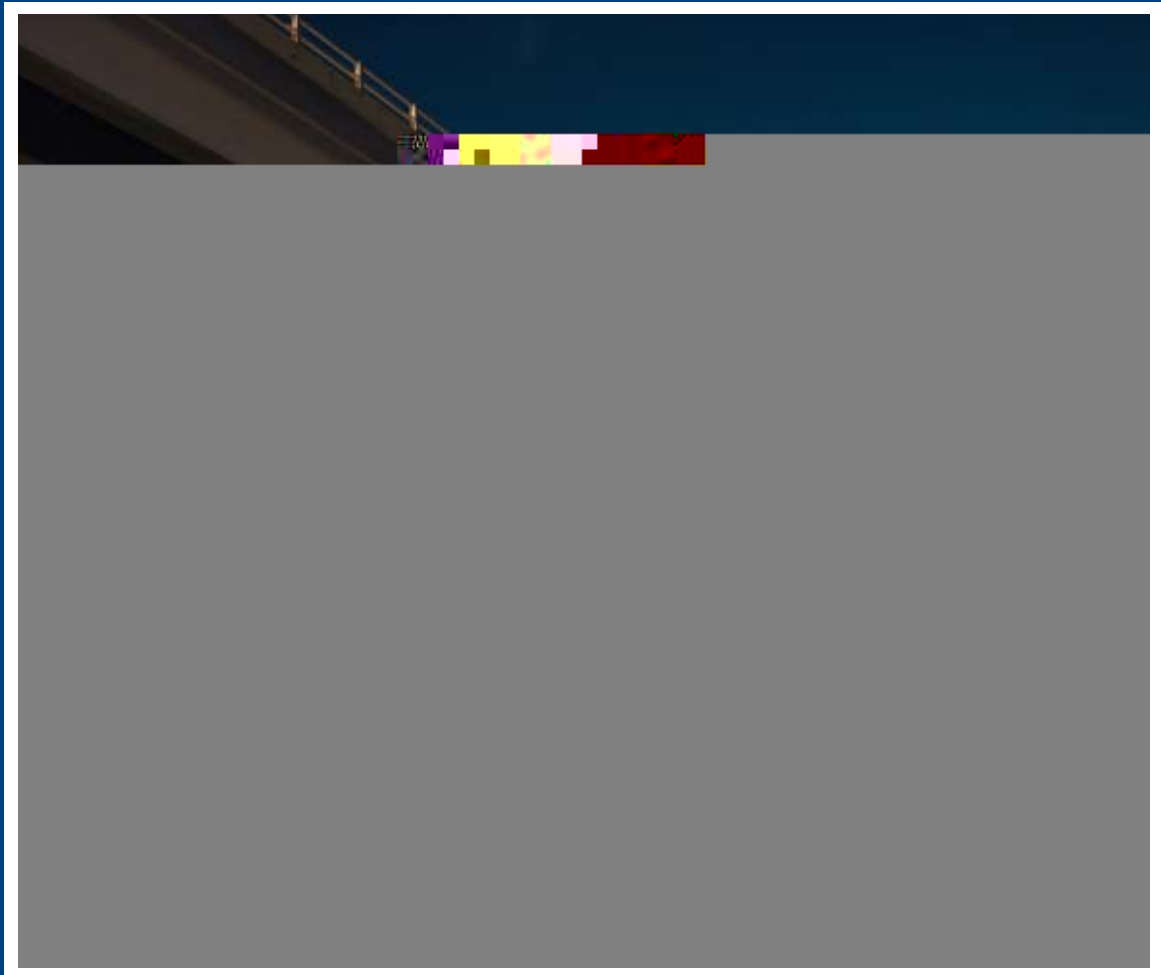


JOTUN

COATING SYSTEMS FOR CONCRETE BRIDGES



Jotun Protects Property

JOTUN – A GLOBAL LEADER

Jotun is a global leader in paints and coatings. We have 74 companies and 40 production facilities on all continents. In addition, Jotun has agents, branch offices and distributors in more than 80 countries.

Jotun's R&D centre is located in Norway and is responsible for the global assortment of products, coatings technologies and product innovation. In addition, the unit is responsible for coordinating

the efforts of the company's network of nine R&D laboratories around the world. Together, Jotun R&D is made up of about 250 skilled employees, including chemists, engineers and assistants.

Committed to excellence in everything we do, Jotun has consistently stretched the boundaries of performance to achieve its position as a global leader in paints and coatings.

•••Bringing protection and beauty to concrete structures

Protection and decoration of concrete structures is an area of particular expertise for Jotun. Jotun's concrete protection systems have been proven across the world, from the heat of the desert to the sub-zero temperatures of a Scandinavian winter.

Add to that a wealth of experience gained across a broad spectrum of successful concrete projects and you have a company that has consistently positioned itself as the leading manufacturer and supplier of high performance coatings.

- 1) *Al Raha Beach Bridge, Abu Dhabi, United Arab Emirates*
- 2) *Interchange No. 5, Sheikh Zayed Road, Dubai, United Arab Emirates*
- 3) *The Palm Jumeirah Monorail, Dubai, United Arab Emirates*



DOES CONCRETE REALLY NEED PROTECTION?

••• Understanding the limitations of concrete

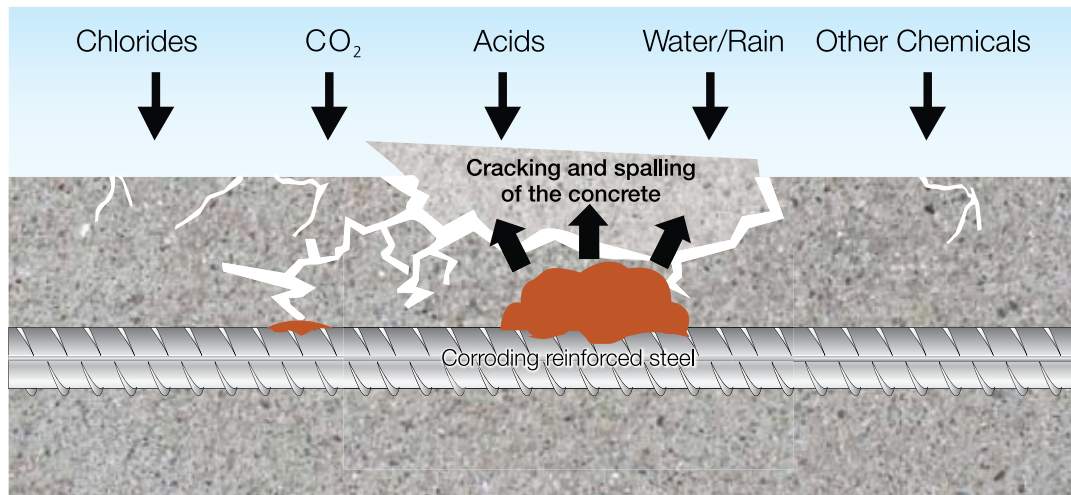
Concrete is frequently thought to be a durable and long-lasting material. This, however, is far from the truth.

Concrete has higher levels of moisture and alkalinity than other building materials. Unprotected concrete will deteriorate when exposed to very aggressive environments - especially in industrial areas, areas exposed to severe elements such as on the coast and areas with high pollution, humidity or frequent weather changes.



•••The special problems associated with concrete

Concrete is a porous material. Unprotected concrete can absorb water, sodium chloride (salt), carbon dioxide (CO₂) and acid precipitation, which in time will affect its integrity.



Chloride ions

Salt can be present from de-icing of roads, the sea on coastal structures or air-borne salt spray. When there is ingress of salt, the chloride ions penetrate deep into the concrete. They eventually accumulate around the steel reinforcement bars, destroying the protective film at the steel/concrete interface. With oxygen and moisture present, corrosion of the steel begins.

Carbonation

When CO₂ gas dissolves with water in the pores, it reacts with the cement to form carbonates which reduce the concrete pH. Carbonation can be a problem in reinforced concrete as a pH of around 7 is below the passivity threshold of steel.

When the steel starts to corrode, its volume increases 4-6 times, resulting in enormous pressure on its surroundings, causing cracks and ruptures in the concrete. Water then penetrates, the concrete is further weakened and the steel corrodes.

BENEFITS OF CONCRETE PROTECTION

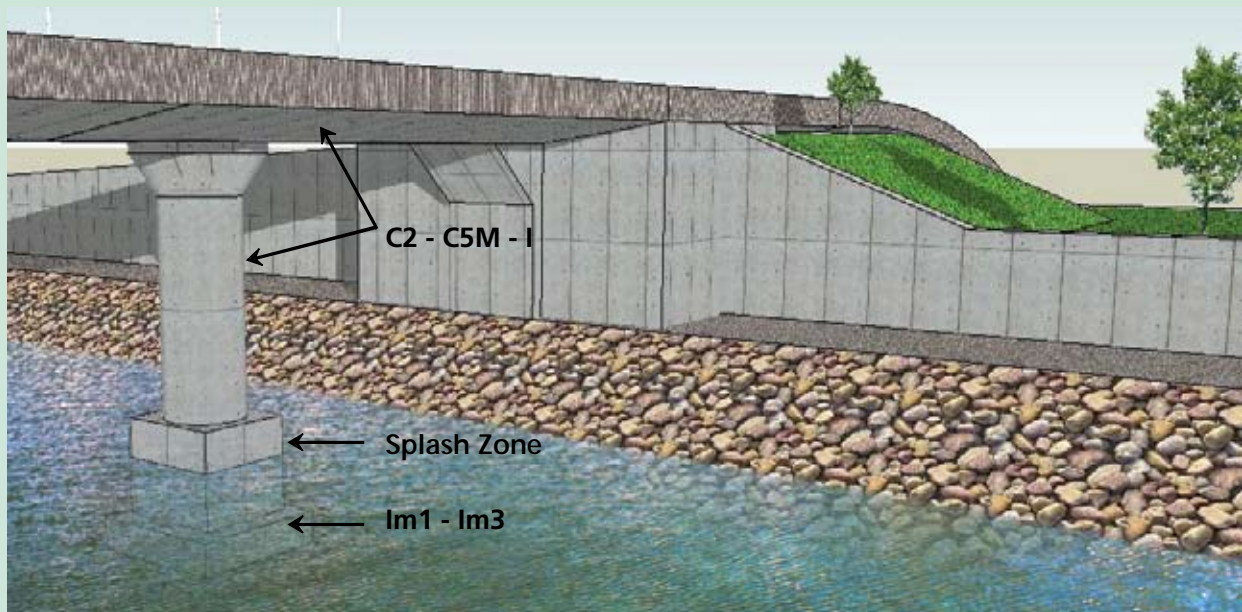
- Protection from carbonation
- Protection from chloride penetration
- Protection of reinforcing steel against corrosion
- Resistance to driving wind-borne moisture
- Protection against frost in cold climates
- Depending on the structure, prevention of ingress of water, whilst allowing the concrete to breathe
- Safety and economy
- Beautification of the structure

••• Understanding the corrosivity categories

Identifying the optimum protective coating for a concrete structure depends on the corrosivity of the atmosphere, the water and the soil in which it exists. The corrosivity of atmosphere refers to the extent of corrosion suffered by a structure caused by exposing it to the atmosphere.

ISO 12944 Atmospheric corrosivity categories	
Corrosivity category	Typical environments
C1 - very low	Climate-controlled indoor environments.
C2 - low	Atmospheres with low level of pollution. Mostly rural areas.
C3 - medium	Urban and industrial atmospheres, moderate sulphur dioxide pollution. Coastal areas with low salinity.
C4 - high	Industrial and coastal areas with moderate salinity.
C5-I - very high (industrial)	Industrial areas with high humidity and aggressive atmospheres.
C5-M - very high (marine)	Coastal and offshore areas with high salinity.
Categories for water and soil	
Corrosivity category	Environment
Im 1	Fresh water
Im 2	Sea or brackish water
Im 3	Soil

The example below illustrates specific areas of a concrete bridge that are subject to different corrosivity categories.



Concrete bridges will normally be split in two or three areas for concrete protection.

Foundation : Im 1 - Im 2 - Im 3

Column and bridge : C2 - C5M - I

Splash zone area : Special system

SURFACE PREPARATION

••• The importance of surface preparation

Correct surface preparation is critical to the performance of the intended coating system. Concrete substrates need to be cured, sound, clean, dry and free from any form of contamination such as laitance, loose particles, oil, grease, curing compounds, shuttering oil and algae growth.

This can be achieved by mechanical means such as light grit blasting or high-pressure water jetting (approx. 340 bar / 5000 psi). Unsound concrete, blowholes, pinholes and other surface defects should be repaired using an approved repair medium.

Concrete should be a minimum of 28 days old to allow for curing. Prior to the application of any coating, the maximum moisture content allowed is 4%.

••• Guidelines for a suitable surface

Recommended surface preparation should follow the guideline from the International Concrete Repair Institute (ICRI) and SSPC/SP 13 and 12.

This guide provides designers, specifiers, contractors, manufacturers with the tools to select the method for preparing the concrete surface before the application of sealers, coatings and screed. The purpose of this guideline is to ensure the preparation of a clean and suitably roughened surface so that the adhesion between the substrate and the paint system is secure.

Coating to be applied	Film DFT* µm**	Concrete surface profile					
		CSP 1	CSP 2	CSP 3	CSP 4	CSP 5	CSP 6
Sealer / dust binder	0 - 70	■					
Thin film	100 - 250	■					
High thickness	250 - 1000			■			
Very high thickness	1250 - 3000				■		
Preparation method		CSP 1	CSP 2	CSP 3	CSP 4	CSP 5	CSP 6
Low pressure water jet 340 bar / 5000 psi		■					
Abrasive sand blasting			■				
High pressure water jetting > 10.000 psi						■	

One psi (pound per square inch) = 0,068 bar. One BAR (atmospheric pressure on earth at sea level) = 14,5 psi

* DFT - Dry Film Thickness

** µm - Micrometre

••• Methods of surface preparation

Water jetting (5000 – 10000 psi)

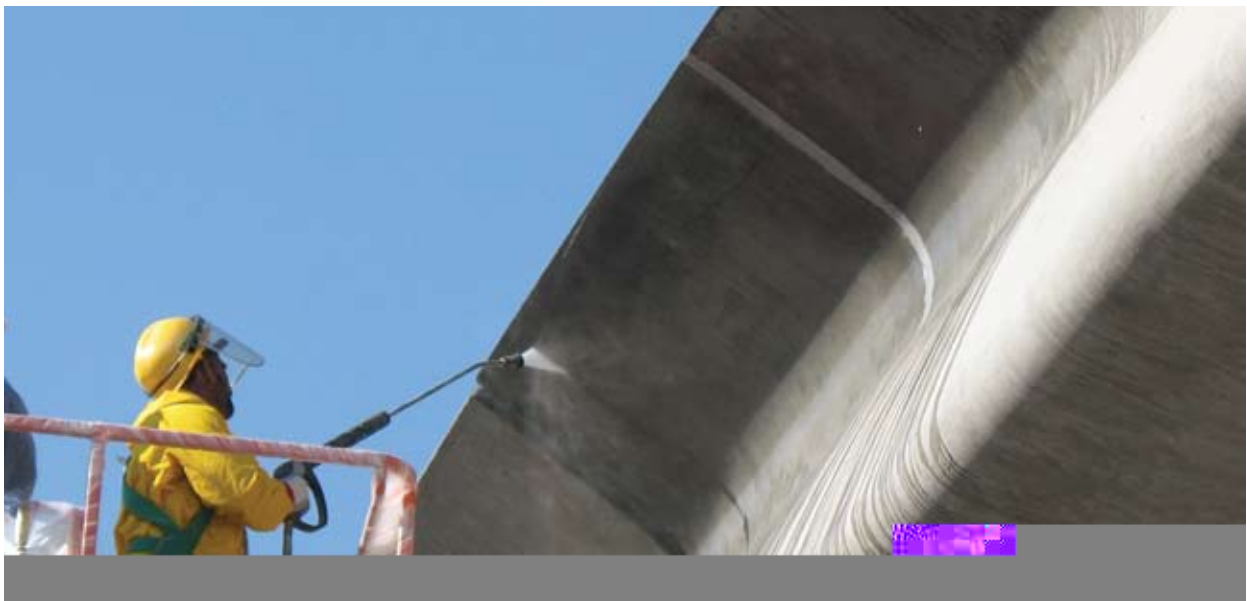
This method is used to remove dust, friable material, water soluble contaminants, laitance, efflorescence and open the concrete with a suitable surface profile.

Abrasive sandblasting

In sandblasting, abrasive particles are propelled at a high-velocity to clean the surface. This method has been used widely for preparing surfaces like concrete, prior to application of coatings. The surface roughness enhances the mechanical adhesion of the coating system.

Note : Concrete condition

Concrete comes in various qualities and has to be treated differently from project to project. Make a survey and do a trial to find the right pressure before the surface preparation begins.



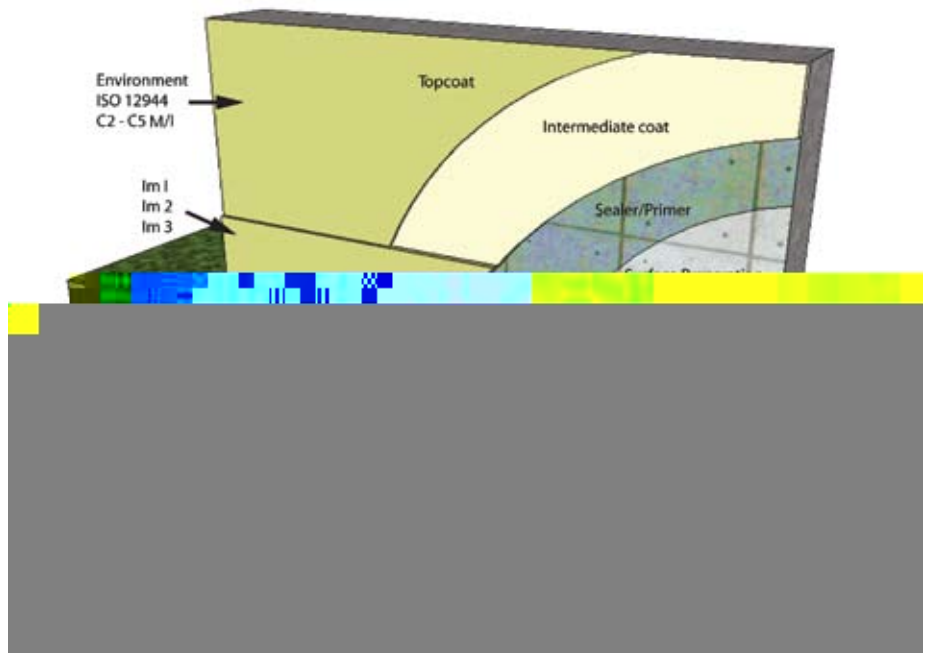
Typical preparation for concrete bridges and concrete objects. CSP 2 Low water jet 5000 psi / 340 bar (1 bar = 14,5 psi)

Water jetting vs sandblasting

Both methods are suitable for vertical concrete. Sandblasting will generate a large volume of airborne dust and the surface has to be cleaned before application starts, normally with water jetting at a low pressure of 1500 - 2500 psi / 90 - 150 bar. Water jetting will consume a large volume of water but will give the same result as sandblasting. Sandblasting, however, has a higher cost than water jetting.

SYSTEMS THAT WORK

Each system comprises a combination of sealer/primer, intermediate coat and topcoat for the above-the-ground structure coupled with a special system for the foundation and splash zone.



While each Jotun product provides particular benefits in terms of protection, economy, ease of application and drying time, it is in the choice of system i.e. the combination of products, which in total are designed to offer the best available protection to each structure.

••• Tested protection systems

Jotun's concrete protection systems have undergone comprehensive tests at independent testing laboratories to prove they are 'fit for purpose'. Approvals are available on request.

The tests on each system vary and include, but are not limited to those listed alongside.

Standard	Type / Description
ASTM 4060:95	Abrasion resistance
ASTM B	Salt water resistance
ASTM C 579:96	Compressive strength
ASTM C 580	Flexural strength
ASTM C 836:96	Crack bridging
ASTM C 870:97	Water resistance
ASTM C-1202:97	Reduction in chloride ion ingress
ASTM D 2370:99	Tensile strength
ASTM D 2794:99	Impact resistance
ASTM D 4541:89	Bond strength
ASTM E-96:94	Water vapour transmission
ASTM G 53:88	UV resistance
BS 6920:00/01	Potable water
BS EN – 12390:00	Water penetration
EN 1062-6:2002	Anti-carbonation

••• Our products for concrete protection include:

FILLER:

Jotun Epoxy Filler – a high strength, non-shrink, two component solvent-free epoxy filler

SEALERS:

Chemclear – a clear vinyl ester sealer

Jotafloor Solvent Free Primer – a high strength epoxy resin-based primer / sealer with excellent adhesion

Jotashield Penetrating Primer – a siloxane primer

Penguard Clear Sealer – an epoxy sealer for concrete

EPOXIES:

Jotacote Universal – a pure epoxy primer / intermediate coat

Marathon – a glass flake reinforced epoxy for extreme exposure

Penguard Midcoat – an epoxy intermediate coat

Tankguard 412 – a solvent-free epoxy

SPECIAL USAGE:

Baltoflake – a glass flake reinforced polyester

Chemflake Special – a glass flake reinforced vinyl ester with high chemical resistance

TOPCOATS:

Hardtop AS – a polyurethane topcoat with excellent gloss and colour retention

Hardtop XP – an aliphatic polyurethane topcoat with excellent gloss and colour retention

Jotashield Tex Ultra – a high performance pure acrylic for extreme exposure

Pilot II – an alkyd-based topcoat for both exterior and interior use

Waterfne Topcoat – a high performance waterborne acrylic topcoat



Abha Bridge, Abha, KSA

JOTUN CONCRETE PROTECTION SYSTEMS

ISO 12944 CORROSION CLASS	SYSTEM CATEGORY				
		1st COAT	D.F.T.	2nd COAT	D.F.T.
C5 - I C5 - M	Premium	Penguard Clear Sealer	50	Jotacote Universal	125
	Premium	Penguard Clear Sealer	50	Jotacote Universal	125
	Standard	Penguard Clear Sealer	50	Jotacote Universal	200
	Commercial	Penguard Clear Sealer	50	Penguard Midcoat	125
	Environmental	Jotafloor Solvent Free	100	Waterfine Topcoat	60
C4	Premium	Penguard Clear Sealer	50	Penguard Midcoat	125
	Premium	Penguard Clear Sealer	50	Jotacote Universal	200
	Standard	Penguard Clear Sealer	50	Penguard Midcoat	150
	Commercial	Penguard Clear Sealer	50	Penguard Midcoat	125
	Environmental	Jotafloor Solvent Free	100	Waterfine Topcoat	80
C3	Premium	Penguard Clear Sealer	50	Penguard Midcoat	125
	Standard	Penguard Clear Sealer	50	Penguard Midcoat	100
	Commercial	Penguard Clear Sealer	50	Pilot II	40
	Environmental	Jotafloor Solvent Free	100	Waterfine Topcoat	80
C2	Premium	Penguard Clear Sealer	50	Penguard Clear Sealer	50
	Standard	Penguard Clear Sealer	50	Hardtop XP	50
	Commercial	Penguard Clear Sealer	50	Pilot II	40
	Environmental	Jotafloor Solvent Free	50	Waterfine Topcoat	60

Im 1-3	Premium	Chemclear	200	Baltoflake	750
	Standard	Penguard Clear Sealer	50	Marathon	300
	Commercial	Penguard Clear Sealer	50	Jotacote Universal	125
	Alternative	Penguard Clear Sealer	50	Tankguard 412	250

Middle East: C2 - C5I / M	Premium	Jotashield Penetrating Primer	35	Jotashield Tex Ultra	150
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Middle East: C2 - C5I / M	Premium	Siloxane Primer	10	Jotashield Tex Ultra	150
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NEW CONSTRUCTION
PAINT

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PROTECTING CONCRETE ACROSS THE WORLD, ACROSS ALL CLIMATES

Jotun has long understood the need to provide solutions for concrete protection that recognise not only the needs of the specific project, but also the effects of its location and environment.

Our concrete protection systems have been proven in-service across the world, from the depths of freezing winters in northern Norway to the desert heat of the Middle East and the high humidity and heavy rain of South East Asia.



Project Name : Al Khodh Flyover
Location : Al Khodh, Oman
Project Size : 3,000 m²

Coating System : 1 x Jotun Siloxane Acrylic Primer @ 10 µm
2 x Jotashield Tex Ultra @ 150 µm



Project Name : Improvement of Jamarat Bridge and surrounding areas
Location : Makkah, KSA
Project Size : 500,000 m²

Coating System : Jotashield AR Primer
2 x Jotashield Tex Ultra @ 150 µm
2 x Jotashield Topcoat Silk @ 30 µm
Colour Grey

Project Name : Lhasa Liu Wu Bridge (approach and piers)
Location : Lhasa, China
Project Size : 21,000 m²

Coating System : 1 x Penguard Clear Varnish @ 50 µm
1 x Penguard Classic MIO @ 80 µm
2 x Hardtop XP @ 80 µm



Project Name : Saudi-Bahrain Causeway
Location : KSA/Bahrain
Project Size : 65,000 m²

Coating System : 1 x Jotaprime 505 @ 50 µm
 2 x Tankguard 412 @ 250 µm

Project Name : Guangzhou Bridge Concrete Maintenance
Location : Guangzhou, China
Project Size : 20,000 m²

Coating System : 1 x Penguard Clear Varnish @ 50 µm
 2 x Primastic Universal @ 100 µm
 2 x Futura AS @ 60 µm



Project Name : Kolehdooz Bridge
Location : Tehran, Iran
Project Size : 14,000 m²

Coating System : 1 x Siloxane Acrylic Primer
 1 x Jotashield Filler
 2 x Jotashield Tex Ultra @ 250 µm



Project Name : Nanning Bridge
Location : Nanning, China
Project Size : Concrete Surface
 - Above water 45,686 m²,
 - Below water 11,081 m²

Coating System : Above water
 1 x Jotamastic 87 @ 50 µm
 1 x Jotamastic 87 @ 200 µm
 1 x Hardtop XP @ 80 µm

Below water
 1 x Jotamastic 87 @ 50 µm
 2 x Jotamastic 87 @ 200 µm



Project Name : Dubai Metro
Location : Dubai, UAE
Project Size : Viaduct 1,200,000 m², Piers 40,000 m²
Length : Red Line 52 kms
 Green Line 18 kms

Coating System
 Viaduct - External
 1 x Jotun Siloxane Acrylic Primer
 1 x Jotashield Filler
 2 x Jotashield Tex Ultra @150 µm

Piers - Up to 3m Height
 1 x Penguard Clear Sealer @ 40 µm
 1 x Tankguard 412 @ 250 µm
 1 x Hardtop HB @ 50 µm

Top Deck
 1 x Jotafloor Solvent-free Primer @ 100 µm
 Jotafloor Non-slip Aggregate - Fine
 2 x Jotafloor PU Topcoat @ 70 µm

*Palm Jumeirah Gateway Bridge, Dubai, U.A.E,
(Connects the Palm Jumeirah to the mainland in Dubai)*



Jotun Coatings and Jotun Paints
Divisions of Jotun A/S

Legal Jotun entities worldwide are listed.
For details of Branch offices and Jotun
representation in countries not listed,
please visit www.jotun.com

AUSTRALIA

Jotun Australia Pty. Ltd.,
P.O.Box 105, Altona North,
9 Cawley Road,
BROOKLYN, VIC 3025
Tel: +61 3 9314 0722
Fax: +61 3 9314 0423

BRAZIL

Jotun Brasil Ltda.
Av Santa Luzia, 2084 - Santa Luzia