

ASHGHAL

Interim Advice Note No. 027/14

Specification for Protective Coating for Above Ground Concrete Surfaces of Highway Structures

Revision No. A1

Summary

This Interim Advice Note (IAN) provides information and guidance on the specification to be adopted for protective coating for above ground concrete surfaces of highway structures. This IAN takes immediate effect. The following shall be noted:

- This Interim Advice Note is for use with the existing Qatar Construction Specifications (QCS) 2014 only.
- This IAN does not make any amendments to the existing Qatar Construction Specifications (QCS) 2014.
- This IAN adds a new Section and new Part to QCS 2014, namely Section 101, Part 5, Specification for Above Ground Concrete Surfaces of Highway Structures.

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QATAR CONSTRUCTION SPECIFICATIONS (QCS) 2014

Additional Section 101, Part 5, Specification for Protective Coating for Above Ground Concrete Surfaces of Highway Structures

INTERIM ADVICE FOR PWA PROJECTS ONLY

1. Foreword

- 1.1 Interim Advice Notes (IANs) may be issued by Ashghal from time to time. They define specific requirements for works on Ashghal projects only, subject to any specific implementation instructions contained within each IAN.
- 1.2 Whilst IANs shall be read in conjunction with the Qatar Highway Design Manual (QHDM), the Qatar Traffic Manual (QTM) and the Qatar Construction Specifications (QCS), and may incorporate amendments or additions to these documents, they are not official updates to the QHDM, QTM, QCS or any other standards.
- 1.3 Ashghal directs which IANs shall be applied to its projects on a case by case basis. Where it is agreed that the guidance contained within a particular IAN is not to be incorporated on a particular project (e.g. physical constraints make implementation prohibitive in terms of land use, cost impact or time delay), a departure from standard shall be applied for by the relevant Consultant / Contractor.
- 1.4 IANs are generally based on international standards and industry best practice and may include modifications to such standards in order to suit Qatar conditions. Their purpose is to fill gaps in existing Qatar standards where relevant guidance is missing and/or provide higher standards in line with current, international best practice.
- 1.5 The IANs specify Ashghal's requirements in the interim until such time as the current Qatar standards (such as QHDM, QTM, etc.) are updated. These requirements may be incorporated into future updates of the QHDM, QTM or QCS, however this cannot be guaranteed. Therefore, third parties who are not engaged on Ashghal projects make use of Ashghal IANs at their own risk.
- 1.6 All IANs are owned, controlled and updated as necessary by Ashghal. All technical queries relating to IANs should be directed to Ashghal's Manager of the Design Department, Infrastructure Affairs.

Signed on behalf of Design Department:

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2. Ashghal Interim Advice Note (IAN) – Feedback Form

Ashghal IANs represent the product of consideration of international standards and best practice against what would work most appropriately for Qatar. However, it is possible that not all issues have been considered, or that there are errors or inconsistencies in an IAN.

If you identify any such issues, it would be appreciated if you could let us know so that amendments can be incorporated into the next revision. Similarly, we would be pleased to receive any general comments you may wish to make. Please use the form below for noting any items that you wish to raise.

Please complete all fields necessary to identify the relevant item			
IAN title:			
IAN number:		Appendix letter:	
Page number:		Table number:	
Paragraph number:		Figure number:	
Description comment:			
Please continue on a separate sheet if required:			
Your name and contact details (optional):			
Name:		Telephone:	
Organisation:		Email:	
Position:		Address:	

Please email the completed form to:

<p>Abdulla Ahin AA Mohd Manager of Roads Design Department Design Management (Roads Section) Public Works Authority aahin@ashghal.gov.qa</p>
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We cannot acknowledge every response, but we thank you for contributions. Those contributions which bring new issues to our attention will ensure that the IANs will continue to assist in improving quality on Ashghal’s infrastructure projects.

3. Introduction

- 3.1 This Interim Advice Note (IAN), which takes immediate effect, provides information and guidance on the Specification for Protective Coating for Above Ground Concrete Surfaces of Highway Structures. This IAN will provide interim guidance prior to issue of a revision to the Qatar Construction Specifications (QCS).
- 3.2 The specification is applicable to exposed surfaces of concrete highway structures (such as bridges and culverts) only.

4. Additional Standard

- 4.1 For application to above ground concrete surfaces of highway structures; Section 101, Part 5 is additional to the existing Qatar Construction Specifications (QCS) 2014.

5. Implementation

- 5.1 This IAN is to be used with immediate effect on projects as follows:
- All Ashghal projects in Design Stage
 - All Ashghal projects in Tender Stage
- 5.2 Ashghal projects in Construction Stage shall be reviewed by the Project Consultant / Contractor and the implications of adoption of this Interim Advice Note discussed with the respective Ashghal Project Manager.
- 5.3 If in doubt, Consultants / Contractors should seek guidance from the respective Ashghal Project Manager or designated Programme Management Consultant (PMC) on a scheme specific basis.

6 Disclaimer

- 6.1 This Interim Advice Note and its recommendations or directions have been provided for application on Ashghal's infrastructure projects within Qatar only and they are not warranted as suitable for use on other roads, highways or infrastructure with Qatar or elsewhere. Should any third party, Consultant or Contractor choose to adopt this Interim Advice Note for purposes other than Ashghal's infrastructure projects, they shall do so at their own risk.

Appendix A

QATAR CONSTRUCTION SPECIFICATIONS (QCS) 2014

**Additional Section 101, Part 5, Protective Coating for Above
Ground Concrete Surfaces of Highway Structures**

INTERIM ADVICE FOR PWA PROJECTS ONLY

Appendix A

QATAR CONSTRUCTION SPECIFICATIONS 2014

Additional Section 101, Part 5, Protective Coating for Above Ground Concrete Surfaces of Highway Structures

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INTERIM ADVICE FOR PWA PROJECTS ONLY

PART 5 PROTECTIVE COATING FOR ABOVE GROUND CONCRETE SURFACES OF HIGHWAY STRUCTURES

5.1 GENERAL

1. This section covers the application of protective coatings to concrete surfaces to prevent the corrosion of reinforcement. Except where waterproofing or ceramic tiling is specified, all concrete surfaces that are not in contact with the soil shall receive a concrete protective coating
2. Certain essential characteristics of protective coatings will only be applicable to certain types of structures and to the conditions the structures will be subjected to in service. Table 5.1 summarises some of the more important characteristics and their application on structures.
3. We note that for instance because of the tensile stress limitations of prestressed concrete structures that it is not necessary to provide a high performance elastomeric protective coating to the surfaces of the structure to enable the bridging of cracks which are common to reinforced concrete structures. In the case of non-elastomeric coatings it is then possible to increase the carbon dioxide and chloride ion diffusion resistance of the coating and in so doing provide a better protection to the reinforcement.
4. All materials shall be from a specialized manufacturer whose products have proven to be highly satisfactory in similar works. The concrete protection system shall have British Board of Agreement (BBA) Certification, or other internationally recognised independent system certification, subject to the Engineer's approval
5. The proposed protective coating to meet the requirements of the chosen coating system shall be recommended by the coating manufacturer for the specific use intended for approval by the Engineer and if approved it shall be applied in full accordance with the manufacturer's instructions.
6. It will be at the discretion of the Engineer which of the coating systems will be applied on the concrete surfaces of the structure.

Table 5.1 - Coating Types

Coating System	Application	Characteristics								
		Exposure class BS EN 206-1; Table 1	Carbon dioxide diffusion resistance	Chloride ion diffusion resistance	Sulphate ion diffusion resistance	Water vapour transmission - breathable	Resistance to water absorption	Waterproof	Active crack bridging	Abrasion resistant
A	Reinforced concrete members (e.g. culverts, bridge piers, abutments, retaining walls, exposed internal surfaces of box girders, etc.)	XC4, XD1 & XS1	✓	✓	✓	✓	✓		✓	
B	Prestressed concrete members with zero tension (e.g. bridge superstructure consisting of box girders, pier columns if always fully in compression)	XC4, XD1 & XS1	✓	✓	✓	✓	✓			
C	Concrete in the splash zone and subjected to wetting and drying (e.g. splash and tidal zone of piers immersed in sea water)	XC4, XD3 & XS3		✓	✓	✓	✓	✓	✓	✓
D	All surfaces of concrete not specified to be painted (e.g. non-structural concrete)	XC4, XD1 & XS1		✓		✓	✓			

5.2 STANDARDS

1. Unless otherwise specified, the coatings shall comply with the requirements in Table 5.2.1.

Table 5.2.1 - Mandatory Standard	
EN 1504-2	Products and systems for the protection and repair of concrete structures – Definitions, requirements, quality control and evaluation of conformity. Part 2 - Surface protection systems for concrete
EN 1062	Paints and varnishes – Coating materials and coating systems for exterior masonry and concrete Part 1: Classification Part 3: Determination and classification of liquid-water transmission rate Part 6: Determination of carbon dioxide permeability Part 7: Determination of crack bridging properties Part 11: Methods of conditioning before testing
ISO 9000	Quality management and quality assurance standards
ISO 9001	Quality systems – Model for quality assurance in design, development, production, installation and servicing
BD 43/03	The Impregnation of Reinforced and Prestressed Concrete Highway Structures using Hydrophobic Pore-Lining Impregnants

2. The documents listed in Table 5.2.2 are not mandatory, however they are considered to reflect good practice and their recommendations and guidance should be followed wherever reasonably practical.

Table 5.2.2 - Advisory Standard	
CIRIA Technical Note 130	Protection of Reinforced Concrete by Surface Treatments
EN 1504 Parts 1,3 to 9	Products and systems for the protection and repair of concrete structures – Definitions, requirements, quality control and evaluation of conformity Parts 1, 3 to 9

3. All the above and any other documents and specifications referred to in this document shall be the latest edition or superseding document and specification

5.3 SUBMITTALS

1. The contractor shall be responsible for the following:
 - (i) Submitting the coating manufacturer's specifications, installation instructions, test results and other data to show compliance with the requirements of this part of the specification and the contract documents for approval by the engineer
 - (ii) The Contractor shall provide independent test certification prior to approval, that proposed coatings are sufficiently durable against high temperatures, humidity, ultraviolet (UV) light, and salt exposure as experienced in the Middle East
 - (iii) Submitting a list of works, executed in the Middle East, in which the same make of protective coating was used successfully
 - (iv) Ensuring that the applicator has a minimum of 5 years successful experience in the installation of the specified material and is approved and trained by the manufacturer
 - (v) Providing documentation to prove that all coating materials including primers, thinners and fillers are sourced from a single manufacturer operating the ISO 9001, ISO 14001 and OHSAS 18001 QA/QC system.
 - (vi) Arranging for the material manufacturer's technical representative to be present at the beginning of the work to re-qualify the approved applicator's personnel in the installation of the manufacturer's coating products.

5.4 MATERIALS

5.4.1 COATING SYSTEM A

1. The coating shall be a crack bridging pigmented elastomeric, aliphatic acrylic coating providing a barrier to water, carbon dioxide, oxygen, airborne acidic gases, chloride ions and sulphate ions but with the ability to allow the outward passage of water vapour which may otherwise become entrapped. Alternative materials may be used, subject to the written agreement of the Engineer.
2. The coating shall have a very high long term U.V. resistance for the warrantee period of the coating.
3. The physical properties of the system shall be as submitted by the manufacturer and approved by the Engineer.
4. The total dry film thickness of the coating shall not be less than 300 microns and shall be applied in two coats.
5. The minimum performance test requirements for the complete coating system shall be as shown in Table 5.4.1.

5.4.2 COATING SYSTEM B

1. The coatings shall be a pigmented aliphatic acrylic polymer based coatings providing a barrier to water, carbon dioxide, oxygen, airborne acidic gases, chloride ions and sulphate ions but with the ability to allow the outward passage of water vapour which may otherwise become entrapped. Alternative materials may be used, subject to the written agreement of the Engineer.
2. The coating shall have a very high long term U.V. resistance for the warrantee period of the coating.
3. The physical properties of the system shall be as submitted by the manufacturer and approved by the Engineer.
4. The total dry film thickness of the coating shall not be less than 150 microns and shall be applied in two coats
5. The minimum performance test requirements for the complete coating system shall be as shown in Table 5.4.2.

5.4.3 COATING SYSTEM C

1. The coating shall be a two component high build epoxy polysulphide or epoxy polyurethane based protective coating system. The material should cure to form a tough yet flexible seamless water proofing membrane that is chemical and abrasion resistant. Alternative materials may be used, subject to the written agreement of the Engineer.
2. The coating shall be U.V. and weather resistant for the warrantee period of the coating.
3. The physical properties of the system shall be as submitted by the manufacturer and approved by the Engineer.
4. The total dry film thickness of the coating shall not be less than 500 microns and shall be applied in two coats
5. The minimum performance test requirements for the complete coating system shall be as shown in Table 5.4.3.

5.4.4 COATING SYSTEM D

1. The concrete protective coating shall be a penetrating low viscosity silane siloxane, which, when applied to the concrete substrate, cures to form a chemically bound hydrophobic barrier to significant reduce water absorption and provide in-depth protection for the reinforced structure against corrosion associated with the ingress into the concrete of moisture, chloride and sulphate ions while still permitting water vapor to escape from the structure.
2. The silane siloxane protective coating shall contain no less than 15% solids content where it is to be the only protection to the concrete. Concrete structures to be subsequently painted may be primed with a silane siloxane primer with a solids content of no less than 10%.
3. The physical properties of the system shall be as submitted by the manufacturer and approved by the Engineer.
4. The minimum performance test requirements for the complete coating system shall be as shown in Table 5.4.4.

Table 5.3.1 - Performance Test Requirements of COATING SYSTEM A in accordance with EN 1504-2

Performance Characteristics	Test Method	Requirements
<i>EN 1504-2, Principle 1.3 (C) An ingress protection coating</i>		
Dry film thickness	EN 1062-1	Class E ₄
No of coats	-	2
Permeability to CO ₂	EN 1062-6	S _D > 100 m
Permeability to water vapour	EN ISO 7783-1	Class I, S _D < 5 m (permeable to water vapour)
Capillary absorption and permeability to water	EN 1062-3	Class W ₃ , Low, ≤ 0.1 kg/(m ² .h ^{0.5})
Crack bridging ability	EN 1062-7 Method A, continuous opening of the crack. EN 1062-7 Method B, Cyclic opening of the crack	Class A4 > 1250 μm / 0.5 mm/min Class B3.1
Adhesion strength by pull-off test	EN 1542	≥ 1 N/mm ²
Artificial weathering after 2000 h	EN 1062-11	No blistering No cracking No flaking Slight colour change, loss of gloss and chalking may be acceptable, but shall be described
Diffusion of chloride ions	Research Laboratories Vinci Technology Centre (formerly Taylor Woodrow Engineering Limited)	No ingress of Cl after 2000 days of testing
Reaction to fire after application	EN 13501-1	Euro classes

Table 5.3.2 - Performance Test Requirements of COATING SYSTEM B in accordance with EN 1504-2

Performance Characteristics	Test Method	Requirements
<i>EN 1504-2, Principle 1.3 (C) An ingress protection coating</i>		
Dry film thickness	EN 1062-1	Class E ₃
No of coats	-	2
Permeability to CO ₂	EN 1062-6	S _D > 100 m
Permeability to water vapour	EN ISO 7783-1	Class I, S _D < 5 m (permeable to water vapour)
Capillary absorption and permeability to water	EN 1062-3	Class W ₃ , Low, ≤ 0.1 kg/(m ² .h ^{0.5})
Crack bridging ability	EN 1062-7 Method A, continuous opening of the crack.	Class A ₁ > 100 µm
Adhesion strength by pull-off test	EN 1542	≥ 1 N/mm ²
Artificial weathering after 2000 h	EN 1062-11	No blistering No cracking No flaking Slight colour change, loss of gloss and chalking may be acceptable, but shall be described
Diffusion of chloride ions	Research Laboratories Vinci Technology Centre (formerly Taylor Woodrow Engineering Limited)	No ingress of Cl after 2000 days of testing
Reaction to fire after application	EN 13501-1	Euro classes

Table 5.3.3 - Performance Test Requirements of COATING SYSTEM C in accordance with EN 1504-2

Performance Characteristics	Test Method	Requirements
<i>EN 1504-2, Principles 2.2(C), 5.1(C), 6.1(C), a moisture control, physical resistant and chemical coating respectively</i>		
Dry film thickness	EN 1062-1	Class E ₅
No of coats	-	2
Abrasion Resistance (Taber Test)	EN ISO 5470-1	Weight loss < 3000 mg abrading wheel H22/rotation 1000 cycles/load 1000 g
Permeability to water vapour	EN ISO 7783-1 EN ISO 7783-2	Class III, S _D > 50 m (not permeable to water vapour)
Capillary absorption and permeability to water	EN 1062-3	$w < 0,1 \text{ kg}/(\text{m}^2 \cdot \text{h}^{0,5})$
Resistance to severe chemical attack Class III: 28d with pressure It is recommended to use testing liquids from the 20 classes given in EN 13529 covering all types of common chemicals.	EN 13529	Reduction in hardness of less than 50% when measured to Buchhoiz method, EN ISO 2815, or Shore method EN ISO 868 24 h after the coating is removed from immersion in the test liquid
Crack bridging ability	EN 1062-7 Method A, continuous opening of the crack. EN 1062-7 Method B, Cyclic opening of the crack	Class A ₄ > 1250 µm / 0.5 mm/min Class B3.1
Adhesion strength by pull-off test	EN 1542	≥ 1.5 N/mm ²
Artificial weathering after 2000 h	EN 1062-11	No blistering No cracking No flaking Slight colour change, loss of gloss and chalking may be acceptable, but shall be described
Impact Resistance	EN ISO 6272-1	After loading no cracks and delamination Class III: ≥20Nm
Reaction to fire after application	EN 13501-1	Euro classes

Table 5.3.4 - Performance Test Requirements of COATING SYSTEM D in accordance with EN 1504-2

Performance Characteristics	Test Method	Requirements
<i>EN 1504-2, Principles 1.1(H), 2.1(H), an ingress protection and moisture control hydrophobic impregnation coating</i>		
No of Coats	-	2
Depth of penetration measured on 100 mm concrete test cubes after 28 days of curing according to EN 1766	prEN 14630	Class I: < 10 mm
Water absorption and resistance to alkali	EN 13580	Absorption ration < 7.5 %, compared with untreated specimen Absorption ratio (after immersion in alkali solution) < 10 %
Drying rate coefficient	EN 13579	Class I: >30%
Reduction in chloride ion penetration		90% minimum at 28 days
Reaction to fire after application	EN 13501-1	Euro classes

5.5 APPLICATION

5.5.1 APPROVAL

1. The Engineer's approval must be obtained prior to applying the coating system in the works. Before approval is given the Engineer will need to be satisfied as to the following:-
 - (i) All construction work in the immediate vicinity of the structure to be coated has been completed.
 - (ii) The surface preparation of the structure has been completed.
 - (iii) The whole of the structure can be coated in a continuous operation with paint from the same batch.
 - (iv) Adequate measures have been taken to protect the property of third parties, including vehicles from coating splatters.
 - (v) The weather conditions accord with the coating manufacturer's directions for coating applications.
 - (vi) The timing of all coating operations.
2. Based on the Engineer selection of colours from a paint manufacturer's standard colours, that manufacturer shall prepare samples for inspection and final approval by the Owner

5.5.2 SURFACE PREPARATION

1. Before the concrete is prepared and coated, its condition should be assessed by a representative of the coating manufacturer on site, and an acceptance in writing of the finished surface shall be provided that it is according to the requirements and specifications for the installation of the specific product.
2. The Contractor shall not proceed with the surface finish or making good concrete surfaces until he has received the Engineer's permission to do so and he shall not apply any fairing coat or repair material or any other coating to the concrete surfaces from which the shuttering has been struck until the concrete has been inspected and approved by the Engineer.
3. The Contractor shall prepare a method statement, which shall be endorsed by a material manufacturer, for all proposed repairs to concrete surface defects, for surface preparation, including covering materials and methods, coating application, quality assurance (QA), and quality control (QC) for approval by the engineer prior to carrying out the work.
4. Repairs to defects observed on the concrete surface:
 - (i) All surface cracks on the concrete surfaces shall be assessed by the contractor prior to their repair. Depending on the cause of the crack and whether the crack is either active or passive, the appropriate repair methods and repair materials shall be proposed by the contractor for approval by the engineer.
 - (ii) The procedure for the repair of areas of honeycombed concrete shall be submitted to the engineer by the contractor for approval prior to carrying out the repair work. Generally, all honeycombed concrete shall be removed entirely until sound

concrete is found, feather edges removed and depending on the extent of the honeycombing, the outer most layer of reinforcement exposed and concrete removed to a depth of at least one diameter beyond the reinforcement. The approved cementitious repair material shall then be applied to the repair area strictly in accordance with the manufacturers specifications and instructions

5. Concrete surface preparation prior to the application of the protective coating.
 - (i) The contractor shall prepare and clean all surfaces in strict accordance with the manufacturer's instructions and as specified herein for each particular application or coating
 - (ii) At the discretion of the Engineer, where it is required to provide a uniform texture to the overall exposed concrete surface, a polymer modified cementitious fairing coat which is compatible with the proposed protective coating shall be applied, strictly in accordance with the manufacturer's instructions.
 - (iii) In preparation for the fairing coat and protective coating all existing surfaces shall be free from oil, grease, loose particles, decayed matter, moss or algae growth and general curing compounds. All surface contamination and surface laitance must be removed through the use of high pressure water jetting.
 - (iv) Blow holes, prepared surface cracks and areas of substantial pitting shall then be filled with a proprietary polymer modified cementitious fairing coat for COATING SYSTEMS A, B and D and with a thixotropic epoxy resin fairing coat for COATING SYSTEM C as recommended by the coating manufacturer. The mixing and application of these materials must be in strict accordance with the manufacturer's recommendations.
 - (v) The fairing coat shall be compatible with the protective coating and approved by the Engineer prior to application.
6. On concrete surfaces that extend into the earth, the protective coating shall extend at least 150mm below the finished grade. The waterproofing membrane installed to protect the below ground concrete surfaces shall extend at least 150mm above the finished grade and applied over the protective coating. The contractor shall propose a proper termination edge protection to the waterproofing membrane to the engineer for approval.

5.5.3 CONSTRUCTION REQUIREMENTS

1. The Contractor is required to adhere strictly to the manufacturer's specifications regarding the use, storage, application and safety rules in respect of the approved materials.
2. Priming
 - (iii) Primer for COATING SYSTEMS A AND B shall be a penetrating film forming silane siloxane acrylic hydrophobic primer applied as a flood coat at a rate of 0.4 litres per m². The silane siloxane primer shall have no less than 10% solids content and adhere to the specification for COATING SYSTEM D above.
 - (iv) Primer for COATING SYSTEM C is not normally required provided the substrate is sound, untreated and good quality non porous concrete however if required it shall be in accordance with manufacturers coating specifications.

3. Trial Panels

- (i) Where required by the Engineer, trial panels not exposed in the finished work shall first be treated using the selected materials. These trial applications shall be carried out using the type of materials, mixing procedures and applications to establish the adhesion of the material to the concrete substrate and fairing coat and the dry film thickness and approved colour as will be used on the contract. A representative of the coating manufacturer shall be present during the preparation and application of the material on the trial panels.
- (ii) The contractor shall, at his own expense, surface coat as many panels as required to satisfy the Engineer that the panel, when accepted will form the standard against which the corresponding coating in the works will be judged. No application of the coating in the works shall be undertaken until trials have been completed to the Engineer's satisfaction.

4. General

- (i) The Contractor shall, on the written instruction of the Engineer, remove and reconstruct any such portion of the work which, in the opinion of the Engineer, is unsatisfactory as regards quality of concrete, incorrect dimension of the cast portion, badly placed or insufficient reinforcement, honeycombing or other such cause as shall render the construction not up to the standard required and which, in the opinion of the Engineer, may prejudicially affect the strength or durability of the construction.
- (ii) Elastomeric and propriety mechanical bearings, painted steel surfaces, exposed bituminous materials and joint sealants adjacent to members to be coated shall be masked off. All masking shall be removed following completion of the coating process. Members shall be protected from rain and traffic spray, sand and dust after application for the period required by the manufacturer.
- (iii) Additional coats shall be applied when undercoats, stains, or other conditions show through the final coat.
- (iv) Sufficient time between successive coats, in accordance with the manufacturer's instructions, shall be allowed by the contractor to permit drying.

5.6 WARRANTY

1. The protective coating shall be guaranteed by the Contractor to perform in the manner described in this part of the specification and the contract documents for a period of 10 years from the date of its application on the structure.
2. The performance guarantee shall be submitted with the tender and shall fully outline the conditions, limitations, exclusions and owners obligations.
3. The warranty shall ensure that repairs to defects shall be completed in a timely manner at no extra cost to the Owner.
4. The warranty shall apply from the date of application of the original coating only and is not required to be extended beyond this period in the event of repairs being completed under the Warranty.

5.7 MEASUREMENT AND PAYMENT

1. If not stated otherwise in the Contract Documents, the tendered rate for the protective coating shall include full compensation for:
 - (i) supply and application of all materials and all complementary works,
 - (ii) all preparation of new concrete surfaces,
 - (iii) temporary works including access arrangements and measures to ensure adequate ventilation,
 - (iv) all labour, equipment, tools, suppliers and incidentals necessary to complete the work to the satisfaction of the Engineer.
2. If not stated otherwise in the Contract Documents, the unit of measurement shall be square meters and the quantity shall be the area of concrete surfaces receiving the coating.