Advice on

Surfaces for routes used with horses

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.

Riders and drivers of horses are referred to generically as equestrians.

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.

Inclusion of a type of surface **does not necessarily infer recommendation by the BHS**. The most appropriate surface will always be site-specific.

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Definitions

Multi-user route: includes all classes of highway available to horses – bridleway, restricted bridleway, byway open to all traffic, general purpose road (surfaced or unsurfaced) – and permitted routes (e.g. local authority rail trail or 'greenway').

Overview

Many rural multi-use paths have a sward of natural low vegetation, some with stretches of beaten earth with or without some stone embedded in the surface, depending on use and history. These unsurfaced paths are ideal for use on foot, horse and off-road cycle and capable of sustaining such use if they are adequately drained and kept clear of excess vegetation (overhanging and surface).

The level of intervention or maintenance required to establish or maintain natural paths is closely related to topography, underlying geology and drainage. On many paths, regularly cutting vegetation well back and maintaining drains will avoid the need for more extensive works.

On free-draining soils, artificial surfacing may be unnecessary as the track will usually remain useable even where farm traffic or other use causes minor erosion. Extreme erosion from heavy use may justify intervention by consolidating the existing surface or preventing material being carried away, rather than introducing artificial surfaces.

On all soils or substrates, even poorly draining ones, successful drainage is often a cheaper, easier and more sustainable way to resolve poaching, erosion or other issues than artificial surfaces. The benefits of attention to drainage cannot be over-emphasised.

Where the soil type is clay, or drainage cannot be improved and use is higher than the surface will bear without poaching, then artificial surfacing may be required for the route to remain passable for all users. If a badly poached or rutted surface dries at some times of year to resemble deeply uneven rock, this too may need attention as it is unpleasant and potentially dangerous for all users.

Successful construction and maintenance of multi-use paths will be aided by an understanding of horses, their physiology and action; the effect that horses may have on a surface, and the effect of a surface on a horse.

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Facts about horses

Horses vary in size and mass between breeds. A small pony (less than 1m high to its back[1]) will weigh about 200kg; the largest draught type horses (1.9m) may be a tonne. These are extremes and the most common range for riding and driving will be 350 to 700kg (1.1 to 1.7m high).

The weight distribution of a standing horse on level ground is 30% each fore leg, 20% each rear leg.

In walk, the peak force on a foreleg is about half the bodyweight so about 2,500N in a horse with 500kg body mass; at maximum speed, about 2.5 times bodyweight, so 12,500N, however, that peak force is momentary and quickly passes to another limb even in walk, where three limbs are in contact with the ground at any time but are not synchronous. In trot, because alternate fore and rear legs are in synchronous movement, it could be said that the peak force moment would be 8,333N (fore plus rear forces), but it is quickly passed.

Guideline values	Walk	Trot	Full gallop
X bodyweight	0.5	1	2.5
Peak force fore leg (500kg body mass)	2,500N	5,000N	12,500N
Peak force rear leg (500kg body mass)	1,666N	3,333N	8,333N

A horse's hoof may vary in size from 100mm to 280mm diameter.

The hoof comprises an insensitive outer layer of horn, which surrounds and protects sensitive inner structures. Many horses in regular work are shod with metal shoes to protect the bearing surface of the hoof wall from excessive wear but unshod horses are common where the amount of roadwork they do is limited (tarmac quickly wears away the hoof). Shoes, especially when well worn, can slip on some artificial surfaces depending on the polished stone value of the surface.[2]

The sole of the hoof appears hard but is thin and easily bruised (comparable with human nails). On flat, compacted surfaces it will not contact the path surface because of its natural arch, but on unconsolidated stone surfaces sharp edges of stones may protrude

[1] The height of horses is measured to the withers; the part of the spine in front of where a saddle sits, at the bottom of the neck/mane, which is the highest static point as the head and neck are very mobile and can rise to nearly half body height

[2] Common measurement of slippage but no record of it being measured for horses has been found; it generally relates to motor vehicles

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into and bruise the sole of the foot, causing lameness. (Put pressure on your nail with a stone to feel what it may be like.) Any loose stone surface, even rounded pea gravel, may be uncomfortable for horses.

Loose stones may also become wedged between the shoe and the sole, exerting painful pressure on the underlying tissues. Infection within the hoof resulting from stone punctures or bruising to the sole can cause serious problems requiring veterinary attention. A stone-free surface is therefore preferred to avoid injury to horses.

An increasing proportion of horses are not shod at all, or shod on only fore feet. Stony surfaces will therefore exclude some horses because walking on them is painful (think of walking barefoot on gravel or shingle). Some surfaces, especially aggregate or grit or with proportions of aggregate or grit at the surface, can be very damaging to unshod horses' feet.

The level of concussion to both the hoof and horses' legs increases with the hardness of the surface and with the speed at which the horse is moving. This is exactly comparable to humans—running on a pavement transfers a lot more stress to the bones, joints and soft tissues than running on a grass sward, with typical increased wear and risk of deterioration and injury—therefore, equestrians favour surfaces with some 'give' where possible. Even walking as a pedestrian or horse puts more stress on joints on asphalt.

The greatest risks for horses are:

- Slippery sealed surfaces such as tarmac or concrete
- Hard surfaces which cause concussion through joints
- Sharp stones which may bruise, puncture or damage the bottom of hooves
- Boggy ground, holes, rough ground (e.g. badly poached and dried clay or ploughed earth) or deep mud in which they may sprain or break a leg

Ideal surface

The ideal surface preferred by riders and drivers of horses will is:

- Non-slip
- Resilient, with some give (10 to 30mm at point load)
- Well-drained
- Adequate bearing capacity to avoid erosion or poaching

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- Free from stones, especially if angular or sharp edged

This is met by short, firm, well-drained grass sward.

Surface types

Types of path surface, in descending order of preference, are:

- Short, firm, well-drained grass, which is ideal for horses and pedestrians, and usually firm enough for cycles and horse-drawn vehicles.
- Vegetated paths on a firm base such as grassed over forest roads or disused railway tracks stripped of ballast to expose consolidated ash solum, which are ideal for supporting year-round multi-use, provided they are well drained.
- Paths where the natural vegetation is protected or reinforced by some type of partial surfacing, such as embedded rounded stone.
- Formally constructed paths with firm, non-slip surface (not asphalt)

Where the existing surface is well-drained grass which is resilient to use, change to any kind of stone or hard surface is disadvantageous to horses and probably pedestrians, as well as having an impact on the natural environment.

Sealed surfaces may be considered necessary to facilitate cycle or wheelchair access, but the finished surface must not be hazardous to horses (see Bituminous Surface Treatment page 13). Where it has been decided that a hard surface is required, retention of short turf over part of the width for those users who prefer softer surfaces should be accommodated, particularly when the change is to a surface which is currently ideal for horse use..

Hard surfaces

On paths where horses are legally included and may be a common user, particularly bridleways and restricted byways, a surface more appropriate to their use than to motor traffic should be provided. If other users are in the majority, then a solution, in consultation with the BHS, may be agreed to provide an appropriate surface for all users or parallel surfaces for different users.

The BHS has found polymer-bound, rubber-grit compounds to be the most successful in providing resilient, free draining, smooth surfaces which accommodate all users throughout the year, particularly in providing a comfortable surface for pedestrians,

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horses and dogs, as well as good for any non-motorised vehicle. They have the additional benefit for all users of being much less prone to hazard from ice and heat or puddles.

On paths where a hard surface is necessary for motor vehicle access, a grass or other vegetated central or parallel strip offers a better surface for horses while providing reinforced wheel tracks and offers a good compromise solution. It is important that the unsurfaced strip has even ground and grass growth is managed by use or cutting because if it obscures potential hazards riders are less likely to use it. It must be free from loose stones or debris that could be a trip hazard or cause injury. Care must be taken during maintenance of the hard surface that spoil or debris is not dumped on the grass strips.

On cycle tracks or permissive paths where horses are included as vulnerable road users but are not the majority user, a less than ideal equestrian surface may be acceptable where such a path gives equestrians a new route free from motor traffic.

Bound rubber-grit has been used very successfully to provide a bound surface that can look like tarmac, is easily used with cycles and wheelchairs but is also excellent under foot for pedestrians and horses as it has some 'give'. This is a surface that the BHS recommends for multi-use paths where a bound surface is necessary. As this material becomes more used, its price is reducing and in 2018, it was found cheaper than tarmac at one site; in 2025, cost was comparable to tarmac but its lifetime and guarantee are greater than tarmac.

Surface options

NOTE: Inclusion here does not necessarily constitute 'recommendation' by the Society; the following is simply a consideration of common options. What is appropriate will always depend on conditions and normal use at any individual site and we strongly recommend consultation with the Society when a change in surface is considered.

Grass

Grass paths should be the first choice for multi-use as best for the environment as well as most users, but sustainability depends on drainage and soil type. Regular use will help maintain a short sward suitable for all users, and provided trampling from use does not exceed plant growth, no maintenance will be required.

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Some mixes of grass species are more resistant to wear than others. Annual meadow grass is one of the most resistant species and can be introduced to or the proportion increased in most swards to improve wear resistance (subject to conservation controls). Usual treatments for grass sward—aerating, scarifying, fertilising, rolling and mowing—can make the sward stronger and denser.

Where use is high and vegetation is unable to keep up with wear resulting in deterioration of the sward despite attention to drainage and the sward quality, artificial surfacing may be required.

Well-drained short grass can provide a suitable year-round alternative parallel to a surfaced path, but it will be avoided if boggy or litter-strewn or where hidden hazards may be concealed by long vegetation. Equestrians will avoid vegetation that may obscure holes, drainage channels or debris because of risk of injury to the horse. Mowing may be necessary where use is insufficient to restrict grass growth.

On vehicular tracks a grass or other vegetated central or parallel strip offers a better surface for horses while providing reinforced wheel tracks. If the grass growth is not controlled by use or cutting, equestrians may avoid it, if it grows long, in case of obscured hazards.

Reinforced grass

Grass-gravel paths are where the turf is reinforced by gravel or small aggregate embedded in the earth and can offer a semi-natural path ideal for all users, with the stone providing increased resilience to wear.

- The proportion of aggregate depends on drainage, soil-type, density of sward and amount of use. 30% aggregate to 70% soil/turf is a reasonable starting point.
- For existing sward, it can be enough to distribute the aggregate and roll it in when the earth is soft enough for the stone to be easily embedded; ground conditions for success are critical.
- For a new surface, distribute aggregate before covering with soil-seed mix and managing (i.e. watering/protection) until sward established. A geotextile below the earth-gravel-seed mix may be required to allow for establishment of the sward before the soil is washed into the substrate.
- Ensure no sharp stones at surface with either method.
- Aggregate proportion can be increased in wheel tracks or wet patches, rather than a uniform high proportion where unnecessary.

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Reinforced (geocell) grass paths are where cellular grids of plastic or concrete (geocell) are filled with earth, gravel or rubber-crumb. If filled with earth and planted or seeded, the resultant turf may be protected from excess wear, especially by use with vehicles, because the grid spreads the contact and prevents poaching. The grass can be mown on a high setting, as with no reinforcement, and the grid can be almost undetectable. Its success depends on the drainage of the subsurface and earth, being laid level, the degree of wear, and quality of turf, which will be affected by the competency of the installation, sward establishment and subsequent maintenance to ensure that contents of cells remains level with the top of the cell walls.

Geocell may also be used simply to confine aggregate on a difficult surface or to provide a temporary route for construction traffic without intention of it being vegetated, however, unless backfilled to the top of the cell walls, and maintained as such, walking on the protruding grid walls can be painful and hazardous.

If considered for use where there is horse access, care must be taken to identify a product with cell walls which are not slippery for horses. The cell size must be no larger than about 100mm so that if the earth contents erodes, the cell will not form a hole which could trap a horse's foot. The cell contents should be frequently checked and topped up if necessary to ensure it is as high as the cells to provide a safe path for horses.

Geocell is unlikely to be appropriate for use on a gradient or significant crossfall because the slip-hazard of the cell walls is increased, and can simulate a ski slope for any user.

Soil reversal is a technique that inverts the soil, burying the top soil, with sub soil on the surface which is then profiled to provide drainage and base for a new surface, sometimes stone or stone on geotextile, or left as a natural surface to vegetate. It has been used successfully on many bridleways over poorly drained peaty ground in northern England.

Unconsolidated surfaces

Woodchips, sand and recycled materials such as shredded tyres, chopped plastic cable casing, and synthetic fabric scraps with sand, can be useful for horse-only routes when laid on a well-drained substrate. They may require regular top up unless provided with a border to contain the material within the path width as it is unbound. Woodchips can rot quickly in damp conditions. Loose material surfaces are not recommended except on a horse-only route with maintenance commitment.

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Care must be taken to ensure there are no metal or other foreign parts included in the material.

Rubber

Bound rubber-grit has been used very successfully on routes used with horses, even on a 1:4 gradient, with a lot of horse use, where erosion was previously a problem. It provides a firm, bound surface that can look like tarmac, is easily used on wheels but is also excellent under foot for pedestrians and horses. It has many advantages over asphalt. This is a surface that the BHS has found optimal for all users on multi-user paths where a natural sward surface is not sustainable.

Rubber mats, blocks and pavers or hot spray application have been successful in many equestrian applications around racetracks and training yards. Hot laid applications are expensive and of relatively short life, but may be a solution for short stretches such as a bridge or ramp where mats or pavers may be harder to fix in place. On inclined surfaces, consideration must be given to the force of hooves which will be much greater than on the flat. Applications will need to be secure so that they do not tear away from anchor points (mats will need reinforced anchor points) or separate from the sub surface (spray or pour applications need applying carefully in conditions compliant with the manufacturer's instructions).

Aggregates

Self-binding gravel is a specific type of quarried aggregate which comprises minerals and particle-sizes in proportions that consolidate when laid correctly and hold that form. Hoggin was originally a name for a specific product, but appears to have been adopted as a generic term for self-binding gravel.

Self-binding gravels can be successful for horse and pedestrian use, providing a surface with more give than a sealed surface, at the same time as being feasible for light vehicle use. It is preferable to a sealed surface when a grass sward is not sustainable.

Care may be required in the first year of use in gateways or inclines where horses' hooves may loosen the surface because of the nature of their movement when manoeuvring for a gate or up or down a slope. Periodic compaction over the first year may be required to ensure the surface does not loosen and degrade.

Examples are Breedon gravel, Coxwell gravel and Fittleworth Stone but their availability varies because of high demand and limited sources. It appears that the best sources for

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self-binding gravel have been exhausted, and the products now available produce variable results, not always successful, so may not be appropriate or recommended.

In Cambourne, Cambridgeshire, a new peripheral bridleway was surfaced with hoggin mixed with topsoil, with a french drain to one side, and has provided an excellent surface for all users with a high level of use. There has been little deterioration over several years and low maintenance demand. Local comment is that 'verges' of at least 1m usable width (i.e. free from overhanging vegetation or crossfall) in the specification would be beneficial. The hoggin width is 3 to 4m depending on popularity of the section.

Hydraulically Bound Material (HBM) is sometimes described as a self-binding gravel but where used, it has either been a base course or has formed a sealed surface, which is likely to be slippery for horses so is not recommended. The Society is not aware of any site where it has produced a self-binding gravel result.

Quarried aggregate without a consolidated dust wearing course is inappropriate for multi-use paths because angular stones will damage horses' feet and may result in serious lameness. Where it is used as a substrate or structural layer, the surface must be finished with 75-100mm depth compacted MOT type 1 (40mm-dust) dressed with dust to fill the spaces between the stones and consolidated to withstand rainfall.

Aggregate surfaces may occur naturally or where erosion has removed an upper surface layer. Such a surface is 'out of repair' as it limits use by natural and legitimate users (horse riders) and should be topped off with a consolidated dust layer.

A specification for an aggregate surface should always include clauses for topping-off as required to a uniform consolidated dust finish and checking after so many months with subsequent top-off as appropriate. This is because aggregate quality is variable; it may settle in transit to give inconsistent levels of fines throughout the laid length of track or may wash through if there is heavy rain before consolidation.

Any new construction or path restoration project should always provide a finished surface to this standard. It is not acceptable to leave an unconsolidated surface of stones following work. Any stony tracks may need improvement by topping-off with consolidated dust to avoid injury to horses.

Rubble or similar recycled material may be used as a substrate but must be finished with a wearing surface as for aggregate. It is very important that it is 'clean', i.e. not contaminated by material such as wire, glass or nails that could work to the surface and cause puncture wounds or trip hazards. Specifications should state non-recycled MOT type 1 or clean rubble as a requirement.

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Chalk is an exceptional quarried aggregate as, being soft, it compacts well and creates its own binding surface with consolidation. It forms an ideal well-draining surface where it is locally available but it is unlikely to be feasible to use chalk in areas where it is not local. It can form a surface 'soup' in damp conditions which is messy for all users.

Road planings (skimmed road tarmac arisings) have been used successfully to form a base course, but results are variable and there are as many failures as successes. As with any aggregate, it must be bound to dust with smaller particle material so there are no sharp fragments at the surface unless it is being topped with soil and expected to vegetate. Planings can be worse than quarried aggregate in being sharp and injurious for horses' hooves, especially barefoot horses.

Planings are often seen as a cheaper option than new aggregate, but must be screened to ensure there are no metal, glass, wire or other foreign bodies included in the material. A surface course on top of the planings as base is still required, as with any aggregate.

Where the wearing course is loose enough to encourage light vegetation, it can be a reasonable solution for all users and is popular for railway trails as it provides some give for horse and pedestrian use but is still smooth enough for cycling or mobility vehicles. In some conditions, relying on leaf mould and nature to soften the surface can take too long so must be assisted by spreading a soil-seed mix in temperate conditions to encourage vegetation.

Planings may consolidate when laid in hot weather, or with heat or compression treatment or added bitumen, to form a sealed surface. The Society recommends against this result because it is again asphalt which is the worst surface for horses and is likely to be a particularly slippery form of it.

Stone flags, setts and concrete

Stone flags have been used historically (and more recently, recycling flags from disused mills) to provide safe paths across boggy uplands. There is a danger where such paths are narrow if the ground immediately next to the path is boggy and a horse could step off the path when attempting to pass others. Additional flags or other hard surfacing should be used to create passing places wide enough for users to comfortably pass each other or for a horse to turn if necessary on long sections or where the full length cannot be seen. Ideally users should be able to see before setting foot on the flags whether the next section of the path is clear.

Setts are dressed stone or concrete blocks placed close together (like modern block paving) on a well-drained sub-surface, with open joints (not grouted or mortared).

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Whether they are appropriate depends on the slip-factor of the stone or concrete for horses. Cobbles are large rounded pebbles set into mortar or concrete and are unlikely to be considered as a surface today because of their challenge to accessibility and any wheeled user.

Concrete gives highly variable results depending on its composition and it can become slippery. Consequently, the Society would recommend against it as a new surface unless approved in specific circumstances. Only the specification of concrete that is most likely to be safe (see below) should be used in those circumstances. Remedial action will be required if the surface should become dangerous, which could be more costly than using the specified mix.

The concrete mix most likely to give a safe surface is RC 35/45 CEM1, without added water, as it is least likely to polish and become slippery. The final tamped and highly roughened surface should be covered to cure slowly and completely. A lower quality concrete may either become polished mortar or, if the aggregate becomes exposed, the aggregate may polish to become slippery. Some gravel aggregates are more likely to become smooth with wear. Crusher run carboniferous limestone or granite is more likely to remain rough even if partially exposed. Aggregate of high Polished Stone Value (gritty when worn) should be used if there is risk of the mortar wearing.

Concrete which has become slippery can be treated with machinery to roughen the surface by cutting grooves, sometimes in a set pattern of squares or a technique known as scarifying. This is common on dairy farms where slurry degrades the concrete and it has been successful even on slopes. Scarifying machines vary from the size of a domestic lawnmower, to equivalent of an agricultural machine mounted on a tractor, or a dedicated unit, with less severe results from the former.

If concrete is required for vehicular access, a safe surface in between concrete wheel tracks or alongside a concrete track may be a solution to preserve safe access for the public, especially equestrians as horses are most likely to slip.

If use of concrete is unavoidable for short distances, such as a bridge or its transition ramps, then care must be taken to ensure the surface is well roughened and ridged across the width by hard tamping (raising and lowering the compacting beam). Brushing does not usually give a durable rough finish. The need for scarifying in future should be taken into account for maintenance plans, especially in damp or shaded environments.

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Concrete blocks, paviours, setts or bricks may be slippery for horses unless the blocks have been specifically made with high Polished Stone Value[3] (PSV: a high PSV is gritty when worn, a low PSV is very smooth and potentially slippery). The quality of cement used in manufacture can also affect slip hazard, as in concrete slab above. It is important to check with manufacturers that blocks sold as non-slip are non-slip to shod and unshod horses as well as to vehicles and pedestrians. Usually on vehicles will have been considered.

Asphalt, macadam or bituminous mastic ('Tarmac' or 'Bitmac')

Asphalt is unlikely to be accepted by the Society where it is proposed to replace a grass or other resilient natural surface which is currently satisfactory, or any surface which has some 'give', such as consolidated stone with dust binding. This applies whether across the full width of a route or removing an existing softer central strip between wheel tracks.

Any change to the surface of a bridleway or byway requires authorisation of the highway authority, whose officers should be alert to the impact on horses and equestrians. The Society **welcomes consultation before** a change of surface is planned to ensure that an appropriate solution for all is identified.

The Society's acceptance of asphalt for **new access for horses**, where asphalt may be appropriate for the majority user, **does not confer acceptance of asphalt for bridleways and byways which have historically had an unsealed surface** or where non-tarmac would benefit other users too.

The argument from people wishing to change the surface of bridleways to asphalt for vehicular use is usually that equestrians use roads, so asphalt on bridleways is fine. This fails to consider that most roads used to be unsurfaced bridleways but were 'improved' for motor use and equestrians have no choice but to use them to reach the remaining bridleways, which may be few and far between. That makes bridleways and byways with natural surfaces even more valuable as relief from tarmac, which may be slippery, overheated or icy, plus it limits choice of pace, which affects fitness and wellbeing of both horse and rider.

[3] Polished stone value is only measured in relation to motor vehicles but a higher PSV has generally been found to also be less slippery for horses

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Where a route is proposed which will create **new additional access** for equestrians, such as a part of a carriageway set aside for non-motorised users, the need for an asphalt surface for cycling or wheeling is no reason to exclude horses. However, non-slip options should be used, which need not increase expenditure or affect other users.

Bituminous mastic is an industry standard for roads and footways. It is designed to provide grip for motor vehicle tyres, not for shod or unshod horses and causes excessive wear on horses' shoes and barefoot horses' feet. It can be dangerously slippery for horses, particularly stone mastic asphalt, which may increase or decrease as a problem with wear depending on the exact compound in use and its final surface treatment.

Asphalt surfaces consist of a wearing layer of aggregate bound with bitumen. Aggregate and bitumen compounds vary depending on specifications and area. The bitumen forms a film over the stone which is gradually removed by wear.

All asphalt surfaces have the potential to be initially slippery unless appropriate preventative action is taken and this applies even more to horses than to vehicles as the surface treatments are designed for motor vehicles. The result is a surface which results in horses having to proceed unnaturally slowly and carefully, much as a car driver in icy conditions, which is unreasonable.

Where asphalt has been **agreed in consultation with the Society** to be appropriate in specific circumstances, the following specification is less likely to be slippery, but does not remove hazards of heat, ice and impact. Provision of this specification **does not confer acceptance of asphalt** as a surface where it is intended to replace natural surfaces on bridleways or byways.

- PSV above 65, the higher the better to reduce smoothing
- Aggregate size around 14mm; larger or smaller grades have been found more likely to polish with vehicular use and be more slippery to horses

A high resistance to polishing, that is, having a high polished stone value[4] (PSV) means that the stone is more likely to retain a surface grittiness even when worn, and once the bituminous film has been worn by vehicular traffic may produce an acceptable surface, but not necessarily, as wear by wheeled traffic can result in an embedded surface that is more slippery to horses. Embedment due to weight of traffic is a common cause of

[4] This is measured in relation to motor vehicles and is not tested with horses, however, the Society has generally found that a high PSV is less likely to be slippery for horses

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failure of surface dressing therefore any surface of this type must be laid on a high quality base layer.

For motor vehicles, the increased skid potential of the unworn film may be reduced in key areas (e.g. junction approaches) by mechanically removal using grit brushing. This can also be helpful for horses on parts of the surface which are less used with motor vehicles, such as close to the edge of the road, so remain slippery for longer periods. Top dressing with grit on routes used with horses is strongly recommended with attention to the usual path of the horses (i.e. road edge on a busy route).

Stone mastic asphalt is such a problem that the BHS worked with a task group of highway engineers (CSS, now ADEPT) to produce a report 'Horses and Highway Surfacing – A guidance note for highway authorities'. Reported incidents of horses slipping on asphalt have increased since the guidance was published in 2005, indicating that it is a continuing and increasing problem. The report recommends grit during construction (e.g. 3mm quartzite at 1kg/m^2) or post application of dry uncoated grit spread at 1kg/m^2 and rolled with a steel roller to abrade the bituminous film. It is important that the specification to contractors includes such measures as appropriate during construction to minimise the slip or skid incidences.

Hot rolled asphalt is usually better than stone mastic asphalt in terms of slip hazard for horses but is still poor as a surface for use with horses.

Remedial top dressing Where an asphalt surface is unavoidable, a top dressing of grit or spray and grit is recommended.

Calcined bauxite was used by North Yorkshire County Council (Lousy Hill, Littlebeck) on a steep minor road and was very successful. It is now thought to be at least fifteen years old and still good though worn. It is likely that such treatments need repeating periodically depending on level of wear.

A treatment of 10mm close graded wearing course of dry steel slag aggregate applied while the surface was still hot (Middleham, North Yorkshire) was not successful after a few months.

In Dorset, a surface dressing of Colas Cationic Bitumen Emulsion was applied at 1 litre/m^2 with Trent Pea 3-6mm Long Rake Spar aggregate (New Milton Sand & Ballast, Hurn). Method: Spray hot bitumen emulsion over tarmac (asphalt or concrete) surface and evenly spread 6mm aggregate over it; spray a further layer of tar and a layer of 3mm aggregate; roll. With hindsight, it would have been worth increasing the emulsion to 2 litres/$metre^2$ to increase adhesion.

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In Ripley, North Yorkshire, quartzite grit was applied at 1 kg/m^2 to day-old asphalt and rolled with good result at less than £2/m^2.

High friction (for motor vehicles) dressing applied on approaches to some crossings and at 'accident black spots' has been no worse for horses than other dressings, to the Society's knowledge.

Additional ill-effects of asphalt

Asphalt surfaces are non-porous so are profiled to disperse surface water to the sides. Without drainage provision, this can make verges too wet, encourage rank vegetation, and render them impassable for horses whose riders would prefer not to use the asphalt, whether to avoid the slip hazard, avoid other users, or to pass dung off the main track.

Wet ground may dry unevenly, potentially causing injury, especially where ruts and holes are hidden by vegetation, therefore riders will naturally avoid such areas.

Where a shared use track has been surfaced with asphalt with the expectation that riders will use the verge, not the asphalt, but the verge is unusable, riders may then be criticised or abused for being on the asphalt section, causing needless conflict.

The lack of porosity means there is higher risk of ice as well as the inherent slip hazard, which may result in the need for road salt, which affects biodiversity.

Hydraulically Bound Material

Hydraulically Bound Material is not recommended for the same reasons as asphalt – it forms a sealed surface which is injurious and can be as slippery for horses as the worst asphalt.

Considerations for shared use or cycle tracks

Bituminous surfaces consist of a wearing layer of aggregate bound with bitumen. Aggregate and bitumen compounds vary depending on specifications and area. The bitumen forms a film over the stone which is gradually removed by wear. Softer surfaces are more ideal for horses than any hard sealed surface, although where a horse-friendly surface is considered impossible because the majority use is cycling there are ways in which horses can be accommodated so that off-road routes are available to all vulnerable non-motorised users.

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Increasingly:

- Off-road routes are being provided for cycling which could benefit equestrians who are also vulnerable road users; and
- Surfaces of routes with rights for riders or carriage drivers are being changed to facilitate cycling but to the detriment of equestrian access.

This is particularly influenced by current funding initiatives making provision for cycling. However, with more awareness in the planning stages, it is obvious that all non-motorised vulnerable road users can benefit from all off-road tracks and none need be excluded. Importantly, it is sensible and cost-effective to include all who wish to exercise and transport themselves in safety away from the danger and pollution of motor traffic and with care for the environment, rather than only accommodating one choice of transport.

Bound rubber-grit mixes have been found to be appropriate for all users and very acceptable for horses on multi-user paths. Although the initial cost may be higher than for tarmac, it has many advantages in construction, particularly on sites with limited access, and in not requiring edging (unlike tarmac) as well as providing a more beneficial surface for pedestrian and equestrian users without detriment to use with cycles, pushchairs or mobility scooters. Its porosity means it is safer for all users in icy conditions, there will no puddles and dung will quickly wash through. It has a very much longer life guarantee than asphalt.

Where equestrian rights exist, natural surfaces are best managed by drainage, strengthening and unsealed surfacing as appropriate to the local conditions rather than seeking a sealed surface. On shared use routes where this has failed or is judged insufficient, the following approach is recommended:

If a sealed surface is judged to be essential (by the highway authority's rights of way officer), the first choice should be two metres of surface suitable for horses alongside the sealed surface, by dedicating additional width as multi-use path if appropriate.

If it is not possible to have different surfaces alongside one another, then two sealed strips for wheels either side of a central softer strip for horses and other non-wheeled users may be appropriate. This is particularly important where there is tall side

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vegetation,[5] as is often the case with old railways, as it allows the tallest users — the horse riders whose head height may be up to 2.75m — to be in the centre away from the overhanging vegetation. The two sealed strips can also act as wheel tracks for maintenance vehicles and encourage 'keep to the left' use by cyclists. Signs should be used to encourage user separation.

Bound rubber-grit is preferred where a bound surface is required. Where a sealed surface is deemed necessary, care should be taken to make it non-slip for horses by top dressing with quartzite grit or other treatments.

N.B. Constructing a central tarmac strip leaving two narrow verges, too narrow for horses is a common bad practice. It forces all users onto the tarmac strip when they would be better served by a choice of surfaces, each of appropriate width. It may cause congestion or conflict between users and excessive wear of one part of the width. It is much better to put the tarmac strip as far to one side as possible.

In circumstances where equestrians have no access currently, a single surface may be appropriate where a split surface or bound rubber-grit is not feasible, because an off-road route for non-motorised users which includes equestrians is better than leaving equestrians no choice but to use roads with motor traffic.

Construction

Where a constructed surface is required, the three elements of a good multi-use path construction to be considered are drainage, foundation and surface. The factors influencing all three will depend on local geology, gradient, nature of the path (such as holloway, in woodland, open and windy), local materials and use.

Points of particular importance on paths for equestrian use

- Weight of horses and effect of horses' hooves must be accommodated when constructing or surfacing any paths and in ensuring drainage level will be adequate to prevent poaching.

[5] Where trees or bushes overhang the track for more than half its width in total, or have reduced the width, clearing to provide the maximum width will let sun and wind into the track to assist in keeping the surface firm and dry, and improve the available width for all users.

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- Where hard edged drainage grips or cut-offs have been created in the path, the space between the sides should ideally be less than 100mm or more than 300mm to prevent a horse's foot becoming stuck. They should be clearly visible.
- Brash or fascines traditionally used as floating rafts to support paths over wet ground are not usually recommended on equestrian paths because of risk of horses' hooves slipping through surfacing to penetrate branches below, leading to potential injury.
- Free-draining sandy or chalk soils are usually able to withstand horse use without need for surfacing.
- Clay soils are particularly prone to damage by horses. Well-used paths on such soils soon become a sticky mess impassable to pedestrians, cyclists or riders and may still be impassable in the driest weather if a badly poached surface hardens to jagged uneven rock. Clay paths will usually therefore need attention to drainage to avoid areas becoming poached and possibly reinforcement of the surface.

Drainage, foundation and surface

Drainage is crucial to the suitability and longevity of a path surface

If drainage is inadequate or inappropriate, any other work may be completely wasted. This is unfortunately too common, so the importance of getting the drainage right cannot be emphasised enough.

In many situations, attention to the drainage may be all that is required for a considerable improvement. It may be feasible to undertake drainage on a project then check how it works for a period before further work to finish the surface. The need for more drainage work may be identified which can then be undertaken without loss of a new surface (because it has not been laid) or it may become apparent that drainage alone has been the solution, or that less surfacing work than originally planned is required.

Drains take many forms in construction, depending on geology, space, gradient and catchment. For routes used by horses, it is important to remember:

- the much greater weight and point load of a horse compared with a pedestrian or cycle, so more drainage may be necessary for the surface to remain sound; and
- that surface drains, cut-offs or other cross slope structures to slow and divert surface water must take account of hoof size as well as potential as a trip or slip hazard.

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Guidance on drainage and construction of paths is well covered in other documents, including On the Right Track: Surface Requirements for Shared Use Routes (Countryside Agency), Making the Best of Byways (Defra) and Paths for All (produced in partnership with, and available from BHS Scotland bhsscotland.org.uk). However, these publications predate the application of bound rubber-grit compounds to public tracks and this option should be considered when reading older publications.

Once a firm foundation has been prepared a bearing surface layer will be required to spread the loads imposed by horse use and to assist in protecting the foundation.

Cross drains

Cross drains are often required on sloping paths or tracks and can pose a particular problem to horses. It is important that drains are of a construction where a horse's hoof is unlikely to go into the drain and particularly not to be caught by it. Wide shallow drains are therefore safer than narrow deep ones unless the latter are slits or covered, in which case buried pipes are better as covers can be slippery. The sides of a cross-drain should form a concave profile, not vertical and particularly not convex as these are more likely to cause injury (figure 1)

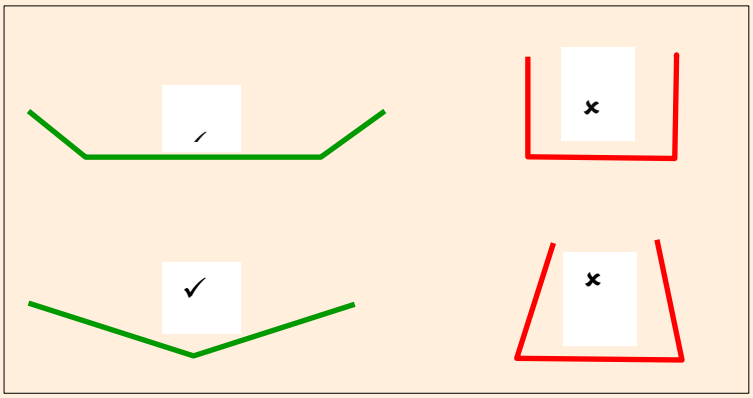

Figure 1 Good and bad profiles

Metal gratings should be avoided as they are likely to be slippery to metal-shod horses and should never extend over the full width of a track. Metal gratings covering a gully across a tarmac road are a common engineering solution. In a case where this is deemed necessary, a 'bridge' should be made of at least 500mm so that horses can cross without touching the gratings or gratings should have a finish which is non-slip to shod and unshod horses.

The wide variety of weather conditions and run-off rates in most areas means that drains will have to be constructed dependent on the requirements of any individual site. A

width between 70 and 200 mm should be avoided as a potential 'hoof trap' unless the drain is constructed with a shallow V profile.

Boardwalk or causeway

Boardwalk is not always appropriate for horse use but some situations have no other solution, although forms of perforated causeway — an embanked path with adjacent pipes for the water laid across the path width, backfilled and surfaced — have been used successfully where boardwalk was also considered.

As with a bridge, solidity and anti-slip finish are important with good landings at the ends, clear sightlines so that any users can choose to wait rather than share the boardwalk or causeway and be of adequate width. 2m is recommended unless the BHS has agreed a lesser width in local circumstances where it is practical. Passing places may be required on long lengths.

Wire mesh must not be used to attempt a non-slip surface as it may catch the nails used in horse shoes. There are grit products which can be applied to boards which are successful for all users, particularly if used from new. A kickboard along edges may increase safety.

Rather than wood, which can be slippery for all users, recycled rubber or non-slip plastic compounds have been used successfully and had greater lifespan.

Stone pitching

Stone pitching is not ideal for horses but may be necessary to provide a firm entry/exit to a ford, and may be the only option on some heavily used steep hill paths. Smaller random (rather than dressed) stones laid to provide a slightly irregular finished surface may provide more grip than large, flat stone faces, but only if the horse's hoof can be placed flat on their top surface. Specialist experience will be required to pitch successfully to accommodate horses. Stone which may become polished and slippery through wear (such as limestone) must be avoided.

Steps

Steps, as for pedestrians, are to be avoided as discriminating against some users. Steps can be used by some horses if the tread is long enough but must only be installed where a ramp, which is better for most users, including those with impaired mobility and cyclists, is not possible. Where steps are the only option, please see BHS Advice on Bridges,

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Gradients and Steps. Steps are unlikely to be accepted as an option except in extreme circumstances and **only following consultation** with the Society.

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