STANDARD FOR

ASPHALTIC PLUG JOINTS

Produced by

THE BRIDGE JOINT ASSOCIATION

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CONTENTS

OBJECTIVES OF THE BRIDGE JOINT ASSOCIATION

The effectiveness of bridge expansion joints is very significant in the life expectancy of bridges. Recognition of the need for high standards of waterproofing to prevent the ingress of water and salt into bridge structures has focussed attention on the importance of bridgejoints.

The Bridge Joint Association members are the leading UK Specialist manufacturers and installers whose principal aim is to raise and maintain standards within the industry.

The Association's main objectives are:

1. To foster research and technical development.

2. To maintain and improve standards of design, manufacture and installation.

3. To co-operate with Government Departments and Agencies, Public Authorities and others who are concerned with the use of bridge joints.

4. To represent the interests of the UK bridge expansion joint industry in the preparation of British Standards, European Standards and other developments within the European Union.

Notes:

a) *In furthering the objectives of the Association as set out above, neither Members nor the Association shall be required or recommended to observe any restriction, act or practice which would or might make this Association registerable under the Restrictive Trades Practices Act or the Competition Act.*

b) *The Bridge Joint Association wishes to emphasise that the contents of this report are the collective views of members and are believed to be accurate. However, all readers and users of this publication should carry out any necessary checks on each specific contract*

in terms of technical relevance and health and safety issues as BJA cannot accept any liability, however caused.

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BJA POLICY STATEMENT

ASPHALTIC PLUG JOINTS

1. GENERAL

1.1 The Bridge Joint Association includes all the principal manufacturers and installers of Asphaltic Plug Joints (Highways Agency Type 2). Each one of the individual systems varies in detail of materials and technique but there is a generally agreed design criteria to which all systems conform.

2. APPROVAL AND INFORMATION

2.1 All Asphaltic Plug Joints shall be registered with the Highways Agency in their Manual of Contract Documents for Highways Works SA1/01 and any superseded editions and conform to the requirements of the List of Approved/Registered Products.

2.2 A method statement and technical publication shall be issued on sufficient detail to outline the standard methods of installation of proprietary joints.

3. DESIGN

3.1 Service movement of the joint matrix shall be +/-20 mm when set at mean; some joint types will accommodate greater movement.

3.2 The deck design shall incorporate drainage independent of the joint. The drainage is present to allow water which gathers at sub-surface level to be removed from the asphalt/waterproofing interface. The drainage which includes collection points or channels transverse to the length of the deck requires discharge points at specified locations to allow the water to drain from the bridge deck into a suitable system.

3.3 There shall be a minimum gap of 50mm between service ducts and bridge decks and 150mm between service ducts, to allow placement of caulking, sealing, tanking and plating to the joint.

4. MATERIALS

4.1 The joint matrix shall be stable within the normal temperature ranges for UK works on condition that the surrounding surfaces provide sufficient continuous support for the joint.

4.2 Materials used in joints shall comply with BJA Specification BJSI Asphaltic plug joints (refer to P4).

5. INSTALLATION

5.1 Joints shall be finished nominally flush with the road surface within the tolerance of the asphaltic surfacing specification.

5.2 Joint material shall be consolidated during installation in accordance with the manufacturer's method statement.

5.3 The air gap to the bridge expansion joint shall be caulked with heat resistant expanded plastic or rubber which shall be sealed and plated with a bridging plate of appropriate thickness and width.

5.4 Installation shall be in accordance with BJA Code of Practice BJCP 1 Installation of asphaltic plug joints (refer to P12).

6. RESISTANCE TO PASSAGE OF WATER

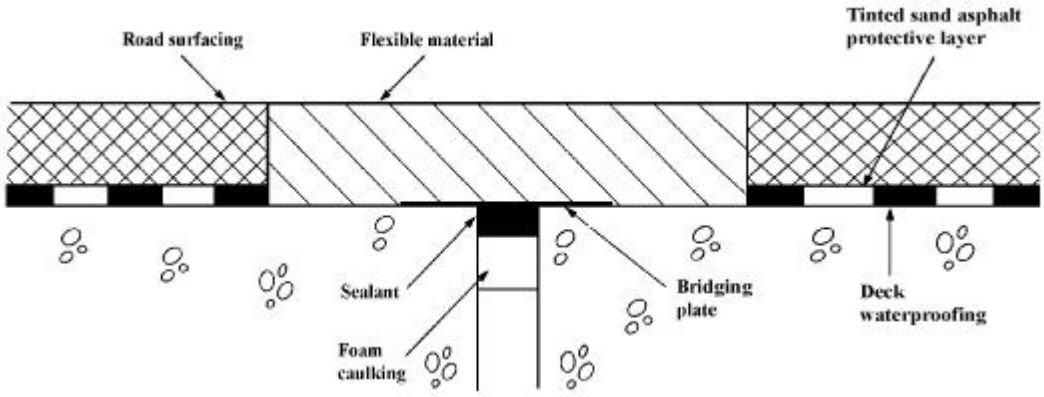
When completed the joint shall prevent the passage of water into the joint gap subject to the satisfactory performance of the adjacent materials.

Continuing resistance to the passage of water depends upon interaction with the bridge deck and the stability of contiguous surfaces inside the bridge deck.

Provision of adequate sub-surface drainage independent of the joint (for example 'Through Deck Drainage'), and proper cleaning and maintenance of such drainage, is essential.

TYPICAL ASPHALTIC PLUG JOINT - TYPE 2

Proprietary systems comprising of layers of specially modified binders and aggregate to provide a homogenous expansion medium and smooth running surface.
Movement ranges for standard grade modified binders up to $\pm$ 20 mm.



BJA STANDARD FOR ASPHALTIC PLUG JOINTS

This Standard is one of a series of standards covering all types of joints in normal use in the UK.

The performance of bridge joints is affected by the range of temperatures and traffic volumes which they experience. In order to accommodate movement the joint filling must remain flexible. Binder properties and conditions of use are related to the service temperature range and the requirements in this standard are for UK conditions only.

The design of bridge decks and bearings should be such that joints can be inspected from the underside of the deck and provision should be made for the collection and discharge of any water which may leak through joints.

Some users may require joints to be certified by an independent accredited body. Certification may include the observation of performance in bridges as well as compliance with the requirements of this standard.

GENERAL

7. DESIGN INFORMATION

The following information should be considered by the bridge design engineer, prior to selection of the joint specification:

Traffic flow
Speed limit
HGV count
Normal incidence of stationary traffic
Working temperature range
Radius of any bend
Maximum gradient
Maximum skew angle
Installation depth
Installation width
Installation length

8. INFORMATION TO BE PROVIDED BY THE SUPPLIER

The supplier shall provide the following information, in a printed form, for each joint system:

Description or proprietary name of joint
Horizontal movement capacity
Vertical movement capacity
Composition - aggregate *
- binder *
- bridging plate
- caulking
- flashing

* NAMAS accredited laboratory certification

9. DESIGN AND DECK PREPARATION

9.1 Adjoining Surface

The joint shall be surrounded by solid materials resistant to the effects of traffic loading. Granular fill should not be used in verges immediately adjacent to bridge joints.

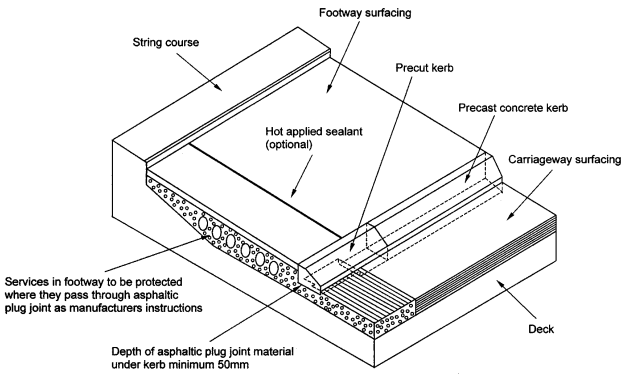
9.2 Concrete Surfaces

The deck concrete should be at least Grade 30 and be fully cured prior to the joint installation. Infill verge concrete should be Grade 30 and cured for at least seven days. Nothing should be included in the concrete mix, that would affect the bond with the joint.

9.3 Kerbs

Kerbs shall be laid with a gap immediately above and equivalent to the deck gap and undercut to the specified joint width, to provide a minimum clearance of 50mm between the underside of the kerb and the deck, or greater as required by the manufacturer.

The gap between kerbs should be caulked. Sealants shall be used which are compatible with bitumen



Pictorial view through asphaltic plug joint in footway

9.4 Service Ducts

Service ducts required to pass through the joint shall be properly sleeved, articulated and sealed to prevent binder ingress.

Ducts and/or sleeves shall be located with a minimum clearance of 50mm above and below to provide joint continuity. A minimum clearance of 150mm between ducts and/or sleeves is required for preparation, caulking, tanking and construction of the joint for services up to 150mm diameter. Additional clearance may be required for larger services in deck recesses or troughs.

(Note - Special conditions apply to the design of plug joints for service troughs.)

Asphaltic Plug Joints may be installed at temperatures of up to 200°C. On new structures, all sleeves should be steel and free of any cables or heat degradable materials prior to joint installation.

On existing structures, consideration should be given to the effect of heat, during joint installation, on contained services and the means to ensure the required clearance and sleeving.

If two or more services pass through a joint at close centres, modification of the deck in the proximity of the services may be necessary before placing the services.

The inappropriate positioning of ducts within joints can seriously affect the performance of Asphaltic Plug Joints.

9.5 Deck Repairs

Repair mortars used on surfaces where Asphaltic Plug Joints are to be located shall be approved by the proprietary joint manufacturer to ensure compatibility with the joint binder.

Repairs should be carried out and fully cured in advance of the joint installation to provide a monolithic repair. The adhesion between the repair material and the reinforcement is important to avoid debonding during joint installation and its service life.

Repairs may be carried out after saw cutting and removal of the joint using rapid setting mortar systems.

9.6 Parapet Detail

Joints should be installed between inside faces of opposing parapet walls on the deck structure to ensure continuity of waterproofing.

9.7 Waterproofing Detail

This shall be carried out in accordance with the provisions of BD33/94.

SPECIFICATION

10. SCOPE

This standard specifies requirements and methods of test for Asphaltic Plug Joints used in highway bridges and parking structures in the UK.

11. REFERENCES

Design Manual for Roads and Bridges, Volume 2.

BA 26/94 Expansion joints used for use in highway bridge decks - Highways Agency departmental advice note.

BD 33/94 Expansion joints for use in highways bridge decks - Highways Agency departmental standard.

12. DEFINITIONS

12.1 Asphaltic Plug Joints (Type 2)

12.1.1 Mixed in-situ

An in-situ joint set into flexible surfacing or a recess in concrete comprising a band of specially formulated flexible, waterproof material, supported over the expansion gap by metal plates or other suitable components. The binder is a plasticised polymer or rubberised bitumen blend with additional modifiers; it is mixed with aggregate during installation of the joint. The joint forms the running surface by replacing the conventional surfacing to its full depth.

12.1.2 Premixed

An in-situ joint formed at deck level using specially formulated flexible waterproofing materials incorporating deck plates and flashing. A premixed blend of aggregates and binders forming a flexible mass completes the joint up to finished carriageway level and forms part of the surfacing.

12.2 Caulking

A compressible material used to fill the expansion joint gap to prevent the binder leaking from the joint during the filling of the joint.

12.3 Bridging Plate

A plate forming part of an expansion joint system at deck level to cover the expansion joint gap and support the jointing material.

12.4 Deck Joint Gap

The gap between adjacent spans in a bridge deck or between a bridge deck and an abutment curtain wall.

12.5 Expansion Joint Gap

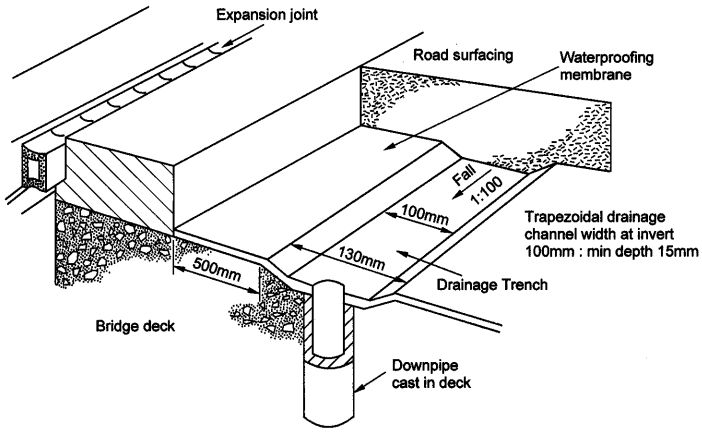
The continuous gap within an expansion joint system at surfacing level along the line of the joint.

12.6 Flashing (Optional)

A membrane placed over the top of the bridging plate.

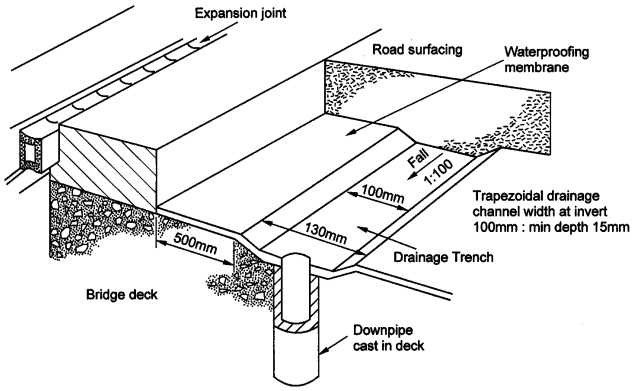
12.7 Sub-Surface Drainage

A system for draining water from within the interface between the surfacing and waterproofing which is independent of the bridge expansion joint.



12.8 In-Joint Drainage (Recommended)

A system of drainage within a joint that is provided to assist sub-surface drainage. The system shall either act as pressure relief or to channel water to an outlet provided within the structure, to which there is access for maintenance. The system shall be non-ferrous or galvanised and capable of withstanding the manufacturers stated binder application temperature.



12.9 **Binder**

A polymer modified or rubberised bituminous compound which precoats and binds the aggregate together.

12.10 **Aggregate**

A graded and dried crushed rock used in the construction of Asphaltic Plug Joints.

12.11 **Tanking**

The application of hot binder to all horizontal and vertical surfaces in the exposed bridge joint recess prior to filling with aggregate/binder mixture.

12.12 **Sealing**

The application of hot binder to seal the expansion joint gap above the caulking materials and sub-surface drainage channel (if installed).

13. SAMPLING

13.1 **Binder**

Samples shall be taken in accordance with BS 2499 : 1993 Part 1.

13.2 **Aggregate**

Samples shall be taken after preheating aggregate on site and tested in accordance with the relevant parts of BS812.

13.3 **Premixed Joint Material**

Sample cut from the installed joint to determine void content.

13.4 **Ratio of Finished Joint**

See manufacturer/installer method statement details for In-situ and Premixed designs.

14. MATERIAL REQUIREMENTS

14.1 Binder

The binder shall be a hot applied, modified penetration grade bitumen having the following properties:

Performance Characteristics	Rubberised Binder	Polymer Modified Binder	Test Method
Cone Penetration @ 25°C	25-45 dmm	25-90 dmm	BS 2499 Part 3
Softening Point	70°C minimum	80°C minimum	BS2000 Part 58
Flow Resistance	5% @ 45°C maximum	5mm @ 60°C maximum	BS 2499 Part 3
Extension Test	(3 cycles) (@ 0°C)	(3 cycles) (@ 0 or –20°C)	ASTM D1191 Modified

Alternatively a blend of bitumen and SBR (Styrene Butadine Rubber), which meets the following requirements, shall be used.

Penetration > 40 dmm when tested in accordance with BS 2000 : Part 49
Softening Point > 55°C when tested in accordance with BS 2000 : Part 58
Ductility > 600mm at 4°C

14.2 Aggregates

The aggregate shall be graded, washed and drained crushed rock from the trade groups basalt, dolerite, gabbro or granite which meets the following requirements when tested in accordance with the relevant parts of BS 812.

The aggregate grading shall give a controllable voids content when placed in the joint.

If the joint filling is mixed on site, the aggregate shall be delivered to the point of installation in pre-weighed sealed bags.

Grading shall comply with the suppliers stated values when tested in accordance with the relevant parts of BS 812:

Flakiness index < 25 tested to BS 812 : Part 105.1
Polished stone value > 55 tested to BS 812 Part : 114
Aggregate abrasion value < 5 tested to BS 812 Part : 113
Aggregate impact value < 9% tested to BS 812 : Part 112
Aggregate crushing value > 11 tested to BS 812 : Part 110

Fine aggregate used in premixed binder/aggregate mixes shall meet the following requirements:

Blast furnace slag to BS 1047 : 1985
Steel slag to BS 1047 : 1985
Crushed igneous rock fines
Natural sand
Filler for the modified bitumen binder shall be limestone

14.3 Bridging Plates

These shall be aluminium or mild steel with or without corrosion protection of a thickness and width appropriate to the expansion joint gap so that it will provide support to the joint under the action of heavy goods vehicles.

14.4 Caulking

This shall be heat resisting to the maximum safe heating temperature of the binder.

14.5 Flashing (Optional)

This shall be heat resisting to the maximum safe heating temperature of the binder.

15. QUALITY CONTROL

The material supplier shall operate quality assurance procedures in accordance with ISO 9000:2000 to ensure that the materials, when supplied, satisfy the requirements of this standard and any other requirements for proprietary systems.

The joint installer shall ensure that the materials are installed in accordance with the BJA Code of Practice described on pages 13-15 and the requirements of the manufacturer of the proprietary joint.

CODE OF PRACTICE FOR THE INSTALLATION OF ASPHALTIC PLUG JOINTS

FOREWORD

Installation in accordance with this Code of Practice and any additional requirements specified by the supplier is essential for the optimum performance of joints. This Code of Practice therefore requires that the installation is undertaken by operatives approved by the supplier of the joint system.

16. SCOPE

This Code of Practice is for the installation of Asphaltic Plug Joints, complying with BJS1, in highway bridges and parking structures.

17. REFERENCES

BJA/S2/APJ - BJA Standard for asphaltic plug joints.

18. DEFINITIONS

18.1 Operative

Any person involved in the installation of the Asphaltic Plug Joint.

18.2 Approved Operative

An operative who has received training and issued with an approval certificate by the company supplying the joint system. This certificate should be renewed at intervals not exceeding three years.

18.3 Joint Materials

A collection of materials including, but not restricted to, the binder, aggregate, bridging plate, caulking, and flashing.

18.4 Installation

The process of placing the individual components of the joint in their final position and mixing the binder and aggregate when this is done on site.

19. INSTALLATION PROCEDURE

19.1 Storage and Delivery

The joint installer shall ensure that the materials are stored correctly and protected from deterioration prior to, and during, delivery to site.

19.2 Setting Out

The Engineer shall provide sufficient information to establish the line of the joint and full depth of surfacing and structural air gap.

19.3 Cutting and Breaking Out

The saw should be set to cut vertically through the full depth of surfacing. Variations in thickness of the surfacing may result in small amounts of the surfacing left uncut or small cuts into the deck. Minor contact points between the deck and the saw blade can be expected and any resulting cuts into the deck should be filled with binder during joint installation. The surfacing should be carefully broken out taking reasonable care not to damage the deck.

19.4 Surface Preparation

All broken-out material and dust shall be removed and the exposed surface cleaned and dried using a hot compressed air lance.

Any damaged concrete shall be brought to the attention of the supervising engineer.

19.5 Deck Joint Gap Treatment

The deck joint gap shall be cleared of loose and loosely bound material, and caulked.

19.6 Bridging Plate Selection

The plate(s) shall span the expansion gap and be fitted in such a manner that the plate(s) bed well on a sound concrete support. The manufacturer shall provide suitable technical advice to enable the selection of the dimensions of the bridging plate appropriate to the joint design.

19.7 Optional In-Joint Drainage

Drainage may be placed within the joint to act as a pressure relief system against the build up of water at the vertical joint/surfacing interface. In joint drainage is not intended to replace the sub-surface deck drainage, which is required to effectively manage water at the waterproofing/asphalt interface.
If drainage channels are required along the length of the expansion joint then an appropriate drainage outlet (linked to the deck drainage system) must be made available in close proximity to the joint either through the bridge deck or linked to the deck

drainage system. The drainage channels may also be placed across the joint, which will allow water to pass from one side of the joint to the other.
After the base of the joint recess has been tanked with binder the drainage channels are secured to the asphalt surface. The ends of the channels are terminated into bridge deck drainage system. The cross drainage channels are placed after the base has been tanked and are located with approximately 30 mm of the channel penetrating into the adjoining asphalt surface. The cross drainage channel sections must be able to accommodate the stated bridge movement.

The channels must be sealed to prevent ingress of binder during joint installation.

19.8 Tanking and Bridging Plate Installation

Binders shall be heated to the supplier's recommended temperature range and applied to all exposed horizontal surfaces and to fill the expansion gap above the caulking. If in-joint drainage channels are required they shall be sealed against binder ingress and installed after horizontal tanking. The bridging plate shall be installed whilst the tanking on the horizontal surface is hot and the remainder of the joint surfaces tanked. All exposed surfaces shall be completely coated with binder.

19.9 Joint Filling

(a) Materials mixed on site

The aggregate shall be heated and coated with binder before placing in the joint in layers with additional binder in accordance with the manufacturer's procedure.

(b) Premixed Materials

The premixed aggregate and binder shall either be brought to site at installation temperature in insulated vehicles or brought to site cold and heated to installation temperature.

It is then placed in layers not exceeding the manufacturer's recommendations and each layer compacted, also in accordance with the manufacturer's recommendations.

The installation programme shall take account of the cooling and curing period prior to opening to traffic.

Note: The installer should be informed by the engineer of any hazards associated with hot lancing of bridge deck waterproofing.

20. QUALITY CONTROL

This shall be in accordance with Clause 15 of BJA Standard BJS1 : 1996. In addition a record, including the information listed below, shall be kept for each joint installed:

Bridge Reference and location
Joint location
Date of installation
Location of ducts and deck condition
Weather during installation (including air temperature)
Materials used
Plate material and size
Joint size
Use of debonding strip
Primer (if any)
Surface dressing (if any)

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