

CAR PARK BARRIERS



INTRODUCTION

Berry Systems are market leaders in 'Off Highway' safety barriers installed for the protection of people, vehicles, plant and buildings. This brochure is concerned specifically with their use in car parks.

Most people are familiar with the appearance of highway barriers - the ubiquitous Armco. However, while looking superficially similar, off highway barriers are quite different and different standards, regulations and operating requirements apply.

Firstly, many accidents in car parks will result in impacts roughly perpendicular to the barrier, not the typically oblique impact of most road accidents. Secondly, the main priority is the protection of both people and property - and that property includes both the barrier itself and the vehicle that hits it. Thirdly, the barriers are also used to protect pedestrians and to physically restrict their access to certain areas.

Fundamentally there are two types of car park safety barriers - column mounted or floor mounted. These two main types of barriers then sub-divide into flexible or rigid options.

Flexible barriers are designed to 'give', i.e. deflect, on impact absorbing minor knocks without damage to either the barrier or the impacting vehicle. Harder impacts will sustain damage but, in the case of the barrier, this will be limited to easily replaceable or repairable components and structural integrity is maintained. Damage to vehicles is minimised and the driver and any passengers are less likely to suffer injury. The level of deflection by the barrier varies from system to system and space must be allowed for this if any external cladding or other facade is also fitted.



DESIGN STANDARDS

EUROCODES

The Eurocodes are limit state codes like the British Standards, although are perhaps a little more explicitly based in reliability theory. They are further divided into parts covering individual types of structures, such as buildings, bridges, silos, towers and masts. In total, there are 58 parts to the ten Eurocodes.

Many of the Eurocode rules are based on the same theory as the British Standards, although the Eurocodes embody the most up to date research on many aspects of structural behaviour.

The Eurocode clauses are structured in a slightly different way in that they contain principles that must be satisfied and application rules that offer a way of satisfying the principles. This is intended to stimulate innovation. The Eurocodes are also less prescriptive than the British Standards, with more aspects left open to the designer.

The relevant codes to the Design of Vehicle Restraint Systems are:

BS EN1991-1-1 General actions. Densities, self-weight, imposed loads for buildings

Extracts from EN1991-1-1 : 2002 & EN1991-1-7 : 2006 confirm the following:

Table 6.12 Horizontal loads on partition walls and parapets (category F & G covering car park areas).

Annex B defines the performance criteria for Vehicle Barrier for Car Parks. For a rigid barrier this equates to a 150kN applied load.

Annex B also advises on specific areas where 'half force' and 'twice force' loads should also be applied.

Table NA.8 (National annex to BS EN 1991-1-1 : 2002) confirming requirements of pedestrian loading of 1.5kN and vehicle loading to Annex B.

Vehicle barriers are defined to be installed at a level of 375mm above the finished floor, this is generally used as a minimum with the maximum extending to 500mm for parking bays and 610mm for ramps.

The loading calculation defined as: $F = \frac{0.5MV^2}{\delta_c + \delta_b}$

Where:

M = Vehicle Mass

V = Velocity in m/s

δ_c = Deformation of Vehicle

δ_b = Barrier Deflection

$$F = \frac{0.5 \times 1500.0 \text{ kg} \times 4.47 \text{ m/s}^2}{100 \text{ mm} + 0 \text{ mm}}$$

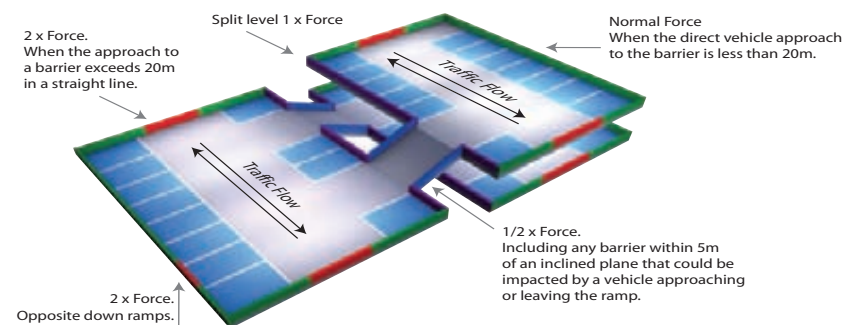
$$F = 150 \text{ kN}$$

BUILDING REGULATIONS

Pedestrian Handrail systems are defined within Part K of the UK Building regulations. The minimum height requirement being 1100mm above finished floor level and systems must be anti climb where a fall risk is viable.

INSTITUTION OF STRUCTURAL ENGINEERS

The fourth edition of the IStructE "Design recommendations for multi-storey and underground car parks" (March 2011) also forms a significant part of the clarification for the use of vehicle barriers and design considerations within multi-storey car parks.



STANDARDS AND REGULATIONS

COLUMN MOUNTED SYSTEMS

The main advantage of column mounted systems is that often they have little or no footprint in the parking bay thereby releasing more space for parking use. The barrier is mounted directly onto the structural columns with interim posts fitted if necessary, subject to the system chosen. The absence of fixings to the deck allows the use of thinner deck substrates and lighter deck materials.

Berry Systems offers three flexible systems plus a rigid RHS system. Alternatively Berry can design a bespoke system to marry architectural aesthetics with BS EN Standard performance by utilising the wide range of experience, test data and expertise accumulated over more than 40 years. The three flexible systems share the same range of panel infill options.

STANDARD FEATURES INCLUDE:

- Independently tested to BS EN 1991 -1-1 2002 Annex B
- Require no anchorage into the car park deck
- Zero bay footprint
- Integrated anti-climb system
- Stylish vehicle and pedestrian protection
- Re-useable after impact
- Cost-effective single panel replacement
- Combined in-fill offers numerous design opportunities





BRISAFE WIRE ROPE EDGE PROTECTION SYSTEM

The Berry Brisafe system is based on three lengths of wire rope anchored under tension to the car park structure. These ropes are then fitted with in-fill panels. On impact, the wire ropes deflect absorbing the impact energy forces and then return to their normal 'resting' position. Following an impact, any damaged in-fill panels can be swiftly removed and replaced. The wire rope elements are fully re-usable and can be re-tensioned on site if required. The deflection of the system under impact means that Brisafe is not usually suitable for use where an additional facade or cladding is also specified.



SYSTEM 3

System 3 utilises tensioned steel bars instead of wire ropes. The system is 'locked off' at each column location and, where suitable columns are not available, the Berry Flexi-Bollard can be employed to give absolute design flexibility and even lower deflection levels when subjected to an impact. The steel bars can be easily and speedily replaced if necessary. The reduced impact deflection figures make System 3 attractive for both new build and refurbishment projects.



FLEXI-PANEL

Berry Flexi-Panels provide a fast fit option ideally suited to steel framed structures, pre-assembled Flexi-Panels are bolted to the columns not the car park deck. Standard panels are 2.4 metres or 4.8 metres wide but where wider spans are required, Berry's own Flexi-Bollards can be used as interim posts. These will 'flex' on impact returning to their normal position thereafter, minimising impact damage to both car and barrier.



INFILL OPTIONS

All Berry Systems column mounted flexible barriers share the same range of panel infill options that provide an anti-climb feature from floor level to the integral pedestrian handrail. Panels can be supplied in any RAL colour and the infill can include custom designs, logos or customer information thereby providing innovative opportunities for designers to create unique themes and to integrate identities between car parks and the facilities they serve.



RIGID RHS

Where façade or other requirements preclude the use of flexible systems, the Berry Rigid Steel Section barrier can be used. Fixed directly to the car park structure the rigid steel barriers provide a very solid resistance to any impact. A wide range of design formats is available including pedestrian handrails and anti-climb infill where needed.

FLOOR MOUNTED PERIMETER SYSTEMS



Berry Systems offer two types of flexible floor mounted systems and one rigid system, each with a choice of three rail profiles - Berry Beam, Barrier Rail or Open Box Beam.

The Berry Spring Steel Buffer System has been the benchmark, flexible, floor mounted system in UK car parks for more than 40 years. Over that time it has been improved and developed to incorporate a range of buffer types to suit almost all circumstances and more recent changes to standards has led to the development of integral pedestrian handrails and anti-climb mesh.

SPRING STEEL BUFFER

One of the key features of Spring Steel Buffers is that they are designed to yield not fail. Deflection during the type of impact defined in the relevant BS EN Standard is typically about 300mm. This means the impact forces are absorbed by the buffers rather than transmitted directly to the mounting bolts or towards the deformation of the rail. Frequently they only require 1 (or at most 2) x 20mm bolts. Embedment can be a mere 80mm and the pull out loading is just 50kN. Compared to rigid posts, this is a quarter of the number of bolts at half the depth. A major saving in terms of installation time and materials.

FLEXI-POST

The Berry Flexi-Post provides a semi-flexible system. The upper part of the post is mounted into a rubber shock absorber which allows a limited deflection of the post - about 120mm. Flexi-Posts use 4 x 12mm screw anchor bolts, 150mm embedment and a pull out loading of only 75kN. They are ideal when a limited amount of space is available for barrier deflection, but reduced anchor bolt loading is essential compared to a rigid system.

RIGID BARRIERS

Berry Rigid Barriers have a near zero deflection and so deformation of the barrier rail and damage to the vehicle is likely with any significant impact. Because of their solidity, high anchor bolt forces are generated and so they require substantial footings. The bolt down type of rigid post uses 4 x M20 resin type anchor bolts with 170mm embedment. These have a pull out loading of 100kN and are best used where there is no room for any barrier deflection and minimising damage can not be a priority.



Main image: Spring Steel Buffer

Top: Rigid Post

Bottom: Flexi-Post



Main image: Ramp Barriers

Top centre: Twice Force Barriers

Bottom right: Split Level Barriers



TWICE FORCE SYSTEMS

The latest BS EN Standard defines the need for a 'twice force' (i.e. 300kN) system where traffic travel can exceed 20m in length. Twice force barriers need to withstand a 1500kg car travelling head on at 14.4mph. Primarily this relates to traffic flow aisle ends and opposite ramps of downward travel. This requirement is achieved by either using heavier duty systems or, in some cases, halving the post centres on standard systems.

RAMPS

Where ramps start or finish within the deck, a drop will be created that needs protecting. In most cases a half force barrier will be sufficient as impacts will be oblique rather than perpendicular. In most situations handrails with anti-climb mesh infill will be needed too.

SPLIT LEVEL

Split level protection is to prevent vehicles and pedestrians falling through the open spaces in between floor levels. Any drop greater than 380mm needs to be protected and a simple barrier system is the minimum requirement. A pedestrian mesh infill system is also recommended. Lighter weight systems can generally be used taking advantage of the free space behind for barrier deflection and to minimise incursion into the parking bay lengths.



TWICE FORCE, RAMPS AND SPLIT LEVEL

COLUMN AND PIPEWORK PROTECTION



Supporting Columns are highly vulnerable to damage from vehicle traffic. Repairs can be costly and, in the worst cases, could affect the structural integrity of the car park with far reaching consequences. Exposed pipework and lighting columns are also highly vulnerable and can not always be placed in traffic free areas. All Berry Systems' column protection products cater for various sizes and can be tailored to your precise needs. These can also be wall mounted to protect pipework.



Main image: Lighting Column Protection

Far left: I-Beam Mounted Column Protection

Left: Pipework Protection

PEDESTRIAN PROTECTION

Protection to stairwell walls adjacent to parking or traffic flow areas were first highlighted as a requirement to be considered in the ODPM report of Sept 2002.

The juxtaposition of cars and pedestrians is obviously dangerous. It is vital that pedestrian areas are delineated with handrails at the very least. The Berry Twin Ball system provides a sturdy and effective solution. However, where there is a risk of vehicles entering pedestrian areas then vehicle barriers must be added.





Berry Systems offer a wide range of Bollards and Parking Posts.

FOR DELINEATING ENTRY/EXIT LANES.

These plastic bollards are highly visible but will give on impact so that no damage is done to the impacting vehicle. They are for use as markers only and do not provide physical protection.

FOR MARKING BOUNDARIES

Steel boundary posts are spring-mounted to give on impact while presenting a substantial boundary marker.

FOR RESTRICTING ACCESS

Lockable hinged parking posts are ideal for restricting access to specific areas or parking bays.

ORNAMENTAL BOLLARDS

A wide range of ornamental bollards is available in either steel or plastic.

SPEED RESTRAINTS

Speed control products can be used to reduce the potentially higher speeds in surface car parks to safer levels. They can also be used in multi storey car parks to reduce the need for Twice Force barriers.

Berry Systems also supply and install a wide range of access control products including:

Goalpost Height Restrictors One of the most cost effective ways to prevent unauthorised vehicles from entering the Car Park area.

Manual Arm Barriers and Swing Gates Both are available as a manual method of entry to site that can be locked to prevent access when required.

One Way Flow Plates Manufactured from heavy duty steel. One way flow plates are designed to restrict traffic flow to one direction.

**BOLLARDS, PARKING POSTS,
SPEED RESTRAINTS & ACCESS CONTROL**



BERRY SYSTEMS LIMITED

Springvale Business & Industrial Park
Bilston, Wolverhampton WV14 0QL. UK

T: +44 (0)1902 491100

F: +44 (0)1902 494080

E: sales@berrysystems.co.uk

W: www.berrysystems.co.uk

hs A Division of Hill & Smith Limited