Introduction

Market Leaders in Expansion Joint Technology.

USL Ekspan provides a complete service to the civil engineering industry for bridge deck protection which includes the supply and installation of expansion joints and spray applied bridge deck waterproofing membranes.

The bridge expansion joint range of products caters for movements from 20mm through to 330mm and includes the “Britflex BEJ” which is the most popular joint used on the UK’s motorway and trunk road network with over one hundred thousand linear metres currently in use.

The division also manufactures and applies their Britdex MDP waterproofing system which is a rapid curing, spray applied methyl methacrylate membrane. All of USL Ekspan’s products have a proven track record and comply with the latest Highways England requirements.

Through their technical department USL Ekspan are able to offer a complete package of services to clients and will review a particular application from initial design to final installation to ensure the selection of the most appropriate and cost effective solution.

PRODUCT IN BRIEF

The ‘BEJ’ Expansion Joint is a surface mounted mechanical system, with an elastomeric insert between two metal runners or carrier rails. It is unique in that the rails which house the insert are set into a rapid curing elastomeric resin compound known as Britflex Resin Mortar (See figure 1).

Anchorage to the deck is achieved through the excellent bonding qualities of the polyureide resin, without the need for any mechanical fixings. The system has an unrivalled worldwide track record of in service-performance in excess of 30 years.

The ‘BEJ’ system is registered with the Highways England for use on highway bridge decks on all classes of roads and motorways (CD357- Modular). ‘BEJ’ Expansion Joints incorporate cellular elastomeric inserts which are load bearing enabling a range of movement to be accommodated up to 150mm.

THE BRITFLEX ‘BEJ’ FOR MAINTENANCE

The Britflex “BEJ” is ideally suited for maintenance schemes to replace other failed joint systems. The benefits of rapid on site assembly allow phased working outside peak traffic hours resulting in minimum traffic disruption which results in a significant saving of associated traffic management costs. The track record of the system ensures that future maintenance costs are minimised.

A close up of the BEJ expansion joint system not normally seen by the travelling public.
Table 1 - Design detail

<table>
<thead>
<tr>
<th>BEJ</th>
<th>Movement* Capacity</th>
<th>Minimum Nosing Sizes</th>
<th>Nominal Nosing Gap</th>
<th>Minimum Nosing Gap</th>
<th>Maximum Nosing Gap</th>
<th>Cover to Services</th>
<th>Kerb Upstand Clearance</th>
<th>Optional Kerb Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Horizontal Vertical</td>
<td>C  D</td>
<td>B</td>
<td>B.Min</td>
<td>B.Max</td>
<td>E  X</td>
<td>W</td>
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<td>3</td>
<td>35               ±12</td>
<td>100</td>
<td>60</td>
<td>45</td>
<td>25</td>
<td>60</td>
<td>70</td>
<td>125±125 tan a</td>
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<tr>
<td>5</td>
<td>50               ±15</td>
<td>120</td>
<td>60</td>
<td>55</td>
<td>30</td>
<td>80</td>
<td>70</td>
<td>125±135 tan a</td>
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<tr>
<td>8</td>
<td>80               ±15</td>
<td>140</td>
<td>70</td>
<td>70</td>
<td>30</td>
<td>110</td>
<td>85</td>
<td>125±145 tan a</td>
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<tr>
<td>10</td>
<td>100              ±15</td>
<td>160</td>
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<td>105</td>
<td>125±160 tan a</td>
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<td>13</td>
<td>130              ±15</td>
<td>180</td>
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<td>125±170 tan a</td>
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<td>15</td>
<td>150              ±20</td>
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<td>200</td>
<td>180</td>
<td>125±180 tan a</td>
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</tbody>
</table>

Note: Elastomeric insert changes according to joint size. All dimensions in mm

Notes
1. Nominal nosing gap is that selected at average design effective bridge deck temperatures and does not take movement into account other than temperature movements.
2. This is the standard design. Please refer to USL Technical and Advisory Service if a ‘special’ is required.
3. For optional kerb detail based on minimum nosing widths – see figure 2 and specification paragraph xi.
4. For skew movements, greater than ±15mm, please refer to USL Technical and Advisory Service.
5. For clarification of kerb upstand clearance (x) see figure 2 and 3.

DESIGN GUIDES

The BEJ is a high performance expansion joint system which is easy to detail at design stage. The USL’s Technical and Advisory Service is however able to assist and advise on all detailing matters, from the most simple to the most complex installations.

Simplicity
Based on essentially three component materials, the BEJ system is flexible and may be adapted in numerous different configurations.

The standard method of installation for new works is to cast the resin nosings directly onto the structural concrete that forms the bridge deck and abutment. Should the deck end and / or abutment require alteration to suit the post system, the elevation or plinth must be cast monolithically with both.

At the kerbline, the deck and kerbwall should be ramped to deal with the change in level. Details are indicated in figure 3. Alternatively the nosing depth may be increased to match the depth of the bridge deck surfacing, both in the carriageway and the verges. However in so doing, attention must be paid to the aspect ratio of the nosing, the passage of any service ducts through the resin mortar and the drainage of the surfacing upstream of the joint.

Flexibility
Britflex resin mortar exhibits excellent bond strength to steel as well as concrete. Therefore the BEJ system may also be placed onto metal deck plates or into a recess provided by metal shelf angle supports. Alternatively the steel carrier rails of the BEJ system may actually be welded directly to the lower steel sub-structure. (See figure 6) Steelwork should be clean and free from rust. Advice should be taken prior to undertaking this application.

Standard nosings for new works have an aspect ratio of nominally 2:1 in width to depth. When using nosings of the same depth at surfacing, the appropriate width will depend on the joint type, class of road and extent of trafficking but never less than an aspect ratio of 1.25:1 width to depth. A spacing of 125mm between them is to accommodate the insert which is routed either down the expansion joint area on both sides of the joint.

In order to provide a satisfactory junction to the bridge deck waterproofing system, the membrane should be brought 50mm into the joint area on both sides of the joint. This is subsequently removed during the installation of the BEJ Expansion Joint and the free edge of the waterproofing sealed with rust at the priming stage.

Movement
Table 1 indicates the basic movement capacity of each joint in the system.
**DESIGN DETAIL**

**a) Carriageway**
In new works or when re-surfacing in maintenance schemes, it is necessary to temporarily cover the expansion gap to prevent ingress of materials into the deck expansion gap. Any such coverings should be easily removed when the trench is excavated for the joint. Temporary saw-cuts into the newly laid surfacing above the deck expansion gap may be required if appreciable deck movement is predicted after surfacing and before joint installation. This may not be necessary when the joint is installed shortly after the surfacing is laid.

**b) Verges**
Granular verge and central reserve construction immediately adjacent to the joint is not recommended. The concrete verge and central reserve should be formed to accommodate the required joint width. If flexible surfacing is required over any verge concrete then a prepared trench may be temporarily backfilled and the position of the trench referenced on the kerb and parapet by the main contractor. Any newly placed concrete should be nominally seven days old and cured in accordance with the contract. Concrete of at least grade 30 is recommended.

**c) Service Ducts**
Any service ducts passing through the joint should be properly sleeved to prevent leakage and anticorrosion to the Engineers’ details. Ducts and sleeves may be in UPVC or other similar materials provided they do not appreciably soften below 80°C. Cores should not be drawn until after the joint is installed, if at all possible.

**d) Kerbs**
Kerbs should be laid starting flush with and working away from the expansion gap. The kerbs are saw cut to the appropriate trench width and removed during the joint installation. Proprietary continuous kerbline side entry gully systems may be used in conjunction with the BEJ Expansion Joint. Expansion units are available which are compatible with the BEJ system. Advice should be sought from USL or the manufacturers of the side entry gullies at the design stage.

**OTHER APPLICATIONS**

- **As an improvement over asphaltic plug joints for low movement joints in heavily trafficked areas.**
- **On heavily skewed joints or steeply graded carriageways however, the NJ system may prove to be more suitable in heavily trafficked areas.**

**SPECIFICATION FOR THE ‘BEJ’ EXPANSION JOINT**

**Materials**

- **Elastomeric Insert**
  The extruded EPDM insert is available in various sizes, each capable of accommodating a different range of movement. The inserts are supplied in coils of lengths between 25 to 60m.

- **Hydraulic Relief**
  Standard hydraulic relief channel is 20 x 20mm square aluminium tubing, in 5 metre lengths. The channel has 11mm diameter holes drilled on one face at 90mm nominal centres.

- **Discharge Tube**
  When an in-joint hydraulic relief channel is specified, this is terminated with a braided PVC flexible tube with a 26mm internal diameter (32mm external diameter), discharging to a suitable collection point.

- **Polyethylene**
  25mm and 50mm sheets of expanded polyethylene are cut to size to form a temporary shutter in the expansion gap between the nosings and also in the kerb area.

- **Kerb Units**
  The metal carrier rails are cut, mitred and welded on site, to suit the kerb upstand detail.

- **Spacer Plates**
  The spacer plates set the rails at the appropriate gap setting during installation. They are available in 5mm increments.

- **Strongbacks/Hangers**
  The spacer plates are connected to the hangers which suspend the rails over the expansion gap at carriageway level.

- **Kerb/Footway Cover Plates (Optional Additions)**
  These may be supplied fabricated from 4.5mm thick aluminium plate with five bar tread pattern.
QUALITY AND TESTING SERVICES

a) Weather and Temperature Criteria

b) The polyureide resin may be installed in temperatures of up to 50°C. It is not affected by freezing, but care must be taken to ensure the substrate is frost free and sufficiently dry before the priming stage.

Once the exposed surfaces have been primed, the joint is effectively sealed. At warmer temperatures, the resin will cure unaided.

Britflex Polyureide Resin does not emulsify in water. Consequently the resin mortar may be placed with care in periods of rain, provided the resin is placed in such a way as to prevent water from being trapped in the trench.

The preliminary operations of saw cutting and breaking out can be undertaken during inclement weather.

c) Time lag after completion and before opening to traffic

Once the resin mortar has cured the elastomeric element can be inserted and the joint opened to traffic. During phased working the joint can be opened to traffic after curing with or without the elastomeric element in place to suit the sequence of installation and minimise traffic disruption.

Britflex Polyureide Resin does not emulsify in water. Consequently the resin mortar may be placed with care in periods of rain, provided the resin is placed in such a way as to prevent water from being trapped in the trench.

The preliminary operations of saw cutting and breaking out can be undertaken during inclement weather.

d) Other Notes

When the ‘BEJ’ system is bonded to steel, this should be prepared by grit blasting or mechanically abrading just prior to the priming operation.

The ‘BEJ’ insert should be protected from white-lining materials, e.g. with sand.
With a comprehensive portfolio of products and a highly developed global network, USL Ekspan is focused on providing specialist construction solutions on a truly global basis.

Notes

The colours used in the illustrations may not be indicative of the finished product.

USL Ekspan reserve the right to update and improve the 'BEJ' Expansion Joint and its specification without notice and Engineers and Contractors should satisfy themselves that they have full and up to date information.

Britflex is a registered trade mark of USL Ekspan.

Technical & Advisory Service

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

Health & Safety

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

The Britflex 'BEJ' System is also approved in the following countries:

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

EXPANSION JOINTS - CD 357

Uniflex - Buried
BP1 - Buried
FEBA - Flexible Plug
Britflex NJ - Rising
ES & 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 Pads & Strip
EOF - Sliding Bearing
Bespoke Bearings

STRUCTURAL WATERPROOFING - CD 358

Pitchmastic PmB
Polyurethane (Pu) Waterproofing System
Britdex MDP
Methyl Methacrylate (MMA) Waterproofing System
Britflex 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
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