Advice on

Bridges, gradients and steps

The British Horse Society

The law and management of public access rights vary widely between the four countries of the United Kingdom. Practical elements of the following advice apply in all of them but the legal requirements in Scotland and Northern Ireland may differ from those in England and Wales.

More advice is available on www.bhs.org.uk/accessadvice.

IMPORTANT This guidance is general and does not aim to cover every variation in circumstances. Where it is being relied upon, The Society strongly recommends seeking its advice specific to the site.

Contents

Bridges

Bridge specification for use with horses Over Watercourses (ditch, stream or river) * Detail in following sections							
Route	Span	Deck height	Width	Parapet Height	Infill Height	Kickboard	Kickboard /Infill Uplift
	< 3m	< 1m	2m	1.2m*	0.6m	250mm	25mm
	< 3m	> 1m	3m*				

Any route used with horses over water or bog	3–8m	< 1m					
	> 8m	< 1m	4m if no parapet	N/A			N/A
			3m with parapet	1.2–1.8m*	0.6m		25mm
	> 8m	> 1m	4m*	1.8m*			

Bridge specification for use with horses Over Roads and Railways * Detail in following sections						
Route	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	N/A

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

All elements marked with * are explained further in the sections below

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 of the deck, what is being bridged and, most importantly, a horse's line of travel relative to the parapet. A railway or fast road with a high span may need solid infill and more substantial or higher parapet than a low span over a stream or minor road. Similarly, the length of the span, the width of the deck and other users, who may affect preferred line of travel, will also affect the need for parapets.

Parapets on bridges are usually designed to prevent a pedestrian or vehicle from leaving the bridge 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.

The psychological benefit of higher parapets is inestimable and can be achieved by wire mesh suspended from cables. 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 knees 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.

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. A person driving a horse may be further from a parapet than a rider, but observation suggests that unless avoiding oncoming traffic (such as on a road), an equestrian is most likely to take the centre line of a bridge.

For a bridge over a dual carriageway, the Society recommend a parapet height of 1.8m if a horse's line of travel is likely to be 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 with low incidence of other users where an equestrian may take the centre line. Alternative measures on carriageway bridges with lower parapets may include warning motorists of oncoming horses in the centre of the 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 on a navigable river, road or railway. Solid infill of parapets to obscure their view may be desirable in some situations.

Solid infill may also be desirable on parapets on ramps parallel to a railway line or motorway on the rail or the road's side of the ramp.

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.

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 prefer to dismount and lead across the bridge (see BHS Advice on Mounting Blocks), however, this should always be the rider's choice, not a requirement to dismount, as some will feel safer mounted or may need assistance to dismount and mount. Equestrians continually risk assess their route and will take all precautions to avoid distress to their horse; their actions or preference may vary depending on conditions.

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 2.5m 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 will not have enough 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 surface should be non-slip to both shod and unshod horses.

Decking should be substantial and non-echoing, ideally without gaps in the decking through which the river, road or railway can be seen by a horse.

Stone mastic asphalt should be avoided as it is too likely to be slippery or become slippery to horses.

Wood can be 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 but it will need frequent replenishing although it can be effective for months, depending on the environment and level of use.

Wooden or recycled plastic struts may be screwed to sloping decks, but water and organic material tend to 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. Struts should be frequently inspected to ensure they are secure.

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 polymer which forms a pouring compound, which is spread and levelled. For a bridge surface, it need not be thick. Grit and rubber options may be used on a central 1m strip rather than the full deck width if necessary. Pedestrians on bridges often walk by the parapet to look over, but equestrians are more likely to use the centre of the deck.

Steel is noisy, which could be alarming to horses and can be deafening with a couple of steel-shod horses, which is unpleasant for the horses, riders and other users, so should be avoided. Polymer bound rubber crumb (poured and levelled) and rubber compound setts, tiles or sheets have been successful in deadening sound and making the bridge seem more solid as well as providing a non-slip and comfortable surface for all users. Attention to the design of the deck's surface below the rubber to ensure drainage is adequate to prevent standing water and rot of steel or wood is essential.

Load

Horses vary in mass from about 200kg to a tonne. The most common range for riding and driving 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. The weight and force distribution is not equal between fore and hind legs.

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

Gates and other hazards

Bridges should never have gates at their ends unless they are at least 3m wide, so that a horse ridden onto the bridge may be turned to stand parallel to the gate to close it (or to open it if leaving the bridge. Bridges less than 3m wide which need gates to exclude livestock will need the gate situated in a fenced area of 4m diameter or square to provide manoeuvring space (6m length on a route used with horse-drawn vehicles) at the end of the bridge.

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.

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 considered 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 unacceptable because a horse would have to jump in or out with high potential for slipping or falling. It is also likely to cause erosion of the bank and riverbed. For a watercourse in a remote location it may be acceptable if the level of use will have negligible impact and if users are likely to have encountered equivalent terrain to reach the ford, however, such decision should only be reached after consultation with the BHS or local riders.

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.

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, but a single wide low 'pipe', effectively a very low bridge, might be accepted in specific conditions.

Gradients

Steep gradients are not necessarily a limiting factor for horse use but, as for pedestrians, will of course compromise accessibility of a route or site for some. 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 can be feasible on a bridleway but greater space at any level will be required than for pedestrians. They are not feasible on a route open to horse-drawn vehicles. Polymer-bound rubbercrumb-grit compounds have been used successfully on steep slopes to reduce erosion, with cross-gullies into the substrate filled with the porous rubber mix.

Ramps

For general purposes of a built path, such as a ramp for a bridge, a gradient of 1 in 12 is the accepted maximum for people in mobility scooters, which is rightly applied across all users to ensure accessibility. However, where a ramp is recognised as unable to accommodate mobility scooters, and a compromise is necessary to facilitate access by a majority, a gradient up to 1 in 7 can be feasible for horses, depending on location, but the steeper the gradient, the more the nature of the surface is crucial to provide good grip, to reduce impact on joints, and sliding on descent.[1] In exceptional circumstances, a ramp steeper than 1 in 7, with appropriate surface (bound rubber-crumb compound for safety) may be acceptable for horses if wheeled users are not a priority in that location.

[1] There are historical rights of way and roads in hilly districts at 1 in 3, which are accessible by horses, however, this cannot be considered acceptable a norm for a ramp. A new ramp greater than 1 in 7 should only be considered on a public right of way in exceptional circumstances because of its potential to limit accessibility for all or to impose a condition of one-way use only.

Account must be taken of the topography and conditions of the area and discussion between the Society and the highway authority is essential. Compromise may be possible where there are no alternatives, particularly with close attention to an appropriate 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 even be considered, there are significant site constraints. Steps are a 'last resort' because they discriminate against many users, including some riders, whose horse may not have capacity for steps. Steps are not feasible on routes open to horse-drawn vehicles. Consideration should be given to the widths needed to safely pass other users or to turn a horse mid-flight of steps. Turning is likely to require a 3m x 3m area for safety.

Ideally, steps should be no less than 2m wide with frequent passing or turning places, but that is dependent on the site, its level of 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.
- 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.

Treads should be no less than 1.7m long (toe to heel of tread), depending on the number of steps and the terrain of the route. At sites likely to be well used by all abilities, 2m is optimum. One or two steps in isolation are different from a longer flight and a shorter tread may be acceptable, depending on the location and use.

For a flight of three or more steps, if insufficient space is available to gain required height, then interspersing shorter tread with longer may be acceptable, after consultation with the BHS, as follows:

- Minimum 1m length treads between 1.7-2m treads
- Minimum 1.5m length each for three treads between 2m treads

Riser height maximum 150mm at sites likely to be well used by all abilities.

170mm may be acceptable in some locations, depending on the likely use and surrounding terrain.

In exceptional circumstances, if insufficient space is available to gain required height, then some risers may be increased up to 200mm, for no more than one-in-three risers, and should only be considered in consultation with the BHS.

Increasing riser height means greater tread length is needed so is rarely a gain, and reducing tread length is usually preferred over increasing riser height in exceptional circumstances when a compromise is required.

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

The 'spacesaver' design for pedestrians does not work for horses (two adjacent parallel narrow flights which are offset vertically by half the tread height, with each foot following its own flight).

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

Some horses can cope with shorter steps, particularly going uphill, but most cannot downhill. At a site where the above guide does not appear feasible, alternatives should be considered with the BHS. 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 and should be considered exceptional circumstances as they will discriminate against users.

On steeper gradients, a horse may trot or canter up steps to maintain impulsion and because the sequence in which its legs are used may make the faster pace easier than in walk, so it is a natural response of the horse.

Mounting blocks will be welcome if the gradient is such that some 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 misunderstood by those unfamiliar with horses, and the fact that it has four feet to accommodate. The following are recommended:

- Study how horses move on slopes and how much space they use.
- 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 150mm. Greater than this height should be occasional, not every step.
- A riser of more than 150mm should 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 higher riser.

However, sometimes limitations of a site indicate higher risers or shorter treads, in which case, the BHS should be consulted on options available.

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 surface 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 with 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 earthwork to reduce the crossfall would likely be beneficial to reduce future maintenance. Natural surface with short grass is likely to be most acceptable. The best alternative is resin or polymer-bound rubber-crumb-grit compound. Asphalt or concrete with a crossfall greater than 1:10 is absolutely unacceptable.

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