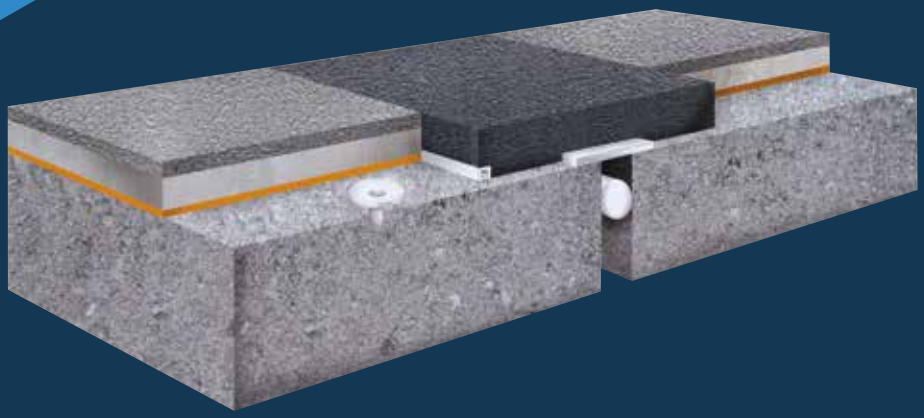
USL EKSPAN

EXPANSION JOINTS

FEBA

FLEXIBLE PLUG



www.uslekspan.com

Introduction

Market Leaders in **Expansion Joint Technology.**

USL Ekspan offers three asphaltic plug joint systems, all in accordance with CD357 standard for use on all classes highway bridges:

FEBA – is a standard asphaltic plug joint which provides a flexible, waterproof joint with excellent ride quality for road users and noiseless characteristics for minimal impact on the environment. Asphaltic plug joints are recognised as being suitable for a maximum design movement of +/-20mm horizontally and +/-1.5mm vertically (standard CD 357) and are ideal for use on bridges with low traffic volumes such as B roads.

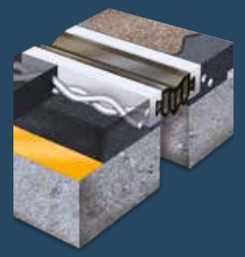
FEBA HM - is a high modulus asphaltic plug joint suitable for low to medium movement on heavily trafficked highway bridges. FEBA HM is a special blend of bitumen, polymers, fillers and a surface active agent, formulated to combine good fluidity at process temperatures with low temperature flexibility and ambient temperature slump control.

The use of basalt aggregates (BS EN 13043) ensures excellent load bearing capacity and high resistance to wheel tracking. This amalgamation of a highly flexible binder and single sized interlocking aggregate allows the system to provide excellent anti rutting characteristics.

FEBA HC- a bituminious asphaltic plug joint which has been developed for use in tropical climates.

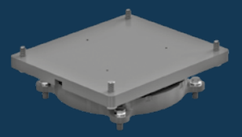
HAPAS Roads and Bridges · Bridge Joint Association · CHAS Accredited Contractor · BSI Registered to ISO 9001 · Bridge Deck Waterproofing Association · Concrete Repair Association · BM TRADA Certification ISO 9001:2008 · UKAS · CPD Certified The CPD Certification Service

USL EKSPAN **PRODUCT RANGE**



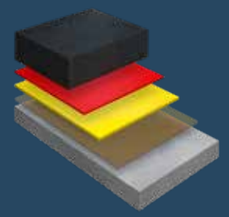
EXPANSION JOINTS - CD 357

Uniflex - Buried
BP1 - Buried
FEBA - Flexible Plug
Britflex NJ - Nosing
EC & EW - Joint Seal
Transflex & Transflex HM - Mat
T-MAT - Mat
Britflex BEJ - Modular
Britflex MEJS - Modular
LJ - Longitudinal Joint
ES - Joint Seal
Aqueduct/Immersed Joint
Open Type Joint - Rail Joint
Britflex UCP - Footbridge Joint
Finger Joint
Roller Shutter Joint



STRUCTURAL BEARINGS

EKE - Elastomeric (EN1337-3)
KE - Pot (EN1337-5)
DE - Line Rocker (EN1337-6)
GE - Spherical (EN1337-7)
FE - Restraint & Guide (EN1337-8)
D - Line Rocker (BS5400-9)
F - Restraint & Guide (BS5400-9)
G - Spherical (BS5400-9)
J - Roller (BS5400-9)
K - Pot (BS5400-9)
Link Bearing (BS5400-9)
EA - Sliding Bearing
EKR - Rubber Pad & Strip
EQF - Sliding Bearing
Bespoke Bearings

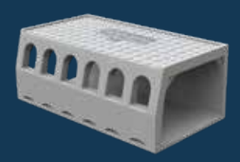


STRUCTURAL WATERPROOFING - CD 358

Pitchmastic PmB
Polyurethane (Pu) Waterproofing System
Britdex MDP
Methyl Methacrylate (MMA) Waterproofing System
Britdex CPM Tredseal
Combined Waterproofing and Anti Skid Surfacing (MMA)
Uradeck BC
Combined Waterproofing and Anti Skid Surfacing (Pu)

SUB-SURFACE BRIDGE DRAINAGE

Ekspan 325 Channel
Ekspan 302 System
ES Seal System
DriDeck



SURFACE BRIDGE DRAINAGE

Envirodeck

i

ii

iii

iv

v

vi

INSTALLATION

i) The surfacing is cut to the specified width in the carriageway using a floor saw and a trench is excavated.

ii) This cut-out together with the previously formed recess in the verge/central reserve is cleaned and dried with hot compressed air.

iii) The expansion gap is then caulked and the deck sealed with hot binder. If specified, in joint hydraulic relief is installed, metal bridging plates inserted over the gap and the entire trench tanked with binder.

iv) The aggregate is heated and pre-coated with the binder before being placed into the trench. The layer is then flooded with binder before subsequent layers are placed. The joint is allowed to cool before the final layer is applied—this is stone rich, brought marginally above the road surface and then compacted to the level of the adjacent carriageway.

v) Finally the joint is flooded with binder to the finished profile and allowed to cool to ambient temperature. Normally the joint can be trafficked in 3-4 hours, but this will depend on the ambient temperature, depth of joint and the general weather conditions.

vi) A final application of binder may be necessary to blend in any small interstices which may appear on the surface of the joint whilst cooling.

vii) Anti skid dressing is applied to the joint.

At the onset of unacceptably wet weather conditions or for example at the end of normal working hours, the joint construction may be suspended and continued at a later stage.

ADDITIONAL INFORMATION

Technical & Advisory Services

Further technical information may be obtained on request and consultation is encouraged to ensure choice of materials selected and detailing is optimised to suit in-service performance requirements and economic solutions.

Health & Safety

USL operate a strict health and safety policy and details are available on request.

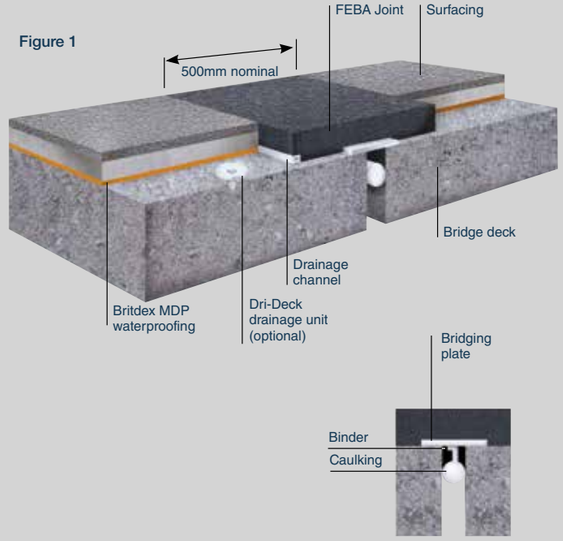
Note:

The colours used in the illustration may not be indicative of the finished product. USL reserve the right to update and improve the FEBA joint and its specification without notice and Engineers and Contractors should satisfy themselves that they have full and up to date information.

The FEBA joint is also approved in the following countries

- Ireland
- Hong Kong
- Singapore
- China
- Brunei
- Philippines
- Russia
- Malaysia
- Indonesia
- Kuwait
- Denmark
- Greece
- Switzerland
- Australia
- South Africa

Figure 1



FEBA joint extends across the full length of the carriageway and into the verges.

GENERAL INFORMATION

The FEBA joint extends to the full depth of surfacing and is installed after the carriageway and verge construction has been completed. Typical construction is indicated in Figure 1. The width of the FEBA is selected depending upon the bridge deck movement factors and the nature of the traffic using the structure. Optimum movement capacity is attained in joints 500mm nominal width and no less than 100mm deep. The materials are applied hot and in fluid condition, with temperatures up to 180°C - consequently careful consideration should be made by the Engineer before utilising FEBA in the vicinity of services of any Statutory Authority unless suitably protected.

Binder compounds are classified as thermoplastic materials and consist of a blend of polymer modified bitumen, mineral fillers and chemical additives.

FEBA utilises a nominal three size aggregate mix of 20mm (nominal) graded chippings. In joints less than 100mm deep, graded aggregate with smaller sized stone may be selected.

Drainage may be built into the joint as a pressure relief system to the adjacent road construction. The use of drainage is designed to protect the surfacing and deck waterproofing from the effects of water trapped adjacent to the asphaltic plug joints, however it should be noted that it is not essential to the correct functioning of the FEBA joint nor is it a substitute for positive deck drainage.

Conventionally pressure relief is installed along the joint on the upstream face, most usually when the FEBA is at the low end of a bridge deck (see figure 1). In this instance it is recommended that in-joint drainage is used in conjunction with a more positive and larger capacity ‘Dri Deck’ drainage system, supplied by Pipeline and Drainage Systems.

Standard metal bridging plates are suitable for up to a 45mm maximum gap opening - for larger gaps, it is recommended that wider plates of a heavier gauge be used. (As a general guide please refer to Table 1).

Figure 2

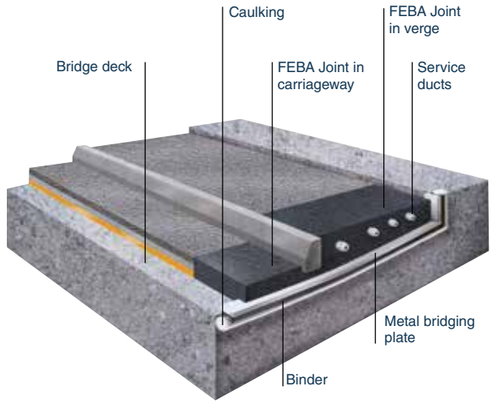
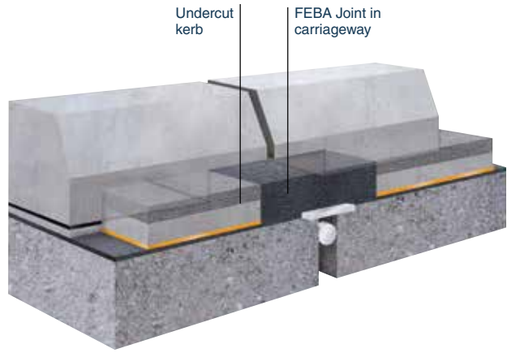


Figure 3



CONSTRUCTION DETAILS

Carriageway

In new works or when re-surfacing during maintenance chemes, it is necessary to temporarily cover the deck expansion gap to prevent ingress of materials into the expansion gap. Any such coverings should be easily removed when the trench is excavated for the joint.

Temporary saw-cuts into the newly laid surface above the deck expansion gap may be considered necessary to prevent unacceptable cracking of the surfacing before the joint is installed. As a general rule, this is not required when the joint is installed immediately after the surfacing has been laid.

However, if appreciable deck movement is predicted after surfacing and before joint installation, then saw cutting should be carried out by the main contractor after the surfacing has cooled sufficiently.

Verges

Granular verge and central reserve construction immediately adjacent to the joint is to be avoided. A concrete verge infill is recommended adjacent to the joint and a trench should be formed to accommodate the specified joint width. If flexible surfacing is required over any verge concrete, the prepared trench may be temporarily backfilled and the position of the trench referenced on the kerb and parapet by the main contractor.

Service Ducts

Any service ducts passing through the joint should be properly sleeved and articulated to the Engineers details. All ducts and sleeves should be in steel and not uPVC and free of any cables prior to joint installation.

Should it not be possible to remove any existing cables or upgrade existing uPVC ducts to steel, then the services must be protected and insulated from the effects of hot binder and heat dissipation from the FEBA joint as it cools, in accordance with the Engineers details. Advice should be sought from the relevant Statutory Authority. Consideration should also be given to the spacing above, below and between service ducts to allow proper construction of the joint so that the performance of the FEBA joint is not impaired (see Figure 2).

Ducts/sleeves through the **FEBA** joint require a minimum of 50mm clearance above and below to provide continuity of the joint material. A minimum of 75mm between ducts is required but 125mm is preferred. Where there are more than four ducts in a verge further advice should be sought.

Kerbs

Kerbs should be laid starting flush with the deck expansion gap and undercut to the specified joint width to allow the FEBA joint to pass beneath them (see Figure 3). The undercut should provide a minimum of 50mm clearance to the deck however 100mm is preferred if available. The kerbs are used to retain the joint in the verge area and the gap between them is caulked with polyethylene foam to provide a neat finish.

Proprietary continuous side entry gully systems installed along the kerbline may be carried through the **FEBA** joint using special expansion units.

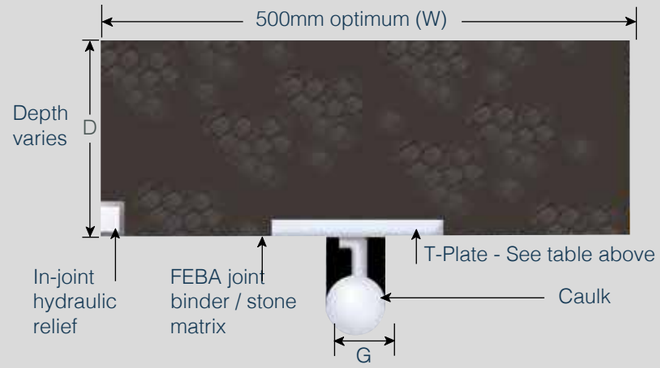
USL EKSPAN recommend the use of **Pipeline and Drainage Systems (PDS)**. Advice should be sought from the manufacturers at the design stage.

Table 1 - Joint gap (refer to G on secton below)

Joint Gap (Max.) mm	T-Plate thickness mm
Up to 45	1.5
45 - 70	3
70 - 95	6

Table 2 - Joint width and depth (refer to W and D on section below)

Joint width (mm)	Joint thickness (mm)	Max. horizontal movement (mm)	Max. Vertical movement (mm)
750	100+	+/-20mm	+/-1.5mm
750	100-75	+/-20mm	+/-1.5mm
750	75-50	+/-12mm	+/-1.5mm
500	100+	+/-20mm	+/-1.5mm
500	100-75	+/-20mm	+/-1.5mm
500	75-50	+/-12mm	+/-1.5mm
300	100+	+/-5mm	+/-1.5mm
300	100-75	+/-5mm	+/-1.5mm
300	75-50	+/-5mm	+/-1.5mm



The chart as shown in table 2 can be used as a guide to show how the allowable movements in FEBA joints vary with different widths and depths of recess. The standard joint can accommodate movement of up to +/-20mm. A reduction of depth down to a limit of 50mm will restrict the allowable movement to approximately +/-12mm.

Increasing the width of a FEBA joint will have no effect on the movement capability. Reducing width to less than 500mm is not recommended for joints which are subject to a significant amount of movement, but these reduced widths are permitted on articulation joints and very small movement joints. If in doubt contact USL's technical and advisory service.

DESIGN GUIDELINES

The FEBA joint is not only simple to install but easy to detail at the design stage. The USL Technical and Advisory Service is able to assist and advise on all detailing matters, from the most simple to the most complex of problems.

In new schemes, both the carriageway and verge construction should be completed prior to joint installation. In a maintenance situation the Engineer should consider if re-surfacing is necessary prior to joint replacement. A FEBA joint cannot properly be installed in a defective or rutted carriageway.

When the joint depth is less than 100mm the movement capacity of asphaltic plug joints is reduced. Joints in excess of 500mm wide may be used but with limitations and attention should be paid to the increase in the length of wheel path over the joint on skewed bridges.

Asphaltic plug joints utilise the bond achieved to the deck and verge infill concrete. All concrete should be at least grade 30 and typically seven days old, as it is imperative that adequate hydration has taken place.

In order to provide a satisfactory junction to the bridge deck waterproofing membrane, the membrane should be brought 50mm into the joint area on both sides of the joint. This is removed during the installation of the FEBA joint and the free edge of the waterproofing sealed when the deck is tanked with hot binder.

The FEBA joint is dressed with 3mm bauxite chippings in order to provide a more textured surface finish to the joint.

The FEBA joint and other similar modified bitumen asphaltic plug joints may require maintaining during the lifetime of the surfacing (BA 26/94 refers).

Deformation occurs due to the correct functioning and mobile condition of the joint. Unacceptable deformations may arise under heavy, slow moving. Consequently careful consideration should be taken before utilising such joints in bridges on roundabouts, close to junctions and traffic lights or on roads with excessive crossfalls and gradients. Surface dressings may settle into the body of the joint or strip off under traffic action, again due to the mobile binder which cannot provide the same resistance to chipping loss as epoxy resin binders.

The foregoing does not in any way relieve USL of their obligations to provide materials of satisfactory quality and workmanship of a suitable standard when installing the FEBA joint. (These limitations are as a result of factors outside the capabilities of asphaltic plug joints which use thermoplastic modified bitumen).

USL EKSPAN

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