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**SERIES NG 2000**  
**WATERPROOFING FOR CONCRETE**  
**STRUCTURES**

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# WATERPROOFING FOR CONCRETE STRUCTURES

## NG 2001 General

1 The most opportune periods for installing waterproofing systems are the spring, summer and autumn when climatic conditions are most favourable.

2 Specification requirements for restrictions on curing liquids, compounds and membranes are given in sub-Clause 1710.5.

3 The use of ventilating layers, partial bonding or bond breakers is not permitted in the Specification as they provide an easy passage for water to pass under the membrane. The pumping action produced by the passage of vehicle wheels exacerbates the problem and leads rapidly to the general failure of the adhesion and disruption of the surfacing.

4 Fillets are generally formed in sharp internal angles to ensure the fitting and shaping of prefabricated sheet and minimum thickness of sprayed membrane in the angle.

### Outgassing

5 (05/01) The design of many bridge decks includes voids, which contain air, and air may be held within the concrete itself. This contained air can move in and out of voids with temperature and barometric pressure changes and such air movement through pores in the bridge deck top surface can cause pin/blow holes in primers and thence blister the membrane. It is less likely to affect sheet membranes, but can cause pin/blow holes or blisters in liquid applied membranes whilst in the partially cured condition.

6 (05/01) Research has shown that the predominant cause of outgassing is a change in concrete temperature that gives rise to expansion of air in the pore structure of the concrete. The rate of outgassing is related to both the rate of temperature change and to the air permeability of the concrete. However it should be noted that outgassing occurs significantly more where primers containing solvents have been used, than from temperature changes alone. This is usually because the primer is not fully cured or set and excess solvent from the primer may still be present, which may then be activated when the membrane is applied (or subsequently when subjected to sunlight or the application of the asphalt). Care should therefore be taken to ensure that primers are set or fully cured in accordance with the manufacturer's instructions before the application of the membrane.

7 (05/01) Under the conditions which simulate outgassing it has been found that thin fast gelling membranes are most susceptible to blistering while the thin slower gelling membranes are most prone to pin/blow holing.

## NG 2002 Protection of Bridge Deck Waterproofing During Construction

1 Before rubber tyred plant and equipment are allowed to travel on bridge deck waterproofing, it should be ensured that the surface is and remains, free of all loose materials and is stable enough to withstand traction forces.

## NG 2003 Materials for Waterproofing Concrete Bridge Decks

### Permitted Waterproofing Systems

1 (05/01) As soon as possible after the Contract has been awarded, it should be ensured that the Contractor provides the BBA (British Board of Agrément) Roads and Bridges Agrément Certificate.

2 (05/01) Should the Overseeing Organisation call for tests it is important that uniform methods of testing be used. Details of the registration tests, test methods and criteria can be obtained from the British Board of Agrément.

3 A bonding agent or liquid waterproofing membrane/adhesive has set or cured when it has become sufficiently stabilized to prevent movement of the waterproofing system during the laying of an additional protective layer or surfacing.

4 (05/01) Unless otherwise described in the particular BBA Roads and Bridges Agrément Certificate the primer should be thoroughly dry or cured before the membrane is applied. Where solvent based primers are used any excess primer that has not been removed is likely to 'skin over' but give the appearance of being dry. The trapped solvent will expand rapidly under the application of hot bitumen and may lead to failure of the membrane.

## NG 2004 Materials for Waterproofing Below Ground Concrete Surfaces

- 1 There should be consideration as to whether the upper surface of buried concrete structures such as subways should be waterproofed with a material complying with Clause 2003 or whether materials complying with Clause 2004 are suitable for the purpose.
- 2 Buried concrete structures which need to be waterproofed with a material complying with Clause 2003 should be identified on the Drawings.

## NG 2005 Workmanship for Waterproofing Concrete Bridge Decks

### General

- 1 Prior to laying the waterproofing, the primed surface should be inspected and any entrapped aggregate or debris removed. Should the primed area be damaged it should be made good using the appropriate primer and allowing the necessary evaporation or cure time.

### Blistering and Pin/Blow Holes

- 2 (05/01) Moisture in the concrete deck, incomplete coverage by primer, unevaporated solvents in primers and general outgassing can lead to blistering of prefabricated sheet waterproofing, together with pin/blow holes (continuous or non-continuous) in liquid applied membranes. The waterproofing system and the additional protective layer should be covered as quickly as possible with the road surfacing in order to minimize the risk of blistering which is usually more prevalent in the late spring and early summer, during clear sunny weather.

### Application of Waterproofing Into Angles Including Chases

#### Sheet Membranes

- 3 Efforts by the operative to seat the sheet into a sharp angle can result in weakening or hidden damage to the membrane. There is also a tendency for the sheet to resist bending sharply into an angle and to draw away leaving a hollow which may give rise to blistering and puncturing when the surfacing is applied.

#### Spray Applied Membranes

- 4 With inadequate equipment or poor application technique there can be a tendency for sprayed coatings not to enter right into the angle but to build up thickness

on the adjacent margins resulting in a thinning of the membrane in the angle. Spraying technique, material rheology and equipment can be selected to minimize these faults.

Vacuoles and pin/blow holes can also be caused by the above inadequacies.

### Permitted Waterproofing Systems

- 5 (05/01) The method of sealing the edges of the waterproofing system and around interruptions such as gullies should be shown on the Drawings. Most manufacturers of permitted waterproofing systems show examples in their marketing literature.
- 6 (05/01) Before commencing each stage of installation the surface should be inspected, using the guide lines given in NG 2005.1, to check the complete evaporation of solvent, the removal of any entrapped aggregate or debris and that necessary repairs have been carried out.
- 7 (05/01) Where oxidised bitumen is used as a bonding agent for sheet material it should not be heated to a temperature in excess of that necessary to secure an effective bond. The required temperature of the bitumen will depend on the air and deck temperature at the time of laying. It should not be heated above 260°C and it is normally suitable for application at a temperature of approximately 240°C. Overheating and prolonged heating of the bitumen compound will drive off volatile oils leaving the residue hard and brittle and unsuitable for bonding layers together. A suitable thermometer should be used to monitor the temperature of the bonding bitumen.
- 8 (05/01) Permitted waterproofing systems, including where necessary a tack coat and also the additional protective layer, should be covered without undue delay with road surfacing materials in order to minimise the risk of blistering. Should blistering occur, repairs should be in accordance with the BBA Roads and Bridges Agrément Certificate.
- 9 (05/01) In considering the Contractor's additional information submitted with the BBA Roads and Bridges Agrément Certificate to cater for site conditions, a site procedure trial may be necessary to confirm the appropriateness of the waterproofing system to local site conditions.

### Additional Bituminous Protection

- 10 (05/01) Where the waterproofing system is to be overlaid with hot rolled surfacing materials, additional protection consisting of red tinted bituminous protection complying with sub-Clause 2003.2 may be required. When it is necessary for the additional protective layer to be trafficked by plant and equipment,

eg. where there is delay in surfacing, any damage is to be made good before surfacing is laid. The areas and thickness, normally  $20 \text{ mm} \pm 2 \text{ mm}$ , should be shown on the Drawings.

### **NG 2007 Integrity Testing of Concrete Bridge Deck Waterproofing**

**1** A method of integrity testing should be considered for inclusion in the contract, where it is considered appropriate to verify the soundness of the waterproofing layer.

### **NG 2008 (05/01) Repair and Replacement of Bridge Deck Waterproofing**

**1** Any additional requirements for the repair or replacement of bridge deck waterproofing systems should be described in Appendix 20/1. Issues that may need to be considered include:

- (i) information on existing waterproofing systems;
- (ii) requirements for removal of existing surfacing;
- (iii) requirements for removal of existing bridge deck waterproofing or protective layer;
- (iv) requirements for examination of deck concrete by the Overseeing Organisation for testing or repairs;
- (v) requirements for preparation work; and
- (vi) requirements for the replacement waterproofing system.

# NG SAMPLE APPENDIX 20/1: <sup>(05/01)</sup> WATERPROOFING FOR CONCRETE STRUCTURES

*[Note to compiler: This should include:]*

- 1 Any restrictions on the use of proprietary materials for waterproofing below-ground concrete surfaces [2004.4].
- 2 Where sealing with primer is not required prior to the application of tar or bitumen waterproofing [2006.1].
- 3 Requirements for non-destructive integrity test(s) compatible with the waterproofing system [2007.1].
- 4 Known details of existing waterproofing systems where repair or replacement is required [2008].

*[Note to compiler: Where the details of waterproofing systems to structures used are available from the National Structures Database, waterproofing type and manufacturer should be scheduled by structure. Where structure specific details are not available but generic types of system are known, these should be listed,*

*Mastic asphalt*

*Spray applied membranes*

*Sheet membranes (bitumen based).]*

- 5 (11/02) Additional requirements for the repair or replacement of existing waterproofing systems [2008].

*[Note to compiler: Surfaces that deviate from a U4 finish may require further deck preparation and/or additional material over the amount specified in the BBA Roads and Bridges Agrément Certificate to ensure that a minimum of 2 mm coverage is achieved.]*