

Concrete Step Barrier Design Guidance

CSB: Transitions and Terminals

DRAWINGS	SSB/204	CSB/1100	CSB/1101	CSB/1102	CSB/1103	CSB/1104
	CSB/1105	CSB/1106				

APPLICATIONS

- **Connection to HVCB**
- **Interface with structures**
- **Terminals**
- **Crash Cushions**

Design Guidance Notes

Standard detail drawings are provided for the connections/transitions as summarised in Table 1:

Structure	CSB	WCSB
Standard transition	CSB/1100 CSB/1100-RB1	
2 x single-sided OBB	Not permitted	Transition Unit Type 1 CSB/1101 CSB/1101-RB1 CSB/1101-RB2
Double-sided OBB	Transition Unit Type 2 CSB/1102 CSB/1102-RB1 CSB/1102-RB2	Not permitted
Single-sided OBB	Transition Unit Type 3 CSB/1103 CSB/1103-RB1 CSB/1103-RB2	
HVCB	Transition Unit Type 4 CSB/1104 CSB/1104-RB1	
SSB	Transition Unit Type 5 SSB/204 CSB/1105 CSB/1105-RB1	SSB/204 CSB/1105 CSB/1105-RB2
Crash Cushion	Transition Unit Type 6 CSB/1106 CSB/1106-RB1	

Table 1: Standard details for connections to non-proprietary barrier systems/structures

The following data sheets provide information on related subjects:

Data Sheet DS/CSB/	Connection/transition
507	CSB to WCSB Bifurcation
509	Structures, Bridge piers Gantry bases, Change in traffic face profile
512	Demountable barriers SSB



CSB transition to bridge pier

Connection details for WCSB to structures, single sided OBB, HVCB and SSB are similar to the CSB connections.

The reinforcement details and bending schedules provided on the drawings listed in Table 1 are applicable only to the layouts and designs shown. Where connection details and layouts are varied to suit a particular location or project, design of reinforcement to suit will be required. A typical connection detail illustrated in Figure 1.

Transitions

Transitions must comply with the requirements of TD 19 Chapter 6.

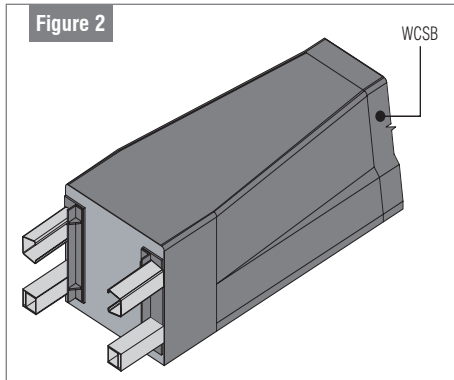
In design and installation of transitions between CSB and deformable barrier systems, the following should be ensured:

A transition must be provided at all changes of type and/or Performance Class of Vehicle Restraint Systems (VRS) to provide a gradual change in performance from the first to the second and prevent the hazards of an abrupt variation.¹

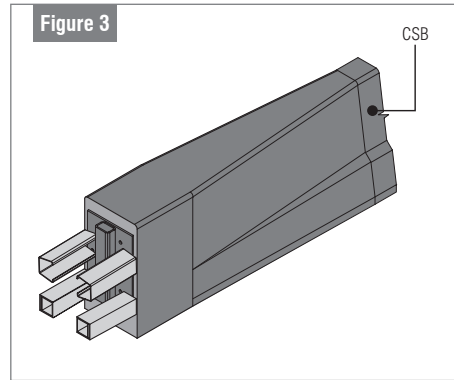
- Continuous profile traffic face with no steps or gaps between systems
- Gradual change in containment level and/or working width

¹ TD 19 Requirement for Road Restraint Systems

² BS EN 1317-2: Road Restraint Systems. Performance classes, impact test acceptance criteria and test methods for safety barriers



WCSB to two single-sided OBB safety fences



CSB to double-sided OBB safety fence

**Connection Unit Type 1
WCSB to two single-
sided OBB safety fences
(Figure 2)**

Both traffic faces transition to vertical.
Width of section 942 mm.
Accommodates two cradle anchorages.
Face of OBB rails flush to face of concrete, both traffic faces.

**Connection Unit Type 2
CSB to double-sided
OBB safety fence
(Figure 3)**

Both traffic faces transition to vertical.
Width of section at end reduced to 430 mm to match double-sided OBB.
Face of OBB rails flush to face of concrete, both traffic faces.
Connection unit provides N2 containment. H2 containment not provided until full CSB section achieved.

For guidance on transitions between different profile concrete barriers see [Data Sheets DS/CSB/507 and 509](#). The most common transitions are likely to be WCSB to two single-sided OBB safety fences (Figure 2) and CSB to double-sided OBB safety fence (Figure 3). Some key points are given above.

Where CSB is to be connected to OBB, it is necessary to form a transition typically 2 m long, rotating the traffic face of the barrier to create a vertical profile. The vertical profile is required to ensure that there are no steps between the face of the OBB rails and the face of the concrete. The cradle anchorages, layout and details of OBB to be connected to CSB and WCSB are as per the standard detail drawings in NPSBS ([Drawings GA/72, GA/74 and associated details](#)).

Standard connection details between CSB and proprietary barrier systems are currently not available from Britpave. An example anchorage system that may be suitable is Fixing centre Limited (FCL) unit [FCL/500](#).

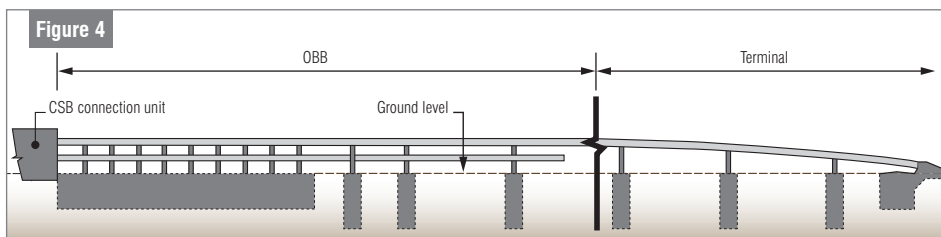
It is the designer's and/or barrier system supplier's responsibility to design any such connections and ensure that they are designed, manufactured, tested and installed in accordance with the requirements of BS EN 1317 - 2^e and TD 19¹.

Terminals

Terminals must conform with the requirements of TD 19 Chapter 5, or the current standard.

There is currently no approved terminal design for CSB or WCSB in the UK. It is therefore necessary to provide a connection from CSB to a steel barrier system; an approved terminal can then be installed on the end of the steel barrier section (Figure 4).

Ramped terminals connected directly to CSB are not permitted. An alternative would be to consider the use of crash cushions. A typical crash cushion unit acts independently of the CSB transition sections. Details of a typical unit are available from Highway Care Ltd. Ramped terminals are not considered safe for use as an approach terminal.



CSB with OBB terminal, typical layout.