

Standards, Regulations and Independent Recommendations

There are two relevant British Standards and one part of Building Regulations: BS 6399 Part 1 1996 - Clause 11 Loading for Buildings BS 6180 1995 Barriers in and about Buildings. Part K of Building Regulations - Vehicle barriers and Loading Bays. However, all these need to be read in conjunction with recommendations published by both the Institute of Civil Engineers and the Institution of Structural Engineers. These two reports were part of the work behind a report entitled 'Partners in Innovation' published by the Office of the Deputy Prime Minister in September 2002.

Building Reg Part K – Vehicle Barriers and Loading Bays

This states quite simply and clearly that barriers must be fitted to the edge of any building with vehicular access and these barriers must have an impact height of at least 375mm and be capable of withstanding the forces set out in BS 6399.

BS 6399 Part 1 1996

The British Standard defines the way to calculate the horizontal force required to be withstood by a vehicle barrier: $F = 0.5mv^2 \sqrt{c} + \sqrt{b}$ where m is the gross vehicle weight (in kilos), v is the velocity of the vehicle in metres per second. \sqrt{c} is the deformation of the vehicle and \sqrt{b} the deflection of the barrier. In practical terms for car parks, for vehicles under 2500kg - i.e. cars - m can be taken as 1500kg, v is taken to be 4.5 metres per second (10mph). In the absence of better evidence the deformation of the vehicle, \sqrt{c} , is taken to be 100mm and, for a rigid barrier the deflection is assumed to be zero. If these values are applied to the formula, $F = 150kN$. BS 6399 also states that, for cars, the force acts at bumper height and this is assumed to be 375mm above the floor and is distributed over a length of 1.5metres. The standard recognises the different types of impact likely and how that affects the forces involved. Where there is a normal perimeter edge or half-level edge the 150kN force applies. Where vehicles are travelling on a confined ramp – and cannot possibly impact the sides of the ramp structure at 90 degrees, then the requirement allows for "half force" i.e. 75kN. Where there is a perimeter edge opposite a down ramp which exceeds 20m in length, then a double or "twice force" barrier will be required i.e 300kN.

BS 6180: 1995

This is the code of practice for barriers in and about buildings. It slightly pre-dates BS 6399 but states that barriers are required where there is a drop greater than 380mm. It further requires that, if these are in areas used by pedestrians, handrails and infill panels are required at a height of 1100mm and no gaps are allowed through which a sphere 100mm diameter can pass. BS 6180 also defines a load requirement of 1.5kN/m² on the handrails and infill panels with a similar point loading on the handrail of 1.5kN. Therefore, a vehicle impact barrier needs to absorb a force **66 times greater** than a pedestrian handrail rail system.

Independent Recommendations

Reports from the Office Deputy Prime Minister, the ISE and the ICE were all jointly inspired by the structural failure of some 1960s concrete built multi storey car parks. Between them they recommended:

Vehicle impact height be increased from 375mm to 445mm centre height - This was to allow for changes in vehicle designs and fashions. Any rail edge less than 550mm from floor level be considered a step up point and that the 1100mm handrail height be taken from this point unless footholds can be spoiled - The 'climb assist' rule. Where the approach to a barrier is greater than 20 metres, typically at aisle ends, then the value of the horizontal force F should be doubled. (See Figure 1) Recognise the need to consider temporary or permanent changes to traffic flow.

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