

Advice on Bridges, gradients and steps in England and Wales

The law and management of public access rights vary between the four countries of the United Kingdom. This advice note applies to England and Wales only. There is an equivalent factsheet for Scotland. www.bhs.org.uk/accessadvice.

In providing specifications for equestrian ways and facilities, the British Horse Society considers all equestrian users, which may result in a high specification which might not be appropriate in all circumstances. The recommendations should be read with this in mind. **If the specification seems inappropriate in a situation, the Society strongly advises consultation with its local representative to establish what may be acceptable at a particular site.**

'Equestrian' includes riders and drivers or horses.

Bridges

Bridge Specifications for Equestrian Use Over Watercourses (ditch, stream or river) *See notes below							
Route Type	Span	Deck height	Width	Parapet Height	Infill Height	Kickboard	Kickboard /Infill Uplift
Bridleway	< 3m	< 1m	2m	1.2m *	0.6m	250mm	25mm
Restricted Byway, Byway	< 3m	< 1m	3m *				
All routes	3–8m	< 1m					
All routes	< 8m	> 1m		1.8m *			
All routes	> 8m	< 1m	4m no parapet 3m with parapet	1.2–1.8m *			
All routes	> 8m	> 1m	4m *	1.8m *			
Bridge Specifications for Equestrian Use Over Roads and Railways *See notes below							
Route Type	Span	Deck height	Width	Parapet Height	Infill Height	Infill Uplift	
Any route over road	Any	Any	Minimum 3m *	1.8m *	1m	25mm	
Any route over railway					1.8m	Not applicable	

Infill is solid panelling fixed to the parapet railings to obscure a horse's view of traffic or turbulent water passing beneath the bridge.

Uplift is the gap between deck and kickboard or infill.

Kickboards form a raised edge to the deck, preventing a foot sliding off the deck.

Parapets

Parapets or infill are not always required, or may be acceptable at a lower height, or desired at a greater height in some circumstances. This is relative to the local conditions, particularly the height of the span, width and proximity of a horse's line of travel to the parapet, and what is being bridged. A railway or fast road will need a more substantial and higher parapet than a stream or minor road.

The psychological benefit of higher parapets is inestimable. Anecdotal evidence shows that even if a parapet would not withstand an impact, it makes an equestrian feel safer, which emotion is transmitted to the horse so both are more confident in passing over the bridge and more likely to do so safely. A standard height parapet may be below the waist of a rider on an average sized horse which may cause a rider to feel very vulnerable on a high span and that unease will be felt by the horse. A person driving a horse is less likely to be as high or as close to a parapet.

The desirable height of a parapet will be influenced by the likely proximity of a horse to the parapet on a normal line of travel as well as the local conditions.

The Design Manual for Roads and Bridges (Department for Transport) says 1.8m *if adjacent to the parapet* but does not define 'adjacent'. For a bridge over a dual carriageway, the Society recommend a parapet height of 1.8m if the natural line of travel is within 2m of the parapet, and 1.5m height if more than 2m away, however, there will be sites where a lower height is acceptable, such as a single track accommodation bridge where an equestrian may take the centre line with low incidence of other users. Alternative measures on carriageway bridges with lower parapets may include warning motorists of oncoming traffic (horses) in the centre of the bridge (or 2m away from the parapet on a wider bridge).

Parapets or infill may not be practical on low spans over watercourses where flood potential could allow waterborne debris to collect and increase stress on the bridge.

Horses might be alarmed by traffic passing beneath them, whether it is on a navigable river, road or railway. Solid infill of parapets to obscure their view may be desirable in some situations.

Parapets on ramps parallel to a railway line or motorway should also have solid infill on the rail or road side of the ramp as for the bridge itself if possible.

Bridges over bogs should be of reasonable width, with non-slip surfaces and edge boards to reduce the risk of a horse slipping off the bridge and being stuck in the bog.

Parapets on bridges are usually intended to prevent a pedestrian or vehicle from leaving the bridge while on the deck. Parapets to provide equivalent protection to a rider would be over 2m high and are rarely practical or desirable therefore the height of any parapet on an equestrian route is likely to be a compromise and there is no single solution for all situations.

Where it is not practicable to meet the recommended standard on any bridge, mounting blocks at each end of a bridge would be welcomed by equestrians who choose to dismount and lead across the bridge (see BHS Advice on Mounting Blocks).

Width and Sightlines

The specified widths are primarily for the comfort of users passing one another. If it is not practicable to provide the recommended width, mitigation may be required such as signs at each end giving priority to horses so that passing another user does not place a horse too close to a parapet. A bridge width of less than 3m may be insufficient to turn a ridden horse safely. A horse drawing a vehicle is likely to need at least 3.5m to turn, depending on the type of vehicle.

Waiting areas should be at least 3m in width and length, 4m is preferable. The area should increase with the potential waiting period as horses may become restless, particularly if the environment is threatening.

Bridges carrying roads with high volumes of traffic should have a segregated marked route for riders.

There should be no bollards, gates or other width limitations on the bridge or in the waiting area. A gate on a bridge less than 3m wide means a ridden horse having insufficient space to manoeuvre into the safest position – alongside the gate with head beyond the latch. Having to tackle a gate head-on is contrary to BHS recommended practice because it increases risk for horse and rider.

Clearance

Where a canopy is provided to any bridge it should ideally have a height of 3.7m and a minimum of 3.4m. In exceptional circumstances a lower height may be acceptable for the horse to be led when mounting blocks are present. Advisory notices may be required if the low height is not obvious at a point where it is safe to dismount.

Overhanging vegetation should be clear of the bridge by 3m. Bridges overhung by trees may become slippery from vegetation or moss and greater attention will be needed to prevent slipping and rot.

Structure and Surface

Structures should be stable.

Deck boards should be laid at right angles to the sides of the bridge. Ideally, decking should be substantial and non-echoing, without gaps in the decking through which the river, road or railway can be seen.

Surfaces of bridges should be non-slip.

Stone mastic asphalt should be avoided as it will require a grit dressing to make it non-slip.

Wood is slippery when wet but a wooden deck can be made non-slip with epoxy resin and bauxite grit as a liquid application or in attached strips or sheets (there are a number of suppliers of both which have been used successfully). A quick and cheap solution on wood decks has been a generous scattering of sand. It will need replenishing but has been successful for months.

Wooden or recycled plastic struts may be screwed to slopes, but water and organic material may collect against them causing rot. This can be reduced by angling them to shed water and recycled plastic struts have been used successfully. Struts may become loose and their edges are vulnerable to wear as struck by hooves.

Rubber compounds as a deck coating have the advantage of deadening sound as well as providing a comfortable non-slip surface. Rubber may come as a liquid, in sheets or as recycled crumbs bound with resin or polymer. For a bridge surface, it need not be as thick as would be used elsewhere and final cost would be roughly double that of bitumen and grit. Both grit and rubber options may be used on a central 1m strip to reduce costs if necessary. People on bridges often walk by the parapet to look over, but riders and carriage-drivers are more likely to use the centre of the deck.

Metal is noisy and alarming to horses so should be avoided. Non-slip surfacing also dulls noise, which may be preferable. Rubber mat surfaces have been successful in some cases.

Load

Horses vary in mass from about 200kg to a tonne. The most common range for riding and driving out will be 350 to 700kg.

In walk, the peak force on a horse's foreleg is about half its bodyweight so about 2,500N in a horse with 500kg body mass. The peak force will increase with speed to about 12,500N at full gallop.

Common exercise vehicles drawn by horses are generally between 100 and 300 kg. A vehicle drawn by a pair or team of horses will not necessarily be heavier.

Other

There should be no barbed wire or electric wire on or adjacent to the bridge or waiting area.

Further technical information on bridge construction is available courtesy of the Scottish Access Technical Information Network www.satonline.org.

Fords

Fords are usually cheaper than bridges and may be appropriate where water in normal conditions is maximum depth of 0.5m. They are particularly suitable on less used routes. Environmental constraints, such as the work required to build the ford, the control of pollution and the watercourse profile may mean a proposal for a ford fails the impact assessment for watercourse consent.

Where a ford is deemed appropriate, the force of water flow in normal conditions should allow a horse to walk easily without being pushed off course.

The base of the ford within the watercourse must be firm, level, free from holes and non-slip. Often levelled bedrock or the natural bed of the watercourse will fit these criteria with little intervention. In other locations, ridged concrete or stone setts may be required.

Entry points must be firm and able to withstand fluctuating water levels and potential damage from horse use without erosion or poaching. Stone pitching may be necessary in some situations to protect the entry points.

Ideally, the gradient of the entry points should be no more than 1 in 12 although 1 in 10 may be acceptable if the bank is low. The entry points must shelve into the river – abrupt banks are not recommended because a horse would have to jump in or out with high potential for slipping or falling. This is likely to cause erosion of the bank or river bed. In a watercourse in a remote location it may be appropriate if the level of use will have negligible impact and if users are likely to have encountered equivalent terrain to reach the ford.

Poles showing the water depth should be provided if the bottom of the ford cannot be seen in normal conditions. Markers for the entry/exit points may be required if the crossing is greater than 4m between banks.

Where the ford is through a river which has a strong current at times, no sharp or dangerous objects should be close to the path on its downstream side.

Stepping stones or footbridges for pedestrians should always be on the upstream side of the equestrian crossing to ensure the horse is not swept towards any sharp edges or forced against the structure.

If a ford is being considered, then permission must be gained from the government agency responsible for watercourse protection prior to any work taking place.

Irish Bridges or Irish Fords

A low water crossing or Irish bridge/Irish ford provides a dry crossing at normal water level but in high water conditions, water will flow over its surface forming a ford. Low water crossings have no parapets or raised edges which would impede flow. Old ones may be constructed by large pipes (round or rectangular cross-section) laid adjacent to each other parallel to the flow with a concrete surface on top so the water flows through the pipes at normal levels and over the whole structure in high water forming a ford depth crossing. This type is now unlikely to be approved by river authorities because of potential effect on fish and scour in high water conditions, however a single wide low 'pipe', effectively a very low bridge, might be considered in specific conditions.

A low water crossing has an advantage over a ford in that earth and other contaminants are not taken into the watercourse during normal conditions.

Gradients and Steps

Steep gradients are not a limiting factor for horse use and should be considered as for pedestrians where variation in experience and agility mean some people will choose to use certain steep routes or not. In natural terrain, the feasibility of any gradient is up to the judgement of the individual. Where use of a popular steep route is causing erosion which needs control, pitching and steps are feasible on a bridleway but greater space at any level will be required. They are not feasible on a route open to horse-drawn vehicles. Polymer or resin bound rubber crumb-grit compounds have been used very successfully on steep slopes with cross-gullies into the substrate filled with the porous rubber mix to reduce possible scour of the substrate.

Ramps

For general purposes of a built path, such as a ramp for a bridge, a gradient of 1 in 12 is the ideal maximum for ridden use which may also be useable by people in mobility scooters or similar, although lower ramps for the latter are preferred. This does not apply to natural terrain where gradients of 1 in 3 or steeper are possible for some horses and riders, though few carriage-drivers would tackle such gradients except for very short distances.

Account must be taken of the geographical features of the area and discussion between the local BHS Access Officer and highway authority is essential. Compromise may be possible where there are no alternatives, particularly with close attention to an appropriate resilient surface and adequate provision to pass other users which, as with steps, may be passing places if an overall width of at least 3m is not feasible.

Steps

The dimensions suggested here assume that for steps to be considered, there are likely to be significant site constraints and that steps are a 'last resort'. They are not feasible on routes open to horse-drawn vehicles. Consideration should be given to the widths needed to safely pass other users and if a horse should need to be turned while on the steps. Turning is likely to require a 3m x 3m area for safety. The ideal is therefore 2m wide with frequent passing or turning places but much will depend on the site, its level or use and locality.

- Width ideally 2m or more, minimum 1.5m
- Sight lines of at least 15m and passing places along the flight at no more than 15m intervals. Passing places should be at least 3m by 3m to allow a horse to be turned if necessary.
- Treads should aim for the optimum length of 2m in locations likely to be well used by all abilities.

If insufficient space is available to gain required height then alternate shorter tread with 2m tread as follows:

- Minimum length 0.5m for one tread between 2m treads
- Minimum 1m length each for two treads between 2m treads
- Minimum 1.5m length each for three treads between 2m treads

Riser height optimum 150mm at sites well used by all abilities. If insufficient space is available to gain required height then alternate risers may be increased as follows:

- Maximum 200mm for maximum of three consecutive risers
- Maximum 300mm for maximum of two consecutive risers
- Maximum height 450mm at remote sites and only with a 2m tread below the 450mm riser

To increase height gain for length, treads may slope slightly towards the front.

The higher the riser, the deeper its supports need to be to stay firm. This may not be possible in some locations.

If it is necessary to have more than one flight with each flight turning back on the previous, the turning area should be 3m x 3m.

Some, but not all, horses can cope with shorter steps, particularly going uphill; therefore any reduction in this specification should only be with approval of the local BHS representative and in exceptional circumstances. Shorter or steeper steps must only be used where there is no option but to create a potentially one way (uphill) section with an alternative descent.

Note that particularly on steeper gradients, a horse may trot or canter up steps to maintain impulsion. This is partly because the sequence in which its legs are used makes it easier than in walk, so it is a natural response of the horse.

Mounting blocks will be welcome if the gradient is such that riders may feel safer leading rather than riding their horse.

Recommendations for a common backfilled timber frame construction are:

- Use hardwood for the frame, especially the riser, e.g. railway sleepers, rather than softwood which is more likely to splinter if caught by a horse's hoof.
- Ensure the supports for the risers are deep to avoid the riser being pushed forwards – the higher the riser, the greater the load against the riser may be (depending on the area of the tread).
- Consolidate the backfill thoroughly and ensure a good layer of fines. As with steps on a footway, erosion at the point of impact coming down and going up need extra attention to ensure hollows do not form with use. Impact increases with gradient so greater attention may be needed to construction and maintenance with steeper slopes.
- Provide for drainage and run-off to the side to avoid cascading down the steps.

If a handrail is desired for pedestrians, the available width for horses should be at least 2m otherwise there is a risk of the rider's foot or leg catching the handrail, potentially with serious injury. A handrail acts like a fence alongside the bridleway and such a situation would normally require at least 3m width to allow users to pass one another in comfort and to avoid a rider being too close to the fence (handrail). For only a couple of steps, the greater width may not be necessary but a longer flight with limited width may need passing places or open ground to one side of the steps without a handrail.

Steps in upland or remote areas

On steep slopes, many horses will tend to descend partly sideways rather than straight, at a roughly 45° angle, and back legs are likely to slide which can cause erosion. It may sometimes be necessary to construct steps to reduce erosion.

Steps in remote areas or a more challenging environment may be very different from in a highly used area. In remote uplands, riders and horses are more likely to be able to cope with steep gradients and higher steps, as will occur naturally in terrain down to bedrock. When improving such a route or incorporating steps to reduce erosion, it is the length of a horse which is most commonly forgotten by those unfamiliar with horses and the fact that it has four feet to accommodate. The following are recommended:

- If possible, study how horses move on slopes and how much space they take up.
- Aim to produce a variety of heights and lengths, as would occur naturally in a large scale version of the stone pitching that is used on some upland paths.
- Step height should not exceed 450mm and this height should be occasional, not every step.
- A high riser must have a long tread below it as it will be most difficult to descend and a horse may try to jump it.
- Leave an area big enough for a horse to have all four feet on one level every several steps to provide relief from the strain of having front and back legs on different levels – this usually works well as the long tread below a high riser.

Crossfall

Generally, a crossfall up to 1:10 is less likely to cause problems of slipping and erosion and is therefore acceptable, although this is dependent on drainage and soil type. Greater than 1:10 will need consideration of location, circumstances and likely use, particularly where this is a proposed diversion or a route used by horse-drawn vehicles. Where crossfall is greater than desirable on a new route which offers an off-road alternative, this may be accepted, however, some earth-work to reduce the crossfall would likely be beneficial to reduce future maintenance.

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