Specification for Road Works Series 2000 - Waterproofing for Concrete Structures

CC-SPW-02000
December 2010
**About TII**

Transport Infrastructure Ireland (TII) is responsible for managing and improving the country's national road and light rail networks.

**About TII Publications**

TII maintains an online suite of technical publications, which is managed through the TII Publications website. The contents of TII Publications is clearly split into ‘Standards’ and ‘Technical’ documentation. All documentation for implementation on TII schemes is collectively referred to as TII Publications (Standards), and all other documentation within the system is collectively referred to as TII Publications (Technical). This system replaces the NRA Design Manual for Roads and Bridges (NRA DMRB) and the NRA Manual of Contract Documents for Road Works (NRA MCDRW).

**Document Attributes**

Each document within TII Publications has a range of attributes associated with it, which allows for efficient access and retrieval of the document from the website. These attributes are also contained on the inside cover of each current document, for reference. For migration of documents from the NRA and RPA to the new system, each current document was assigned with new outer front and rear covers. Apart from the covers, and inside cover pages, the documents contain the same information as previously within the NRA or RPA systems, including historical references such as those contained within NRA DMRB and NRA MCDRW.

**TII Publication Attributes**

<table>
<thead>
<tr>
<th>TII Publication Title</th>
<th>Specification for Road Works Series 2000 - Waterproofing for Concrete Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>TII Publication Number</td>
<td>CC-SPW-02000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Construction &amp; Commissioning (CC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stream</td>
<td>Specification for Works (SPW)</td>
</tr>
<tr>
<td>Document Number</td>
<td>02000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Document Set</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication Date</td>
<td>December 2010</td>
</tr>
<tr>
<td>Historical Reference</td>
<td>Series 2000</td>
</tr>
</tbody>
</table>

**NRA DMRB and MCDRW References**

For all documents that existed within the NRA DMRB or the NRA MCDRW prior to the launch of TII Publications, the NRA document reference used previously is listed above under ‘historical reference’. The TII Publication Number also shown above now supersedes this historical reference. All historical references within this document are deemed to be replaced by the TII Publication Number. For the equivalent TII Publication Number for all other historical references contained within this document, please refer to the TII Publications website.
WATERPROOFING FOR CONCRETE STRUCTURES

Contents

<table>
<thead>
<tr>
<th>Clause</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>General</td>
<td>2</td>
</tr>
<tr>
<td>2002</td>
<td>Protection of Bridge Deck Waterproofing During Construction</td>
<td>2</td>
</tr>
<tr>
<td>2003</td>
<td>Materials for Waterproofing Concrete Bridge Decks</td>
<td>2</td>
</tr>
<tr>
<td>2004</td>
<td>Materials for Waterproofing Below Ground Concrete Surfaces</td>
<td>2</td>
</tr>
<tr>
<td>2005</td>
<td>Workmanship for Waterproofing Concrete Bridge Decks</td>
<td>3</td>
</tr>
<tr>
<td>2006</td>
<td>Workmanship for Waterproofing Below Ground Concrete Surfaces</td>
<td>3</td>
</tr>
<tr>
<td>2007</td>
<td>Integrity Testing of Concrete Bridge Deck Waterproofing</td>
<td>3</td>
</tr>
<tr>
<td>2008</td>
<td>Testing of Waterproofing Membrane</td>
<td>3</td>
</tr>
<tr>
<td>2009</td>
<td>High Voltage Pinhole/Holiday Detection for Bridge Deck Membranes - Equipment</td>
<td>4</td>
</tr>
<tr>
<td>2010</td>
<td>High Voltage Pinhole/Holiday Detection for Bridge Deck Membranes – Equipment - Procedure</td>
<td>4</td>
</tr>
<tr>
<td>2011</td>
<td>Repair and Replacement of Bridge Deck Waterproofing</td>
<td>5</td>
</tr>
</tbody>
</table>
Waterproofing for Concrete Structures

2001 General

1. The surface finish for new bridge decks between parapet upstand and to top of buried structures to be waterproofed shall be Class U4 finish in accordance with sub-Clause 1708.4.

2. Existing waterproofing systems to bridge decks between parapet upstands are to be repaired or replaced in accordance with Clause 2011.

3. The concrete surface shall not be primed, nor the waterproofing membrane laid:

   (i) when the ambient temperature is below 6° centigrade;

   (ii) when the surface temperature of the concrete is 3° centigrade or less above dew point.

4. The concrete deck shall not be primed or waterproofed until the deck has been cast for at least 28 days and cured as specified. Where cementitious repairs have been carried out these shall be cured for at least 10 days before the deck is primed or waterproofed.

2002 Protection of Bridge Deck Waterproofing During Construction

1. On any structure, providing no damage results, plant and equipment all fitted only with rubber tyres may stand or travel on permitted waterproofing systems solely for the purposes of laying an additional protective layer or surfacing course on that structure.

   Rollers shall not be permitted to stand or travel directly on the waterproofing system.

   Where it is necessary for plant, equipment or traffic to stand or travel on a bridge deck that has been waterproofed with a proprietary system before the laying of an additional protective layer, suitable temporary protection shall be provided. All such plant and equipment shall have its tyre treads regularly inspected and any embedded hard objects removed.

2. Temporary protection shall be provided where damage to the waterproofing, protective layer or additional protective layer could result from particular site traffic.

3. The protective layer of a permitted two layer waterproofing system, or any protective layer additional to that included as part of a permitted waterproofing system, shall be laid immediately after the waterproofing layer’s bonding agent has set or cured.

   Where a waterproofing membrane also serves as an adhesive for the protective layer, any additional protective layer shall not be laid until the liquid waterproofing membrane/adhesive has set or cured.

2003 Materials for Waterproofing Concrete Bridge Decks

Permitted Waterproofing Systems

1. Permitted waterproofing systems incorporated in the Permanent Works shall be spray applied, satisfy the requirements of NRA BD 47, shall be capable of being non-destructively tested and shall have a current NSAI Agrément Certificate or equivalent.

   Prior to the commencement of the Works the Contractor shall provide to the Employer’s Representative a copy of the NSAI Agrément Certificate or equivalent appropriate to the work to be undertaken. The procedure shall be repeated for each subsequent operation either for a different system or a different location.

Additional Bituminous Protection

2. Bituminous protection is required as an additional protective layer and shall comply with IS EN 13108-4 recipe type F wearing course mixture designation 0/2 except that 5% ± 0.5% of the total mix shall be inorganic red oxide and regarded as part of the filler content, where the additional protective layer is required to be tinted.

2004 Materials for Waterproofing Below Ground Concrete Surfaces

Epoxy Resin

1. All buried concrete faces of structures shall be treated with two coats of epoxy resin waterproofing for below ground concrete. Alternative forms of below ground waterproofing must be agreed with the
Authority prior to commencement of the Works.

Proprietary Materials
2 Subject to any restrictions specified in Appendix 20/1, any proprietary materials used shall be as proposed by the Contractor and as agreed by the Employer's Representative.

2005 Workmanship for Waterproofing Concrete Bridge Decks

Permitted Waterproofing Systems
1 Permitted waterproofing systems shall be installed in accordance with the NSAI Agrément Certificate or equivalent.

The formation of defects affecting the integrity of the membrane including pin/blow holes (continuous or non-continuous) and blisters in the waterproofing shall:

(i) be made good by repair in accordance with the NSAI Agrément Certificate or equivalent before any subsequent layers are applied; or

(ii) require the system to be replaced.

Additional Bituminous Protection
2 Bituminous protection complying with sub-Clause 2003.2 shall be laid on the clean and dry substrate, and compacted in accordance with Clause 901 to the areas and thickness shown on the Drawings.

Bond Between Additional Protective Layer or Surfacing and the Waterproofing System
3 The additional protective layer or surfacing laid on the waterproofing system shall be firmly bonded to the system for the life of the system. The bond shall be achieved by either:

(i) the binder within the directly applied additional protective layer or surfacing; or

(ii) a separate tack coat which has been assessed by the NSAI or equivalent as part of the registration procedure and details of which are given on the NSAI Agrément Certificate or equivalent.

Where the tack coat is of the type activated by the heat of the succeeding bituminous layer, the rolling temperature of this layer shall be sufficient to ensure adhesion.

Workmanship for Waterproofing Concrete Bridge Decks
4 The detail of the joint overlap between the deck waterproofing system and the expansion joint system shall be such as shall not result in any loss of effectiveness or damage to the deck waterproofing or to the expansion joint.

2006 Workmanship for Waterproofing Below Ground Concrete Surfaces

Epoxy Resin
1 Each coat shall be applied at a rate of 300 grams/m². All areas to be painted shall be clean, dry and free from all loose particles, dust, oil and other contaminants. A minimum concrete compressive strength of 25N/mm² and a minimum sub-strata pull-off strength of 1.5N/mm² is required before application of coatings. In addition, all blowholes in concrete surfaces shall be cleared out, filled with approved non-shrink cementitious filler and the repair work properly cured before application of paint.

Proprietary Materials
2 For proprietary materials the method of application, rate of spread, number of coats and other requirements for each system shall be as described in the manufacturer's method statement and application.

Details of any proprietary system used shall be submitted for the written acknowledgement of the Employer's Representative prior to the inclusion in the execution and completion of the Works.

2007 Integrity Testing of Concrete Bridge Deck Waterproofing
1 Waterproofing systems to concrete bridge decks shall be tested to verify the integrity of the waterproofing.

2008 Testing of Waterproofing Membrane
1 The Contractor shall provide with all batches of material delivered to Site a Certificate of Compliance with the Specification.

2 The Contractor shall provide two free film samples, sprayed on to open moulds (at least 200 x 200 millimetres in area and minimum thickness 2 millimetres), for tensile strength, elongation at break to BS ISO 37 and tear strength to BS ISO 34-1. The Contractor shall
supply the Employer’s Representative with four copies of the test results with the samples.

3 The Contractor shall continuously monitor the coverage rate of the material applied to the deck and shall provide the Employer’s Representative with daily sheets showing the start/finish weights and area covered for each period of spray operation.

4 The Contractor shall continuously monitor the wet film thickness using a gauge pin or a standard comb type thickness gauge. The Contractor shall provide the Employer’s Representative with daily sheets indicating the wet film thickness measured and location.

5 The Contractor shall measure the adhesion of the fully cured membrane to the deck using Elcometer Adhesion Tester Model 166 or similar. Three tests shall be required per 500m² of sprayed membrane. The Contractor shall provide the Employer’s Representative with the test values and location of test before these areas are covered. The Contractor shall reinstate the test areas including primer if necessary. It should be noted that test values below 0.7N/mm² shall require spraying operations to be suspended while further investigation is undertaken. Areas deemed not to meet this value shall be removed and resprayed.

6 The Contractor shall undertake a “Holiday Test” on the finished waterproof membrane surface as described in the following paragraphs 2009 to 2010 inclusive. Any Defects detected shall be rectified by the Contractor.

**2009 High Voltage Pinhole/Holiday Detection for Bridge Deck Membranes - Equipment**

1 Pinhole detection shall be carried out using an approved manufacturer’s detection equipment having the following facilities:

   (i) Variable DC test voltage (1-20kv DC);
   (ii) Audible and visual alarm signals;
   (iii) Sensitivity adjustment;
   (iv) Phosphor Bronze or Silicon Rubber electrode;
   (v) Earth lead connection with clip.

2 The output voltage of the Pinhole Detector shall be adjusted in accordance with the following table.

<table>
<thead>
<tr>
<th>COATING THICKNESS (millimetres)</th>
<th>TEST VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0 to 2.5</td>
<td>12.5kv</td>
</tr>
<tr>
<td>2.5 to 3.0</td>
<td>13.5kv</td>
</tr>
</tbody>
</table>

The coating thickness shall be the maximum expected not the average.

**2010 High Voltage Pinhole/Holiday Detection for Bridge Deck Membranes – Equipment - Procedure**

1 Identify a site on the Bridge Deck to which the Earth lead connection from the Pinhole Detector can be fixed, i.e. a metal object imbedded in the Bridge Deck.

Connect the leads from the Pinhole Detector in accordance with the manufacturers written instructions.

Fix the Earth lead from the Pinhole Detector to the substrate and ensure that a good electrical contact is made.

Adjust the Pinhole Detector to the required test voltage in accordance with the above Test Voltage table.

With the Pinhole Detector turned OFF, connect any extension rods that may be required to the test probe handle. Connect the electrode to the end of the extension rods if fitted. NOTE: A damaged electrode that does not make 100% contact along its length shall not be used.

To check the Pinhole Detector is working correctly, touch the electrode onto the exposed substrate. The Pinhole Detectors alarm signal should be activated. If not, check the lead connections to the equipment and the Earth lead to the substrate, also it may be necessary to adjust the Sensitivity Control on the equipment.

Pass the electrode over the coated surface at a maximum rate of 100mm/s, paying particular attention to edges, holes and visible irregularities in the coating. The test MAY have to be reduced where testing edges as the coating may be thin.

When a fault has been identified by the detector, the electrode shall be moved sideways in order to identify its precise location.
location. Subsequently the fault shall be ringed with a suitable marker. Such markings shall be made sufficiently distant from the coating defect to allow the repair procedure to be carried out without detriment to the adhesion of the repair material.

Continue testing and marking defects until all the coating has been tested, changing the electrode size as necessary.

All repaired areas shall be re-tested.

2 Always follow safety precautions as laid down in the equipment manual.

2011 Repair and Replacement of Bridge Deck Waterproofing

1 The repair and replacement of existing bridge deck waterproofing systems shall comply with the requirements of Clauses 2002, 2003, 2005 and 2007 and any additional requirements described in Appendix 20/1.