THE HIGHWAYS AGENCY

THE SCOTTISH OFFICE DEVELOPMENT DEPARTMENT

THE WELSH OFFICE
Y SWYDDFA GYMREIG

THE DEPARTMENT OF
THE ENVIRONMENT FOR NORTHERN IRELAND

TD 19/85
Amendment No. 1, dated
November 1986

Your attention is drawn to Interim Advice Notes 24, 26 and 34
which have been issued by the Highways Agency for use on trunk roads and motorways
in England. Click on the relevant number to view that Interim Advice Note.

Safety Fences and Barriers

Summary: This Standard gives the requirements for Safety Fences on new and existing trunk roads.

Volume 2 home page

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VOLUME 2	HIGHWAY STRUCTURES: DESIGN (SUBSTRUCTURES AND SPECIAL STRUCTURES), MATERIALS
SECTION 2	SPECIAL STRUCTURES

TD 19/85

SAFETY FENCES AND BARRIERS

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Figure 1 Typical Layout of Cross Section Showing Setback and Clearance

Table 1 Safety Fences and Barriers - Types and Clearances at Obstructions

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1. INTRODUCTION

1.1 This Standard gives the requirements for safety fences and barriers on new and existing trunk roads.

1.2 The Standard supersedes:-

(a) Layout of Roads in Rural Areas. Section 3.17;

(b) Technical Memorandum H9/71. Section 9 and the Appendices referring to safety fence requirements;

(c) Technical Memorandum H9/73 completely.

1.3 Changes from Technical Memorandum H9/73 include:-

(a) Removal of obsolete material;

(b) Removal of material now in the Specification for Road and Bridge Works (Ref 1);

(c) Improved description of fence types;

(d) Revised criteria for safety fences in central reserves of roads and other places.

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2. SCOPE

2.1 In addition to detailing the various types of safety fences to be considered for use on verges and central reserves and criteria for their provision, this Standard gives the dimensions which shall be used for positioning them laterally.

2.2 Information regarding materials, specifications and manufacturing details for Safety Fences and Barriers is contained in the "Specification for Road and Bridge Works" (Ref 1), the RM/F series of Standard Drawings and TRRL Drawings.

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3. DEFINITIONS, TYPES AND USES OF SAFETY FENCES AND BARRIERS

3.1 The objective of installing safety fences and barriers within a highway is to reduce the consequences of vehicles leaving the carriageway and entering areas where it would be unsafe to travel.

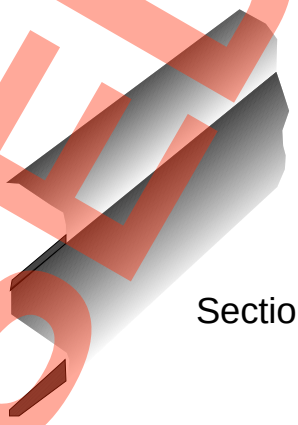
3.2 A safety fence is intended to absorb some of the energy impact caused by an errant vehicle striking it and to redirect the vehicle within a narrow angle to follow the line of the fence so that it does not gyrate or overturn.

A safety barrier is intended to provide containment without significant deflection or deformation under impact, and to redirect errant vehicles along the line of the barrier in the direction of traffic movement.

3.3 Tensioned Steel Beam

3.3.1 Tensioned Corrugated Beam (TCB).

3.3.1.1 This consists of 'W' section beams, used single or double sided, attached to 'Z' section posts by shear bolts and tensioned between anchorages. These safety fences may also be attached to angled brackets. This type of safety fence shall be used on central reserves and where other than short lengths are necessary on verges.



Section of Beam

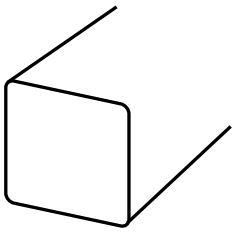
3.3.1.2 A TCB safety fence shall not be used:-

(a) Where the length of fence between anchorages is less than 45m, or

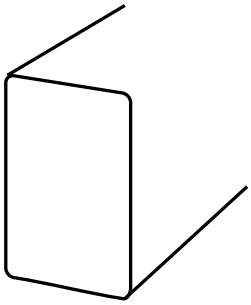
(b) On curves of radius less than 120 m.

3.3.2 Tensioned Rectangular Hollow Section Beam (RHS)

3.3.2.1 This consists of a single beam, which may be 100mm x 100mm or 200mm x 100mm, attached by shear bolts and "U" Section straps to the top of "Z" section posts. Alternatively the 200mm x 100mm beam may be mounted on the traffic side of the "Z" Section posts and attached by shear bolts and clips.



Section of Beam
100 x 100



Section of Beam
200 x 100

3.3.2.2 This type of safety fence may be used wherever the TCB is appropriate providing the ground surface on which it is situated is hardened when 100mm x 100mm section is used. It may therefore be an

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economically viable alternative to the TCB (Paragraph 3.3.1.1) where central reserves are paved.

3.3.2.3 A RHS safety fence shall not be used:-

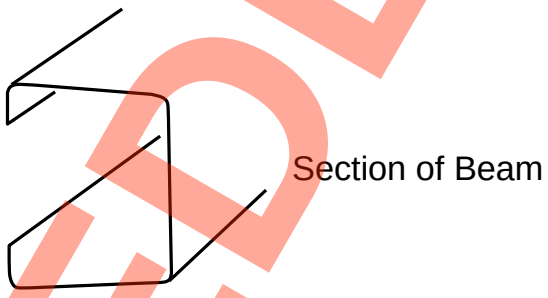
(a) Where the length of fence between anchorages is less than 45m, or

(b) On curves of radius less than 120m.

3.4 Untensioned Steel Beam

3.4.1 Open Box Beam (OBB).

3.4.1.1 This is a trapezoidal section beam, 150mm x 200mm and may be used either single- or double-sided attached to stronger "Z" section posts than those used in tensioned systems. OBB safety fences shall be used for providing protection at obstructions over short lengths and/or where space for deflection is limited.



3.4.1.2 Beams may be attached to discrete obstructions by hexagonal brackets.

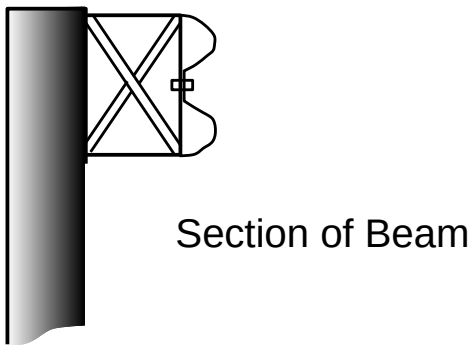
3.4.1.3 The beams may be used double-height, where a higher level of containment is essential.

3.4.1.4 OBB safety fences shall not be used on curves having radii less than 50m.

3.4.2 Blocked Out Beam (BOB).

3.4.2.1 This is a beam of similar section to the TCB and is rigidly attached to timber or large "Z" section steel posts by means of blocking out pieces or steel brackets.

3.4.2.2 Because of the high risk of vehicles not being contained by block-out beam fences, they shall be installed only in situations where speeds are expected to be low and not be used on roads having a speed limit above 50 mph.



3.5 Safety Barriers

3.5.1 British Concrete Barrier (BCB).

3.5.1.1 This type is 816mm high and has a profile contoured to assist vehicle redirection. It requires a hardened foundation to ensure relative levels are maintained with some precision since the relationship between ground surface level and height of contoured profile is critical to its safe performance. It requires dowelling into place or rebating into the adjacent pavement.

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4. CRITERIA FOR PROVISION OF SAFETY FENCES AND BARRIERS

4.1 General.

4.1.1 Safety fences shall be installed on all new trunk roads where speeds of 50 mph or above are allowed and for which the circumstances described in Paragraphs 4.2, 4.3.1 and 4.3.2 herein apply.

4.1.2 Where there are exceptional local hazards, involving either layout or the roadside, safety fences may be needed as described in Paragraphs 4.2 and 4.3.2.

4.2 Verges.

(a) On embankments 6m. or more in height;

(b) On other embankments where there is a road, railway, water hazard or other feature (eg a subway entrance) at or near the foot of the slope;

(c) On the outside only of curves less than 850m radius on embankments between 3m and 6m in height;

(d) At obstructions including bridge piers or abutments, posts of large signs and sign gantry legs and trees;

(e) At substantial obstructions such as retaining walls or steep sided (1 in 2 or steeper) rock face cuttings or earth banks (1 in 1 or steeper) closer than 4.5m to the edge of the running carriageway on roads with speed limits above 50 mph;

(f) At noise barriers or screens closer than 4.5m to the edge of the running carriageway.

4.3 Central reserves.

4.3.1 On new dual carriageways:-

(a) Motorways with central reserve up to 10m wide;

(b) Dual two and three lane all purpose roads where the 24 hour AADT flow is expected to be greater than 30,000 vehicles in the year of opening;

(c) At obstructions including bridge piers, sign gantry legs and trees;

(d) Where there are lighting columns;

(e) Where the difference in carriageway inner channel levels exceeds 1.0m and the slope across the reserve exceeds 25%; the safety fence shall be sited at the top of the slope, but where the difference in carriageway inner channel levels exceeds 0.5m and the slope across the reserve exceeds 15%, a case, including a forecast of costs and benefits, shall be submitted to DTp Headquarters for approval;

(f) Roads in urban areas with a 40 or 50 mph speed limit without central lighting columns where the central reserve is less than 1.75m wide and adequate clearance between the face of the safety fence and the edge of the carriageway can be obtained.

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4.3.2 On existing dual carriageways:-

(a) At obstructions including bridge piers; sign gantry legs and trees;

(b) Where there are lighting columns;

(c) Where the difference in carriageway inner channel levels exceeds 1.0m and the slope across the reserve exceeds 25%; the safety fence shall be sited at the top of the slope, but where the difference in carriageway inner channel levels exceeds 0.5m and the slope across the reserve exceeds 15%, a case shall be submitted to DTp Headquarters for approval including a forecast of costs and benefits;

(d) Roads in urban areas with a 40 or 50mph speed limit without central lighting columns where the central reserve is less than 1.75m wide and adequate clearance between the face of the safety fence and the edge of the carriageway can be obtained;

(e) Dual two and three lane motorways and all purpose roads where they can be economically justified by likely accident savings. Intermittent lengths shall be avoided;

(f) Over short lengths at sites such as service areas, petrol filling stations and roadside cafes for the prevention of unauthorised movements crossing the central reserve.

In (e) above, a calculation shall be made of the likely benefits and also the traffic disbenefits that would occur during installation. QUADRO (Ref 2) assessment may show that the traffic disbenefits on dual two lane roads are more than trivial. For the accident savings and benefit calculations mentioned in Paragraph 4.3.2 (e), advice should be sought from DTp Headquarters.

4.4 Light Wells.

4.4.1 The use of subway light/ventilation wells in dual carriageway central reserves is prohibited and the question of safety fence protection does not arise in new designs.

4.5 Removable Safety Fences.

4.5.1 Where safety fences are used to close Emergency Crossing Points (ECPs), they shall be as shown on TRRL 1040.36 series drawings. This type of safety fence is intended only for short lengths and shall not be used to close crossings longer than 17m constructed for contra-flow traffic working. In these circumstances, standard TCB fences shall be used but removable posts in accordance with TRRL 1040.36 series drawings shall be installed in the paved section. (See Ref 3).

4.6 Safety Barriers.

4.6.1 The feasibility of concrete safety barriers shall be considered as an alternative to steel safety fences on dual carriageway roads having a mandatory speed limit not greater than 50 mph, and where central reserves are necessarily narrow. Where concrete barriers are installed, the critical height of the contoured profile relative to the road surface shall be maintained, it is therefore essential to harden the surface adjacent to such barriers to withstand occasional heavy wheel loads.

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5. GENERAL DETAILS

5.1 Treatment of Ends of Safety Fences and Barriers

5.1.1 The end of safety fences facing on-coming traffic shall be ramped down to an anchorage at ground level and flared away from the carriageway setting back the anchorage behind the line of the fence as detailed in the Specification for Road and Bridge Works, the RM/F series of Standard Drawings and TRRL Drawings.

5.1.2 All other ends of each type of safety fence shall terminate in one of the following ways:-

(a) By means of a transition piece to another type of fence;

(b) A rigid full height anchorage;

(c) A direct connection with a bridge parapet by means of an approved connector;

(d) An expansion joint assembly.

5.1.3 The ends of concrete safety barriers facing on-coming traffic shall be ramped or connected to an OBB safety fence by means of an approved connector as detailed in the Specification for Road and Bridge Works, the RM/F series of Standard Drawings and the TRRL Drawings.

5.1.4 All other ends of barriers shall be ramped.

5.2 Positioning of Safety Fences and Barriers.

5.2.1 The positioning of safety fences and barriers, especially on existing dual carriageway roads, creates problems with respect to stopping sight distance, clearance and height relative to the existing levels. The following paragraphs contain standards which it may not always be possible to strictly implement. In such cases, application shall be made to DTp Headquarters for approval for a Departure from Standards which will be assessed taking into account the safety and economics of the case.

5.2.2 Set-back.

5.2.2.1 The set-back is the dimension between the traffic faces of safety fences and edge of the trafficked carriageway shown in Fig 1 and shall normally not be less than 1.2m, (or 0.6m from the back of a hardstrip or hardshoulder on the verge side only). On roads subject to a speed limit of 50 mph or less, the set-back from the edge of the trafficked carriageway may be reduced to 0.6m.

5.2.2.2 At barriers, the set back may be reduced to a minimum of 0.33m in urban areas where space is limited.

5.2.2.3 The set back may be reduced to a minimum of 1 m adjacent to short obstructions such as bridge piers, and on long structures.

5.2.3 Clearances.

5.2.3.1 Minimum clearances between the rear of the safety fence beam and fixed objects as illustrated in Fig 1 shall be not less than those given in Table 1. The desirable minimum value shown in Column 4 of Table 1 shall be used wherever possible.

5.2.4 Visibility.

5.2.4.1 The visibility requirement given in Departmental Standard TD 9/81 (Ref 4) in respect of safety fences shall also apply to safety barriers. In urban areas and other difficult cases, for both safety fences and barriers,

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applications for Departures from Standards of stopping sight distance shall be referred to DTp Headquarters. See also Departmental Advice Note TA 43/84 (Ref 5).

5.2.5 Height of Safety Fences.

5.2.5.1 Where the set-back is less than 1.5m, the height of the beam shown in Column 2 of Table 1 shall be related to the edge of the carriageway pavement. Elsewhere the height shall be measured from the general ground level beneath the line of the safety fence.

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6. PROTECTION AT ABNORMAL SITES AND AT OBSTRUCTIONS

6.1 Additional height and/or strength of safety fences.

6.1.1 Where there is an exceptional hazard to the occupants of vehicles which might penetrate or roll over a single beam safety fence (eg a road crossing a dam, high mast lighting units within 10m of the carriageway or other major hazard), a special two rail OBB safety fence shall be used. Details of these layouts may be obtained from DTp Headquarters to whom all such cases shall be referred.

6.2 Underground obstructions at restricted sites.

6.2.1 Where there is a risk of driven posts or standard concrete footings interfering with cables, ducts and pipes and the alignment of the safety fence cannot be adjusted to avoid the obstruction, or the depth of pavement construction is such that the standard driven post or concrete footing would not penetrate into the subgrade, special posts or footings shall be provided, details of which may be obtained from DTp Headquarters.

6.3 Protection at Obstructions.

6.3.1 Where tensioned safety fences are provided for protection at roadside obstructions, the length of fence at full height shall extend at least 30m in advance of the obstacle and not less than 45m in total or 7.5m beyond the obstruction, whichever is the greater.

6.3.2 Alternative layouts for protection at obstructions on the central reserve are shown on the RM/F series of Standard Drawings. Some variation to suit local conditions is permissible but the following shall be ensured:-

(a) Vehicles cannot pass behind the approach flare;

(b) Trailing ends on central reserves are adequately protected by the opposite approach flare;

(c) Anchorages and concrete ramps shall be located so they do not protrude into the deflection space of the opposite fence.

6.3.3 On embankments 6m or more in height the length of the fence or barrier should be extended beyond the 6m high section to ensure that vehicles leaving the carriageway at places of lesser drop will not reach the 6m high section. On curves further extension may be needed to reduce the risk of vehicles passing behind the fence or barrier. The amount of extension will depend on the rate of change of embankment drop.

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7. REFERENCES

1. Specification for Road and Bridgeworks: HMSO.

2. QUADRO 2. Manual: DTp: 1982.

3. TA 45/85 The Treatment of Gaps in Central Reserve Safety Fences: DTp: 1985.

4. TD 9/81 Highway Link Design: DTp: 1981 and Amendment No 1: 1985.

5. TA 43/84 Highway Link Design: DTp: 1984.

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8. ENQUIRIES

All technical enquiries or comments on this Departmental Standard must be sent in writing to:

Head of Division
Engineering Intelligence Division
Department of Transport
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Southwark Street
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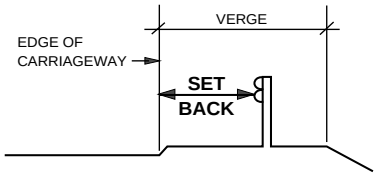
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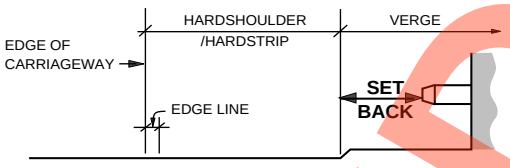
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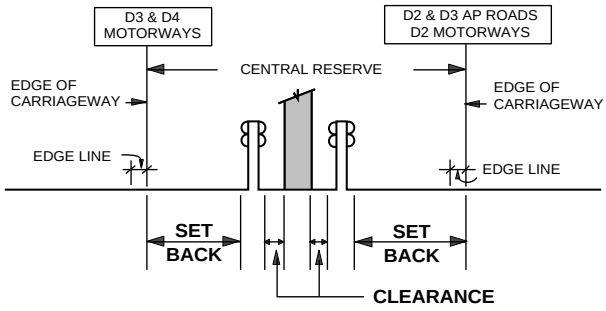


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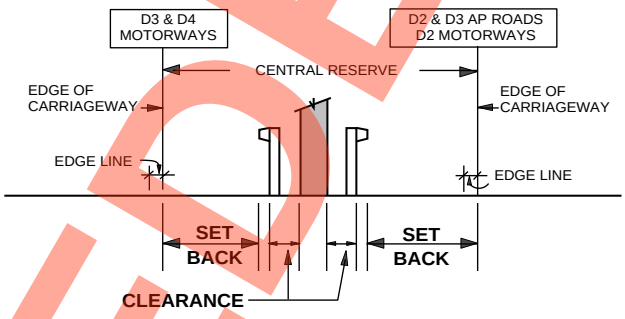


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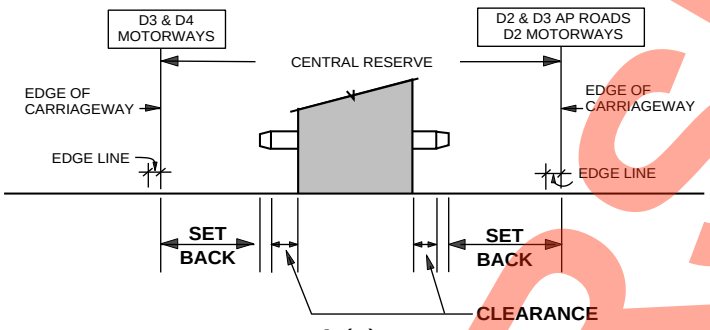
VERGE



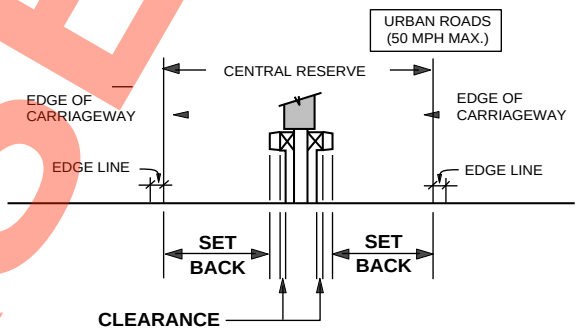
1 (c)



1 (d)

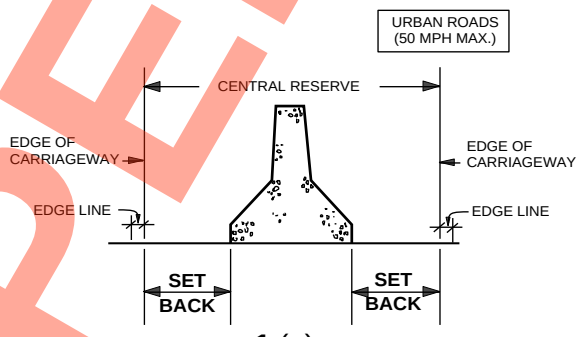


1 (e)



1 (f)

CENTRAL RESERVE



1 (g)

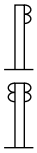
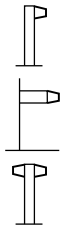
VERGE AND CENTRAL RESERVE

TYPICAL LAYOUT OF CROSS SECTIONS SHOWING SETBACK AND CLEARANCE

FIGURE 1

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TYPE 1		HEIGHT OF BEAM CENTRES (mm) 2	POST/ BRACKET SPACING (m) 3	CLEARANCES		APPLICATION 6
				DESIRABLE MINIMUM (m) 4	ABSOLUTE MINIMUM (m) 5	
	Tensioned Corrugated Beam (TCB) (on knock-down Posts)					Verge and central reserve
	Single-sided TCB	610	3.2	1.20	1.00	(See para. 3.3.1.1 and Fig. 1(a) and (c))
	Single-sided TCB	610	1.6**	1.20	+0.60	
	Double-sided TCB		3.2	1.00	0.60	
	Double-sided TCB	610	1.6	1.00	0.46	
	Rectangular Hollow Section (RHS) (on knock-down Posts)					Verge and central reserve
	100mm x 100mm RHS	610	3.2	1.20	1.00	(See para. 3.3.2.1)
	200mm x 100mm RHS	610	3.2	1.00	0.80	
	200mm x 100mm RHS mounted on traffic side of post.	610	3.2	1.00	0.80	
	Open Box Beam (OBB) (On knock-down Posts)					Verge and central reserve where deflection space is limited, eg. at bridge piers.
	Single-sided OBB	610	2.4	1.00	0.60	
	Single-sided OBB	610	1.2	1.00	0.46 +(0.33)	(See para. 3.4.1.1 and Fig.1(b), (d), (e) and (f))
	S ingle-side OBB bracket mounted on pier.	610	1.2	0.30	0.30	
	Double-sided OBB bracketed to posts	610	2.4 1.2**	++(0.04)	++(0.04)	
	Blocked Out Beam (BOB) (on rigid posts)	530	3.2	(1.20)	(0.65)	Verge only on speed restricted roads (50 mph max.) (See para. 3.4.2.2)
	Blocked Out Beam (BOB)	530	1.6	(1.00)	(0.30)	
	British Concrete Barrier (BCB)	816*	-	-	-	Verge and central reserve on speed restricted roads only. (50 mph max.) (See para. 3.5.1 and Fig. 1(g))

NOTE:
Figures in brackets denote values where speed is restricted to 50 mph or less.
* Height to top of barrier from adjacent road surface level.
\+ For use at lighting columns.
++ When lighting columns are erected between beams bracketed to posts on 1.8 m central reserve.
** For 10 m in advance of lighting columns.

SAFETY FENCES AND BARRIERS - TYPES AND CLEARANCES AT OBSTRUCTIONS

TABLE 1

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