrete, tendons or bearings.

Correct understanding of the bridge joints is vital to designing successful structures. Fosroc has a problem-solving suite of products and systems including mechanical joints and flexible sealants. Our team can assist with the correct specification and installation of joints considering the relevant movement and planes of movement, trafficability and chemical resistance.

Fosroc's range of solutions for bridge joints includes:

- Trafficable neoprene mechanical joints
- Steel and aluminium finger joints
- Embedding mortars & grouts for mechnical joints
- Transition strip mortars
- 1 & 2 component polyurethane sealants
- Polysulfide sealants
- MS Sealants
- Backing boards

JOINTS

Fosroc EJN (pictured left) is combined with chemical fixings, bedding mortars and transition strips which offers a multitude of technical advantages:

- Moulded neoprene elements
- Reinforced with steel plates
- Resist oil, grease, salt and sand
- Accommodate movements from 30mm up to 330mm
- Supplied in 1m lengths, tongue and groove ends
- Kerb and skewed units availableto special order
- Properties exceed AASHTO standards test requirements (also comply with EN)
- No dynamic effect on the bridge structure
- No aluminium wearing plates that could de-bond
- Life expectancy >15 years
- Easy and quick installation
- Waterproof and corrosion resistant
- Capable of horizontal and vertical movements
- Low road noise

DECK WATERPROOFING

A key element of maintaining structural integrity is ensuring that the bridge remains watertight, as moisture and environmental contaminants can cause corrosion of reinforcement and delamination of road surfaces. Deck membranes play a major role in this.

To ensure water tightness, materials and application must be of a high quality. Fosroc supports applicators in the field with inspection, training and advice. This covers specification, surface preparation, product mixing and application. Products are developed with usability in mind, to ensure that when they are on site in difficult conditions they have the best chance of successful application.

Fosroc offers two main systems for bridge deck waterproofing:

- Fosroc Polyurea WH500 – Spray applied Polyurea
- Nitoproof ET Slurry – Coal Tar Epoxy Hand Applied system

Fosroc Polyurea WH 500 is EAD 030675-00-0107 certified (ETAG 033) giving high quality performance for use in bridge deck waterproofing projects.

The rapid spray application provides high productivity especially beneficial for large bridges where construction times can be kept to a minimum. Polyurea technology provides excellent waterproofing, crack bridging, elongation, puncture and chemical resistance found in typical bridge structures. Hot rolled asphalt is laid on top of the membrane as the finished wearing surface.

WATERPROOFING

With a track record stretching back over 40 years Nitoproof ET Slurry (formerly Cicol ET Slurry) is an industry stalwart for deck waterproofing in many countries, from the cold climates of Scandinavia to the heat of the Middle East.

Nitoproof ET slurry is hand applied, without the need for specialist equipment. It's highly adhesive nature ensures a great bond with asphalt and concrete surfaces.

Due to it's highly robust with good abrasion, impact, and chemical resistance Nitoproof ET Slurry can even be left as a wearing surface. This may be advantageous for fast return to service or for reducing deck weights. This also makes it ideal for projects where the material must be resistant to site works prior to asphalting. As a hand applied material, incidental damage can be easily repaired. Where an asphalt top-layer is required intercoat adhesion is strong.

Fosroc has solutions for every type of below ground waterproofing, enabling unbiased material recommendations and a unique capability to solve issues with multiple systems, covered by a single point of responsibility.

Fosroc is well versed in detailing complex structures and ensuring the continuity of membrane coverage. In-house technical support may provide CAD detailing as well as training and supervision.

PROTECTIVE COATINGS

Although resilient, concrete and steel are subject to atmospheric attack over time, the action of moisture, chlorides and carbon dioxide cause corrosion of steel reinforcement which left unchecked can lead to premature repairs or even failure.

The selection of effective coatings and impregnations at the start of the project can add decades to the life of a structure. Applying during construction typically utilises existing site access, making it substantially cheaper than retrospective application.

The Dekguard range of products are specifically formulated for the protection of reinforced concrete structures such as bridges. The range has been used and proven over many decades, exhibiting high resistance to atmospheric contaminants such as chlorides and carbon dioxide, while allowing the concrete to breath. While being decorative in appearance, Dekguard coatings applied in a few microns thickness can provide many centimetres of equivalent concrete cover.

Dekguard E2000 and Dekguard Elastic are water-based coatings with crack bridging properties. The elastomeric nature of the product means that fine cracks do not rupture the coating and allow ingress of contaminants. This makes them ideal for more dynamic structures or bridges affected by extremes of thermal changes .

Fosroc also supplies an array af abrasion and chemical resistant coatings as well as silane-based protective impregnations.

REPAIR AND FINISHING

When constructing large and complex structures such as bridges, it is unrealistic to expect that each pour or lift will be defect-free. It is prudent to plan for contingency repairs in advance to enable a swift response to problems.

Fosroc's experience in repairing older structures is most useful in dealing with source problems in construction. Being able to identify the severity of an issue and understand the likely long term effects means that the best remedial solution can be provided.

With a comprehensive range of solutions, Fosroc is able to provide products for repairing minor surface blemishes to major cracking and voids in structural members. Technical teams can also provide advice on identification and best application procedures. Our range includes:

- Light and heavy duty mortars
- Injection resins
- Waterstops & leak plugs
- Surface skim coatings
- Pourable microconcretes
- Epoxy mortars
- Sprayable mortars
- corrosion protection systems

CONSTRUCTIVE SOLUTIONS IN ACTION

Fosroc has supplied products, expretise, support and training to bridges, viaducts and elevated sections in many countries around the world. Below is a small selection of examples showing the depth and quality of work.

Sheikh Jaber Al Ahmed Al Sabah Causeway - Kuwait

Constructed in 2 sections the Causeway has a total length of 44.5km.

After much investigation and testing Cicol ET slurry was selected as the deck membrane for the project due to it's robust nature and easy application in challenging hot conditions. Fosroc provided continual project support in all phases of the project to ensure high quality application.

The overall project was a major one for Fosroc, supplying many products from admixtures in the concrete foundations and precast sections to grouts, concrete finishing and repairs.

Temburong - Brunei

With a total length of over 30km the Jambatan Sultan Haji Omar Ali Saifuddien bridge is the longest bridge in South East Asia. The Fosroc Korea International Team liaised with the contractor and the local team produced and supplied the materials. Superplasticisers and corrosion inhibitors were supplied for the cast-in-situ concrete piers and precast box girders, optimising their durability and performance.

Conbextra grouts secured the bridge bearings and protected the post tensioning cables, that were specified to meet EN445.

GAC Link Roads - Saudi Arabia

Two major bridges into the Government Agencies Compound in Riyadh utilised Fosroc's mechanical and chemical solutions. Potetic pot bearings were bespoke manufactured for the requirements of the project and grouted in place with Conbextra epoxy grout for enhanced early strength.

The bridge joints were complex, with numerous movement factors in effect. Neoprene coated EJN joints were installed with Nitomortar epoxy mortar transition strips for heightened durability.

Shay Murtagh Precast - Ireland

Shay Murtagh produce pre-stressed bridge beams to prestigious projects such as the Mersey Gateway and London City Airport.

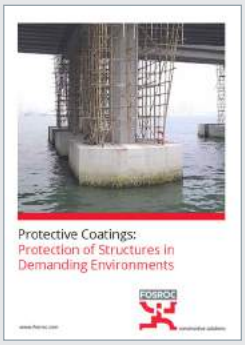
Auracast 550HE was developed by the Fosroc technical team to compliment the manufacturing process and component materials. High flowability ensures good compaction and excellent surface finish straight from the mould. High early strengths enhance factory productivity. Preco Hydrotard is used for roughened finishes on end sections.

PRODUCT RANGE SELECTOR

Below is a selection of Fosroc products that are particularly suited to bridge construction. They sit among many hundreds of supplementary solutions in our portfolio. Fosroc's technical team can help to select the right material for the specific need.

Application	Product	Description
Concrete Casting	Auramix & Structuro	Superplasticiser ranges for cast-in Situ concrete. Products will be tailored to meet the project needs for strength, workability retention and fluidity.
	Auracast & Auramol	Superplasticisers and mould release agents designed specifically for precast concrete.
Segmental Adhesives	Nitobond SBA	2 component , thixotropic epoxy adhsive corresponding to FiP requirements. Available in varying temperature grades.
	Nitobond PC20	3 Component, thixotropic epoxy adhesive for binding precast concrete sections. Compliant with EN1504-4
Post-Tensioning	Conbextra Cable Grout	Proprietary grout with high flow and stability for cable grouting. Conforms to requirements of EN445.
	Cebex Cable Grout	Superplasticiser and shrinkage compensation admixture for site-batched cable grouts.
Grouting & Anchoring	Conbextra HF	High flow cementitious grout with dual phase shringage compensation. For embedment, section filling, and rapid strength gainsupport.
	Conbextra UW	Cementitious grout with anti-washout properties. For grouting, repairs and consolidating under water.
	Lokfix E77	High strength epoxy resin anchor for heavyweight fixing and deep section rebar setting. EAD Accredited with design life of 100 years and seismic C2 tested.
Bridge bearings	Conbextra BB	High strength cementitious grout for setting below or above bridge bearings.
	ETIBLOC	Rubber encased bloc bearing with embedded steel reinforcement plates. High absorbtion and movement accommodation with protection from water.
	POTETIC	Steel pot bearings with multiple movement planes. Bespoke manufactured to size and movement requirements.
Mechnanical Movement Joints	ETIJOINT EJN	Moulded neoprene mechanical movement joint with reinforced steel joints. Acommodates high movement and traffic. Waterproof with high life expectancy.
	ETIJOINT EJF	Steel mechanical finger joints. Waterproof movement in high trafficked areas. Compliant with AASHTO and EN standads.
	Nitomortar TS	Epoxy mortar with wear resistance for transition between mechanical joints and carriageway. Rapid setting with good CoTE and adhesion to steel, concrete and asphalt.
Bridge Deck Membranes	Nitocote ET Slurry	Hard-wearing coal tar epoxy bridge deck membrane. Hand applied and may be used as an intermediate membrane or wearing course.(Formerly know as Cicol ET Slurry)
	Polyurea WH 500	Highly elastic polyurea bridge deck membrane. Rapid spray application and fast setting with rebust finish and crack bridging properties. EAD (ETAG) accredited system.
Foundation Waterproofing	Nitoproof 230	Rubberised bitumen waterproof membrane. Crack bridging system for protection above or below ground.
	Proofex Engage	Mechanically bonded, pre-applied waterproofing membrane for below ground construction. Highly robust and anti-water tracking.
	Supercast PVC	Range of central and externally placed waterstops for movement and construction joints. Highly durable and flexible.
Concrete Protection	Dekguard E2000	Crack bridging anti-carbonation coating. Provides a decorative finish and high resistance to contaminants such as chlorides and CO2.
	Dekguard S	Robust anti-carbonation coating. Good resistance to abrasion and protection from contaminants. Ideal for areas exposed to road spray.
	Nitocote SN Range	Clear silane impregnations for concrete. Effective for concete exposed for high moisture, humidity and airborne contaminants.
Concrete Repair	Renderoc Range	Cementitious repair mortars for concrete. High strength and resistance for use on new or old concrete defects. Available in hand-placed, pourable and sprayable grades.
	Nitofill LV	Low viscosity epoxy injection resin for injection. Structurally bonds and permanently seals fine static cracks in concrete and masonary.

Fosroc offers a full range of construction chemical solutions, helping to protect structures throughout the world. Please refer to our brochures, which include:



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