A trial of self-closing bridle gates and a horse-friendly vehicle barrier by The British Horse Society 2011

The British Horse Society






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Summary

Self-closing bridle gates have become increasingly popular with landowners, highway authorities and Natural England. The British Horse Society (BHS) has become increasingly aware of problems and accidents when horse riders negotiate them. In the absence of any formal published trials of self-closing bridle gates, the BHS conducted a trial to identify a commercially available, self-closing bridle gate, installed to comply with British Standard 5709:2006, which closed reliably and which was safe and easy for horse riders to use.

Six self-closing gates were installed in ideal conditions by a competent gate installer, following which, 26 experienced horse riders attempted to ride through each gate and their attempts recorded on video in an initial and main trial conducted in Kent in 2011. The number of attempts each rider took to pass through each gate, whether each gate closed or whether adverse events occurred were analysed numerically. An adverse event was recorded when the gate, gatepost, handle or latch caught the rider, the horse or the horse's tack.

The key findings and recommendations were:

1. Self-closing bridle gates are inherently neither as safe nor as easy to use for horse riders as British Standard 5709:2006 compliant non-self-closing gates and, following the principle of the least restrictive option, should not be used routinely on public rights of way or other land with statutory equestrian access.

2. The Centrewire 'Worcester' hydraulic one-way gate was the best of the gates trialled when set to its maximum closing speed of 26 seconds. However, there were still some problems for riders with this gate.

3. The Centrewire 'Chiltern' two-way self-closing gate as supplied is not recommended for use and should be discontinued promptly.

4. None of the other self-closing gates (the Centrewire 'Henley' one- and two-way gates, the Centrewire 'Chiltern' one-way gate and an unbranded wooden one-way gate) can be recommended in preference to non-self-closing gates installed to meet British Standard 5709:2006.

5. Stockproof handles increase the difficulty of use. Following the principle of least restrictive option, these handles should not be installed except where it can be proved that they are needed and that the need outweighs the potential damage to horse and rider.

6. Further research is required to
   - try to establish an optimum overall closing speed and the best balance between the controlling screws for the Centrewire 'Worcester' hydraulic one-way gate (gate five) which will allow safe and easy passage for riders and their horses but ensure that livestock cannot escape
   - test the Centrewire 'Worcester' hydraulic two-way bridle gate
   - establish whether self-closing bridle gates perform better if they were widened to provide more than 1.52 metres clear width when fully open
   - establish whether the comparative results between the Centrewire gates in this trial

would be substantially different if all or none of the handles were stockproof

- test the gates with users with a full range of disabilities who access the countryside and rights of way in compliance with the Equality Act 2010

7. Pending this further research, if installation of a self-closing gate is essential, without prejudice or liability the BHS found that the best of the existing self-closing bridle gates trialled is the 'Worcester' hydraulic gate, correctly installed as per the BHS gate installation guidelines and BS 5709:2006, set to close in approximately 26 seconds. Mounting blocks should be constructed on both sides of the gateway if the local authority's equality impact assessment concludes that they are to be provided.

8. Because of the problems associated with the majority of self-closing gates in this trial, and because of the manoeuvring space used by riders negotiating the gates, it is very strongly recommended that any self-closing bridle gates which have been installed in conditions which do not provide clear manoeuvring space to the British Standard (including those which self-close only through non-purpose-made offset hinges) and The British Horse Society's recommendations for gate construction should either be repositioned or their surroundings altered so that they fully meet the requirements for manoeuvring space, and adjusted to close as slowly as possible, or be replaced by well-balanced non-self-closing gates.

9. British Standard 5709:2006 requires revision in respect of self-closing bridle gates. The further trials referred to above should be conducted by Natural England, other government bodies, gate manufacturers and landowner organisations, in conjunction with the BHS. Meanwhile it is recommended that the routine installation of self-closing bridle gates should be discontinued.

Background

In recent years, self-closing bridle gates have become increasingly popular with landowners, who are understandably worried about livestock escaping if a gate is not closed properly. For the same reason, self-closing bridle gates have also become the first choice of some local and central government bodies and non-governmental organisations. However, the BHS has become increasingly concerned about the numerous reports of problems negotiating self-closing bridle gates and accidents or near-accidents experienced by horses and riders using them. Riders describe the gates as snapping shut on them 'like giant mousetraps' and as being impossible to open in windy conditions.

Once injured or frightened while going through a gate, a horse will remember the experience. Afterwards, it may then either refuse to go through gates or panic and rush through them, making it more likely that the rider's leg will be caught against the gatepost and possibly the rider be unseated and/or severely injured. Even after months of retraining, some horses will never go through a similar looking gate again without fear. An accident at a gate can also damage the horse's overall confidence in its rider, making horse and rider altogether less safe, not only while negotiating gates, but also in other situations such as in traffic or on a bridge over a motorway.

A previous accident at a gate, or fear of an accident at a gate, leads riders to avoid using routes with gates. Once one horse or rider in a district has been injured by a gate, other riders will understandably be reluctant to risk their horses' and their own safety by using the gate.

It had been difficult to make an objective study of the operation of self-closing gates because of the various different designs and the wide variety of places and circumstances in which they have been installed. In particular, as the installation and location of many of the gates has left much to be desired – for example, lacking sufficient manoeuvring space – it was difficult to establish to what extent it was the gate design and to what extent it was its poor location or installation that was causing the problems. Moreover, a self-closing gate installed on a wind-blown site at the top of a hill may perform quite differently from the same design of gate installed in a more sheltered setting.

The British Standard for Gaps, Gates and Stiles, BS5709:2006, is designed as a generic Standard for all structures on rights of way. At present, all it states in respect of self-closing bridle gates, in addition to the general statements applying to all gates, is (paragraph 4.4d):

> "Self-closing pedestrian gates and bridle gates which do not adjoin roads shall be two-way.
>
> NOTE 1: Gates are normally easier to use for all users if they open in the direction of travel, i.e. they are two-way. This avoids back-tracking to open the gate. It also avoids the risk with self-closing gates of the horse or mobility vehicle being jammed by the closing gate.
>
> NOTE 2: The recommended method of self-closing is by means of purpose made offset hinges."

However, the BHS was unaware of any empirical trials that had taken place to establish whether this was correct or sufficient in respect of self-closing gates.

The BHS therefore decided to run a trial of six commonly used self-closing gates in a single location at which riders would be invited to take part and their experiences recorded. Centrewire Ltd, a gate manufacturer whose products are used by a large number of local authorities and other bodies,

had originally proposed to take part in the trial and supply most of the bridle gates, but subsequently withdrew. The BHS decided to go ahead on its own, which had the advantage that the study was independent of Centrewire, but the charity's funds were limited and consequently the number of gates trialled had to be limited to six. A decision was made to trial the one-way 'Worcester' hydraulic gate rather than the two-way, because the one-way gate was the more likely to be installed near a road, which is where self-closing gates are most likely to be required by the landowner. (Although it did not form part of this trial, a two-way 'Worcester' hydraulic gate has been installed near Funtington in West Sussex and a report of a visit by the trial organiser to this gate appears at Appendix 5).

Finding a suitable site proved difficult. Since a gates trial is not a legally valid reason for installing a row of gates on a public highway, it needed to be off-highway. It also needed to be on land that could be taken out of agricultural production for at least part of the year and was not on a track needed for use by agricultural vehicles. The site needed to be near to where there was room to park horseboxes as most riders could not hack to the trial site. Some landowners and BHS local committees were reluctant to participate owing to concern about potential liability issues, given the reputation of self-closing gates.

Eventually the trial took place in a field in Kent owned by the BHS Regional Access and Bridleway Officer (RABO) for the South East. The BHS North and West Kent county committee and the RABO ran the trial, with advice and financial assistance from BHS headquarters.

Aim and objectives

The main aim of the trial was to compare commercially available, self-closing bridle gates, installed to comply with British Standard 5709:2006, to identify a gate(s) which closed reliably, which was safe and easy for horse riders to use and thus could be recommended for use. In addition, information was sought to determine a gate closing time which allowed gates to close reliably and was safe and easy for horse riders to use. This was achieved by objectives to:

1. determine if the self-closing bridle gates closed and latched reliably
2. determine the safety of the self-closing bridle gates
3. determine the ease of use of the self-closing bridle gates
4. identify the minimum gate closing time as far as was feasible with the bridle gates as supplied

This report does not concern itself with the legality of structures on public rights of way. It is purely concerned with practical issues.

Methods

Gates

Five Centrewire bridle gates and one unbranded bridle gate were installed in November 2010 of which:

- three were wooden gates (gates 1 to 3) and three were metal H-frame gates (gates 4 to 6)
- One of the wooden gates (gate 1) and one of the metal gates (Gate 6) were two-way opening
- The other four gates were one-way opening, including one hydraulic one-way metal H-frame gate (gate 5)

A summary of the gates used, with their commercial names, is given in Table 1. The gates are described in detail, with photographs, at Appendix 1 and their measurements (both from the manufacturer's catalogue and as measured in the trial) are given in Appendix 2.

> NOTE: The results in this trial refer to the particular bridle gates as supplied, and may not necessarily apply to outwardly similar bridle gates, or earlier or later versions from the same manufacturer, where minor differences may have been made to the design.

The bridle gates were installed by Environmental South West, whose clients have included the National Rivers Authority (now the Environment Agency), Devon County Council, Devon Wildlife Trust and North Devon District and Torridge Council. They were installed around the edge of a field in Kent in November 2010 and left to overwinter. All the bridle gates were installed initially in the state in which they were received by Environmental South West from the factory, and to the manufacturers' instructions (where these were provided). The contractor was asked to install and adjust the gates so that they closed as slowly as possible, while still closing reliably. However, with most of the gates (other than the hydraulic gate) very little adjustment was possible if the gates were to self-close.

In accordance with the British Standard for gaps gates and stiles 5709:2006, the bridle gates were all installed on reasonably level ground, with no overhanging branches, no hazards underfoot and ample manoeuvring space. The gates were installed round the edges of the field, at right angles to the hedge or fence, with approximately 1.8 metres of fencing on either side of each gate. The gates and fencing were installed in the land manager's absence, which the contractor said was usual.

After the initial trial day (see trial protocol below), alterations were required to gates 1, 2 and 4 and some oil was applied on the hinges and springs of gates 1, 2, 3 and 4 where necessary to ease operation and ensure that they closed reliably. A major adjustment to the timing of the hydraulic bridle gate (gate 5) was made before the main trial began. The alterations and adjustments made to the bridle gates and the reasons for them are described in the section below on the initial trial and at Appendix 1.

Closing times of each gate from opening to 90° (or as far as it would open in the case of Gate 6, which does not open fully to 90°) were measured on 26 March 2011 and 7 October 2011 and are given in Appendix 3.

Table 1: Summary of bridle gate parameters in main trial

Parameter	Gate					
	1	**2**	**3**	**4**	**5**	**6**
Commercial name	Centrewire "Henley"	Unbranded	Centrewire "Henley"	Centrewire "Chiltern" H-frame	Centrewire "Worcester" H-frame	Centrewire "Chiltern" H-frame
Wooden/metal construction	wooden	wooden	wooden	metal	metal	metal
1 or 2 way opening	2	1	1	1	1	2
Latch type	sprung	not sprung	sprung	sprung	sprung	sprung
Handle	trombone	Autolatch with handle	extended	extended	extended	extended stockproof
hydraulic closing mechanism	no	no	no	no	yes	no
Mean closing time[a] on 26th Mar/7th Oct.	4.34/3.13	4.49/3.89	4.60/3.69	4.57/5.62	3.60 /25.67	2.29/2.31
(overall mean)[b]	(3.24)		(4.15)	(5.1)		(2.3)

[a]: closing time was taken as the time to close when opened to 90° except for gate 6 which failed to open to 90°. Mean closing time was calculated from three determinations made on 26th March 2011 (start of trial) and three determinations on 7 October 2011 (end of trial) for each direction in which each gate opened

[b]: the overall mean closing time using determinations on 26 March and 7 October was calculated where there were no substantial alterations to the gate after the initial trial.

Trial protocol

An initial trial day with four riders was held on 26 March 2011 in order to refine the trial method. The results from this trial are reported separately to the main trial. After a pause to allow the grass to grow and be harvested, and following the alterations to some gates described previously and in Appendix 1, the trial resumed during the summer and autumn of 2011.

The riders made an appointment to take part, usually in pairs but some singly or in a threesome. The riders were initially left to approach and try to operate each gate as they thought best, with the assessor capturing each gate on video and noting any difficulties experienced. If the horse or rider became agitated while trying to negotiate a gate, the assessor allowed them to move on to another gate, to go away for a short ride or to abandon the trial if they felt they needed to do so in the interests of safety. However, the assessor sometimes invited the rider to try the 'heels to hinges' method if this had not yet been tried, the horse was not too agitated, and the rider was willing/able.

Each gate was negotiated in both directions by each horse and rider combination, unless the rider decided it was unsafe to continue trying to negotiate the gate. The order in which the gates were ridden, and the direction from which each gate was approached, were varied between participants, in order to ensure that the trial was as random and fair as possible. Thus, no one gate's score benefited or suffered more than any other from a horse and rider's experience at the other gates. However, for reasons of practicality, horses and riders either negotiated the three wooden gates first, or started with the three metal gates. Each horse and rider was encouraged to go away and ride around the field and adjoining orchards after tackling the first three gates, in order to give the horse a rest to minimise the chances of it becoming stressed and disobedient.

The video recordings were analysed following the trial days, with most of them being analysed by two observers. Records were made of the number of attempts each rider took to pass through each gate, whether the gate failed to close properly and whether any adverse events occurred. An attempt at a gate was recorded when the rider had positioned the horse, reached the handle and attempted to open it. Occasions when the rider failed to get the horse close enough to reach the latch and consequently had to reposition the horse were not counted as an attempt. An adverse event was recorded when the gate, handle, latch or gate post caught the rider, the horse or the horse's tack. Events when the gate, handle, latch or gate post nearly caught the horse or rider or the horse's tack were also recorded, but were not included in calculations of adverse events.

A score was calculated for each gate using the formula:

> percentage success at the first attempt minus sum of (percentage adverse events + failure to close properly)

Participants

The participants had all volunteered for the trial. Each rider was invited to provide information about his/her height, age and experience together with similar information about their horse, including any disability suffered by horse or rider. The questionnaire is at Appendix 6.

All 26 riders (including the four on the initial trial day in March) were experienced adult riders, except for two teenagers who had ridden since earliest childhood. Four of the riders in the main trial and one in the initial trial had teaching qualifications in riding and one of these had also been the chef d'equipe of the British Endurance riding team. Several other riders had passed British Horse Society or Pony Club riding tests. The riders included one Swedish, two French and one Australian rider. All except one of the riders were female and all had prior experience of using gates. The local pony club was approached to take part but declined because of concerns about safety and liability.

In the initial trial, the four equines ranged in height between 14 hands (14hh) and 15 hands 2 inches

(15.2hh). In the main trial, ten of the equines were above 16hh and five (not including the led pony) were ponies, 14.2hh or smaller. The largest horse was 17hh, the smallest ridden pony 13.2hh. There was also one very small unridden pony, of 8.1hh, which was led through the gates by a rider on a 14.2hh pony. In the statistics, this pair has been counted as one unit.

There were a further three riders whose results unfortunately were not captured on video (owing to a failure by the video operator) and whose results have therefore not been included in the statistics.

Most of the horses were older horses. Three in the initial trial were aged above 20. In the main trial, two of the equines were young, aged four to six, seventeen were aged seven to 19 and three were aged above 20.

Weather and ground conditions

The weather on all the trial days was generally fine, with no more than a light breeze, and the ground conditions were good to firm.

Results

The initial trial

The purpose of the initial study was to refine the trial method and to identify any problems with the gates or practical organisation before the main trial began. The six gates varied in whether they closed reliably and in their safety and ease of use for riders and this was reflected in scores ranging from 0 to 100 (Table 2). Gates 1, 2 and 3 failed to close properly, even though they had closed correctly when first installed. Gates 2 and 6 produced adverse events. All four riders were able to pass through all six gates but with some gates riders took between three and nine attempts. The initial trial identified some problems for horse and/or rider. To address these issues and other issues which became apparent, the following adjustments were made to some of the gates before the main trial:

- A trombone handle was fitted to Gate 1 instead of the stockproof handle. This did not require any change to the latch mechanism. The prong on the Gate 1 catch was also cut shorter because gate movement had begun to cause the catch to stick.
- The stockproof sprung handle on Gate 2 was removed and replaced with the autolatch with handle and D ring that had originally been planned. It had, in the first instance, been intended that Gate 2 was a very simple gate of the type that most fencing contractors would be able to source locally. It was considered by the observers and participants in the initial trial that the stockproof sprung handle installed by the contractor unnecessarily increased the gate's difficulty of operation. It was also noticeable that the autolatch, as installed, was difficult to reach, performed unreliably and was difficult to see from the far side of the gate when it failed to latch. It also created an additional hazard when it stuck out.
- A gate stop was fitted to Gate 4 as had been originally ordered to ensure that it would close reliably. Although the gate had closed reliably when used by the four riders in the initial trial, it had been noticed when measuring its closing speed that it did not always close if pushed open beyond 90°.
- The closing time of Gate 5 was extended to 26 seconds. The advantage of including Gate 5 was meant to be that it could be set to close slower than the equivalent non-hydraulic gate. It was installed by the contractor at the factory setting but this meant that it closed at a faster speed than its non-hydraulic equivalent (Gate 4). At this speed, and given that it was somewhat heavier to push than Gate 4, it was not considered by the participants in the initial trial to offer sufficient advantage to justify its extra cost. Thus, in order to establish if it could be set to close very slowly while still closing reliably, and in order to provide some information about the influence of closing speed on ease of use and adverse events, on the contractor's return visit before the main trial, it was adjusted to close very slowly (approximately 26 seconds).

TABLE 2: Percentage of occasions with various outcomes at Gates 1-6 in the initial trial with a group of four riders

Outcome	Gate									
	1	2		3		4		5		6
		T	A	T	A	T	A	T	A	
Success on 1st attempt	100	75	0	75	50	100	25	75	75	62.5
Success on 2nd attempt	0	25	50	25	50	0	25	0	0	12.5
3-9 attempts required	0	0	50	0	0	0	50	25	25	25
Failure to pass through	0	0	0	0	0	0	0	0	0	0
Adverse events	0	25	0	0	0	0	0	0	0	25
Gate failed to close properly	50	50	0	0	25	0	0	0	0	0
Score	50	0	0	75	25	100	25	75	75	37.5

Gates 1 and 6 were two-way gates where data for each direction was pooled.

Gates 2 to 5 were one-way gates. Data for each direction was analysed separately. T= one-way gate pulled towards rider; A = one-way gate pushed away from rider.
Score: % success at the first attempt minus sum of (% adverse events + failure to close properly.

The main trial

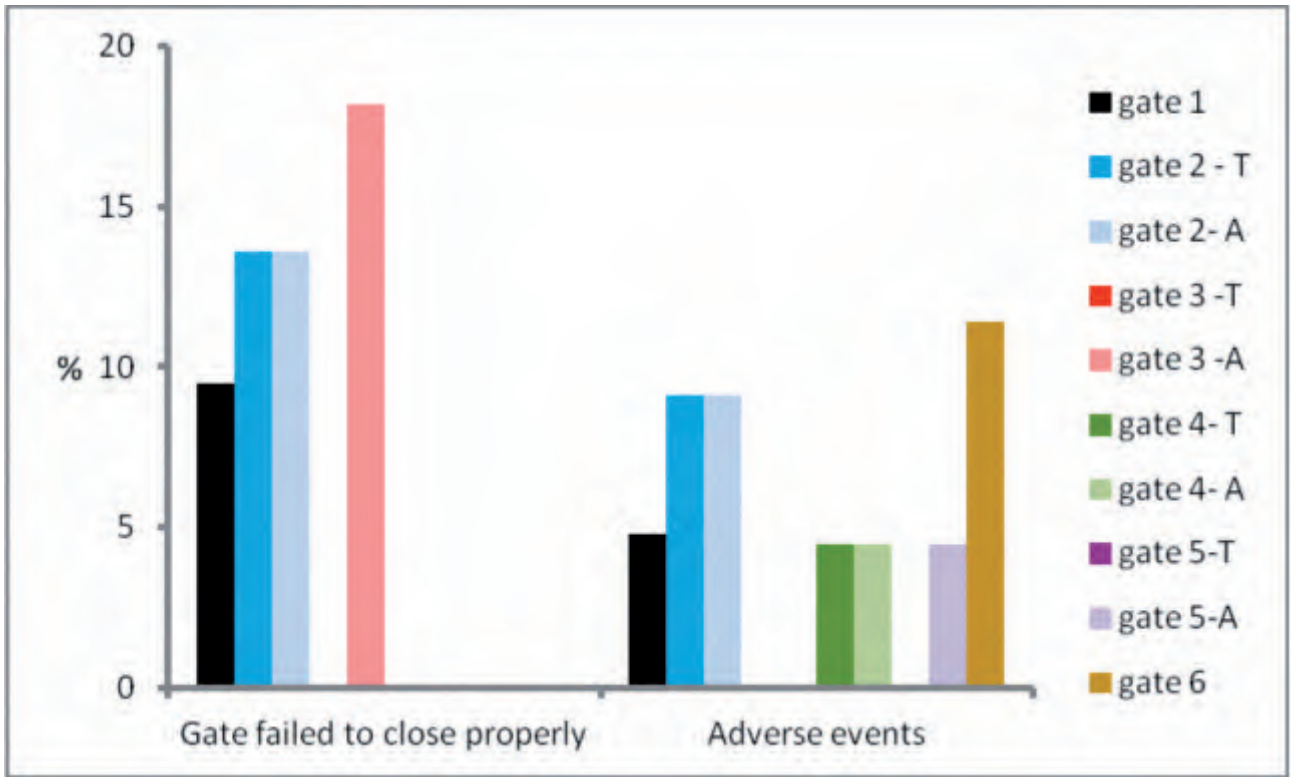
The results for each individual gate are described in Appendix 4 so that the performance of each gate can be readily seen. Below, the results are analysed by each trial objective to identify a bridle gate which closed reliably and was safe and easy for riders to use, that is, the aim of the study.

Objective 1:
To determine if the self-closing gates closed and latched reliably

As the main purpose of self-closing gates is that they close and latch securely without the aid of the user, this was assessed as part of the trial (Fig 1). Only the metal H-frame gates (Gates 4, 5 and 6) closed and latched reliably. The wooden gates (Gates 1, 2 and 3) did not, except for Gate 3 when the gate was pulled towards the rider.

Fig 1: Percentage of occasions when the gate failed to close and latch properly or when adverse events occurred in the main trial

Gates 1 and 6 were two-way gates where riders chose which way to open the gate (not recorded).



Gates 2 to 5 were one-way gates. Data was analysed when riders had to pull the gate towards them (T) or push it away from them (A).

Objective 2:
To determine the safety of the self-closing bridle gates for horse and rider

As it is essential that self-closing gates do not injure horse or rider, the potential of each gate to cause an accident was assessed by recording adverse events, that is, when the gate, handle, latch or gate post caught the rider, the horse or the horse's tack. Gate 3 was the only gate not to incur adverse events when ridden in either direction (Fig 1). Gate 5 incurred one adverse event (4.5 percent) but only when pushed away from the rider. Gates 1, 2, 4 (each in both directions) and 6 all incurred adverse events. The number of times when an adverse event almost occurred was also recorded for each gate. When these events were included in the number of adverse events, just under a quarter of riders experienced an adverse event with Gate 6 and with Gate 4 when it was pulled towards the rider.

Objective 3:
To determine the ease of use of the self-closing bridle gates for horse and rider

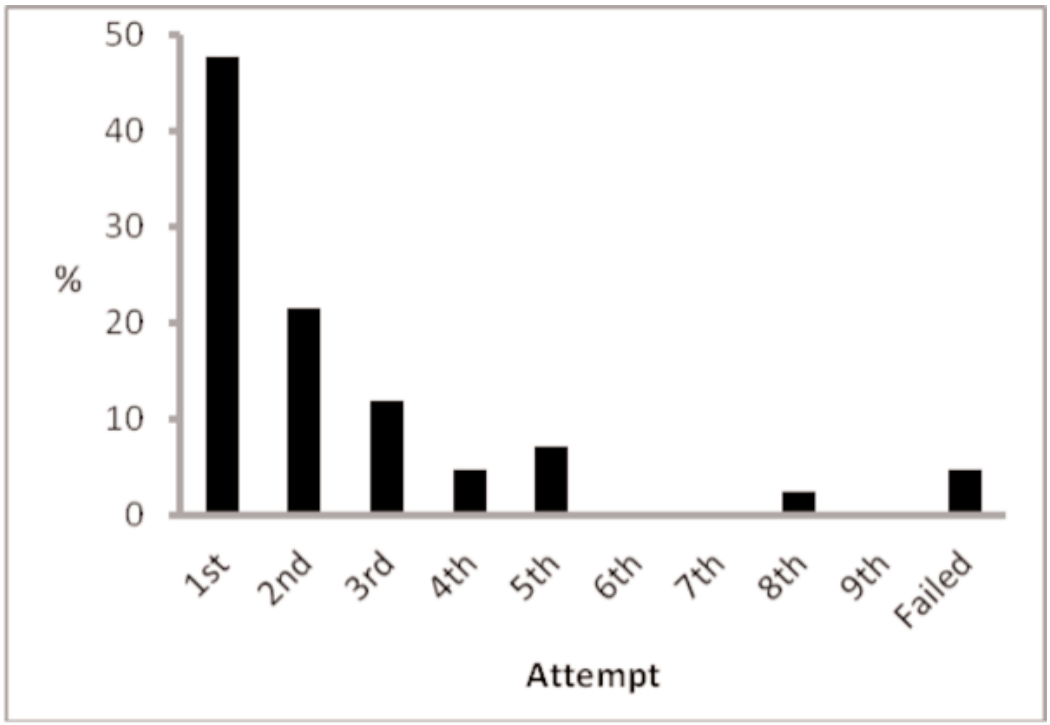
As an example, the full results obtained for Gate 1 are shown in Fig 2. Riders were unable to pass through Gate 1 at the first attempt in either direction on more than 50 percent of occasions. The majority of riders took two to nine attempts and one rider failed to pass through in both directions (two occasions). For ease of analysis, the third to ninth attempts were pooled to compare ease of use for all gates.

The gates varied markedly on their ease of use (Fig 3). Gates 2, 3 and 5 had the highest success rates at the first attempt with Gate 5 having the highest success rate of 95.5 percent. However, of these three gates, only Gate 5 allowed all riders to pass through in both directions on all occasions. In contrast, both the two-way gates, Gates 1 and 6, had poor success rates at the first attempt: fewer than 50 percent of riders were able to pass through them at the first attempt and, for both gates, some riders were unable to pass through them at all.

Almost without exception the riders had to give the gates one or more extra push as they went through, or hold on to the gates while they passed through, in order to keep the gates from closing onto the horse. For example, on Gate 5, even with its hydraulic action and relatively slow closing speed, all but two of the riders had to give it one or more extra pushes, and the two who did not do this held on to the gate throughout.

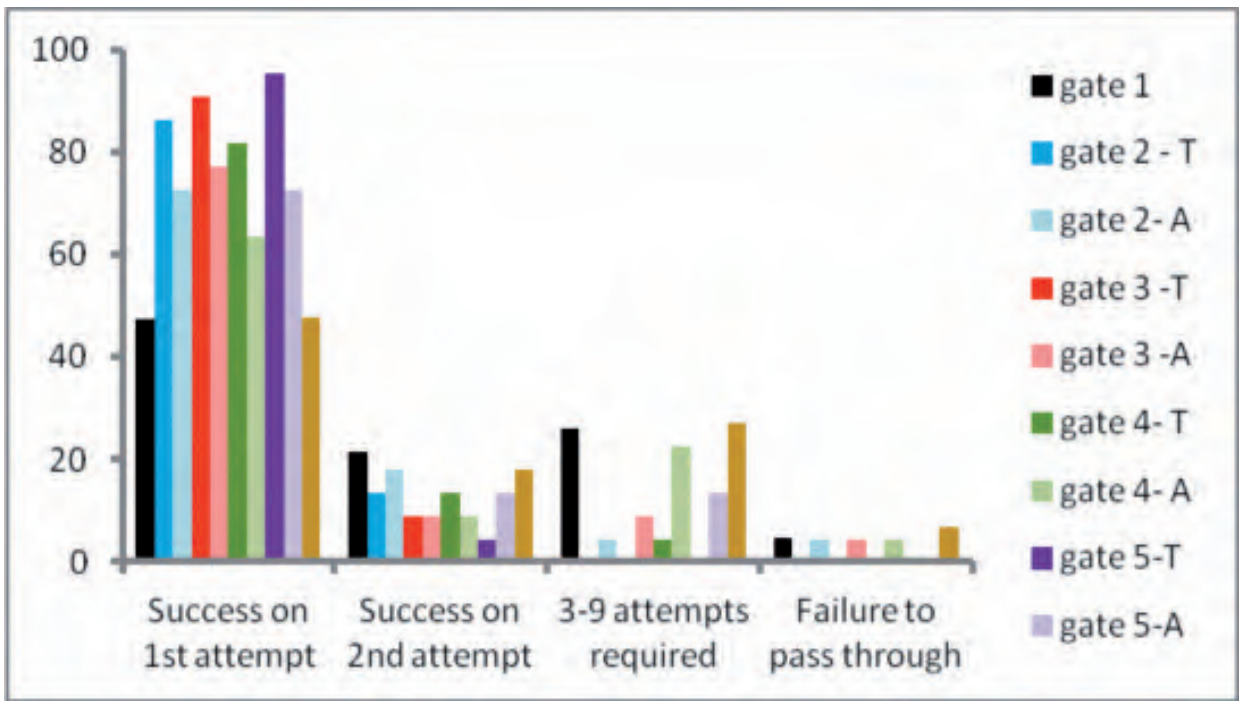
The direction in which the one-way gates (Gates 2 to 5) were ridden influenced the ease of use (Figs 3 and 4). Success rates were higher at the first attempt when riders pulled the gates towards them (range 82 to 95.5 percent) than when they pushed the gates away from them (range 64 to 77 percent) (Fig 4). As the two ranges of figures do not overlap, they are significantly statistically different.

Fig 2: Percentage of successful occasions at the first to ninth attempt, or failing to pass through, gate 1 in the main trial



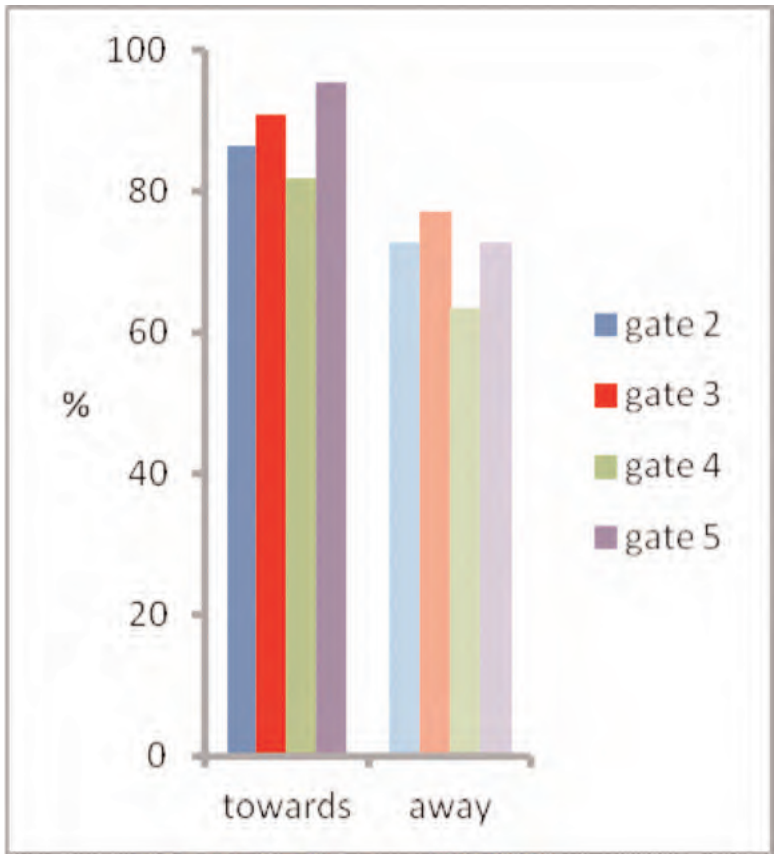
Twenty-one riders attempted the gate from two directions to give a total of 42 occasions

Fig 3: Percentage of occasions when riders passed through Gates 1 to 6 at the first attempt, the second attempt, the third to ninth attempt or failed to pass through the gate in the main trial
Gates 1 and 6 were two-way gates where riders chose which way to open the gate (not recorded).



Gates 2 to 5 were one-way gates. Data was analysed when riders had to pull the gate towards them (T) or push it away from them (A).

Fig 4: Percentage of successful occasions with the one-way gates in the main trial when pushed away or pulled towards the rider when analysed by success at the first attempt



Objective 4:
To identify the minimum closing time as far as was feasible with the gates as supplied

There was no statistically robust correlation between gate closing time and success at the first attempt or the number of adverse events. However, the gate with the best success rate at the first attempt had the slowest closing time of 25.7 seconds (Gate 5 when pulled towards the rider) and the two gates with the worst success rate had the fastest closing times, 2.3 and 3.2 seconds (Gates 1 and 6) (Table 3). The gates where one or no adverse event occurred had closing times at the higher end of the range, 4.15 seconds and 25.7 seconds (Gates 3 and 5 both when pulled towards and pushed away from the riders) but by contrast adverse events occurred with Gate 4, which closed in 5.1 seconds. Gate 6, which had the fastest closing time, had the worst number of adverse events.

Table 3: Mean closing time, percentage of success at first attempt and percentage of adverse events for each gate in the main trial

Outcome	**Gate**									
	1	**2**		**3**		**4**		**5**		**6**
		T	**A**	**T**	**A**	**T**	**A**	**T**	**A**	
Closing time (seconds)	3.24	3.9	3.89	4.15	4.15	5.1	5.1	25.7	25.7	2.3
Success on 1st attempt	47.6	86.4	72.7	90.9	77.2	81.8	63.6	95.5	72.7	47.7
Adverse events	4.8	9.1	9.1	0	0	4.5	4.5	0	4.5	11.4

[a]: Mean closing times were calculated from measurements made on 26th March and 7th October 2011 for gates 1, 3, 4 and 6. For gates 2 and 5, mean closing times were calculated from measurements on 7th October after adjustments were made to the gates after the initial trial (see methods).

T = when riders pulled the gate towards them. A = when riders push the gate away from them.

Additional issues

Ponies on lead rein and less able users

A rider on a 14h 2in pony showed exceptional skill by leading one very small unridden pony, of 8.1 hands, through Gates 1 to 5. However, on examination of the videos, it appears that this would not have been possible if the equines had been larger or if the led pony had carried a rider. This rider decided it would be unsafe to attempt Gate 6 with the led pony because of the gate's speed of closing.

Another participant, an experienced BHSAI who has, for several years, been the Chief Instructor for the local Pony Club, tried the gates on foot with her two small children on two ponies. One was riding off the lead rein and the mother led the other pony. She judged that it was not safe to allow the unled child to try to operate the gates, so she opened each gate, led the lead rein pony through and held the gate for the unled child rider to pass through. These riders have not been included in the statistics for the gates because the trial is about operation of the gates on horseback. However, this family group's use of the gates, which was captured on video, clearly showed that they needed plenty of manoeuvring space on both sides of the gates so that the mother could hold onto the led pony while holding the gate open for the other child.

One rider, whose results were unfortunately not captured on video (due to video operator error) was under medical advice not to lift anything heavy with her right arm, following removal of the lymph nodes because of breast cancer. This caused her difficulty when her direction of travel required her to operate the gate with her right arm.

Discussion

The main aim of the trial was to identify a commercially available, self-closing gate, installed to comply with British Standard 5709:2006, which closed reliably and was safe and easy for horse riders to use. The trial produced quantitative data on self-closing gates for the first time as far as the BHS is aware. However, none of the gates as tested in this trial can be unreservedly recommended at the present time. Gate 6 produced sufficient adverse events and was sufficiently difficult to use for the BHS to advise that it should now be withdrawn.

It should be noted that the trial took place in optimum conditions. The weather was fine, the riders were experienced, the gates were installed with ample manoeuvring space and there was no vehicular traffic for the horse and rider to worry about. These conditions will not normally all apply, so the difficulties recorded will be likely to occur more frequently and to be more serious in real situations than in this trial. Although fortunately no adverse events occurred in the trial which would need medical or veterinary treatment, it was considered that some of the adverse events which did occur could easily have led to a more serious incident requiring medical or veterinary treatment. It was noticeable that when a horse had experienced an adverse event, some became more nervous and unsettled at the next gate which may make it more likely that an adverse event would occur.

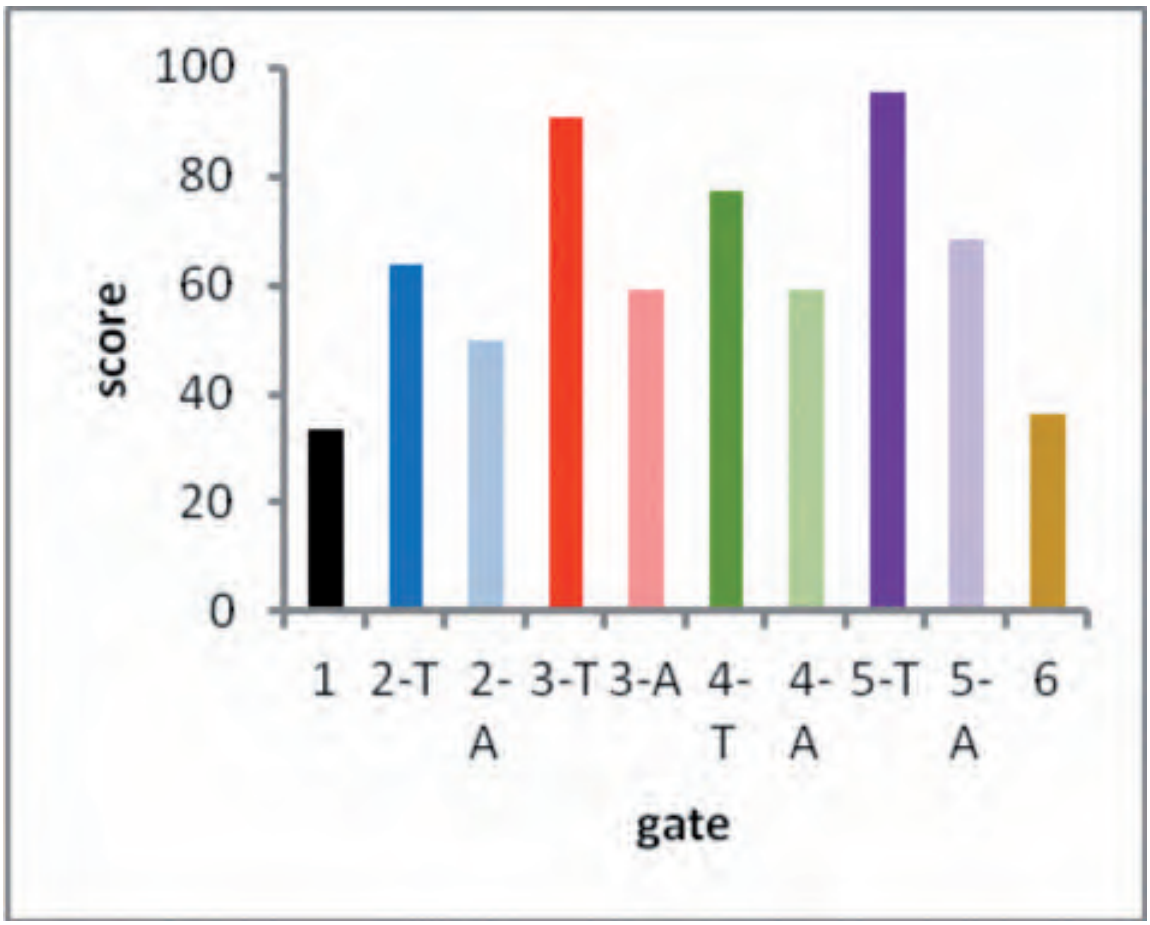
To bring the three issues of reliability, safety and ease of use together, a score was derived by calculating:

> percentage success at first attempt minus the sum of (percentage adverse events + failure to close properly).

In the main trial, Gate 5, the Centrewire 'Worcester' one-way hydraulic gate, had the highest score of 95.5 (maximum 100) when pulled towards the rider. This was because 95.5 percent of riders passed through at the first attempt, there were no adverse events and the gate closed properly on

all occasions (Fig 5). However, it did not fare as well when pushed away from the rider. The gate closed properly but there was one adverse event (4.5 percent) and just over a quarter of riders had to have more than one attempt. This appeared to be because the gate was stiff to push, and despite its slow closing time of 26 seconds it still reclosed on some riders before they could open it sufficiently for their horse to go forward. The practicalities of using Gate 5 are discussed below.

Fig 5: Scores for Gates 1 to 6 in the main trial



[a]: the score was derived using percentage success at first attempt minus sum of (percentage adverse events + failure to close properly). Maximum score = 100

Both the two-way gates, Gates 1 (the Centrewire two-way wooden 'Henley' gate) and 6 (the Centrewire two-way metal H-Frame 'Chiltern' gate) performed poorly with the lowest scores of 33.3 and 36.3 respectively. This was mainly because some riders found them difficult to use safely. Although the majority of horse and rider combinations found it easier to open a gate towards them, some found it easier to open a gate away from them. This might appear to suggest that two-way gates are best by allowing choice, but in this trial both the two-way gates had a poor success rate at the first attempt. This may be partly explained as they both closed faster than their equivalent one-way gates (Gates 3 and 4). Two-way, self-closing gates are also inherently less safe as they require a catch on the inside of the gate post and a prong on the gate to connect with it, which increases the risk of the horse or rider getting caught.

During the trial period, the Centrewire two-way wooden 'Henley' gate (Gate 1) dropped and twice required major readjustment, requiring a metal cutting saw and large wood drill, as well as minor adjustment (oiling hinges). Hence at times it did not close reliably and twice became almost impossible to open. Sometimes it stayed open when opened beyond 90 degrees[1]. Riders were confused by the latch instructions, some of which were designed to help pedestrians to operate the catch. Some riders complained that the gate was heavy (though this may perhaps have been attributable to the gate's need to be readjusted). Wooden gates tend to be heavier when they have absorbed water after prolonged rain, but this was not the case on the trial days.

The Centrewire two-way metal H-Frame 'Chiltern' gate (Gate 6) has metal lugs on its lower hinge which prevent the gate from opening to 90°. Thus, depending on how the rider keeps the gate open, the opening for the rider to pass through could be even narrower than for the other self-closing gates. This failure to open to 90° may explain its speed of closing and also the high level of adverse events which was unacceptable, especially as the riders were all experienced and the installation, ground and weather conditions were ideal. The stockproof handle may have increased this gate's difficulty of use compared with the other gates in the main trial.

From the evidence of this trial, the statements in paragraph 4.4d of British Standard 5709:2006 appear to require revision in respect of equestrians, because the two-way gates performed no better, indeed less well, than their equivalent one-way gates in terms of ease of use and safety. Nor did the two-way gates appear any less likely to jam the horse than the one-way gates. The danger of a gate jamming a horse arises mainly when the horse starts forward through the gateway, realises that the gate is closing on it, then changes its mind and tries to reverse when it may be too late to avoid being trapped between the gate and the post. The trial produced no evidence as to how this can be any less likely to happen with a two-way gate than with a one-way gate.

There was little to choose between the remaining one-way gates, that is, Gate 2 (unbranded, wooden, one-way opening gate with offset hinges (not purpose made) and D ring into autolatch with handle), Gate 3 (Centrewire wooden, one-way opening 'Henley' gate with sprung latch and extended handle) and Gate 4 (Centrewire 'Chiltern' one-way opening metal H-frame gate, sprung latch with extended handle) which had scores of between 50 and 77.3 apart from Gate 3 which, when pulled towards the rider, had a good score of 90.9. However, it should be noted that Gates 3 and 4 did not have stock-proof handles, and if these had been fitted this might have made them more difficult to use and lowered their scores somewhat. As noted above, the wooden gates (2 and 3) would also have been heavier to push if the weather had been wet.

The D rings on Gates 2 (main trial) and 4 should eliminate the chance of a serious wound being caused by the prong on the gate, though as the trial demonstrated, other adverse events are still possible with these gates. Gate 3 had no adverse events in the trial.

Practical issues with the Centrewire 'Worcester' hydraulic gate (Gate 5)

The gate was initially fitted with the closing speed set as supplied by Centrewire, which was 3.48 to 3.68 seconds, that is considerably faster than the five seconds implied in the instructions (which were not initially supplied with the gate). Adjustment of the timing requires a 3mm Allen key which was not supplied with the gate. Once the instructions had been supplied by Centrewire and an

[1] With a similar gate on Ashdown Forest this defect has been "resolved" by placing a low gate stopping post within the gate's manoeuvring space, in which the author has seen a horse get its hind legs tangled. It was to avoid using this gate that a rider used another pathway and caused a vehicle collision in which the vehicle driver died.

Allen key acquired, adjusting the timing was awkward and difficult, involving lying or kneeling on the ground blindly fiddling the Allen key into two screws under the hinge just above the ground. Moreover, the instructions supplied did not entirely fit with the way the gate worked. It took several attempts to adjust the gate's timing, the whole operation taking a considerable time. A very small turn of the screws can produce a noticeable change in speed of closing and, because of this, it takes several attempts to adjust the speed to that desired. For all these reasons, it is likely that the closing speed of the 'Worcester' gate will be difficult to adjust to a set speed in field conditions.

In the initial trial, riders tried the gate with the timing as supplied by Centrewire (3.48 to 3.68 seconds). At this speed, once the rider had managed to open it far enough, the gate closed in a slightly more measured way than the non-hydraulic metal one-way gate (Gate 4). It appears that from 90° the gate closes quickly for the initial 15° or so, then the first screw controls the speed of the gate's closing over the next 55° and the second screw controls the remaining 20°. The difficulty which some riders had with this gate when pushing it away was that additional strength was required to push it open. This counterbalanced the advantage of its more measured closing. It was not clear whether the additional difficulty in pushing it away was due to the gate's additional weight or to the resistance of its hydraulic closing mechanism.

When, for the main trial, the timing was adjusted to close as slowly as possible (26 seconds in total, of which the last 20° took approximately eight seconds), the gate was felt to be much more rider-friendly. It was noticeable that even when closing as slowly as possible, it self-closed 100% reliably. Moreover, unlike the other metal gates, it did not clang when it closed. However, most riders in the trial found that after passing through the gate they then had to wait for several seconds for it to close completely. Some riders commented (and the observer agrees) that with it set at this speed there could perhaps be a possibility of livestock following the rider and escaping. Although riders were able (and usually needed) to push the gate open again repeatedly while passing through it, there was nothing a rider could do to speed up the gate's closing. Indeed, a rider's attempts to hurry it would only slow it down further. The closing can only be speeded up by adjusting the timing with the Allen key.

It must be questionable whether most landowners and installers would have the inclination or the time to adjust the gate, especially as the instructions require the installer to wait at least one hour after first installation before adjusting the gate. Thus, it is strongly recommended that the gate should be supplied from the factory set to close at a much slower speed than at present, and that it should always be supplied complete with its instructions and the necessary tool to adjust it. The minimum closing speed which is safe and easy for riders to use has yet to be determined. Nor has the balance between the two screws controlling the closing time been experimented with and the best balance established. However, the results from this trial indicate that whatever the speed of closing, this gate will reliably self-close.

The D ring above the prong on Gate 5 should reduce the risk of a tear wound being caused by the prong.

Reasons for considering the reliability of self-closing (Objective 1)

A self-closing gate which does not self-close reliably combines disadvantages for horse riders with a failure to provide the security for the landowner, which was the reason for installing a self-closing mechanism. Indeed, it may actually provide less security than a well installed non-self-closing gate because a rider or walker who believes a gate is self-closing may perhaps not bother to check that it has latched securely. Moreover, a rider who has had difficulty caused by a self-closing mechanism may, because of this, be disinclined to take the trouble to check that it has latched properly or to dismount and struggle to close it. A self-closing gate which does not self-close reliably is not fit for purpose: the landowner's and horseriders' needs could be better served by a British Standard-

compliant non-self-closing gate with notices asking users to close it.

Safety of the self-closing gates (Objective 2)

The potential consequences of an accident at a gate are extremely serious for the horse and/or the rider. There have been documented cases of horses requiring major surgery and riders requiring hospitalisation after accidents involving self-closing gates. If the rider is thrown and/or the horse collides with a vehicle, there is potential for catastrophic injury. During the trial, the BHS and its insurers were insistent that every possible precaution should be taken to minimise the risk of an accident. Therefore, the gates' closing speeds were set as slow as possible, and some participants commented that they closed slower than the similar self-closing gates they had encountered elsewhere. The other conditions of the trial, such as the lack of motor vehicles or livestock and the ability of participants to cease trying to negotiate a gate and move on to the next, will also not be replicated in real life.

The number of adverse events which occurred with Gate 6 led to the conclusion that for safety reasons this gate is not fit for purpose.

The D rings on Gates 2, 4 and 5 should remove or reduce the risk of a serious wound being caused by a prong on the gate, though other injuries to horse or rider are still possible.

The safety of gates is to some extent related to their ease of use.

Ease of use of self-closing gates (Objective 3)

Self-closing gates have inherent difficulties when compared to non-self-closing gates where horse and rider can relax and take all the time they need. With a self-closing gate:

a) The gate can start to close or even re-latch completely while the rider is trying to open it, which can lead to frustration, confusion and fear in the horse. This is compounded when the gate is poorly sited, the rider's approach has not been perfect for whatever reason, the horse has been inattentive and uncooperative for whatever reason, or the rider's reach and strength are insufficient.

b) The gate will close on the horse while the horse is part way through it, unless the rider is able to hold or push it off the horse, or unless the gate will stay open when flung open beyond 90°, when it will not be reliably self-closing.

Direction of opening

The finding that the gates were easier for the majority of riders when pulled towards horse and rider is highly relevant where one-way gates are used to prevent stock from escaping onto a road. In this instance, one-way gates usually open away from the road into the enclosure, in order that the strength of the gatepost should reinforce that of the latch if livestock push against the gate. The trial showed that this situation is the least satisfactory for riders, some of whom may be circling in or backing onto a road while making multiple attempts to open a gate away from them. Therefore, the one-way self-closing gates which required multiple attempts to open them away from the rider could cause a serious accident.

Influence of gate closing time (Objective 4)

The trial was not primarily designed to assess the influence of gate closing time. However, it was notable that Gate 5 (the Centrewire 'Worcester' hydraulic gate) which had the best score had the slowest closing time and Gate 6 (the Centrewire metal 'Chiltern' two-way gate) which had the fastest closing time had one of the worst scores.

The trial was not fully able to assess the influence of gate closing time because the gates used in the trial varied in design and latch type, and with all except Gate 5, the possible adjustments to the closing time were minimal if the gate was to self-close. Influence of closing time would be best assessed by varying the closing time on a single design of gate.

Other issues

Participants

It was felt that the riders who took part in the trial, although not specifically selected for their expertise with gates, allowed sound comparisons to be made between the gates. For example, as a whole, the group showed a high level of competence with the Centrewire 'Worcester' hydraulic gate, when set to close at 26 seconds, showing they were competent to use gates. This may be taken as a baseline from which to compare the other gates.

Horse riders vary in their experience and skill in negotiating gates. With increased use, their skill may improve if no adverse events occur. However, negotiation of all gates, whether self-closing or not, requires a schooled horse and competent rider because the horse must be positioned close to the gate and must be responsive to the rider's commands. Many riders who enjoy the countryside on horseback may not ride very often and their mounts may not be highly schooled. Thus, this trial has probably produced the optimal results for the gates compared to use by the average horse rider. It is also worth noting that one of the horses which was not captured on video, and hence was not included in the results given above, became distressed at the first gate they tried, with the result that this horse and rider were unable to negotiate any of the gates independently and only managed to pass through them when the rider accompanying them managed to hold them open for them.

Although the trial did not set out to assess whether self-closing bridle gates could be used when a child on a pony is led from another horse, the two results with lead rein ponies indicated that self-closing bridle gates would usually exclude lead rein riders. Bridle gates may also be used by people with pushchairs and those with disabilities, whether on foot, in wheelchairs or on horseback. Thus, self-closing bridle gates need to be tested with these categories of user.

Size of horse

The proportion of the riders with larger horses who failed to negotiate the bridle gates at the first attempt was in some cases higher than the proportion of all the riders who failed to do so. For example in the case of Gate 6 (the Centrewire metal 'Chiltern' two-way gate), travelling eastbound, eight out of the 10 larger horses failed to negotiate it at first attempt. Possible reasons for this could be that

- the riders on larger horses had to stretch out and down further in order to reach the handle and then to hold or push the gate;
- the larger horses had less confidence that the opening they could see was wide enough for them to pass through; and
- the larger horses found it harder to negotiate the narrow space without bumping themselves or their riders.

The latter two problems might be alleviated by requiring self-closing gates to be wider, but see width of gates below.

Riders' approach to the gates

There was a wide variation in the ways different riders approached the self-closing gates. It depended on the characteristics and the abilities of both the horse and the rider. The 'heels to hinges' method (whereby the horse is lined up parallel to the gate with its hind quarters at the hinge

end) is safer because there is less likelihood of the bridle becoming caught, but it does not work for all horses, especially large horses where the rider may not be able to reach far enough to hold on to or push the gate away while the horse starts to move. Most riders in the trial approached head-on to some extent. Several put the horse's head over the adjoining (in-line) fence. Some of the large horses which put their head over the gate were hit under the jaw by the gate as the rider flung it open and some horses which put their head over the gate also very nearly caught their bridles or reins on the extended latch. Endurance riders usually approach a gate approximately head-on, in order to save time, and the two relatively small endurance horses which took part in the trial appeared to have learned to bend their heads out of the way of the gate as it opened. But most horses have not acquired this skill and for a larger horse the gatepost would be in the way.

Manoeuvring space

Landowners and local authorities tend to assume that manoeuvring space is less important for self-closing gates than for non-self-closing ones because riders do not need to turn round to close them. In fact, because of the aforementioned factors, manoeuvring space is even more important for self-closing gates, as the videos demonstrated.

A self-closing gate starts to close while (or indeed before) the horse goes through, so riders usually have to pass through at an angle. This increases the chance of the rider/horse getting caught on the catch on the gatepost, especially on two-way gates. It also reinforces the need for ample manoeuvring space.

Width of self-closing gates

From the measurements given in Appendix 2 it can be seen that the width of gates as described in the Centrewire catalogue is the width between the outsides of the posts, that is, the space the gate installation takes up between fences, not the space between the posts referred to in Section 145 of the Highways Act 1980. For example, although Gate 1 (the Henley two-way gate) is described in the catalogue as being 2100mm (6ft 10½ ins) wide, in fact it provides barely more than the statutory minimum of 1525mm (5ft) space between the posts. However, all of the gates trialled provide at least the statutory minimum width.

Arguably, because a self-closing gate will be partly closed as the horse and rider pass through it, the gate ought to be wider to compensate. However, this would need to be trialled, because the additional weight of a larger gate might also cause difficulties.

Gate construction

Handles

The stock-proof handles on Gates 1, 2 and 6 in the initial trial and Gate 6 in the main trial appeared to increase the difficulty for some riders, though those who were encountering them for the first time improved somewhat as they practised with them. Because of the additional difficulty they present, following the principle of least restrictive option these handles should not be used except when there are cattle or horses which would otherwise escape.

The trombone handle (Gate 1) was felt by the riders to be easier than the stock-proof one but it was not particularly liked: the ordinary extended handle as fitted on Gates 3, 4 and 5 was preferred. Some horses were reluctant to approach the trombone handle, perhaps because it was unfamiliar to them.

Notices

The notices on the stockproof handles and the wooden two-way gate clearly confused riders who had not previously encountered these mechanisms. They could be improved so as to reduce riders' initial confusion when using them.

Metal versus wood for gate construction

Some horses seemed generally more shy of the metal gates, perhaps because, despite rubber dampers, these tend to clang or because those horses may have been less familiar with this type of gate. On the other hand, the metal gates did not require the constant adjustments that the wooden gates needed. Apart from the hydraulic gate, metal gates are usually lighter for the rider to open and they do not catch the wind quite so much.

All three of the self-closing wooden gates required adjustment more than once during the trial. Landowners considering installing them should be aware that they will need to be checked at least weekly, or even daily when there is livestock in the field, and it may be necessary to remove livestock from the field in order to make necessary adjustments. Some non-self-closing gate catches, such as the safety hook and eye, the throwover chain or even the traditional hunter catch, allow for more movement in a wooden gate and post and will require much less frequent checking and adjustment.

Further studies

Future trials should include riders with disabilities and a wider range of gates. However, the BHS's funds are limited as is the field space and the time which the current landowner and BHS volunteers can dedicate to further trials. The current trial has shown the need for carefully designed studies to examine the problems with self-closing gates and that carefully designed trials yield useful results. If Natural England, other government bodies, gate manufacturers and landowner organisations wish to continue the use of self-closing gates, they should fund a future trial so that a reliable, safe and easy to use self-closing gate can be identified.

Further research is required to:

1. try to establish an optimum closing speed and the optimum balance between the two controlling screws for the Centrewire 'Worcester' hydraulic one-way gate (Gate 5) which will allow safe and easy passage for riders but ensure that livestock cannot escape;
2. test the Centrewire 'Worcester' hydraulic two-way bridle gate. One of these has been installed for two years on a bridleway near Funtington in West Sussex. A report of a visit to this gate is at Appendix 5;
3. establish whether self-closing bridle gates perform better if they were widened to provide more than 1.52 metres clear width when fully open;
4. establish whether the comparative results between the Centrewire gates in this trial would be substantially different if all or none of the handles were stockproof;
5. test the self-closing bridle gates with users with a full range of disabilities who access the countryside and rights of way in compliance with the Equality Act 2010.

Key findings and recommendations

1. Self-closing bridle gates are neither as safe nor as easy to use for horseriders as British Standard 5709:2006 compliant non-self-closing bridle gates and they exclude some horseriders. Following the principle of the least restrictive option, self-closing bridle gates should not be used routinely on public rights of way or other land with equestrian access.
2. The trial showed that there was considerable variation in the performance of commonly available self-closing gates with respect to their reliability to self-close, their safety for horse and rider and ease of use by riders.
3. The Centrewire 'Worcester' hydraulic one-way gate (Gate 5) was the best of the gates trialled when set to its maximum closing speed of 26 seconds. However, there were still some problems for riders with this gate.
4. The Centrewire 'Chiltern' two-way self-closing gate (Gate 6) as supplied is not recommended for use. In the interests of rider safety, it is recommended that it should be discontinued promptly.
5. None of the other self-closing gates tested (Centrewire 'Henley' one- and two-way self-closing gates, Centrewire Chiltern one-way self-closing gate and unbranded one-way gate with D ring and autolatch with extended handle) can be recommended in preference to non-self-closing gates installed to meet British Standard 5709:2006 as none of them performed reliably well for both riders and/or landowners.
6. Stockproof handles increase the difficulty of use. Following the principle of least restrictive option, these handles should not be installed except where it can be proved that they are needed and that the need outweighs the potential damage to horse and rider.
7. Further research is required to
   - try to establish an optimum overall closing speed, and the best balance between the controlling screws' closing speed, for the Centrewire 'Worcester' hydraulic one-way gate (Gate 5) which will allow safe and easy passage for riders and their horses but ensure that livestock cannot escape
   - test the Centrewire 'Worcester' hydraulic two-way bridle gate
   - establish whether self-closing bridle gates perform better if they were widened to provide more than 1.52 metres clear width when fully open
   - establish whether the comparative results between the Centrewire gates in this trial would be substantially different if all or none of the handles were stockproof
   - test the gates with users with a full range of disabilities who access the countryside and rights of way in compliance with the Equality Act 2010
8. Pending this further research, if installation of a self-closing gate is essential, without prejudice or liability the BHS found that the best of the existing self-closing bridle gates trialled is the 'Worcester' hydraulic gate, correctly installed as per the BHS construction leaflet and BS 5709:2006, set to close in approximately 26 seconds. Mounting blocks should be constructed on both sides of the gateway if the local authority's equality impact assessment concludes that they are to be provided.
9. Because of the problems associated with the majority of self-closing gates in this trial, it is very strongly recommended that any self-closing bridle gates which have been installed in conditions which do not provide clear manoeuvring space to the British Standard (including those which self-close only through non-purpose-made offset

hinges) should either be repositioned so that they fully meet the requirements for manoeuvring space and adjusted to close as slowly as possible, or else be replaced by well-balanced non-self-closing gates.

10. British Standard 5709:2006 requires revision in respect of self-closing bridle gates.

Acknowledgements

The BHS thanks the members of the North and West Kent County Committee of the Society for assistance with running the trial and analysing the results, the riders who took part in the trial, Sir Robert and Lady Akenhead for allowing their land to be used, and Dr J C Bridger for assistance with writing the report.

Appendix 1: detailed description of self-closing gates

Gate 1

Centrewire wooden 'Henley' two-way bridle gate with stockproof handle. The handle operates a spring-loaded 'easy latch' catch whose prong fits into a two-way catch designed to be helpful to users of mobility vehicles and pedestrians.

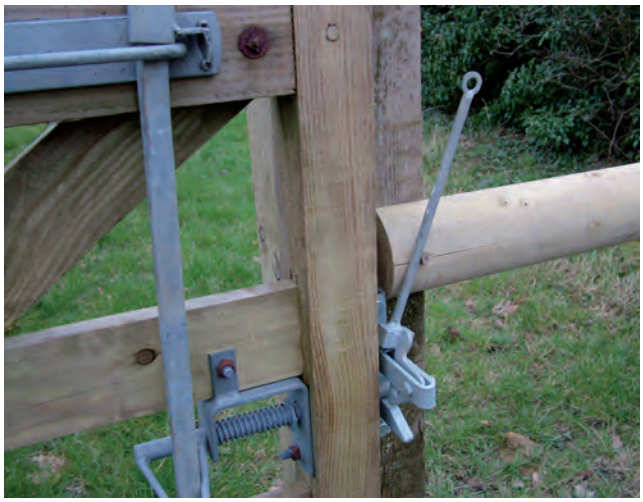
For the main trial, the handle was changed to a trombone handle (see lower right hand figure)

Gate 2

Gate and catch specified: Wooden one-way self-closing gate from another manufacturer with off-set hinges to self-close with auto-latch (extended handle).

Gate and catch installed (initial trial):

Wooden one-way gate with offset hinges. Extended stock-proof handle operated a spring-loaded latch whose unprotected prong closed into an auto-latch with an extended handle.



Following concern expressed by riders in the initial trial that the autolatch sticking out was a hazard, the extended stockproof handle and spring catch were removed and the extended handle autolatch also changed from the version commonly used in Devon (see above) to the version commonly used in Kent (see below), with a "D ring" on the gate instead of a prong.

Note: to avoid having to re-drill the gate, the contractor initially tried to use part of the Devon catch and part of the Kent catch, but when he did this the gate failed to close reliably. For the balance of the Kent autolatch to work properly, it must be installed as supplied, and in order to be stockproof its handle must not extend above the gatepost.

Gate 2 for main trial

Gate 3

Centrewire wooden 'Henley' one-way bridle gate with extended handle. The handle operates a spring-loaded latch with an unprotected prong into an autocatch.

Gate 4

Gate ordered: Centrewire galvanised metal H-Frame 'Chiltern' one-way opening bridle gate with gate stop.

Gate supplied: Centrewire galvanised metal H-Frame 'Chiltern' one-way opening gate. Centrewire initially failed to supply the gate stop, so it was not fitted for the initial trial but was supplied in time for it to be fitted for the main trial. This was necessary to ensure that the gate did not stay open when pushed open to more than 90°. The gate has an extended handle (not stockproof), and a 'D' fitting round the spring-loaded latch which fastens into an autocatch. The gate does not hang straight between the posts because it is hung from the centre of the post at the hinge end and rests against the side of the post at the catch end.

Gate 5

Centrewire galvanised metal 'Worcester' one-way opening bridle gate. The gate has a 'Prosafe' self-closing mechanism (hydraulic and adjustable). The handle operates a spring-loaded latch whose unprotected prong fits into an autocatch. Further up the gate, there is a D-shaped fitting which rests against the gatepost and prevents the gate from opening two ways.

The gate was initially fitted with the speed of closing set as supplied by Centrewire. Adjustment requires a 3mm Allen key which was not supplied with the gate. Nor were the instructions for altering the closing speed initially supplied. The closing speed was adjusted (the process was not easy) to be as slow as possible in time for the main trial.

Gate 6

Centrewire metal galvanised H-Frame 'Chiltern' two-way opening bridle gate with stock-proof handle. The handle operates a spring-loaded catch whose unprotected prong fits into one of the autocatches which are mounted on both sides of the gatepost.

NOTE: This gate is prevented from opening fully to 90 degrees in either direction by the lugs underneath the bottom hinge. This is how the gate arrived from the factory. The installer said there was nothing he could do to rectify it.

Appendix 2: Gate dimensions

Table 4

Gate	Catalogue post to post (mm)	Inside post to inside post after installation (mm)	Clear space with gate open 90° after installation(mm)
1. Centrewire wooden, two-way opening "Henley" gate with sprung latch and trombone handle	2100	1750	1605 at top 1505 at bottom
2. Wooden, one-way opening gate with offset hinges and extended handle auto latch	1525	1525	1525
3. Centrewire wooden, one-way opening "Henley" gate with sprung latch and extended handle	1900	1600	1600
4. Centrewire "Chiltern" one-way opening metal H-frame gate, sprung latch with extended handle	1800	1630	1530
5. Centrewire "Worcester" one-way opening metal H-frame gate with hydraulic closing mechanism, sprung latch with extended handle	None stated	1751	1595 at top 1525 at bottom
6. Centrewire "Chiltern" two-way opening metal H-frame gate with extended stockproof handle	1900	1790	1550 at top 1560 at bottom

Appendix 3:
Gate closing times and weather on the day of the initial trial (26 March 2011) and at the end of the main trial period (7 October 2011).

Table 5

Gate	Opening direction	Time to close and latch (seconds)[a]	
		26th March 2011	7th October 2011
1. Centrewire wooden, two-way opening "Henley" gate with sprung latch and trombone handle			
	west	Did not close on 3 occasions	3.01; 3.04; 2.80
	east	4.65; 4.18; 4.18	3.20; 3.28; 3.42
2. Wooden, one-way opening gate with offset hinges and extended handle autolatch			
	west	4.47; 4.98; 4.01 Did not latch on 2 occasions	4.20; 4.12; 3.35
3. Centrewire wooden, one-way opening "Henley" gate with sprung latch and extended handle			
	south	5.02; 4.69; 4.09 Did not always close when opened beyond 90°..	3.36; 3.82; 3.89
4.Centrewire "Chiltern" one-way opening metal H-frame gate, sprung latch with extended handle			
	west	4.71; 4.44; 4.56 Stayed open when opened over 90°	
5. Centrewire "Worcester" one-way opening metal H-frame gate with hydraulic closing mechanism, sprung latch with extended handle			
	east	3.48; 3.68; 3.65 (as supplied)	26.18; 26.60; 24.24 (slowest setting)

6. Centrewire "Chiltern" two-way opening metal H-frame gate with extended stockproof handle

	west	2.38; 2.48; 2.46	2.17; 2.12; 2.13
	east	2.38; 2.32; 2.36	2.42; 2.17; 2.18
Weather		Dry	Dry
Wind		Very light from north-east	Light gusts from north-west

[a]: Closing times were measured three times from a 90° open position, except for gate 6 which did not open to 90° and was thus measured from its maximum opening. Where a gate could open to beyond 90° and it failed to close this was noted

Appendix 4:
Analysis of results for each gate in the main trial

Table 6: Percentage of occasions with various outcomes at gates 1- 6 in the main trial

Outcome	Gate									
	1[a]	2		3		4		5		6[a]
		T	A	T	A	T	A	T	A	
Success on 1st attempt	47.6	86.4	72.7	90.9	77.2	81.8	63.6	95.5	72.7	47.7
Success on 2nd attempt	21.4	13.6	18.2	9.1	9.1	13.6	9.1	4.5	13.6	18.2
3-9 attempts required	26	0	4.5	0	9.1	4.5	22.7	0	13.6	27.3
Failure to pass through	4.8	0	4.5	0	4.5	0	4.5	0	0	6.8
Gate failed to close properly	9.5	13.6	13.6	0	18.2	0	0	0	0	0
Adverse events	4.8	9.1	9.1	0	0	4.5	4.5	0	4.5	11.4
Score	33.3	63.7	50	90.9	59	77.3	59.1	95.5	68.2	36.3
Mean score[b]		56.9		75		68.2		81.9		
No. events	42	22	22	22	22	22	22	22	22	44

[a] : *for the two-way opening gates data was not analysed by the direction each rider chose to open the gate*

T = when the one-way gate was pulled towards the rider; A = when the one-way gate was pushed away from the rider

[b] : *a mean score was calculated for the one-way opening gates*

Gate 1 (Centrewire wooden, two-way opening 'Henley' gate with sprung latch and trombone handle)

Riders were unable to pass through at the first attempt on more than 50 percent of occasions. Adverse events occurred on just under five percent of occasions. The gate failed to close properly on 9.5 percent (four) occasions. The gate had the lowest score, 33.3, of the six gates in the trial.

Gate 2 (Unbranded wooden, one-way opening gate with offset hinges and extended handle autolatch)

For one-way gates, the data obtained for each direction was analysed separately. When pulled towards riders, riders were able to pass through Gate 2 at the first attempt on 86.4 percent of occasions. None required more than two attempts. However, adverse events occurred and the gate failed to close properly on 13.6 percent of occasions. Riders found Gate 2 less easy when pushed away from them, with some requiring three to nine attempts or failing to pass through. The number of adverse events and times when the gate failed to close properly were the same as when pulled towards the rider. The scores were in the middle of the range of scores.

Gate 3 (Centrewire wooden, one-way opening 'Henley' gate with sprung latch and extended handle)

Gate 3 had one of the highest success rates (90.9 percent) at the first attempt when riders pulled it towards them. No rider required more than two attempts, there were no adverse events and the gate closed properly on all occasions, giving a score of 90.9. However, riders found Gate 3 much less easy when pushed away from them. Some required three to nine attempts or failed to pass through. There were no adverse events but the gate failed to close properly on just under a fifth of occasions when used in this direction, giving a score of 59.

Gate 4 (Centrewire 'Chiltern' one-way opening metal H-frame gate, sprung latch with extended handle)

Gate 4 did not perform well with respect to ease of use for riders. Riders needed three to nine attempts on just under a quarter of occasions when pushing it away. Adverse events occurred in both directions. However, the gate closed properly on every occasion in both directions. Scores were 77.3 and 59.1.

Gate 5 (Centrewire 'Worcester' one-way opening metal H-frame gate with hydraulic closing mechanism, sprung latch with extended handle)

When pulled towards the rider, riders were able to pass at the first attempt on 95.5 percent of occasions, a few required two attempts but none required three to nine attempts and none failed to pass through. There were no adverse events and the gate closed properly on all occasions, thus giving the highest score of 95.5. However, when pushed away, the success rate at the first attempt was lower (72.7 percent) and some riders required three to nine attempts. None failed to pass and the gate closed properly on all occasions, but there was one adverse event giving a lower score in this direction of 72.7

Gate 6 (Centrewire 'Chiltern' two-way opening metal H-frame gate with extended stockproof handle)

Gate 6 performed poorly producing the second lowest score of 36.3. On more than half of occasions, riders had to have more than one attempt, some failed to pass through and there were a high number of adverse events. However, the gate always closed properly.

Appendix 5:
Note of visit to two-way hydraulic bridle gate on West Sussex Bridleway 509 near Funtington, 6 May 2012

Accompanied by Mrs Sue Montila of the Hants and West Sussex Borders Bridleways Group, I visited the two-way hydraulic bridle gate which has been installed on Bridleway 509 for the last two years. It was raining lightly with a light wind from the Northeast, and the ground was slightly muddy but not deep.

The gate is installed on a field-edge bridleway with 800mm manoeuvring space at the hinge end before a thorn hedge begins, and, at the latch end the old rusty field gate. The bridleway gate was installed because riders had been finding the field gate impossible to negotiate on horseback as it had to be dragged along the ground.

The closing times of the gate from 90° were measured three times in each direction as follows:

With gate opened to North: 5.83 seconds, 5.64 seconds, 5.05 seconds

With gate opened to South: 6.20 seconds, 6.07 seconds, 6.27 seconds.

Sue Montila explained that when the gate had arrived from the factory, it had been set to close too quickly, causing great difficulty for riders. After it had been adjusted to close more slowly, it had failed to close reliably when opened to the North, and the current settings were the slowest closing times that it had been possible to achieve for the gate to close reliably.

A group of four riders from a local riding school came along while we were there, a ride leader and three clients out for a 'walk, trot and canter hack'. They agreed that I could video them. The horses were all substantial cobs. The ride leader was male, the three clients female, all adults.

Riding northwards, the ride leader took three attempts to open the gate, opening it away from him. He turned and held it open (precariously) for the other three riders. The handle was under the horse's head and if the horse had been wearing a martingale it could have become caught up.

Riding southwards again at our request, the ride leader managed the gate at the second attempt, pushing it away. The horse bumped its head on the gate handle.

One of the other riders decided to attempt the gate on her own, although it was only the second time she had ever opened a gate on horseback. She managed it riding southwards at the first attempt (with some verbal assistance from Sue Montila and myelf), pulling it towards her.

On the return northwards, the lead rider passed through the gate at the first attempt, pulling it towards him. However he had to lift his leg right up to avoid hitting the gatepost. The riding school client then made nine attempts to open and pass through the gate, but despite our verbal assistance she was unable to do so and admitted defeat. She said she could not go 'heels to hinges' and pull the gate towards her, because the horse would then have to back into the thorn hedge.

The riders appeared to have difficulty in pushing the gate wide open away from them. Whether this was due to the hydraulic action or to some other factor was unclear.

Elizabeth Akenhead

Appendix 6:
Gates trial rider questionnaire

BHS SELF-CLOSING GATES TRIAL: HORSE AND RIDER QUESTIONNAIRE

Date

Weather

Rider

Name

Emergency telephone numbers

Male or female

Height

Age (approximate age if rider is over 18 years old)

Years of riding experience

Any equestrian qualifications

Any disabilities

Registered disabled?

Horse

Name

Height

Breed or type/build

Approximate age

Current normal use

Previous use or experience

Any disabilities

Gate order

Trial of horse-friendly vehicle barrier

Background

Horse friendly vehicle barriers have been designed for use on bridleways and horse rides in situations where

- there is no livestock to be contained
- it is necessary to keep public vehicles out while continuing to provide a means of private vehicular access through a locked barrier
- there are good reasons why the less restrictive option of a 1.5 metre wide gap alongside a locked farm gate would not suffice.

There is a British Standard for horse stiles (BS 5709:2006), but at present there is no British Standard for horse-friendly vehicle barriers.

A horse-friendly barrier was installed some years ago at Burgate Farm in Yorkshire and had not caused problems, following which similar barriers have been installed elsewhere, some of which have caused problems for horseriders. However, information about the performance of these barriers has hitherto been largely anecdotal and no formally assessed trial has been made.

The BHS has had some concerns as to whether the minimum set-back space of four metres between a horse stile and the edge of a carriageway recommended in BS 5709:2006 is sufficient, either for a horse stile or for a horse-friendly vehicle barrier. The opportunity was therefore taken to include a horse-friendly vehicle barrier in the gates trial, in order to provide evidence about the adequacy of a four metre set-back. In addition, the ease of use and safety for horses and riders of the horse-friendly vehicle barrier was assessed.

The main objective of the study was:

1. to determine whether a 4 metre set-back of the barrier from the edge of a carriageway provides sufficient stopping and waiting distance

Subsidiary objectives were:

2. to determine the ease of use of the barrier for horse and rider
3. to determine the safety of the barrier for horse and rider

Method

'Standard' Horse friendly vehicle barrier

Centrewire brochure: 3,000mm wide, central gap 1,200mm wide at bottom and 2,000mm wide at top. Maximum installed height at centre 250mm (9⅞ ins).

Installed height to top of wooden section: approx. 250mm at centre

British Standard 5709:2006 height for bars of horse stiles: 190mm ±60mm, i.e. 250mm max

The barrier was installed 2.1 metres away from the fence at the edge of the field, and the gap between the barrier and the fence was roped off. Pairs of white electric fence posts were placed four metres away from the barrier in each direction of travel, and on the field side a rope joined the electric fence posts to the barrier, to simulate a hedge or fence line. Participants were asked to visualise an imaginary line, parallel with the barrier, between the white posts as the edge of a busy road. They were asked to walk their horse over the barrier and to stop before their horse's nose crossed the imaginary line (before their horse's head would be hit by the imaginary passing traffic for example). They were recorded on video while they attempted to do this. The number of attempts taken by each horse and rider to step over the barrier, whether the horse hit the barrier and whether the horse stopped before the four metre mark were recorded.

Some riders were also asked to negotiate the barrier in a pair or group of three, to simulate situations when a group of horses is hacking out: as horses are herd animals it is unsafe to leave a single horse alone while its companions cross or ride up a road.

The first direction of travel over the barrier was varied between participants. The northbound direction was very slightly downhill, the southbound very slightly uphill.

Participants

The same riders who completed the gate trial took part in the trtial of the barrier.

Weather and ground conditions

The weather on all the trial days was generally fine, with no more than a light breeze, and the ground conditions were good to firm.

Results

To determine the adequacy of a four metre set-back (Objective 1)

Twenty-five per cent of horses failed to stop before the four metre mark (Fig X).

Most of the participants also tried the barrier in pairs or groups of three, and these pairs or threesomes made full use of the extra 2.1 metres of track width which was provided beside the barrier while they waited for their companions to step over the barrier so that they could all then wait for imaginary traffic to pass before they moved across the imaginary road together. There was no room to spare.

To determine the ease of use of the barrier for horse and rider (Objective 2)

The majority of horses (90 percent) stepped over the barrier at the first attempt. None failed to step over it after repeated attempts, though one horse, having stepped over it in one direction, then refused to do it in the other direction.

To determine the safety of the barrier for horse and rider (Objective 3)

A high percentage of horses, 52 percent, hit or touched the barrier as they went through, making it ring, although it was fitted with a rubber damper and with wooden cladding on the stepover. The horses which had previously regularly encountered horse stiles were better at avoiding hitting the barrier but it was noticeable that the height and nature of the barrier was difficult for the horses to estimate. One horse refused to go near the barrier again after hitting it the first time, and BHS bridleway officers have also received reports of this happening elsewhere, particularly with young racehorses.

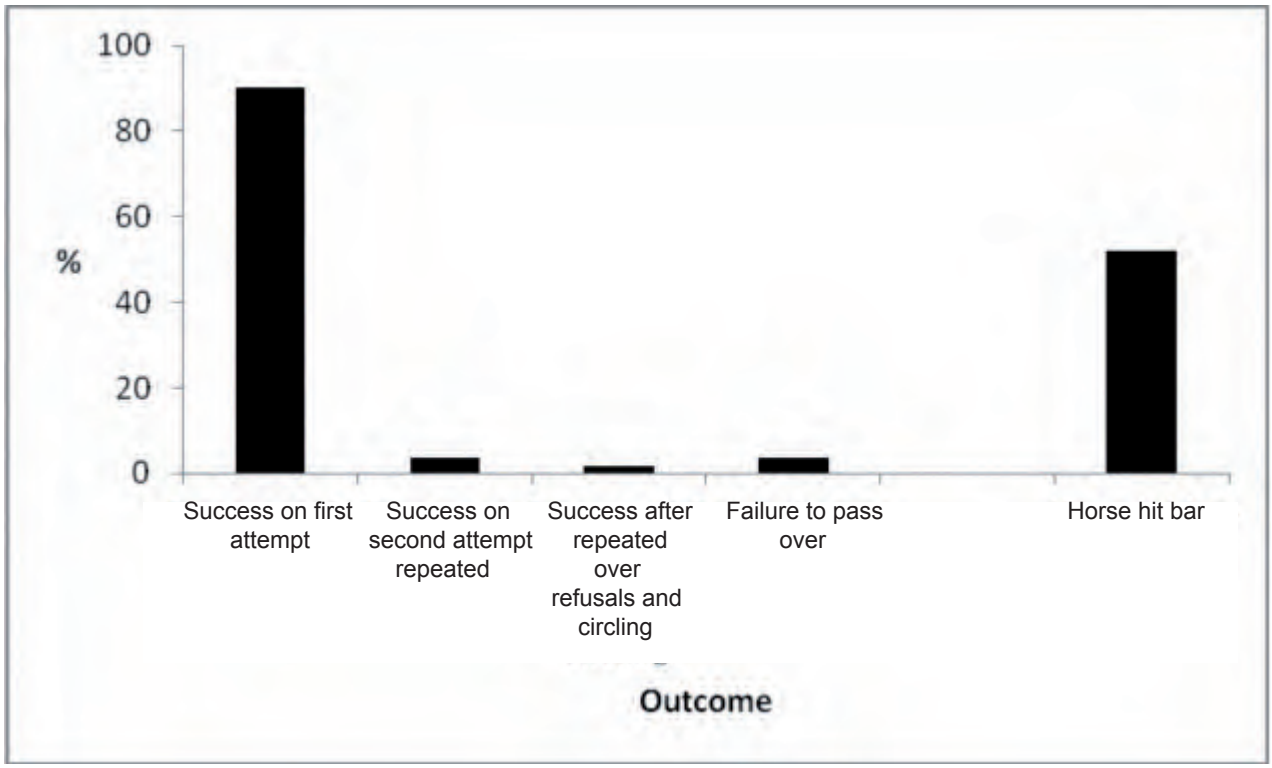
Less able riders

The BHSAI on foot with the two small children said that she would not have attempted the barrier with them had there been a road close to it, so this barrier would have excluded them. However, in the safe setting of the enclosed field, she sent the non-lead-rein child ahead to walk over the barrier. The pony jumped the barrier and failed to stop by the four metre mark. Consequently, because of the worry that the rider may fall off if the pony chose to jump the barrier, the child on the lead rein pony dismounted, crossed the barrier on foot and the pony was led over the barrier by the adult. However, there was difficulty in putting the child back on the pony without straying beyond the four metre mark. This family was not included in the statistics above.

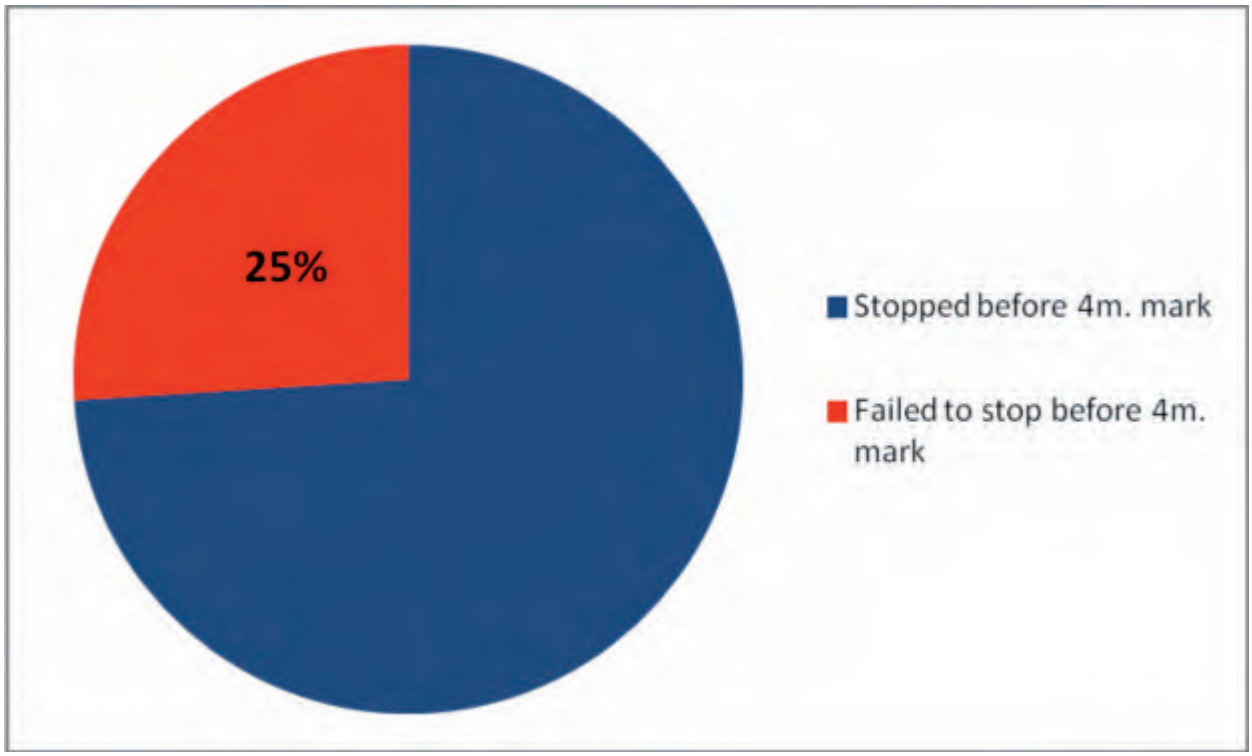
The rider with the very small unridden lead-rein pony initially tried the barrier without the led pony, which, left loose, then jumped the barrier behind her. She then succeeded in leading the pony over

the barrier, but made it clear that had there been a real road, she would not have dared to try it with the led pony, so it would have excluded her.

FIG 1(A) Percentage of occasions with various outcomes at the horse friendly vehicle barrier



(B) Percentage of horses which failed to stop before the four metre mark



26 riders attempted the barrier in two directions to give 52 occasions

Discussion

While some of the times when horses failed to stop before the four metre imaginary line appeared to be due to the rider concentrating so hard on getting over the barrier that they forgot they needed to stop before the imaginary road, others were clearly unable to stop in time. Most riders in the trial felt that at least one more metre was needed, preferably two if space permitted, in order to avoid hitting imaginary traffic. So the set-back from the carriageway needs to be five metres minimum, and six metres if space permits.

To accommodate groups of three horses, unless a minimum width of five metres in the waiting space such as was provided here can be supplied, at least an additional 4.5 metres length (the length of a horse plus half a horse's length[2]) before the edge of a carriageway would be needed for safety. This would give a total set-back of 9.5 metres.

Although a horse stile was not tested in this trial, it is likely that the same minimum set-back distances will be required for a horse stile as for a horse-friendly barrier, since some horses will also try to jump a horse stile rather than stepping over it in walk. In this respect the British Standard 5709:2006 will require revision.

It was noticeable that many horses were unsure about the barrier. This may be because normally with jumps, a pole is placed in front of the jump to help the horse to see the 'ground line' or else the jump is made to look very solid and substantial so that the horse can see it better. BHS bridleway

[2] To avoid the horse in front kicking the horse behind, a space of half a horse's length should be maintained between them

officers have received reports of horses, particularly young racehorses, refusing to approach a barrier as seen in this trial with one horse.

Given that so many horses hit the barrier, the wooden sections will need regular replacement.

The top of the wooden section of the barrier had been set at 250mm from the ground, the maximum height as recommended by the manufacturer. This is the maximum height recommended for a horse stile in British Standard 5709:2006. However, some riders commented that it was lower than the other 'horse-friendly barriers' they had encountered, and hence much easier to negotiate. It appears from this and from the experience of BHS bridleway officers that horse-friendly vehicle barriers are often installed too high off the ground.

It should be noted that in this trial the horses and riders could see an entirely clear approach and exit from the obstacle, the ground cover was grass and the ground on either side of the barrier was almost flat. This made the barrier look as inviting as possible, and will have contributed to the low refusal rate.

Conclusions

1. That the set-back distance for a horse stile or horse-friendly vehicle barrier from the edge of a carriageway should be a minimum of five metres, and that six metres or more is desirable where space permits.
2. That unless at least five metres of width can be provided in the waiting space on the road side of the barrier, the minimum set-back from the carriageway should be increased to 9.5 metres, to allow for use by groups of up to three horses at a time.
3. That BS 5709:2006 requires revision in respect of the set-back distance from the carriageway and the width of the waiting space.
4. That greater care should be taken in installing horse-friendly vehicle barriers to ensure that they are not set above the maximum recommended height of 250mm.
5. That further research is carried out to establish whether any alterations to the design will make horse-friendly vehicle barriers easier for horses to judge so that they are less prone to hitting them.
6. That pending such research, where possible the British Standard horse stiles should be used in preference to horse friendly barriers.
7. That where horse-friendly vehicle barriers are installed, provision should be made for regular inspection and replacement where necessary of the wooden section.

The British Horse Society
Abbey Park
Stareton Lane
Kenilworth
Warwickshire CV8 2XZ

Tel: 02476 874599

Fax: 02476 840501

www.bhs.org.uk
enquiries@bhs.org.uk

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