Concrete Step Barrier Design Guidance
CSB: Foundation and Restraint

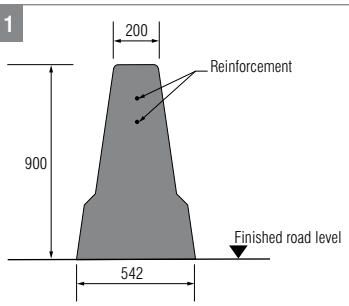
DRAWINGS CSB/1001

APPLICATIONS

A surface mounted CSB is the preferred Britpave product and should be the default method of installation used in most situations.

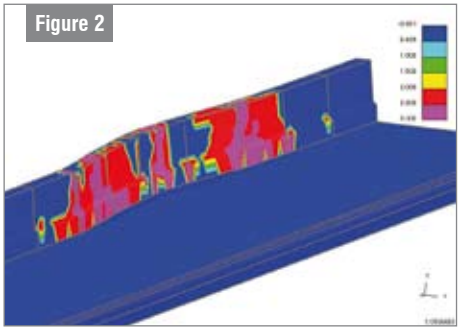
However on bridge decks the embedded barrier must be used see (Data Sheet DS/CSB/504 and Britpave Report BP/35 for details).

Figure 1



Britpave Surface-Mounted Step Barrier

Figure 2



Developmental modelling and crash test simulation using LS-DYNA

The main difference of surface mounted compared to embedded CSB is that it is constructed directly on the bituminous or concrete road surface, and does not require a separate concrete foundation or restraint.

This reduces construction time and traffic management, requiring less excavation, and less material compared to embedded CSB.

Britpave Surface-Mounted Step Barrier (Figure 1) is an innovative product developed by Britpave to simplify installation of CSB. The barrier was developed using a combination of computer modelling and simulation (Figure 2) and empirical testing.

The key features of Surface-Mounted Step Barrier are:

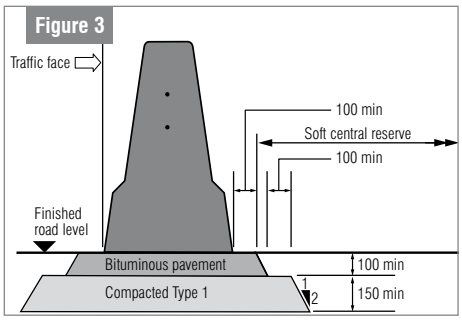
- Same barrier height, step height, width and traffic face profile as standard CSB products (Data Sheet DS/CSB/502).
- H2 containment, working width W2 (for standard width barrier).
- Barrier is mounted directly onto bituminous road surface course –no separate concrete foundation or restraint required.

Surface-Mounted Step Barrier, in both the standard and variable profile, was successfully crash tested at MIRA in April 2006 and conforms to BS EN 1317[1].

Designers and installers should note that the stability and performance of the barrier is directly attributable to the foundation materials on which the barrier sits, and good adhesion and interlock between the barrier concrete and bituminous surface course must be achieved. The foundation (Figure 3) must be no less than 100 mm bituminous pavement material in accordance with SHW Series 900[2] on 150 mm compacted Type 1 material in accordance with SHW Series 800[3]. At least 100 mm of compacted bituminous pavement material must extend beyond the barrier on the non-traffic face. These minimum foundation conditions are those under which the Surface Mounted Barrier was tested. Installation under conditions other than those described in the Britpave data sheets and drawings will result in a barrier which does not conform to BS EN 1317.

- Step Barrier must not be installed directly on granular material.

Figure 3



Minimum foundation requirements for Britpave Step Barrier

THE KNOWLEDGE
Issue No **03**
Issue Date **July 09**

Surface Course

A minimum thickness of bituminous or concrete pavement material of 100 mm is required. This may comprise of a combination of surface course and binder course.

Adhesion between the slipformed Step Barrier and the bituminous surface course is critical in ensuring stability of a Surface-Mounted Step Barrier, and compliance with BS EN 1317. The adhesive bond is formed by interlock of the concrete into pores in the bituminous material.

The surface of the bituminous or concrete pavement material should be cleaned prior to slipforming the concrete barrier. The surface on which the barrier is to be cast must be free from loose material, detritus and any contaminant, fluid or other material that may adversely affect the formation of the bond between the slipformed concrete and the bituminous/concrete surface course. The surface of the pavement should also not exhibit characteristics such as bleeding or fatting up.

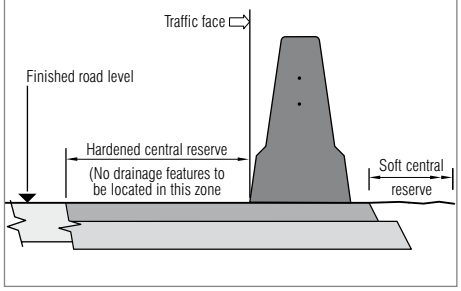
The average depth of pavement surface macrotexture of the bituminous surface course should not be less than 0.7 mm, on each 1000 m length where barrier is to be installed, or the complete section where this is less than 1000 m in length. Surface macrotexture of the bituminous/concrete surface course, on which the barrier is to be cast, should be measured using a volumetric sand patch technique as described in BS EN 13036-1[4].

Base

The base shall be at least a 150 mm layer of compacted Type 1 granular material. A greater thickness may be specified and use of hydraulically bound materials may be considered, where ground conditions dictate that additional strength is required. The designer should give consideration to the need for construction traffic to run on the base material.

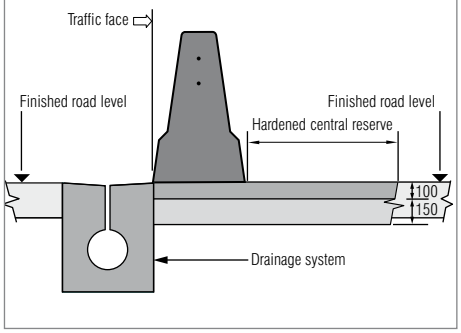
Figures 4 to 6 show typical surface mounted CSB arrangements.

Figure 4



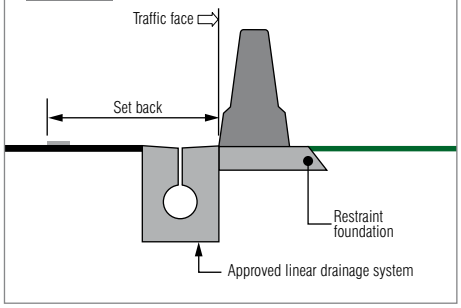
Typical layout, no drainage

Figure 5



Typical layout fully hardened central reserve

Figure 6



Typical layout, soft central reserve

[1] BS EN 1317-2: Road Restraint Systems. Performance classes, impact test acceptance criteria and test methods for safety barriers
[2] Specification for Highway Works, Volume 1, Series 900. Road Pavements – Bituminous Bound Materials
[3] Specification for Highway Works, Volume 1, Series 800. Road Pavements - Unbound, Cement and other Hydraulically Bound Mixtures
[4] BS EN 13036-1 Measurement of pavement surface macro texture depth using a volumetric patch technique

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