



Equestrian use of trunk road structures

A study of key issues for riders

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Executive Summary

As part of a review of BD 29/87, Design Criteria for Footbridges, Parsons Brinckerhoff Ltd was required to undertake tests using ridden horses to investigate a range of parameters relating to equestrian use of overbridges. Data was collected both through practical trials at two separate locations and via a questionnaire circulated through the British Horse Society. Opportunity was taken within the questionnaire to invite equestrian comments on the use of highway bridges generally.

From the responses received to the questionnaires it is apparent that a significant proportion of horse riders consider that, in many cases, crossing existing bridges is a major hindrance to access of desirable riding areas because of concerns about parapet provisions. However the vast majority of the structures which give rise to such concerns are highway bridges, which are not designated as bridleways or equestrian routes and therefore do not have equestrian provisions such as appropriate parapets or segregation. The majority of respondents considered that these concerns would be greatly reduced by upgrading parapet provisions on such bridges, where they are used regularly by riders to access equestrian routes.

Of those riders taking part in the trial that had used dedicated equestrian crossings, the concerns were reduced considerably although it was generally felt that existing equestrian provisions could be improved.

Data gathered from the trials and feedback from regular equestrian users via questionnaires would suggest that a significant body of riders consider the existing DMRB requirements for equestrian parapets to be insufficient in the following areas:

- A significant minority of respondents considered that the height at which the parapet top rail is set should be increased.
- A greater height of solid infill panel would be preferred.
- More careful consideration should be given to the choice of materials used for solid infill.
- Where the bridge is wide enough to enable the bridleway to be located more than 2m away from the parapet, it was generally considered that the solid infill height could be reduced to about 1.0m.
- The preferred minimum width of bridge carrying a bridleway would be 3.5m clear between faces of parapets.
- The alignment of the crossing should allow a clear view across the structure from the approaches, for both horse and rider. Wherever possible, areas should be provided at the entry points to a structure to allow other users to wait in a safe environment while equestrians cross.

The specification of surfacing types acceptable to all users requires further consideration.

1 Introduction

1.1 General

In September 2000, the Secretary of State for the Environment, Transport and the Regions invited tenders for the Review of BD 29/87, Design Criteria for Footbridges (Tender No 3/352). The Highways Agency (HA) appointed Parsons Brinckerhoff (PB) on 5 January 2001.

The contract is a research project with the aim of updating design guidance for footbridges, with shared cyclists and equestrian use and to reflect current policy on encouraging walking and cycling, provision for the disabled and mobility impaired users, environmental sensitivity and construction related issues.

The brief also included a research element comprising practical testing involving equestrians in order to clarify issues such as preferred deck width, desirability of permitting horses to pass each other and pedestrians while on a bridge, parapet height and configuration and preferred visibility criteria.

As part of the above review, trials have been undertaken to investigate the effect of parapet height and infill on comfort levels of both horses and their riders. This report primarily details the findings of these trials.

In addition to the trials, questionnaires have been distributed through the British Horse Society to obtain a sample of the views of riders that regularly use crossings over major roads. The responses to the questionnaires have been analysed and are discussed in this report.

2 Horse & Rider Trials

2.1 General

The trials were organised and directed by Parsons Brinckerhoff Limited. Two structures were selected by geographical location and construction type suitability. These were Goor Lane Bridge over the M4 near Swindon and Cow Lane Accommodation Bridge over the A34 near Didcot.

The structures were open to normal traffic throughout the trial, however the extremely

low volumes using each crossing appeared to have no bearing on the reactions of the participating riders and horses.

Members of a local riding school affiliated to the BHS took part in the trials. Although it would have been advantageous to have a broad mix of rider abilities for the trials, safety considerations meant that the majority of participants were relatively experienced riders.

2.2 Structure locations & description

HA Structure No:	Goor Lane M4/114.0	Cow Lane A34/62.70
HA ST Key No:	1088	7344
National Grid Reference:	SU 42810E 17860N	SU 44974E 18998N
Road Over:	Unclassified road	Farm Access Track
Road Under:	M4	A34
Overall length:	73.6m	49.4m
Headroom at centre of bridge:	6.6m	5.5m
Clear width between parapets:	9.14m	4.50m
Existing parapet height:	1.80m	1.90m
Existing parapet infill	Mesh only	Mesh only

2.3 Methodology

The trials took place on 7 August 2001 at Goor Lane and 30 August 2001 at Cow Lane. A similar procedure was used in both cases. Participants were asked to ride firstly along the centre line of the bridge and then along the kerb line for a number of different configurations of parapet infill height, ranging from no fill up to the full height of approximately 2m. The configurations are illustrated in Appendix A.

The varying infill height was achieved by fixing sections of plastic sheeting in place. In the case of Goor Lane Bridge, temporary Herras Fencing was installed adjacent to the parapet to achieve an effective height of 2.0m. Because the deck was relatively wide, the sheeting was installed on one side of the bridge only. On Cow Lane Bridge, the existing parapet was used with the sheeting fixed along both sides of the deck. Typical parapet height, infill and width configurations are shown in Appendix C.

After each pass, each rider was asked to complete a questionnaire to record the reactions of both horse and rider while making the crossing. In addition, at the end of each trial, a final questionnaire was completed ranking the infill heights used in order of preference. Summaries of the responses to the trial questionnaires are presented in Appendix B.

2.4 Summary of results

When first introduced to the structures the majority of the horses were uneasy. However,

after a period of acclimatization and before the trials themselves started, the horses were generally calm.

The horses and riders generally felt more anxious during the Cow Lane Bridge trial. Although the A34 is only a dual two-lane carriageway and is therefore shorter than the Goor Lane crossing, there is a much higher HGV content in the traffic. The bridge deck is also at a lower level and therefore closer to the traffic. The combination of traffic noise and the view of the approaching vehicles, particularly HGVs, passing beneath the horse and rider appear to have an unsettling effect.

There was a general consensus among all the riders who took part in the trials that they felt least secure with the existing configuration of the parapets i.e. with no solid infill panels. The width of the selected bridges was a source of less concern, particularly when they were able to ride along the centreline of the bridge.

On both structures used in the trials, the height to the parapet top rail was greater than that normally specified for equestrian parapets in accordance with BD52/93. As a result, the riders generally noted that they felt more secure during the trials than they would normally do on a number of the bridges that they regularly used. The largest of the horses used in the trial was 16.1hh and the increased top rail height was sufficient to ensure that the rider's centre of gravity was lower than the rail, in the event that he/she was thrown against the parapet. The existing standard height of 1.8m was sufficient to ensure that this was the case for the smaller category of horses used in the trials (15.1 to 15.3hh), into which the majority of horses used for leisure purposes fall. Horses in the larger category are generally ridden by more experienced riders. However, the extra 200mm was deemed to give the rider an added degree of comfort should the horse rear up.

Although riders expressed an initial preference for the infill to be as high as possible, the 1.6m infill height proved the most popular among the riders who took part. It was noted however that this was the height used for the final trial at each structure; it is not clear whether this had any influence on the preferences expressed. Parapet configurations noted as being preferred by participants generally fell into one of the following options:

- The infill panel should be as high as possible to eliminate all sight of traffic and as much of the associated noise as possible,

- The infill panel should stop at the eye level of the horse, allowing it to identify traffic in the distance but significantly reducing closer range effects 'below' the horse.

The smallest horse used in the trial was reported to feel uncomfortable with the 2.0m high infill. The rider's opinion was that his mount was probably intimidated by the enclosure being above eye level, particularly when walking adjacent to it. The nature of the sheeting may also have contributed to the sense of anxiety. However, it serves to highlight that a compromise must be arrived at which caters for the requirements of riders of horses over the entire spectrum of breeds and sizes. Careful selection of material texture and colour was also considered to be important, in order to provide a neutral background to minimise the risk of startling horses.

The trials confirmed that the existing standard for 600mm of infill is widely considered to be inadequate among riders. The results would also suggest that, on narrow bridges, less than 1.0m infill would not be favoured, because the horse and rider would still be able to view the approaching vehicles closing on them while having a minimal effect on reducing traffic noise. Only in cases where a dedicated equestrian route is located a significant distance away from the parapet was an infill of 0.6-1.0m considered to be sufficient.

One effect noted by some of the riders was that, on wider bridges where horses could only see the traffic underneath to one side, they felt noticeably less comfortable when the traffic underneath was moving towards them compared to when the traffic was moving away from them.

The riders and horses taking part in the trials were fairly experienced and this will therefore be reflected in the responses given. We understand that some less experienced riders who were invited to participate did not feel sufficiently confident to take part in the trial. The less confident horse and rider combinations taking part in the trial were able to follow the lead of other more seasoned participants, which helped to reduce any anxiety experienced.

It was noticeable that both horses and riders became more confident making the crossing during the course of the trial and this will have had an impact on their reaction to the different parapet configuration used. It was not, however, practical to extend the trials over a longer period in order to reduce this effect.

One further factor which affected the reaction to the infill being used during the trial was the nature of the infill itself. Because flexible temporary sheeting was used, it tended to flap slightly under the action of both the background wind and wind

generated by passing vehicles. Thus when an HGV passed under the structure, the horses had to contend both with the noise of the vehicle and the moving sheeting. One horse in particular appeared to react to the royal blue colour of the sheeting. Notwithstanding this, the horses appeared to be more comfortable with the sheeting in place rather than an open parapet.

3 Questionnaire Survey

3.1 Introduction

A questionnaire was circulated through the regional areas of the British Horse Society to roughly 100 of their access officers to gather information from riders across the country. The questionnaire gathered information on riders' experiences of using existing crossings, any incidents that have occurred while using them, and what criteria they considered should be incorporated into an equestrian parapet specification.

A total of 47 responses were received which are summarised below. The majority of bridges identified in the responses are general highway structures and not necessarily allocated bridleway status. Consequently, these structures are fitted with parapets with heights of between 1.0m and 1.5m and no solid infill panels. This configuration would not be considered appropriate for equestrian use in accordance with BD52/93. However, the responses still provide relevant data in as much as they are representative of a large number of highway bridges that provide frequently used links between severed bridleways.

3.2 Parapet requirements

The main criterion governing rider safety is the height of the top rail of the parapet. This acts as a physical barrier in the event of a horse being startled and prevents the rider from being thrown over the side of the bridge. The specified height of a P4 equestrian parapet in BD 52/93 is 1.8m. The majority of respondents considered this to be an adequate height; however a number who regularly rode larger horses considered that a 2.0m minimum height would be more appropriate.

There were a small number of responses, mainly from those who rode large horses, who felt that a top rail height of up to 3m would be desirable.

We are not aware of any cases where a rider has actually been thrown over the side of a

bridge while crossing it, although we are aware of anecdotal reports of events occurring which have been considered to be highly dangerous.

The main parameter, which appears to influence the apparent level of comfort experienced by a horse crossing a bridge, is the height of the solid infill to the parapet. The current requirement for a P4 equestrian parapet is 600mm. The lowest preferred height, noted in responses was 1.0m, with nearly 50% preferring full height infill to 1.8 to 2.0m.

A number of responses indicated that the width of the bridge should be a factor in deciding the infill panel height, with narrower bridges requiring a higher infill in order for it to be effective in reducing noise.

3.3 Bridleway Details

A broad range of preferred minimum crossing widths were quoted in responses. This is possibly a reflection of the fact that most respondents generally use existing trafficked bridges rather than pedestrian bridges. However, it was clear that the general consensus was that there should be sufficient width for two horses or a horse and another user to pass each other comfortably. The widths specified in existing standards vary between 1.8m and 3.0m. The consensus among respondents was that this should be increased to at least 3.5m and preferably 4.0m. Notwithstanding this, under The Countryside Act, horses have the legal right of way on bridleways and as such, on a narrow bridge or footpath, other users should allow horses to pass before moving into a constricted area such as a footbridge. From the responses to the questionnaires, however, it is apparent that some members of the public, particularly cyclists, tend not to fully respect this. Sustrans, the overseeing body for the UK cycle network, endeavour to ensure that where a cycle route is shared by a bridleway, appropriate signage is provided informing cyclists of their legal duty.

Where a crossing is regularly shared by other users e.g. on a combined cycleway and equestrian route, there was general agreement that there needs to be better separation. There was also a consensus of opinion that the installation of a physical barrier should be avoided from the standpoint of rider safety.

With regard to the surfacing of the bridleway the main criterion identified was for the materials used to be as stable as possible to prevent horses from slipping. A dressed surface would therefore be preferred, although one problem with a bituminous surface is the level of noise generated by the horses' hooves. A bituminous wearing course should have a textured finish and not be smooth. Where appropriate, a dust

surface would be a significantly quieter option, but would clearly require considerably more maintenance. The British Horse Society prefers to specify a tamped concrete finish in accordance with BCA Farm Note 16, 'Concrete Floors for Dairy and Beef Cattle'. The specification of a direct tamped finish to the concrete would however preclude the use of deck waterproofing and will require a Departure from Standard unless a separate, stable layer of concrete is provided for the bridleway surface.

Whatever surface is adopted, it must be maintained in good condition to prevent trip hazards. Concern was raised about hardened surfaces icing over during the winter. The issue of maintenance costs associated with the de-icing of such shared use footbridges would clearly become a consideration for designers.

A common form of joint used has a metal plate covering the gap in the footway. Concern was expressed that these can become slippery when wet and it is not easy for a horse to avoid placing at least one hoof on the cover plate when crossing the joint. Asphaltic plug joints could be used as an alternative for shorter spans, but where a cover plate is unavoidable due to the need to cater for larger movements, it was noted that the provision of a non-slip surface coating should be considered.

The form of the expansion joint used needs to be carefully considered during detailed design.

3.4 Other Factors

The current design code specifies the use of mounting blocks on the approaches to a crossing to help less agile people dismount in order to walk their horse across the bridge. The consensus among respondents was that the safest way of taking a horse across a bridge is with the rider remaining mounted. Although one or two people did strongly support the use of mounting blocks, it was generally considered that, if the parapet is of a sufficient height to make the horse and rider feel safe, there should be no reason to provide them.

There was general support for the provision of some form of waiting bay on the approaches to a crossing, which would allow other users to wait in a safe area, off the structure, while allowing a horse to cross. In some cases, the site location or layout of existing structures might make this difficult to achieve.

Some respondents also suggested positioning warning signs on the approaches

to trafficked bridges to give drivers advanced notice that there is a risk that horses might be using the crossing. The most commonly reported sources of problems for riders using highway overbridges are inconsiderate or unsighted car drivers crossing bridges at inappropriate speeds, rather than general traffic passing under the bridge.

Where crossings are frequently used by more than one type of user, the respondents expressed a preference for the provision of warning signs to notify other users of the likely presence of horses. This is detailed in the specification for the UK cycle network where the cycleway is common with a bridleway. The signs could also be used to inform other users of their legal obligation to give way to horses using the crossing, in the interests of safety.

Respondents also identified poor alignment and visibility as factors that compounded this problem on a number of structures. For example, a driver's ability to observe the presence of an equestrian crossing an overbridge may be significantly hindered on arched or curved structures or where vegetation overhangs the approaches.

3.5 Summary of questionnaire responses

Respondents identified a number of factors that they consider could improve the safety of riders using bridge crossings.

A significant majority of responses highlighted safety concerns about riding across highway overbridges, with a number either modifying their preferred route to or electing not to use a particular area. The most significant influence on their decision was whether the existing parapet had been designed solely for pedestrians or catered for equestrian use.

In the case of designated equestrian routes, where specific equestrian parapets are provided, riders generally expressed satisfaction with safety provisions. An increase in the height of the solid infill was generally considered to be desirable in terms of reducing the risk of horses being startled by the noise of traffic passing under the structure. A number of respondents expressed a preference for infill panels to be the full height of the parapet.

Most respondents considered that education of other users of highways and foot and cycle ways is important for equestrian safety. Tolerance from vehicle drivers and cyclists in particular were identified as key issues.

There was a consensus of opinion that an increase in the widths specified for crossings would also be desirable in terms of enabling

horses to pass each other or other users without being forced to walk tight up to the parapet.

4 Conclusions

Based on the results of the trials and in particular on the replies to the questionnaire, it is clear that regular riders consider that the existing requirements for the provision of equestrian parapets merits review in the following areas:

- a) The overall height of the parapet.
- b) Infill panel height
- c) Infill panel materials, colour and texture

In addition, there was a consensus among the respondents that the current provisions for footbridges to accommodate shared pedestrian, cyclist and equestrian use should be reviewed in the following areas: -

- a) The overall width of the structure between parapets.
- b) Surfacing materials.
- c) Expansion joint details/finishes.
- d) Provision of guidance regarding alignment.
- e) Provision of guidance on signage.
- f) Provision of safe waiting areas at bridge approaches, wherever feasible.

There was a general consensus that there is a need to review the classification of existing crossings which could link popular riding areas, especially in rural areas.

5 Recommendations

5.1 The following 5 recommendations reflect, to varying degrees, issues that could have an economic impact on footbridge design projects. As such it is considered that further research/investigation is merited.

1 The height of the parapet infill panel was clearly viewed to be a significant parameter to riders in terms of personal safety. However, the provision of solid infill panels to the suggested height of 1.6m could have significant implications in terms of aesthetics and loss of utility to other users. There will also be cost implications as a result of the increase in wind loading that will need to be catered for and possible adverse effects on aerodynamic considerations. Before any decision is made with regard to revision of the existing provision, a desk study of the potential cost implications should be undertaken, in terms of both design and

construction, for a variety of typical structures using a variety of infill panel heights. The study should encompass a sample of more contemporary footbridge designs, which might be more susceptible to adverse aerodynamic response. The desk study should be supplemented by field trials on selected structures over a reasonable period to assess user reactions.

2 Consultations should take place to establish the perceived effects on aesthetics and potential loss of utility to other bridge users resulting from any significant change to the height of solid infill panels.

3 The existing guidance requires an un-segregated, mixed use structure (pedestrian/cyclists) to have a clear width between parapets of at least 2m. However, a number of designers and bridge owners consider this to be inadequate. As a result, many recently designed structures have adopted a width of 3.0m and above, more consistent with the requirements for segregated facilities. As such, a width to 3.5m for bridges that cater for equestrian users would not represent a significant shift in practice. Notwithstanding this, an economic assessment could easily be incorporated into the study suggested above.

4 The existing specification for equestrian parapet height (1.8m) appears to be acceptable to riders in general. However there is a general consensus that a minimum height of 2m would be preferable. This would appear to be a relatively minor revision to existing provisions, with potentially minor implications on cost and appearance. It would be beneficial to install 2.0m parapets on a number of new or upgraded crossings as a pilot study in order to review the reactions of equestrians and other users to such a change.

5 A scoping study should be undertaken to identify existing highway overbridges between popular riding areas that might merit re-classification as bridleway status. This could then be followed up by site-specific feasibility studies and cost/benefit analyses.

5.2 The following 5 recommendations are issues that require due consideration of existing advice and practice. As such we consider that they merit incorporation in some form within forthcoming revisions to the appropriate Departmental Standards.

1 The choice of surfacing materials requires careful consideration. A preferred option of many respondents was a well-maintained dust surfacing. While this is understandable, there are

several characteristics that make it impractical from the point of view of general bridge use. It is by nature a high maintenance surfacing and may also be thrown by vandals onto traffic using the carriageway below. Recently developed pavers made of recycled rubber have been increasing in popularity as surfacing in equestrian establishments. These provide the benefits of a compliant surface with a high degree of slip resistance. Advice should be provided on the variety of surfacing materials available that are appropriate to mixed use crossings.

2 The requirement to provide slip resistant cover plates to expansion joint details on mixed use bridges should be included in the new revisions to BD29.

3 Guidance should be provided to ensure appropriate attention is paid to the alignment and landscaping of highway overbridges which accommodate bridleways, in terms of both design and maintenance, to ensure that sufficient and clear sight lines are provided.

4 Advice should be provided within the relevant standards and advice notes on appropriate signage. A joint publicity campaign by BHS/Sustrans would be beneficial in raising awareness of safety aspects of the joint use of bridge crossings.

5 Guidance should be provided within the new revisions to BD 29 with respect to the provision of safe waiting areas on the approaches to new, shared use footbridges.

Appendix A
Parapet Configurations Used in Trial

Figure 1
Goor Lane Bridge

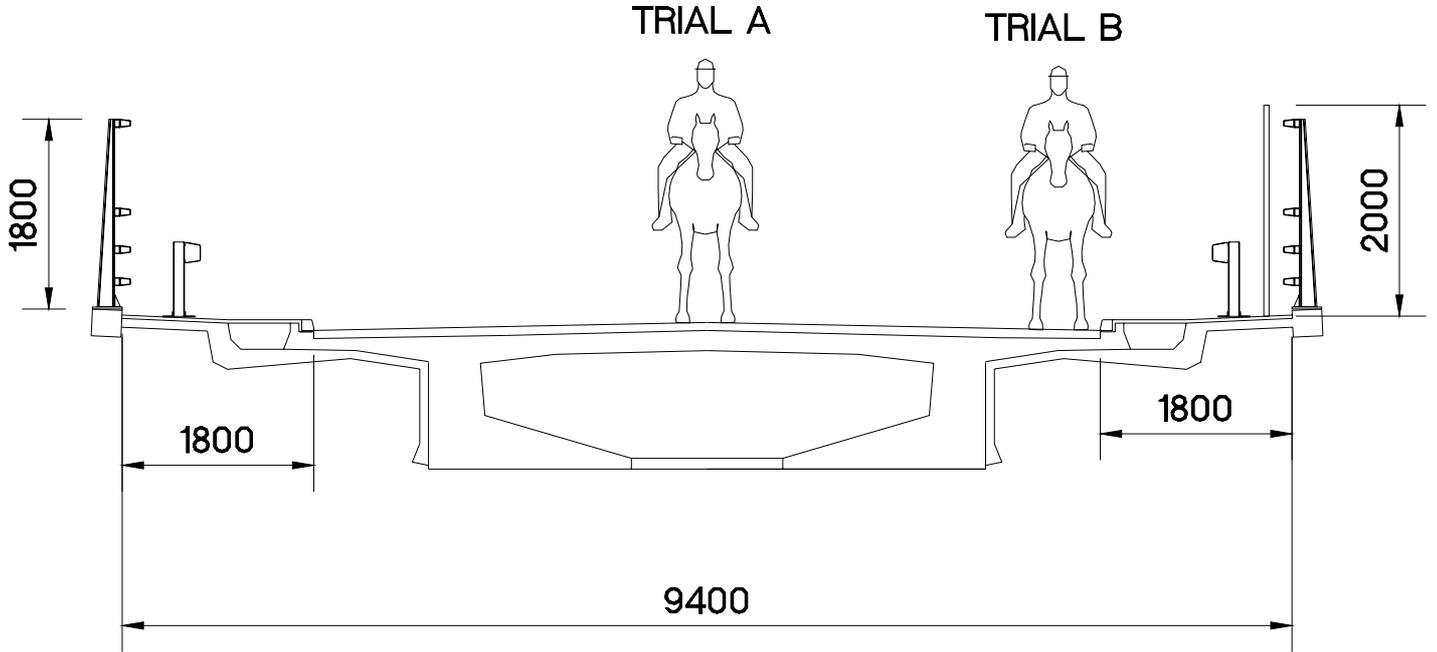
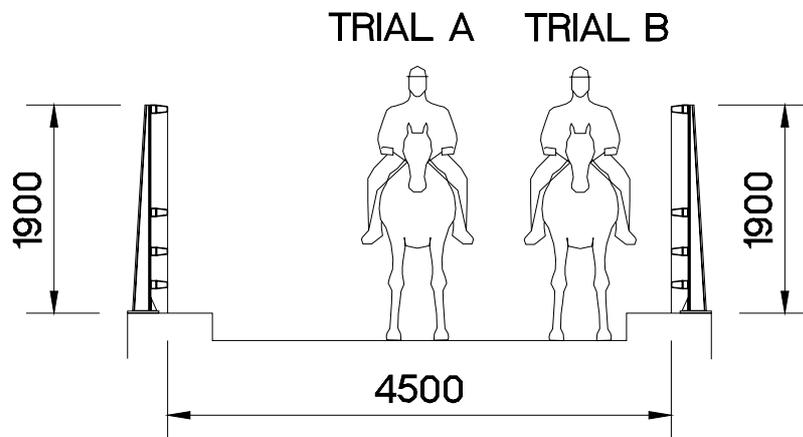


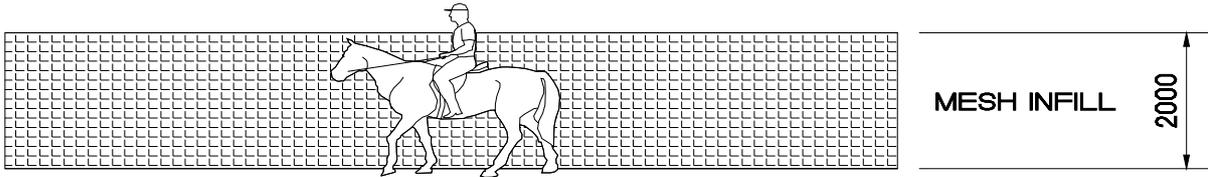
Figure 2
Cow Lane Bridge



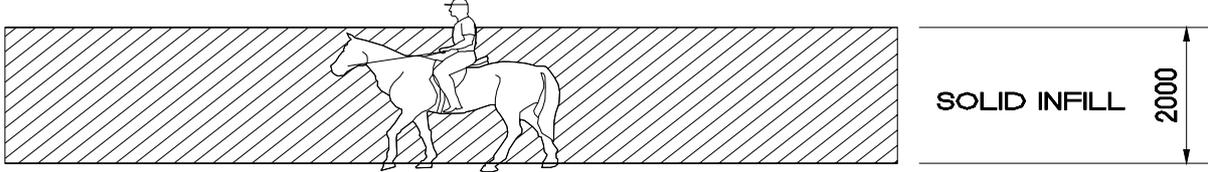
Appendix A
Parapet Configurations Used in Trial

Figure 3
Goor Lane Bridge

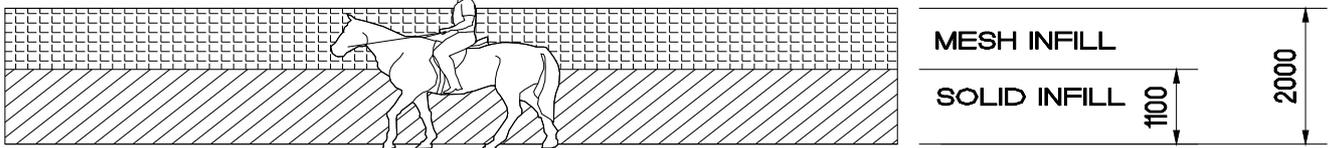
TRIAL 1



TRIAL 2



TRIAL 3



TRIAL 4

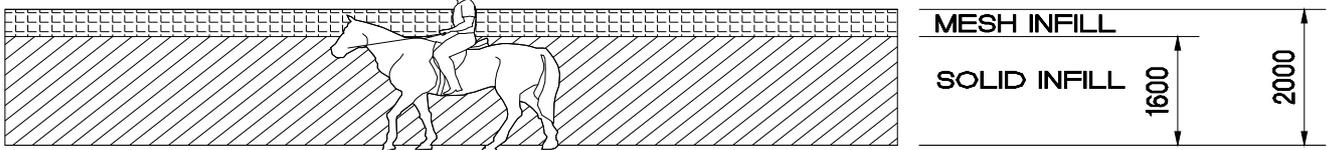
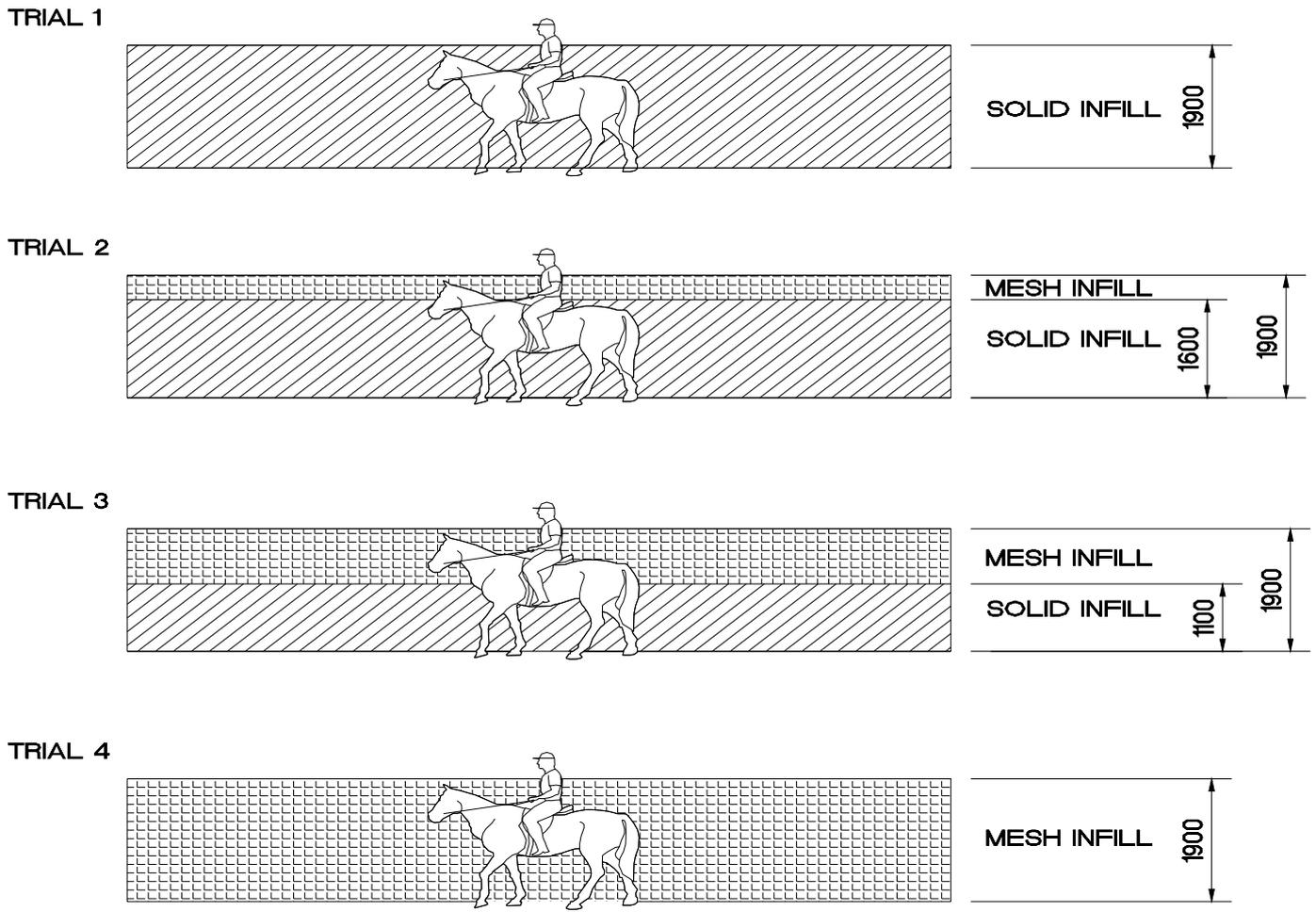


Figure 4
Cow Lane Bridge



Summary of Responses Given at Trials

Table 1
Goor Lane Bridge

Parapet configuration (Overall height 2.0m)	Rider 1	Rider 2	Rider 3	Rider 4	Rider 5	Rider 6
No Infill	Uneasy	Relaxed	Relaxed	Relaxed	Relaxed	Relaxed
	Tense	Uneasy	Uneasy	Slightly uneasy	Slightly uneasy	Slightly uneasy
1.0m infill	Relaxed	Relaxed	Relaxed	Relaxed	Relaxed	Relaxed
	Relaxed	Relaxed	Relaxed	Relaxed	Slightly uneasy	Slightly uneasy
1.6m infill	Relaxed	Relaxed	Slightly uneasy	Relaxed	Relaxed	Relaxed
	Relaxed	Relaxed	Relaxed	Relaxed	Relaxed	Relaxed
2.0m infill	Relaxed	Relaxed	Relaxed	Relaxed	Relaxed	Relaxed
	Slightly Uneasy	Uneasy	Tense	Uneasy	Relaxed	Relaxed
Comments	Horse frightened by flapping sheets Horse prefers to see traffic in distance. 1.0m or 1.6m height is preferred option.	Horse doesn't like solid sheeting, likes to see where noise is coming from. 1.6m is preferred height of infill for this width of bridge	Horse doesn't like blue! Not sure why horse was uneasy on 1.6m trial as this was riders' preferred height.	Horse disturbed by flapping sheet, would be good if solid. Prefers 1.6m height of infill.	Direction of traffic makes a difference with no sheeting. Prefers 1.6m height of infill.	Horse very familiar with bridge. Sheeting is better than existing mesh.

Notes:
Order of trial: No infill, 2m infill, 1.0m infill, and 1.6m infill.

Table 2
Cow Lane Bridge

Parapet configuration (Overall height 1.9m)	Rider 1	Rider 2	Rider 3
No Infill	Centre	Relaxed	Relaxed
	Channel	Relaxed	Relaxed
1.1m Infill	Centre	Relaxed	Relaxed
	Channel	Slightly uneasy	Relaxed
1.6m infill	Centre	Relaxed	Relaxed
	Channel	Relaxed	Relaxed
1.9m infill	Centre	Relaxed	Relaxed
	Channel	Relaxed	Relaxed
Comments	Prefers 1.6m infill height Oncoming traffic makes rider less secure for clear parapet	Prefers 1.6m infill height Horse probably used to bridge on pass with no infill.	Small horse so could find 1.9m infill intimidating on narrow bridge. Horse likes to see where noise is coming from.

Notes:
Order of trial: 1.9m infill, 1.1m infill, 1.6m infill, No infill

Appendix C
Sample Parapet Configurations

Typical dimensions of horse and rider

