

ITINERA

THE JOURNAL OF THE
ROMAN ROADS RESEARCH ASSOCIATION

VOLUME II, 2022



Published by the Roman Roads Research Association



Published by the Roman Roads Research Association
Ellerbeck Cottage, Ellerbeck, Northallerton, North Yorkshire, UK. DL6 2RY
A charity registered in England and Wales No. 1163854

ISSN 2635-1579 (print)
ISSN 2635-1578 (online pdf)
ISBN 978-1-8383918-1-2

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The Roman Roads Research Association also wishes to acknowledge the contributions of all the other individuals who have volunteered their time and expertise in the preparation, production and distribution of this volume, without whom it would not have been possible:

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ABOUT THE ASSOCIATION

The RRRA was formed in 2015 as a registered charity to bring together disparate individuals who were researching Roman roads, and to coordinate a nationwide programme of consistent and high quality research, promoting the study of Roman roads and Roman heritage throughout the former Roman province of *Britannia*. Over the last couple of decades, it has often been a race against time to discover and record what we can of the 60% of the Roman road network about which we are still uncertain, since modern agricultural methods and urban development have been steadily removing surviving features from the landscape. Fortunately, new technologies such as lidar and geophysical survey have helped enormously and enabled researchers to identify the remains of hundreds of miles of previously unknown Roman roads, along with associated Roman sites, and we continue to work to fill the many gaps. Research is only half the story though, we also have to ensure that the results of our work are readily available. We aim to:

1. bring together all known information on Roman roads in Britain, summarised in a freely accessible online interactive gazetteer, hoped to be complete by 2026.
2. identify key sites where important questions remain, and organise fieldwork necessary to answer those questions. 200 Ha of geophysical survey have been completed, with a further 400 Ha already planned, and several future excavations are currently at the planning stage.
3. encourage the involvement of as many people as possible in our activities. We care passionately about community archaeology, and will always encourage local people to get involved in our work, without any charge (unlike some organisations, we will never do this!).
4. make resources available to researchers and other groups, organise events to keep people up to date with research including online talks & seminars.
5. ensure that all our published work is Open Access, including our quarterly newsletter and *Itinera* (following a brief one year members only embargo).

Membership is open to everyone, and our four hundred and seventy or so members come from a wide variety of backgrounds, ranging from those with just a general interest in our Roman heritage to professional archaeologists from both the public and commercial sectors, alongside seasoned Roman roads researchers. The Romans tended to apply their technology uniformly across the empire, this is especially so for Roman road layout and construction. Consequently we do not just restrict our interest to *Britannia* and our membership now includes many international members. Joining the RRRA gives you the knowledge that your modest subscription (just £14 a year for a single adult) is helping to support our important work. You might even get a warm and fuzzy glow.



EDITORIAL

ROBERT ENTWISTLE



The publishing of *Itinera* Volume II is no less an important moment than that of Volume I: it demonstrates that our journal has arrived definitively as a point of reference for all transport-related aspects of Roman archaeology – and that this has been possible in a year dominated by Pandemic-related lockdowns. As in Volume I, you will find a range of authoritative and stimulating papers aiming to develop the study and understanding of everything to do with Roman roads and transport, for academics and the informed public alike.

In this volume you will find some contributors familiar to you from the last volume, and other important new ones. We are delighted to have a welcome extension of focus to other regions of the Roman empire, drawing us beyond a comfortable local perspective. We publish a lively paper (translated by Mike Bishop) from the Spanish academic and presenter Isaac Moreno Gallo, who has, single-handedly, done much to develop an informed awareness of Roman roads in his native country. A man of trenchant views, he champions a rational and rigorous approach not always evident in the past. The perspective he provides has much in common with that of the UK, while being stimulatingly distinct. *Itinera* would be most pleased to host other papers from international contributors, developing an understanding of roads and transport systems across the empire.

Once again, we have an impressive range to the topics covered in our journal. The international theme is continued by Bev Knott who considers an aspect of transport that may be new to many: the likely extent and impact of brigandage and banditry on the roads across the empire. Closer to home we have a major paper from David Ratledge, who has become Britain's leading interpreter of Lidar in terms of Roman roads. He demonstrates the remarkable degree to which he has been able to extend knowledge of Norfolk's Roman roads, filling in gaps on the map. At the other end of the country, our Chairman, Mike Haken, explores what Lidar is able to reveal for the Stainmore Pass. He investigates how this might develop understanding of a murky but much-debated topic, the relation of some Roman roads to Iron-Age predecessors.

Of course, roads are not only a topic of study in their own right but help us develop understanding of other areas of archaeology and history. Thus Dave Armstrong, who recently published a book on the Hadrian's Wall Military Way, contributes a paper that is likely to become a work of reference in its own right. It explores and sets out the sum of present knowledge on the network of link roads connecting the Wall to other aspects of Roman infrastructure in the North, a topic little examined in the past.

Yet another topic is tackled by John Poulter in a paper recording how Roman Long-distance Alignments came to be suspected, recognised and understood, with worked examples from

across the country. A further paper investigates how such matters could potentially elucidate aspects of the Claudian Invasion. Finally, and returning us to basics, we have accounts of road excavations from different ends of the country: the Culver Archaeology Project in East Sussex, and an excavation supported by NAA (Northern Archaeological Associates) in Lancashire.

Our section 'Roman Roads in 2021' is inevitably impacted by a year in which Covid 19 has limited much fieldwork, including the work of many local societies. Fortunately, through our valued local correspondents, we can see that not all the work of investigation ceased.

A new enterprise this year is our introduction of Book Reviews, a feature we hope to continue and develop in years to come. We are most grateful to Dave Fell and John Poulter for their contributions on this occasion.

We should not forget that the RRRA is a charity supported only by its own expanding membership. The dedicated band that makes the production of this journal possible to the highest professional standards, has done so through generous donation of time and expertise, whether they be experienced archaeological professionals or knowledgeable enthusiasts contributing specialist skills, understanding and commitment. This is the group that make up our Editorial Committee and Advisory Panel (listed at the front of this volume), and our wider network of supporters and contributors.

Ultimately, of course, we are dependent upon our authors for demonstrating the health and range of this aspect of Roman archaeology. Our 'Notes for Contributors' are readily available on the *Itinera* section of the RRRA website, and we encourage all, professional or otherwise, to submit their papers to us. All contributions will be peer reviewed, and we take great pleasure in publishing all that can pass that test. We look forward to your contributions for our next volume.

Robert Entwistle

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THE IDENTIFICATION OF LONG-DISTANCE ALIGNMENTS IN BRITAIN, AND THEIR POSSIBLE PURPOSES

BY JOHN POULTER

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ABSTRACT

Although the straight lines of Roman roads have often led to use of the term 'Roman alignments', the recent recognition that Long-distance Roman Alignments were actually physical entities raises the questions: what were they, how can they be identified, and what purposes did they serve? Drawing upon examples discovered by the author or with the identification of which he had been involved, this article sets out to answer those questions. It also suggests that such alignments may have been a feature of the early periods of the Roman conquest of Britain, and that their relevance may have subsided as the Romans became more familiar with the territory they had acquired.

It should be noted that this article presents a personal view, and that in a small number of cases, Rob Entwistle, with whom the author has worked closely on this subject, might possess views which differ slightly in emphasis or detail, but this is normal in fields of scholarship in which there are no simple yes/no answers.

THE QUESTIONS

Previously, many scholars have postulated that the Romans set out and followed long straight alignments in their planning of the province of *Britannia*. However, it may be that it was Rob Entwistle and this author who, initially working quite independently, first revealed the physical existence of such Long-distance Roman Alignments in Britain, and systematically began to diagnose their possible purposes. Some of these Long-distance Alignments were found to extend for considerable distances. The Long-distance Roman Alignment from London to Chichester, for instance, stretches for some 55 miles (88 km) across the Sussex Downs, whilst the Long-distance Alignment from Leicester to Cirencester possessed a length of more than 73 miles (116.8 km). Our pathways to these discoveries had been slightly but fruitfully different, so leading to the questions: what was a Long-distance Roman Alignment, how can one be identified, and what purposes might they have served? This article is an attempt to answer these questions.

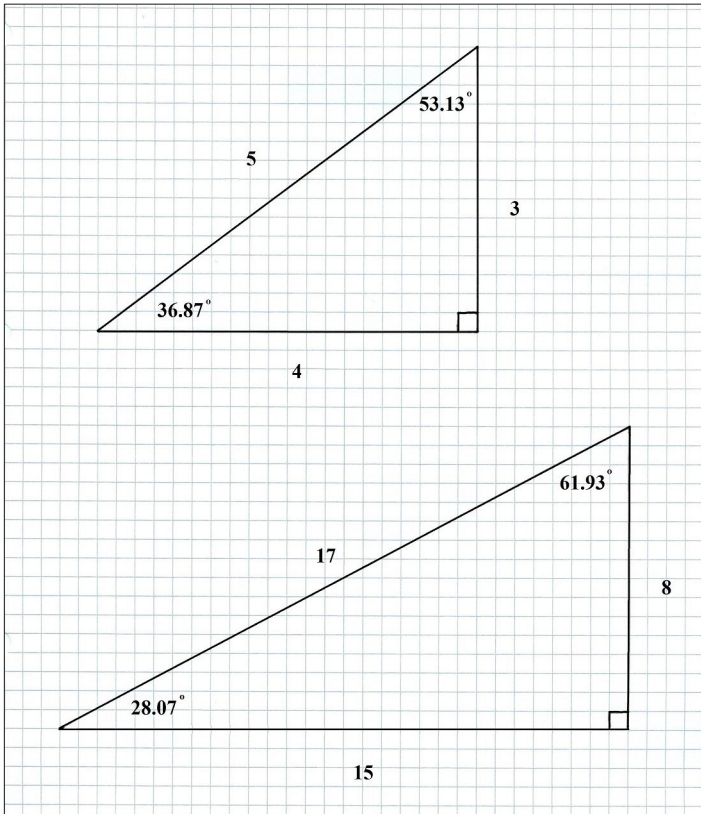


Figure 1: Pythagorean triangles apparently used by the Roman surveyors.

In order to answer the questions, the author began by looking back over the processes by which he had identified or examined each of the Long-distance Alignments with which he had been concerned. Subsequently, it was felt that the records of these trains of thought would be of interest to readers of *Itinera*. Hence their documentation in the first part of this article.

It should be noted that most of the Long-distance Alignments considered by the author happen to occur in the north of England, whereas those detected by Entwistle are not only more numerous but also range much more widely over the country. In addition, it should be noted that it was Entwistle who recognised that the Long-distance Alignments often ran at set angles to each

other, to within an accuracy of 1° . These angles were right angles, half right angles (45°), and the angles of the Pythagorean 3:4:5 and 8:15:17 triangles. For ready reference in what follows the angles of these two Pythagorean triangles are shown in Fig. 1.

EXAMPLES

Example 1: Dere Street: New Inn/Healam Bridge to Scotch Corner

This was the discovery which first revealed the existence of Long-distance Roman Alignments as physical entities, something which had hitherto remained unsuspected, or at least, not really understood. The author had developed a methodology for determining the direction in which Roman surveyors had been working when setting out the courses of their roads (Poulter 2009, 4-7; Poulter 2010, 25-31). Testing it out on Dere Street (Margary RR8) between the Vale of York and Newstead in Scotland, the methodology had produced clear indications of the directions of planning along nearly all of the route of this trunk Roman road.

However, the directions in which the Roman surveyors had been working appeared to be chaotic. They changed from one direction to another for reasons which seemed inexplicable, and this remained the position for several months (Poulter 2009, 8-12). Then suddenly it was noticed on an Ordnance Survey map that the course of Dere Street for the first two or three miles northwards from the Roman settlement of Healam Bridge was exactly aligned upon the Roman site at Scotch Corner, some 15¼ miles (24.4 km) away to the north. Healam Bridge lies beside Dere Street (now the modern A1), just to the south of New Inn Farm, at about Ordnance Survey Grid Point SE 323 837, whilst Roman Scotch Corner stands a little to the north of modern-day Scotch Corner, at around NZ 214 055. It was possible to establish that the Roman Scotch Corner would have been visible – just – from Healam Bridge, especially if there had been a bonfire on top of it. Therefore, in practical terms, this alignment could have been set out from the location of Healam Bridge.

However, it also became apparent that the course of Dere Street, as built, had deviated from this alignment at Leeming to run through Catterick and Catterick Bridge before reaching Scotch Corner. Further examination of the map showed that the reason for the deviation

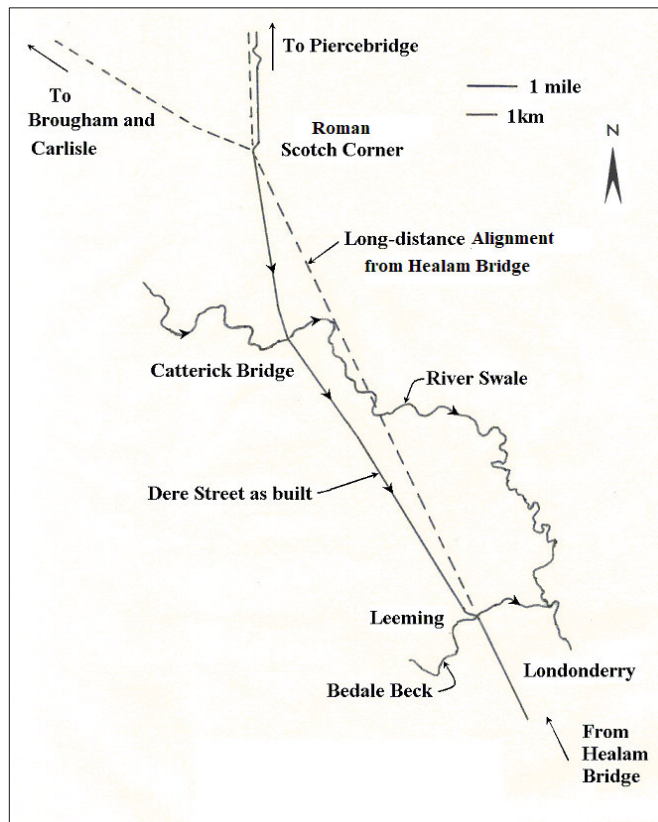


Figure 2: Deviation to cross the River Swale at Catterick Bridge. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

was obvious: the alignment from Healam Bridge, if extended northwards, would have run through some two miles or so of the flood plain of the River Swale, so that any road and bridges built along it would have been liable to suffer damage at every snow-melt. See Fig. 2.

Apparent purpose of the initial alignment from Healam Bridge: a strategic decision that Dere Street should run northwards to Scotch Corner, but worked out on the ground from Healam Bridge, once Roman Scotch Corner had come into sight.

Example 2: Dere Street: Scotch Corner to Esh, and Dry Burn to Esh

The discovery of a Long-distance Alignment leading up to Roman Scotch Corner prompted an examination of the line of Dere Street northwards from there. Immediately to the north of Scotch Corner, the land falls away into the valley of the River Tees, where the course of the Roman road is largely followed today by the B6275. Across the valley of the Tees, the road that the Romans built did not quite follow a single line, but it was observed that, over and beyond the other side of the Tees valley, the stretch of Dere Street running northwards down Brusselton Hill towards the River Wear was exactly aligned upon Roman Scotch Corner, yet out of sight of it. In addition, the Roman fort at Piercebridge where the River Tees was crossed, was found to stand exactly upon the same line. See Fig. 3.

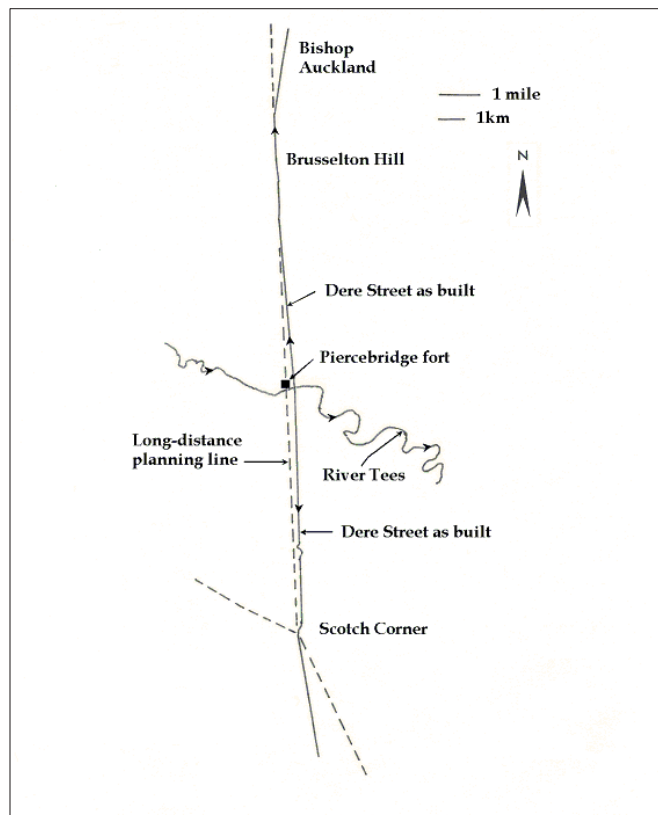


Figure 3: Possible Long-distance planning line north of Scotch Corner. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

It thus appeared that this could be another Long-distance Alignment. However, Dere Street then left the line to run through Bishop Auckland and the Roman fort at Binchester, before crossing and then continuing to the west of the Wear, without showing any further relationship with the line. This was not altogether surprising because for part of the way the alignment ran in or close by the bed of the River Wear.

However, 24 miles (38 km) north of Scotch Corner, Dere Street can be seen to make an abrupt change of direction to the north-west. Unlike the relatively gentle changes of direction which Roman roads such as Watling Street (Margary RR1, the modern A5) or the Fosse Way (Margary RR5) were inclined to display, this was a major shift of orientation, but the reason for it had long remained a curiosity. It was also noticed that the 4¼ miles (6.8 km) of Dere Street to the north of a place named Beukley seemed to perpetuate the new direction, and yet go only to a rather insignificant stream called the Dry Burn. Beukley lies some 1¼ miles (2 km) north of Hadrian's Wall, at around NY 983 707. So, using Ordnance Survey maps, this

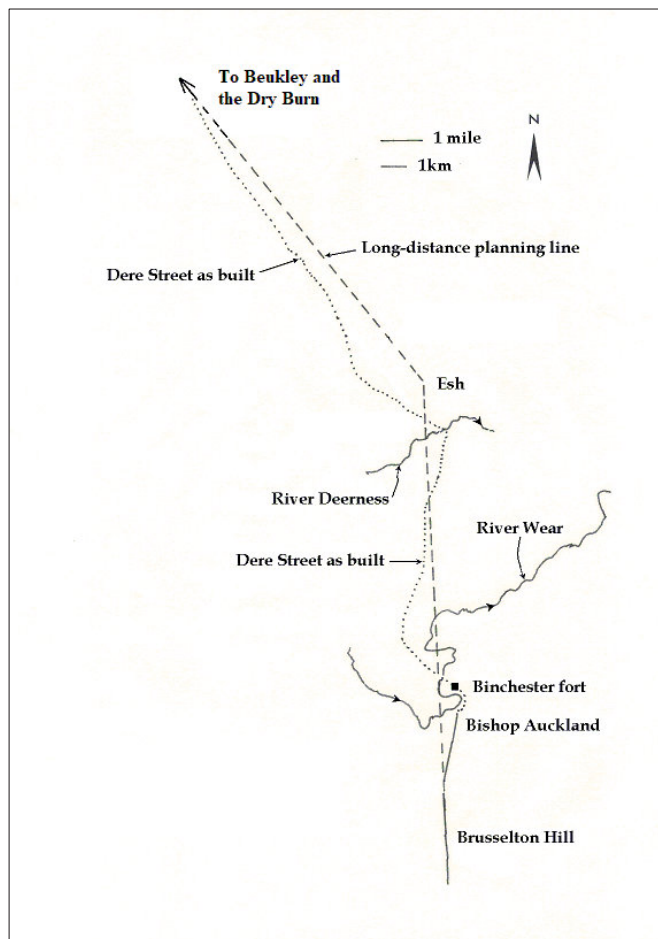


Figure 4: Possible Long-distance planning lines from Brusselton Hill to Esh and from Esh to the Dry Burn. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

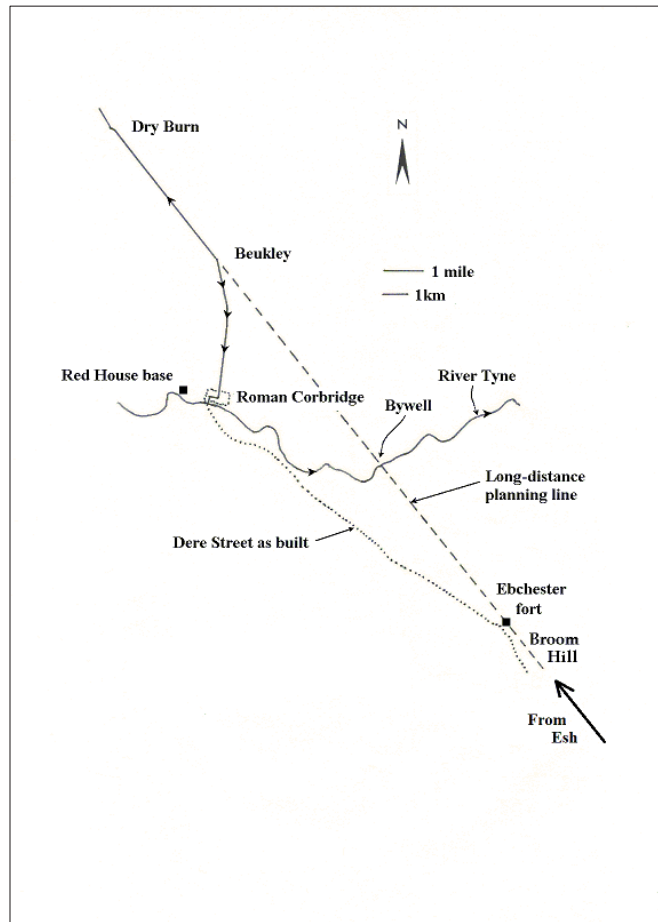


Figure 5: Long-distance planning line from Esh through Ebchester to the Dry Burn. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

stretch was extended backwards (i.e. south-eastwards from Beukley) until it crossed the possible alignment coming up from Scotch Corner, which it did at the village of Esh in County Durham. See Fig. 4.

A visit was then made to Esh, to stand at the exact point at which the two possible alignments intersected on the map, and it was found to be on an elevated north-facing position, ideally positioned from which to set out a new alignment to the north-west¹. It was also noticed, on the map, that the Roman fort of Ebchester appeared to stand exactly upon this north-western line. See Fig. 5.

That clinched it. Two more Long-distance Alignments seemed to have been found, both of them set out from south to north. In addition, the course of Dere Street as built, running southwards from Beukley through the Roman site of Corbridge to re-join the alignment at Ebchester, could now clearly be seen to be a deviation from this north-western alignment.

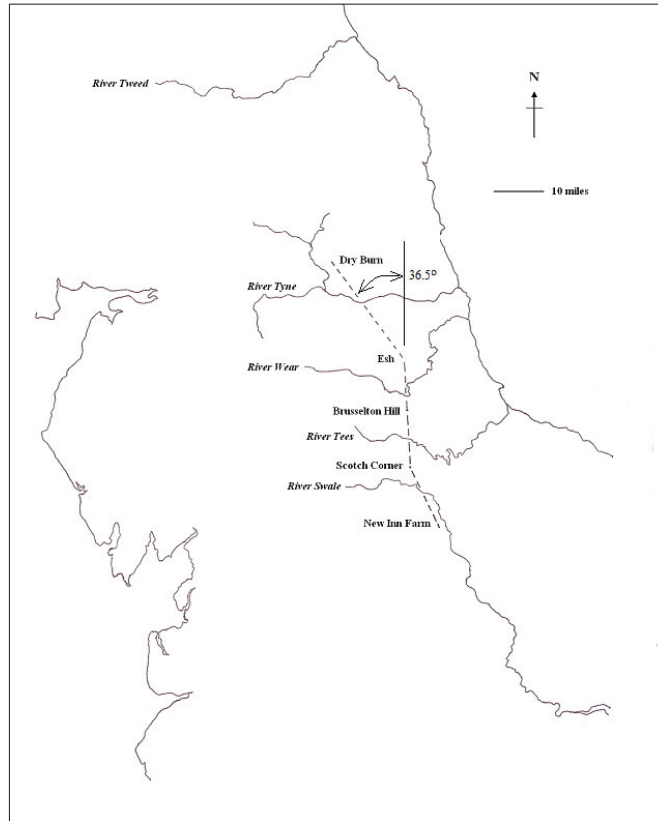


Figure 6: Long-distance Roman Alignments from Healam Bridge (New Inn Farm) to Scotch Corner, Scotch Corner to Esh, and Esh to the Dry Burn.

See Fig. 5 again. Later, after having become aware of Entwistle's discovery of the use of set angles, the change of angle at Esh was measured accurately and found it to be 36.5° – almost exactly a Pythagorean angle. This added to the sense of certainty that Scotch Corner to Esh, and Esh past Beukley to the Dry Burn, had indeed been two Long-distance Roman Alignments. See Fig. 6.

Apparent purpose of these two alignments through Esh: strategic planning of where this trunk Roman road should go, probably directed from a table-top without much awareness of the intervening topography, since the line northwards from Scotch Corner ran straight into the valley of the River Wear, thus causing the builders of Dere Street considerable difficulty in deviating around it. See Fig. 4 again. With only a few degrees difference in the alignment, the difficulty could have been avoided easily. Separately, Entwistle has pointed out that the reason why the Long-distance Alignment from Esh terminated at the rather insignificant Dry Burn is that it could have represented the limit of Brigantian territory at the time (Poulter 2014, 87).

Example 3: Dere Street: Sinderby Services to Tadcaster

The discovery of the three foregoing Long-distance Alignments prompted an examination of the line of Dere Street running southwards from Healam Bridge. This began with a short stretch of about 2½ miles (4.2 km) to where Sinderby Services used to be, at Grid Reference

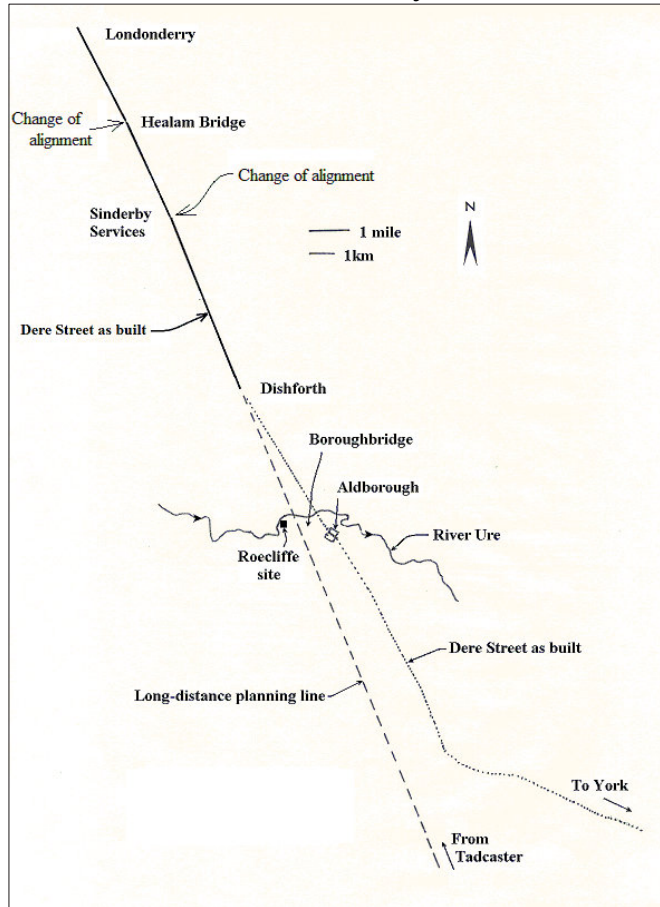


Figure 7: Course of Dere Street as built southwards from Healam Bridge through Sinderby Services to Dishforth, then deviating to run through Aldborough before turning to head for York.

SE 338 804. (These services have recently been demolished.) At this location there was a slight change of direction which Dere Street then followed as far south as Dishforth. See Fig. 7.

At that point Dere Street, as built, sloped away from the line to run to the Roman site of Aldborough and then turned south-southeastwards to continue to York. However, when the line from Sinderby Services was extrapolated southwards beyond Dishforth, it came as a surprise to find that, after a distance of nearly 25 miles (39.5 km), it ran exactly to the Roman site of Tadcaster, beside the River Wharfe. Subsequently, Entwistle and Mike Haken of the

Roman Roads Research Association have suggested that the line might have begun even further south, by the Roman fort of Roall, just beyond the River Aire.

Based upon this and the foregoing discoveries, there seems to be little doubt that this had been another Long-distance Alignment. This view was strengthened when it was noticed that what is believed to be the Roman road known as the Rudgate (Margary RR280), running southward from Whixley on Dere Street to cross the Wharfe a little upstream of Tadcaster,

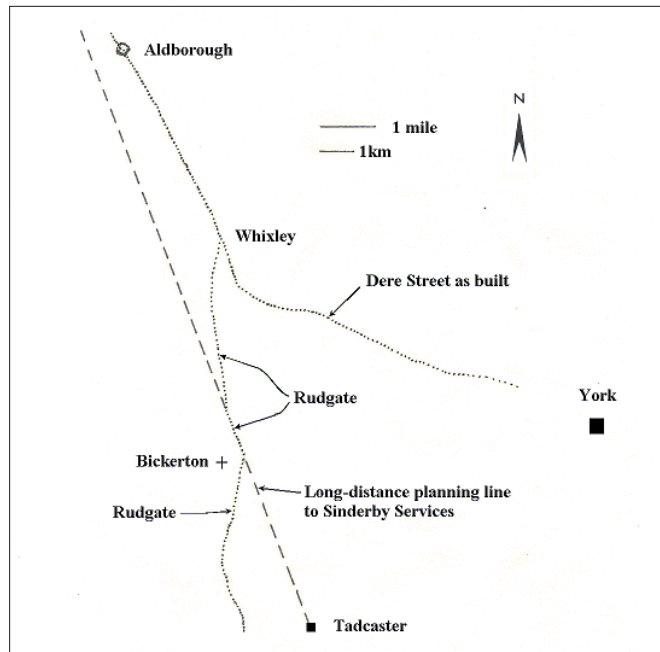


Figure 8: Brief use of the Long-distance Alignment by the Rudgate Roman road. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

appeared to swing onto the line for about a mile (1.6 km), thus increasing the likelihood that this had indeed been another Long-distance Roman Alignment. See Fig. 8.

Entwistle (*pers comm*) has suggested that the Long-distance Alignment coming up from Tadcaster, followed by the two slight turns at Sinderby Services and then Healam Bridge – in order to reach Scotch Corner – could have been a similar tactical road-planning exercise to that of the course of Dere Street coming down from the Cheviot Hills to run to the Dry Burn (see Example 4, below).

Apparent purpose of this alignment: strategic planning, possibly specifying where a Roman campaign trail and supply line should run up the Vale of York, probably as a result of directions from a table-top. However, once Sinderby Services had been reached, the course of the trail then appears to have been worked out on the ground, via small adjustments to

the line at Sinderby Services and then Healam Bridge, in order to attain the ultimate objective of Scotch Corner.

Example 4: Dere Street: coming south from the Cheviot Hills to the Dry Burn

Although Dere Street, coming south from the Cheviots, possesses a 2½ mile (4 km) straight stretch just north of the Roman fort at High Rochester (to be discussed later), no clear signs of long-distance planning could be identified until the Roman road had continued southwards beyond this point, crossed the River Rede and reached Blakehope farm. From that location a framework of what appeared to be straight alignments running generally

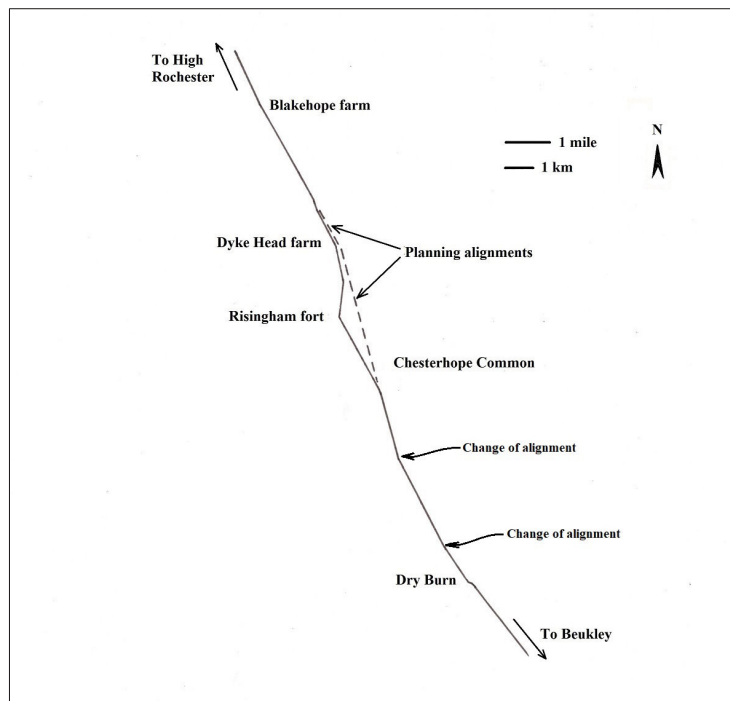


Figure 9: South-facing alignments of Dere Street coming down from Blakehope farm to the Dry Burn.

south-southeastwards could be detected on the Ordnance Survey map. This series of alignments seemed intended to curve the road gradually more eastwards so as to meet the alignment coming up from the south at the Dry Burn. See Fig. 9.

Interpretation of the planning of the alignments was complicated because a deviation had evidently been put in to service the Roman fort at Risingham. This deviation commenced from the first (most northerly) of the alignments but re-joined the long-distance framework on the second of the alignments. See Fig. 10.

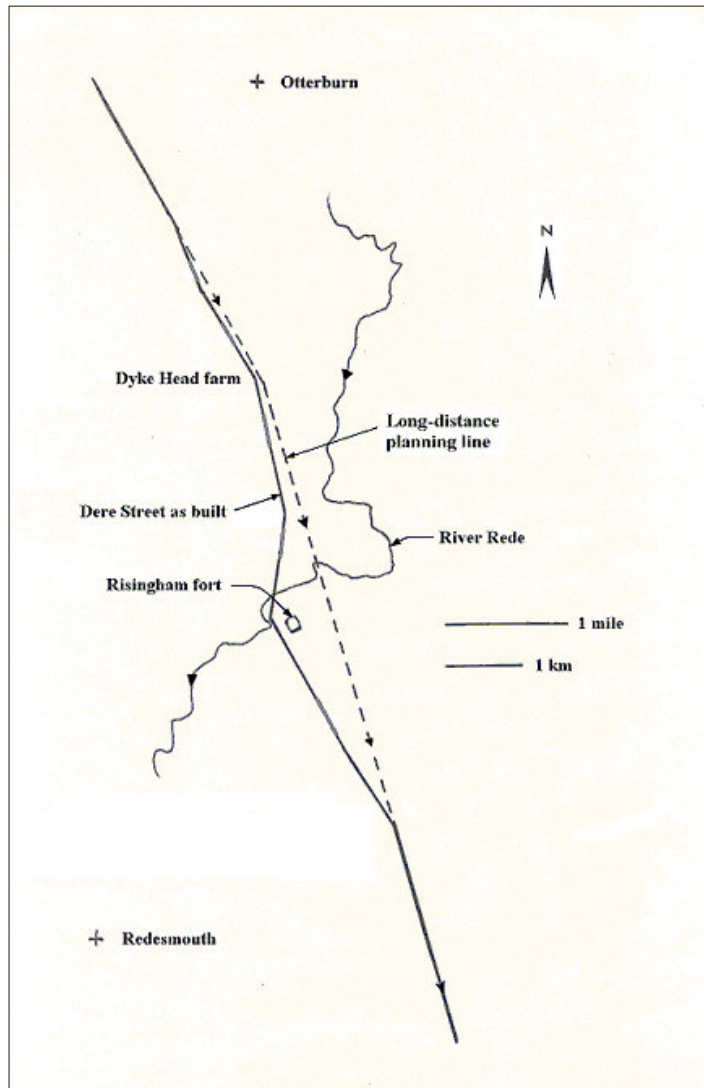


Figure 10: Deviation of Dere Street to service Risingham fort. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

Careful visual observation at each of the turning points verified, however, that all of this sequence of possible alignments had been set out from north to south, indicating the existence of consistent long-distance planning. From Blakehope farm southwards, their lengths were, respectively, $3\frac{3}{4}$ miles (6 km), $5\frac{1}{2}$ miles (9 km), $2\frac{3}{8}$ miles (3.8 km) and 1 mile (1.6 km), so that to call any of them Long-distance Alignments would probably be stretching a point, but the presence of an overall long-distance planning framework here seemed assured.

Purpose of this planning framework: working southwards from the Romans' chosen pass through the Cheviot Hills, and having reached a part of the countryside where it was

practical to set out straight alignments, it appears that the Roman surveyors had set out a series of short alignments on the ground so as – eventually – to meet up with the Long-distance Alignment coming up from the south at the Dry Burn.

Example 5: Dere Street: heading north from the Cheviot Hills to Newstead

Blackhall Hill, standing right alongside the border between England and Scotland, is the point at which Dere Street completes its traverse of the highest ground of the Cheviots and begins to drop very steeply to the north-west. Blackhall Hill offers a superb vantage point in the north-west direction, and, at a distance of 19½ miles (31.2 km), the Roman fort at Newstead (or the smoke rising from it) would have been clearly visible from that point on a good day. Blackhall Hill would thus have been a natural place from which to have set out a

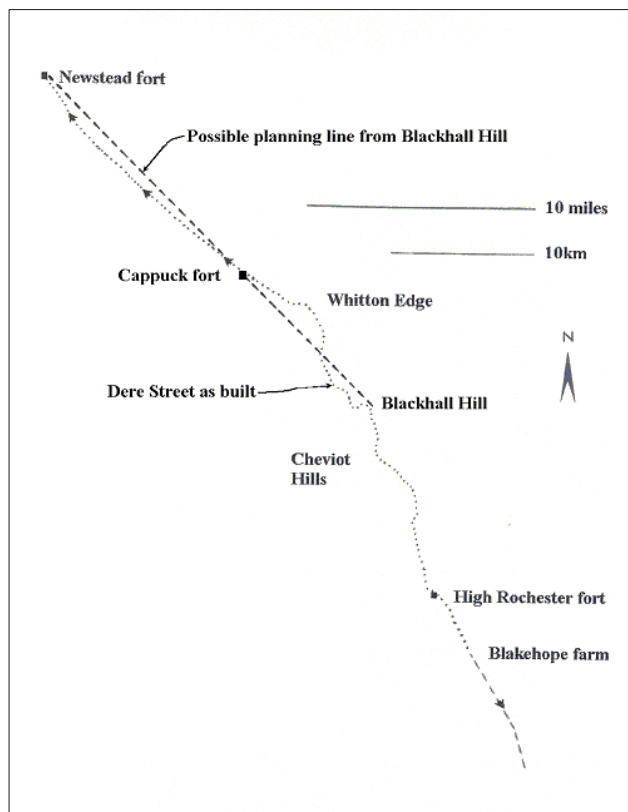


Figure 11: Possible Long-distance Alignment from the vantage point of Blackhall Hill to the Roman fort at Newstead. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

long-distance alignment towards the north-west, but although Dere Street, as built, follows the general direction of such an alignment towards Newstead, nowhere does it run exactly

upon it. However, the intermediate Roman fort at Cappuck appears to lie exactly upon such an alignment. See Fig. 11.

The location of the fort at Newstead commands an important crossing place of the River Tweed, and so it was in a naturally strong position. If its position had been chosen for this reason, and the fort had already come into existence – or, at least, its location had already been fixed and marked – then such an alignment from Blackhall Hill could have been used to determine the location of the intermediate fort at Cappuck. It would have been entirely practical for it to have done so, but in the absence of any other evidence the existence of such an alignment must remain no more than just a possibility.

This is the only example of a possible Long-distance Roman Alignment which the author had detected solely from observation on the ground, even though the position of Cappuck fort along the alignment had subsequently been derived from a map.

Purpose of the possible alignment: strategic need for an intermediate fort between the Cheviot Hills and Newstead; if so, its location may have been worked out on the ground by sighting between the two end points of Blackhall Hill and Newstead fort.

Example 6: Dere Street: southwards from Ebchester

As noted above, the course of Dere Street, as built through Corbridge, had been a deviation from the Long-distance Alignment from Esh to the Dry Burn. See Fig. 5 again. Coming down from the north, this deviation had turned off southwards at Beukley and then re-joined the Long-distance Alignment by the Roman fort at Ebchester. However, to the south of Ebchester, Dere Street did not then follow the alignment to Esh. Instead, it took a new line a few degrees more southerly. This had been noticed when writing the author's original report on the planning of Dere Street (Poulter 2009, 18). It was then addressed specifically in the more popular account (Poulter 2010, 41), where it was suspected that it represented a 'secondary alignment'. However, it had not been investigated further until the author became involved in examining what Bill Trow and his Northern Archaeology Group colleagues had excavated to the west and north of the fort at Ebchester (Trow, 2021).

Prompted by the notion of a 'Proto Dere Street' Roman road, which had been proposed by the late Raymond Selkirk to have run directly from Ebchester to Beukley, Trow had conjectured an alignment for it which had extended from Leadgate, just to the south of Ebchester, to run on to the course of Dere Street at Beukley. It was felt, though, that this conjecture embodied an assumption which might be invalid, and so the line of Dere Street through Leadgate was examined more carefully. The result was a slightly different alignment through Leadgate which, it was felt, matched the course of the road there more accurately. Moreover, when this new alignment was extended northwards to Beukley it was found to run exactly to Beukley farm, which stands about a furlong (220 yards) (200 m) to the east of where Dere Street turns to run to the Dry Burn. See Fig. 12. This farm had previously been noted as standing on the highest spot around, and so it seemed that it would have been the natural position on which a Roman surveyor would have stood if wishing to set out a new Long-distance Alignment to the south.

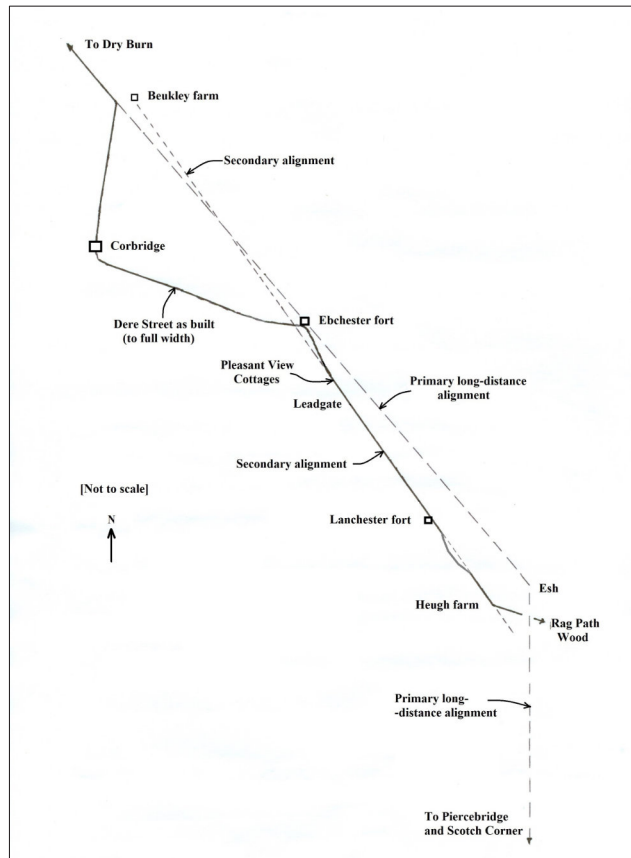


Figure 12: General arrangement of alignments around Ebchester.

Using digital Ordnance Survey data, an examination was carried out of the profile of the landscape between Beukley farm and the approach to the River Deerness to the south, some 22 miles (35.2 km) distant. See Fig. 13. Through an analysis of options this examination was able to reveal that Beukley farm was about the only practical place from which such a Long-distance Alignment could have been set out (Poulter 2021, 179-81). Moreover, very many of the excavations which Trow and colleagues had undertaken were found to lie on this alignment, and not on the one predicted by Trow himself. Hence it appeared that this revision of the existence and inclination of this secondary Long-distance Alignment had been correct.

Estimated purpose of this Long-distance Alignment: road planning on the ground, presumably in order to take a shorter line so as to avoid following the dog-leg of strategic Long-distance Alignments through Esh. See Fig. 12 again. The indications of a Roman road that Trow and his colleagues had found – along this Long-distance Alignment to the north of Ebchester – had been narrow and very lightly built. Indeed, there were some doubts that it had been a Roman road at all. If it had been such, it seems most likely that it had originated in the

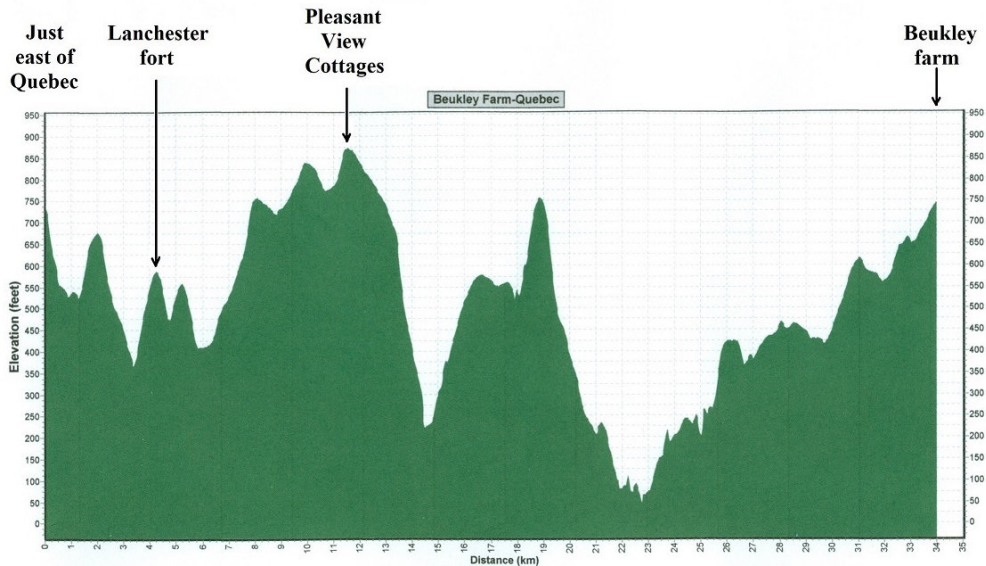


Figure 13: Profile of the landscape under the 'secondary alignment' southwards from Beukley farm. South is to the left and Heugh farm lies about $\frac{2}{3}$ mile (1 km) beyond the hamlet of Quebec.

Roman conquest period, and one possibility is that it had been created as part of a campaign trail to facilitate supply lines for the Roman advance into Scotland under Agricola. Another possibility, though, is that it might even have been constructed beforehand, in order to speed the Roman army's impending advance through Brigantia into Scotland, which does seem to have been notably rapid.

Example 7: Western Main Roman Road: between Whittlestone Head and the valley of the River Lune

Whereas Dere Street is the name which is nowadays given to the Romans' trunk road running northwards up the eastern side of the Pennine Hills (it used to be known as Watling Street), the Romans' trunk road up the western side of the Pennines has remained nameless. For convenience here, as in other publications, Entwistle and the author have referred to it as the Western Main Roman Road (Margary RR7). Entwistle had already established the existence of a Long-distance Alignment running from Manchester to Lancaster, and the branch from it which the Western Main Roman Road took from near Whittlestone Head to Jeffry Hill. See Fig. 14.

Entwistle had also observed that the 5 miles (8 km) of the Western Main Road to the south of Casterton in the Lune valley were exactly aligned upon Jeffry Hill, which was completely out of sight on the other side of the Bowland Forest. The author's interest had lain in trying to understand what the Romans had been trying to achieve here, and how they had accomplished it.

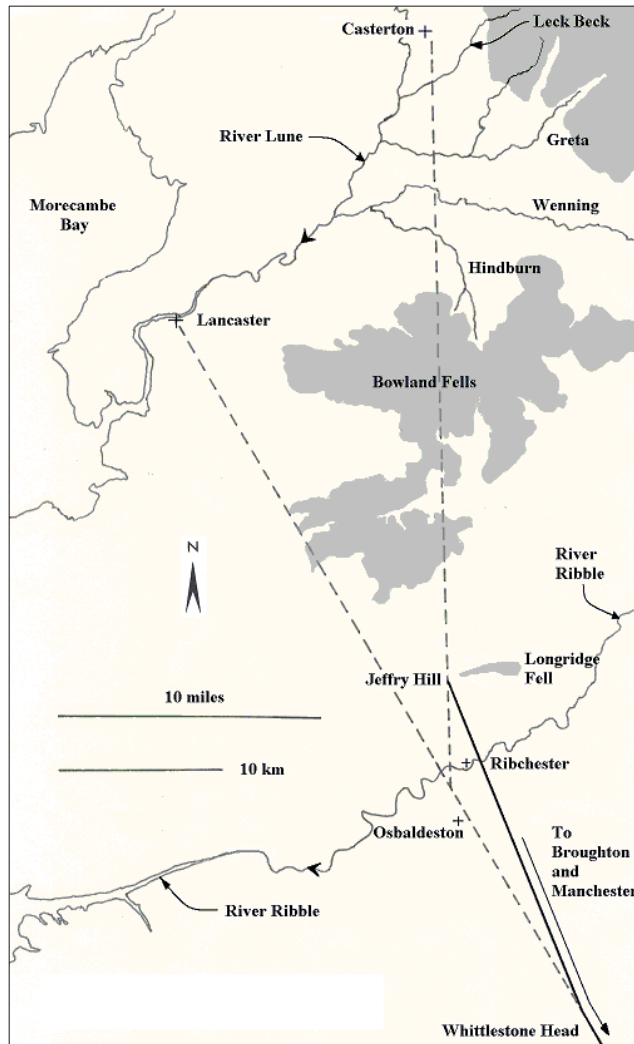


Figure 14: Long-distance Alignments to Jeffry Hill on Longridge Fell.
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Firstly, the course which the Western Main Road, as built, had then taken from Jeffry Hill over the Bowland Fells can only be described as quite extraordinary, since it incurred several miles of travel across very open and exposed moorland – entirely unsuitable for an all-weather trunk road. See Fig. 15.

This, when considered together with the general positioning of Dere Street on the eastern side of the Pennines, indicated that the Roman policy appeared to have been to keep their two north-south trunk roads well inland from the coast. An exploratory examination by the Romans' surveyors would have established that the upper Lune valley, north of Casterton, would have been ideally situated to carry the Western Main Road well to the north of the Bowland Forest – and, at the same time, well inland, in line with the apparent policy.

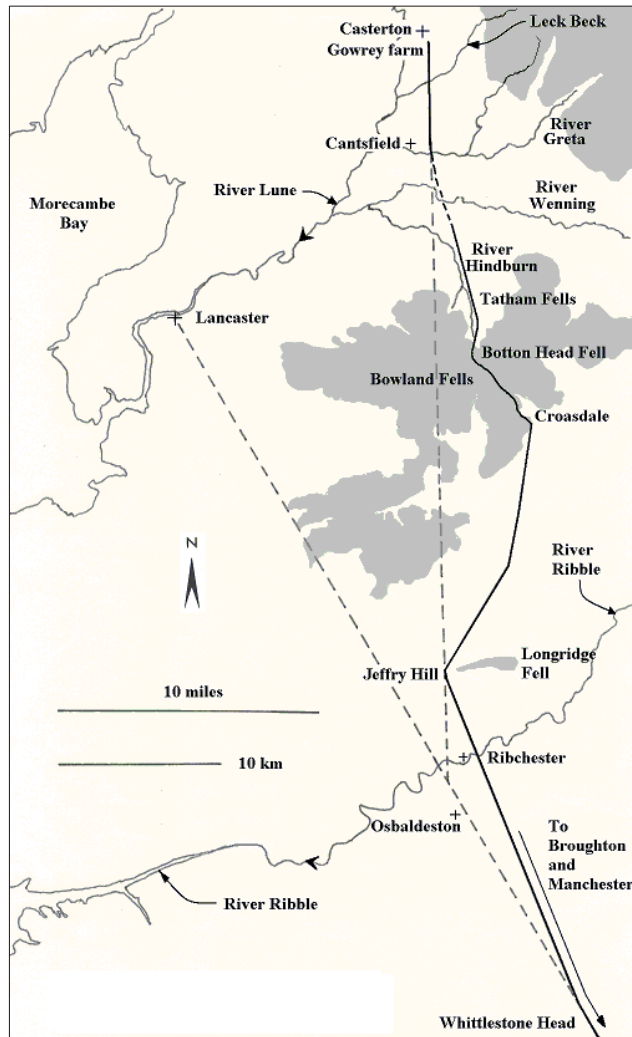


Figure 15: Course of the Western Main Roman Road over the Bowland Fells. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

Nevertheless, working southwards, if it should have been against orders for the road to follow the valley of the River Lune down to Lancaster, which would have taken the road close to the coast, then the problem for the road's planners would have been how to get their Roman road over the Bowland Forest, since viewing the latter from either north or south would have revealed no obvious practical route to be seen.

From the evidence observed by Entwistle, it seemed that the road's planners had resolved this issue by setting out a Long-distance Alignment almost due south from Casterton in the Lune valley, and that this had landed on the other side of the Bowland Forest at Jeffrey Hill, on Longridge Fell. See Fig. 14 again. Via the use of lights at night, Jeffrey Hill would have been

visible from Whittlestone Head, so that it would then have been easy to have set out a branch to Jeffry Hill from Whittlestone Head, on the Manchester to Lancaster alignment.

However, it appears that the Romans' intentions had been more complicated than this, and that they also wanted at the same time to set out a Long-distance Alignment from Jeffry Hill to cross the Pennines and meet the initial alignment of the Roman road which was heading north-westwards from Scotch Corner towards the Stainmore Pass and Penrith (Margary RR82, the modern A66). Moreover, it appeared that this new Long-distance Alignment from Jeffry Hill was intended to stand at a Pythagorean angle to the alignment from Whittlestone Head and at another Pythagorean angle to the Manchester to Lancaster alignment. In addition, after crossing the Pennines, it was apparently intended to meet the alignment from Scotch Corner at a right angle – something which it succeeded in doing where the

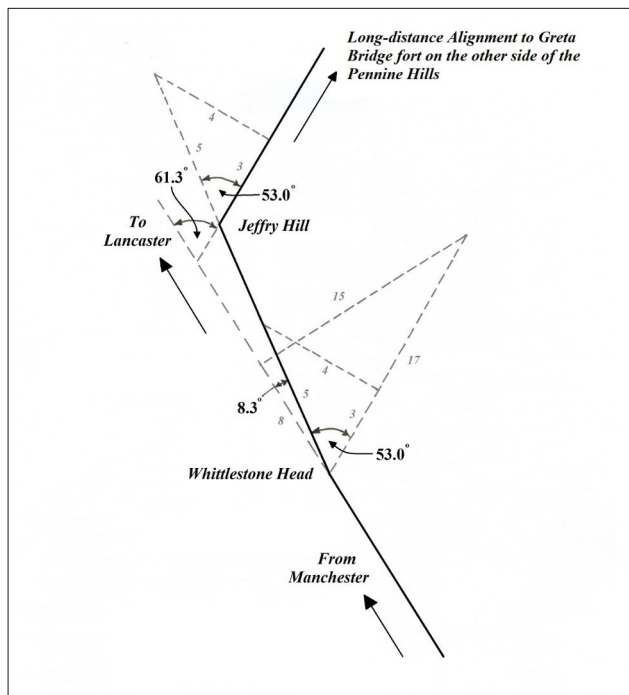


Figure 16: Pythagorean angles at Whittlestone Head and Jeffry Hill.

Roman fort at Greta Bridge came to be located. In this way the Romans would have established a geometrical link between their Long-distance Alignments on either side of the Pennines.

In order to accomplish this feat, the alignment from Whittlestone Head had to be aligned at an angle to the Manchester to Lancaster alignment such that it would have been equal to the difference between the two Pythagorean angles to be attained at Jeffry Hill. The author was able to show how the Roman surveyors would have achieved this by manipulation of their 3:4:5 and 8:15:17 Pythagorean triangles. See Fig. 16.

However, making the turn at the highest point on Whittlestone Head would have taken the resulting alignment a little to the east of Jeffry Hill. Hence the Roman surveyors delayed taking the branch off to Jeffry Hill until they were somewhat past the highest point on Whittlestone Head. This unusual displacement from an obvious sighting position is something that had attracted attention from early on, but the reason for it only became clear once the Romans' intentions had been recognised.

This remarkable story had come together bit by bit, as Entwistle's discoveries were made over a period of some years. It was he who had first discovered the Long-distance Alignments from Lancaster, and then the Romans' frequent application of Pythagorean angles, followed by the alignments from Casterton southwards and from near Whittlestone Hill to Jeffry Hill. Entwistle also discovered the Long-distance Alignment from Jeffry Hill to Greta Bridge, which, despite initial scepticism on the author's part, was confirmed to be an alignment by a lidar image published by the late Hugh Toller in 2013 (Toller 2013). The author's own contribution to this story has come from analysing and interpreting the Romans' probable policies and intentions, and showing that they did have practical processes and solutions by which to achieve them.

Apparent purpose of these Long-distance Alignments: table-top planning and directing, in order to determine the course of the Western Main Roman Road over the Bowland Forest, and also to form a geometrical link with the Romans' Long-distance Alignments on the eastern side of the Pennines. The unsuitability of the course of the Western Main Road over the Bowland Forest, as with the Long-distance Alignment of Dere Street from Scotch Corner into the Wear valley (see Example 2, above), indicates that the Roman table-top decision-makers had little familiarity with the nature of the landscape on the ground.

Example 8: Western Main Roman Road: north of the Lune Gorge and on to the Maiden Way

The northerly of the three Long Distance Alignments which Entwistle had identified as radiating from Lancaster ran to or close by the Roman forts at Kirkby Thore, Whitley Castle, and High Rochester. See Fig. 17.

It was observed that the Western Main Road, after exiting from the upper Lune valley, headed almost due north and then conspicuously curved onto this alignment as it crossed Crosby Ravensworth Fell. According to Margary, the road (Margary RR7d) then followed the alignment from Crosby Ravensworth to Low Dalebanks farm before swinging off north-northwestwards to run to the Roman fort at Brougham near Penrith. However, whilst a description of the planning of this part of the Roman road was being written for the BAR 598 monograph (Poulter 2014), news came through from the late Hugh Toller (*pers comm*) that lidar images showed that this Western Main Roman Road had not swung off at all but had headed directly for the fort at Kirkby Thore. Although, as shown on the lidar images, no part of the road had run exactly upon the alignment between Low Dalebanks farm and Kirkby Thore, the course of the road clearly appeared to have been guided by it. See Fig. 18.

Further to this, the Roman road known as the Maiden Way (Margary RR84), running from Kirkby Thore past Whitley Castle to the Roman fort at Carvoran, now looked like being a

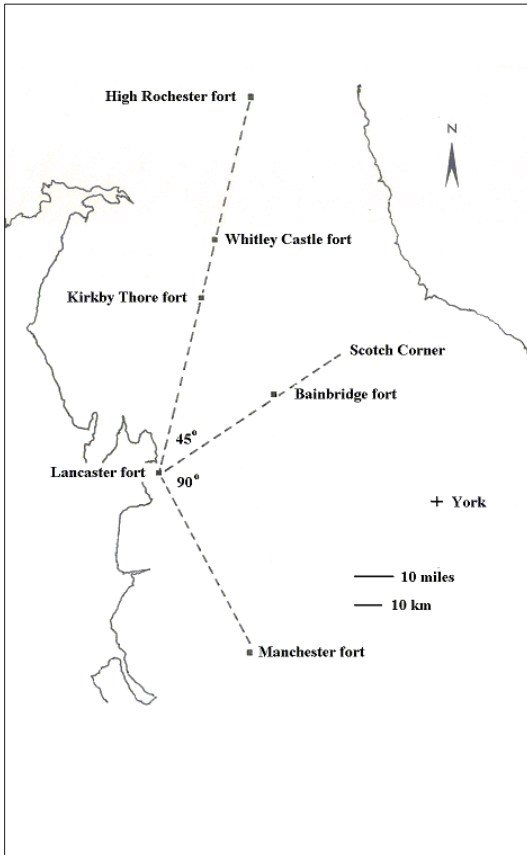


Figure 17: Long-distance Roman Alignments radiating from Lancaster. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

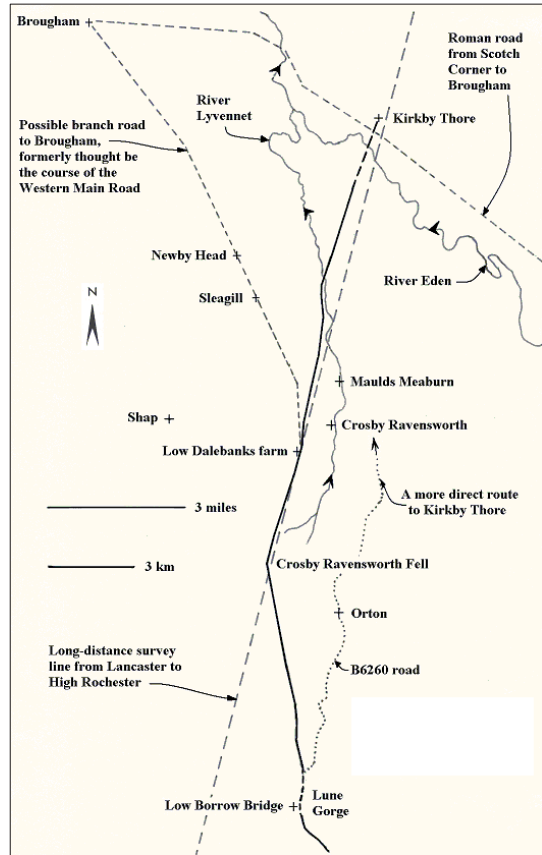


Figure 18: Turn of the Western Main Roman Road onto the Long-distance Alignment from Lancaster. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

continuation of the Western Main Road. Leaving Kirkby Thore, the Maiden Way had had to forsake the Long-distance Alignment from Lancaster to High Rochester in order to surmount the stiff climb past Melmerby Fell, but once over the top it notably veered back to the Long-distance Alignment and in fact ran onto it for about 1½ miles in the Gilderdale Forest, before finally bearing away northwards to curve past Whitley Castle fort and then run down the South Tyne valley to the fort at Carvoran. The course of the Roman road was checked on the ground in the Gilderdale Forest, and no physical reason could be seen why the road, as built, should have veered onto the alignment in that area. See Fig. 19.

These findings added support for the existence of this Long-distance Alignment. Along the remainder of the alignment's course between Whitley Castle and High Rochester, though, no sign could be detected that any other Roman road or installation had lain upon its line. However, if the Long-distance Alignment from Esh to the Dry Burn (see Example 2, above) were to be extended north-westwards it would meet the Lancaster to High Rochester alignment near a place called Pit Houses, between Tynedale and Redesdale, and the angle of intersection of the alignments there would have been 36.8°. This is a Pythagorean angle, thus

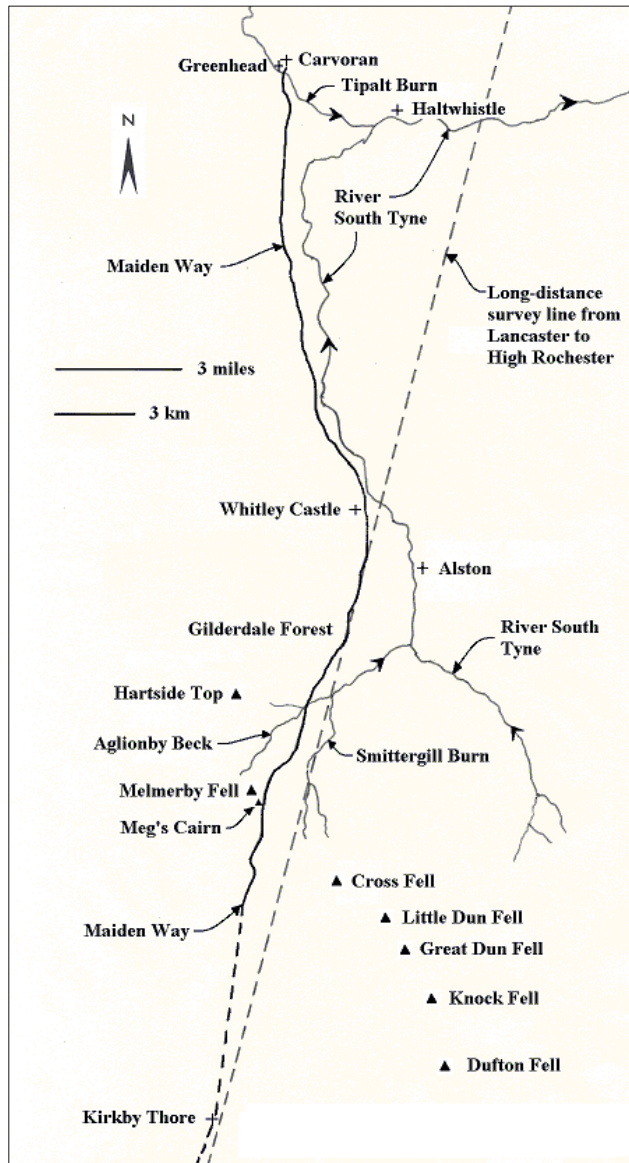


Figure 19: Course of the Maiden Way Roman road from Kirkby Thore past the Roman fort at Whitley Castle to the Roman fort at Carvoran. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

illustrating the geometrical linkage between the Romans' Long-distance Alignments on either side of the Pennines.

Use of the Long-distance Alignment from Lancaster to High Rochester: table-top decision-making about where the courses of the Western Main Roman Road and the Maiden Way should go, executed as closely as practical on the ground until passing the Roman fort at Whitley

Castle, after which the alignment would no longer have been relevant to the course of the road.

Example 9: Central Long Distance Alignment: Lancaster to near Scotch Corner

Of the three Long-distance Alignments which Entwistle discovered to be radiating from Lancaster, the central one may have been the original one, to which the other two were inclined at angles of 45° (to the north) and 90° (to the south). See Fig. 17 again. This central alignment began by running up the lower valley of the River Lune to Hornby and then continued over Ribblehead and across the valleys of Wensleydale and Swaledale towards Scotch Corner. It is difficult to judge if it ran exactly to the Roman site at Scotch Corner, but since the recent excavations have shown that the settlement of Scotch Corner began in the Iron Age, it is perhaps unlikely – unless the Roman surveying should have been undertaken

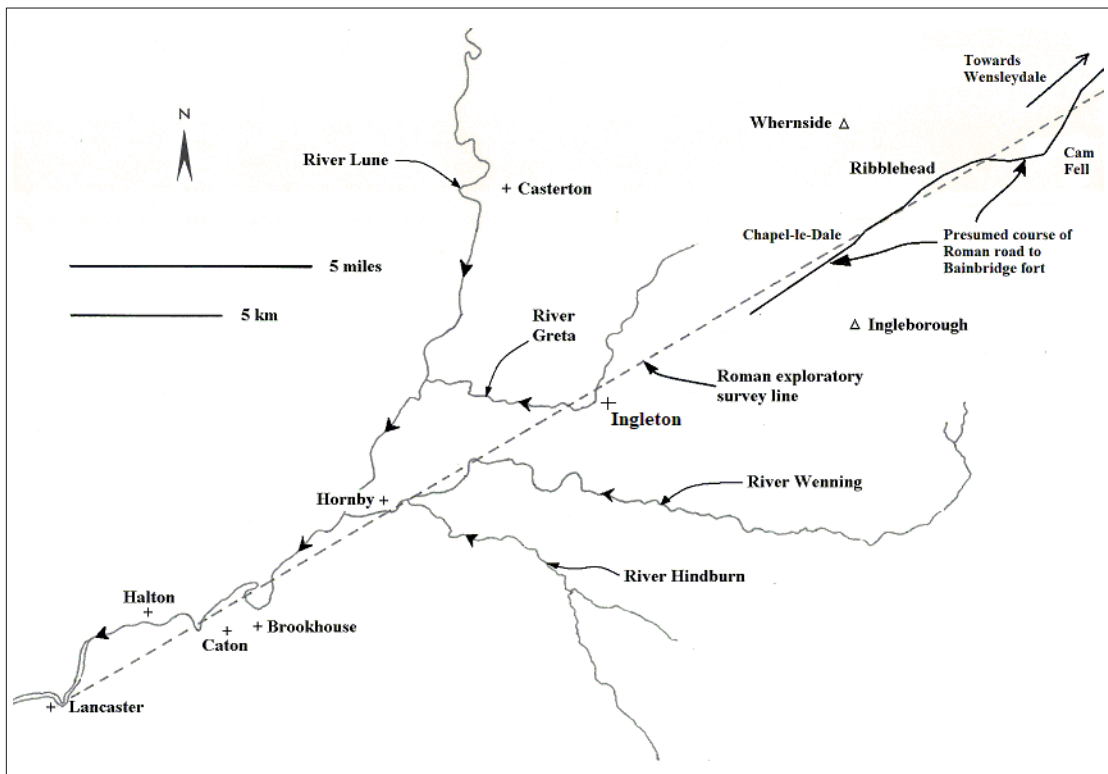


Figure 20: Course of the Long-distance Alignment as a possible exploratory survey line from Lancaster, running past Ribblehead and then on towards Wensleydale and Scotch Corner. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

before their conquest of Britain began (i.e. before AD 43), which also may be considered unlikely.

It is possible that the Long-distance Alignment may have influenced the positioning of the Roman fort at Bainbridge in Wensleydale. In addition, the road from Ingleton to Bainbridge does run exactly (although briefly) upon the alignment in two places – immediately east of

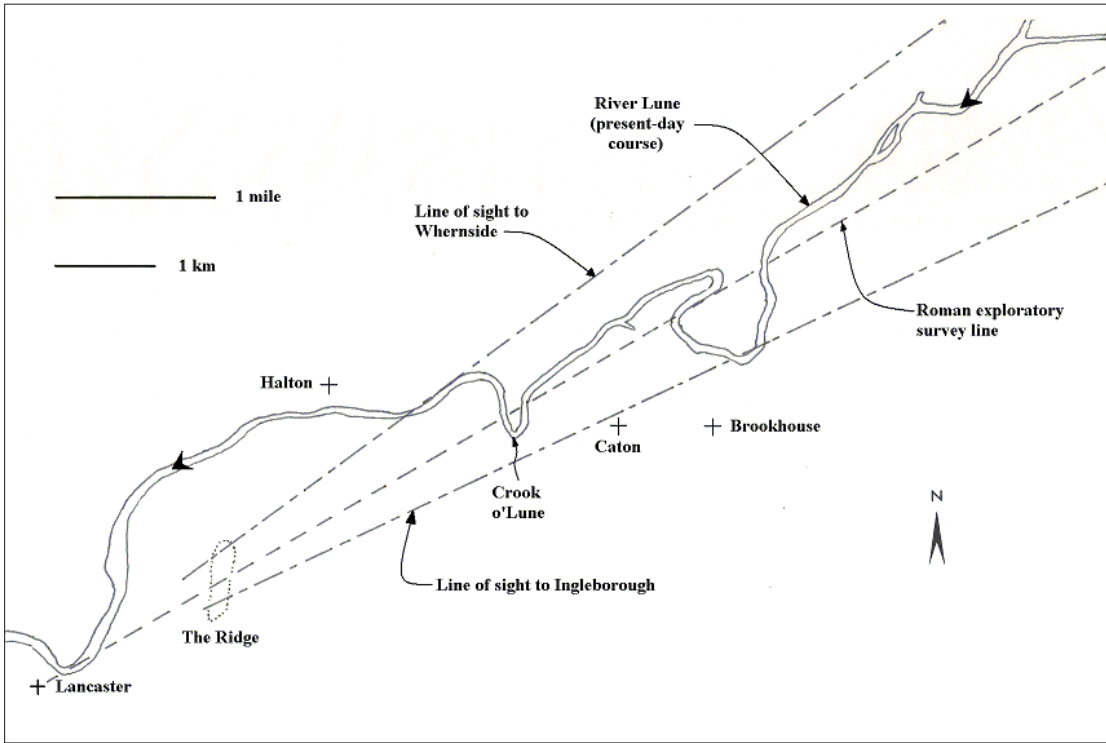


Figure 21: Possible initial sighting of the central Long-distance Alignment from the Ridge above Lancaster as an exploratory survey line up the Lune valley. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

Chapel-le-Dale and then beneath Dodd Fell – and it also broadly takes the same general direction of the alignment. These, in the author's view, are among the strongest indications that this road had been Roman. See Fig. 20.

Nevertheless, this Long-distance Alignment seems to have been a rather unproductive one in terms of the positioning of Roman forts and roads, and the suspicion is that it may originally have been set out simply as an alignment from which to survey the interior of the country. When viewed from the high ground just to the east of Lancaster, the River Lune appears to be heading straight inland, and this impression is reinforced by the appearance of the two notable peaks of Whernside and Ingleborough which, in the distance, stand prominently on either side of the river. See Fig. 21.

If this had been what had attracted the Roman surveyors, then they were to be deceived, because beyond Hornby the River Lune starts to curve to the north, leaving the alignment to continue across a great deal of land which proved to possess, apparently, little military significance. This suspicion is speculative, but it would fit in with the impression that this alignment may have been the original one from Lancaster, relative to which the other two had then been created at set angles.

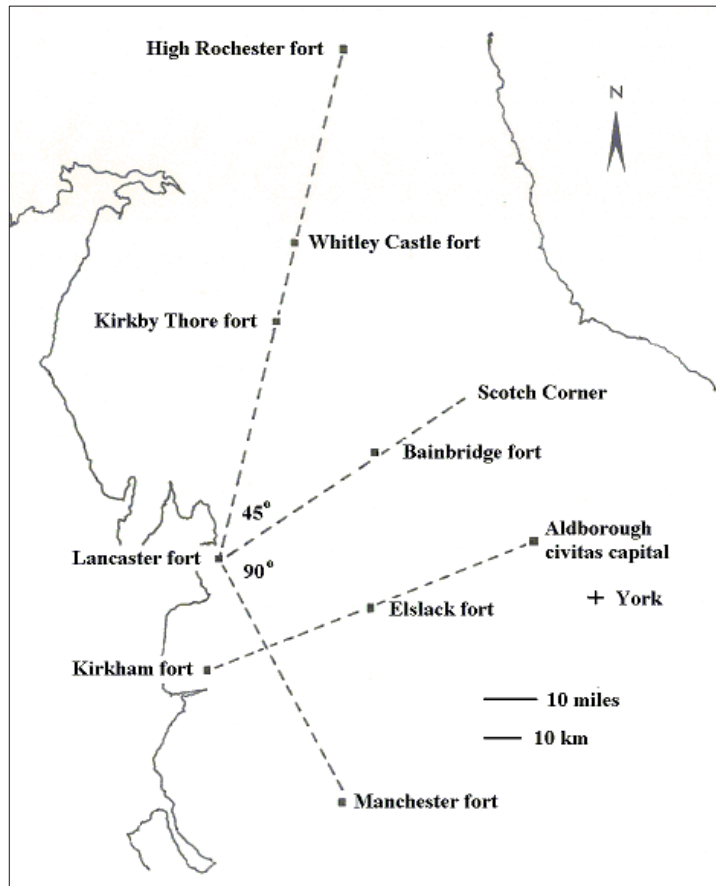


Figure 22: Long-distance Alignment from Kirkham to Aldborough, in relation to the Long-distance Alignments radiating from Lancaster. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

Possible purpose of this Long-distance Alignment: an initial survey of the interior of the country, starting from Lancaster, in order to provide information for table-top planning and decision-making.

Example 10: through the Craven Gap: Kirkham to Aldborough

This Long-distance Alignment was discovered by Entwistle, but although it ran not that far from Lancaster it seemingly bore no geometrical relationship to the alignments radiating from that site. This alignment ran from the Roman fort at Kirkham, in the Fylde, to what became the Roman *civitas capital* of Aldborough beside the River Ure in Yorkshire, passing exactly through the Roman fort at Elslack in the Craven Gap along the way. See Fig. 22.

Margary's RR72a Roman road from Ribchester picked up the alignment at Downham Park near Clitheroe and then followed it past Barnoldswick and through Skipton before turning off to run to the Roman fort at Ilkley. See Fig. 23. The author's interest lay in understanding

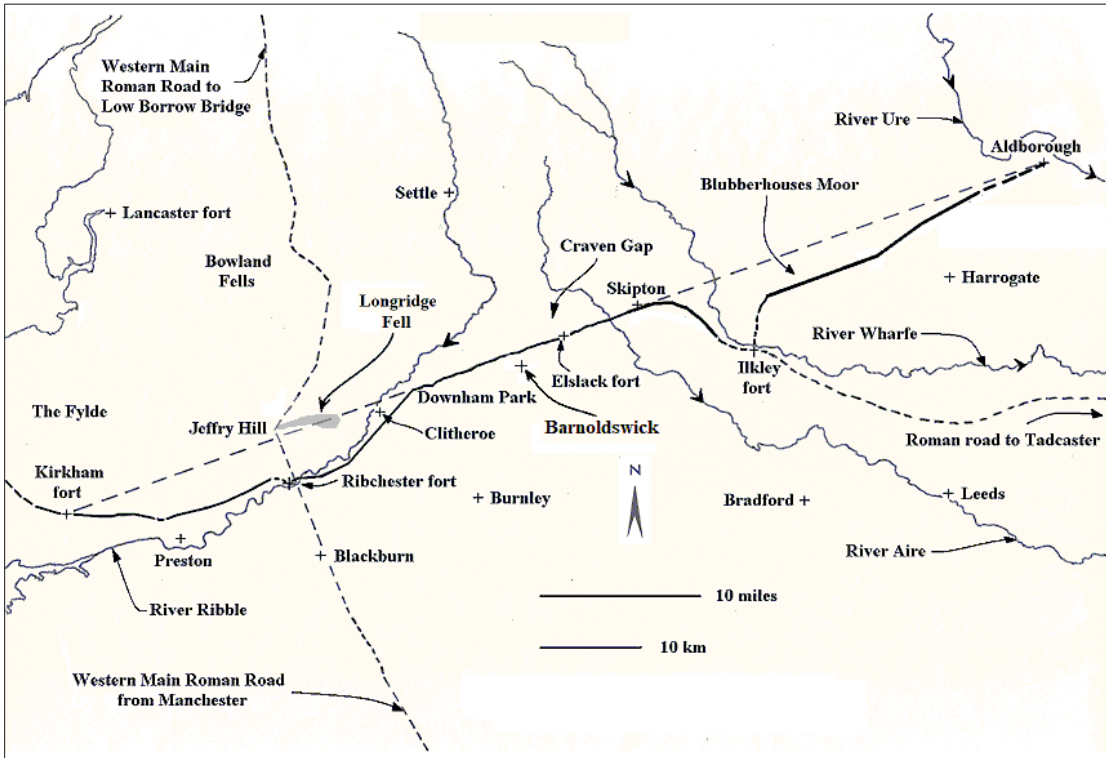


Figure 23: Relationship of the Roman roads as built to the Long-distance Alignment between Kirkham and Aldborough. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

how this alignment might have been set out, since Kirkham and Aldborough are decidedly not intervisible.

The Pennine Hills run up the spine of northern England, separating the western and eastern sides of the country, but there are a number of places where they can be crossed without great difficulty. The Tyne-Solway gap is one, through which the Stanegate Roman road ran (Margary RR85), and the Stainmore Pass is another, through which the Roman road from Scotch Corner towards Penrith (Margary RR82) made its way. The Craven Gap, between Clitheroe and Skipton, offers another of these crossing points, and it is clear that the Romans were well aware of its existence. Inspection both on the ground and on maps led to the observation that this Long-distance Alignment ran exactly through the Craven Gap, and it was therefore guessed that the alignment had been created by the Romans to direct a cross-Pennine route linking their western and eastern north-south trunk roads, i.e. the Western Main Roman Road and Dere Street. See Fig. 23 again.

The Craven Gap is not easy to spot on the ground. It is not deep, nor steep-sided, and it is populated by low hills amongst which it is easy to lose a sense of direction. Hence it was judged that the Romans, with their predilection for straight lines anyway, would have wanted to set out an alignment that would run straight through the gap without any

deviation. In order to do this they would have needed to stand back, as it were, and get a view through the gap from a height and a distance. From the lie of the surrounding land, the obvious place from which to take such an aim would have been from the eastern shoulder of Longridge Fell.

The eastern shoulder of Longridge Fell is now thickly wooded, so that it was not practical to try to check the view from where it was anticipated that a Roman surveyor would have been sighting. However, from the foot of the tree line it was possible – just – to make out the notch by which the Craven Gap cuts through the higher ground to the east. This appeared to confirm the practicality of how the Romans could have set out the central part of the Long-distance Alignment. Once this part of the alignment had been established, standard long-distance Roman surveying practices would have allowed them easily to extend the alignment in straight lines to both west and east, and therefore, probably as by-products, to fix the locations of Kirkham fort, Elslack fort and a probable fort as a predecessor to the *civitas capital* at Aldborough. This could all have been carried out as part of the Romans' strategic planning at the time.

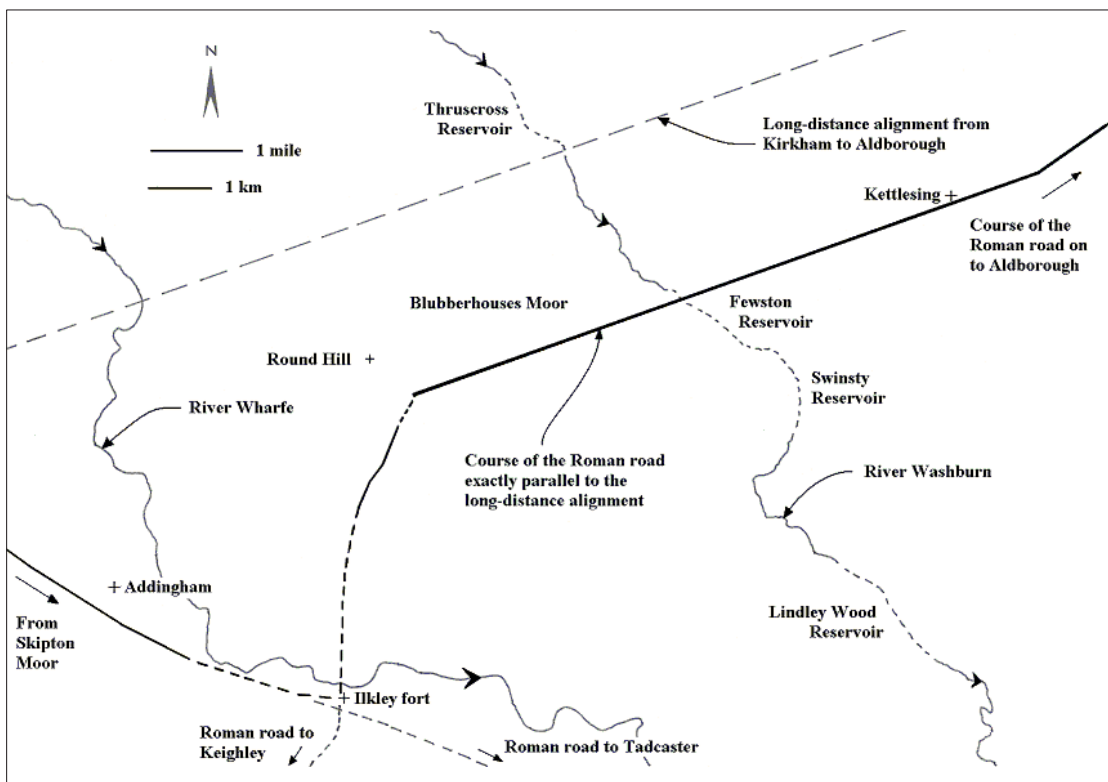


Figure 24: Course of the Roman road from Ilkley to Aldborough across Blubberhouses Moor. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

As noted above, Margary's RR72a Roman road turned off the alignment past Skipton in order to service the Roman fort at Ilkley, but then, renumbered by Margary as RR720b, it set off northwards from Ilkley, seemingly to return to the Long-distance Alignment to Aldborough. However, on reaching the shoulder of Round Hill, to the north of Ilkley, it then abruptly turned to follow an alignment across Blubberhouses Moor which was exactly parallel to the Long-distance Alignment, but some 2 miles south of it. No physical advantage can be detected from doing this, and so it has remained a puzzle as to not just why but how the Romans had managed to accomplish this. See Fig. 24.

Over time, the author has become more and more convinced that the Romans had set out a scheme of centuriation in the Vale of York, but not implemented it for some reason. The late John Peterson concluded that not enough evidence existed for him to accept it as a centuriated area, but this does not mean that the grid of alignments had not been marked out in preparation. If so, it is possible that on Round Hill the builders of the Roman road had picked up one of these grid lines – possibly in error – and used it to direct the course of the road across the Blubberhouses Moor and on in the direction of Harrogate. Before nearing Harrogate, however, the course of the Roman road is now known (Mike Haken *pers comm*) to have angled more northwards at a point around SE 2411 5723, between the villages of Kettlesing and Hampsthwaite, and then, after crossing the River Nidd, to have turned more east-northeasterly again so as to aim towards its evidently intended target: the site of Roman Aldborough.

The implication of this assessment is that not only had the Romans probably set out an embryonic scheme of centuriation in the Vale of York, but that its orientation had been based upon the Long-distance Alignment from Kirkham to Aldborough. This indicates that the alignment had been set out first. All this is consistent with planning in a period of Roman consolidation in northern Britain, possibly dating to around AD 80. Thus this would not have been part of the strategic planning which may have accompanied or even preceded the invasion of Scotland, which is likely to have given rise to the Long-distance Alignments from Lancaster and Jeffry Hill and underlying Dere Street, etc., all described above. Hence it should not be surprising that the Kirkham to Aldborough alignment bears no geometrical relationship to these seemingly earlier ones.

Apparent purpose of this alignment: a strategic Roman desire to create another cross-Pennine route, but left to be worked out on the ground. This exercise appears then to have been extended to determine the locations of the forts at Kirkham and Elslack and probably an early fort at Aldborough. The alignment may also have been used to help set out a skeleton scheme of centuriation in the Vale of York which was, for whatever reason, never – or never fully – implemented.

Example 11: The Devil's Causeway: Dere Street to Tweedmouth, southern end

The course of the so-called Devil's Causeway (Margary RR87) was largely recorded by Henry MacLauchlan in 1864, and in the almost complete absence of any physical evidence of this Roman road nowadays, the author's analysis of its course had to depend wholly upon its line

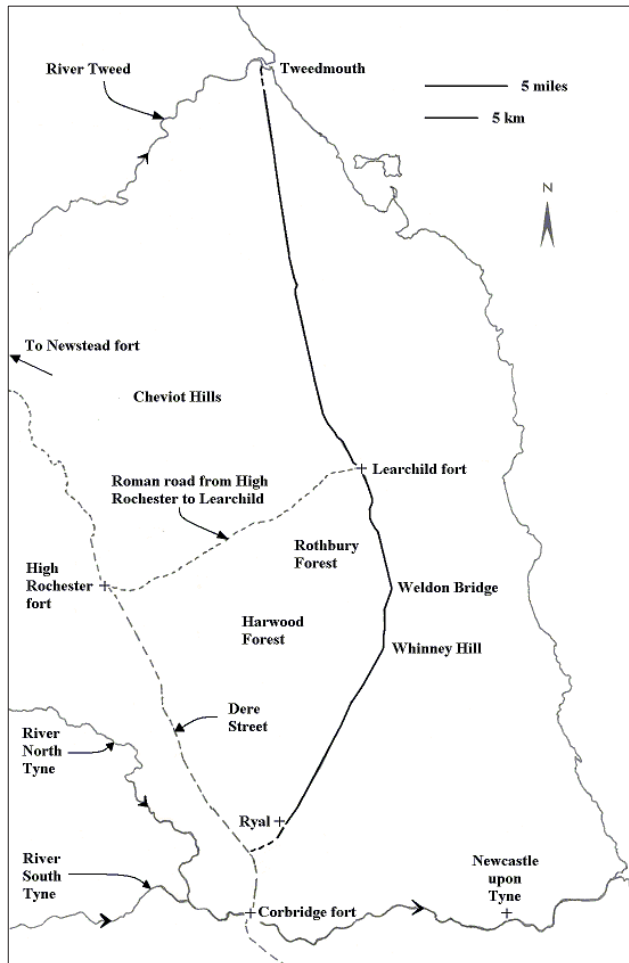


Figure 25: Course of the Devil's Causeway. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

as shown on the Ordnance Survey maps². Slightly to the author's surprise, it was found that its course had been underpinned by two Long-distance Alignments. See Fig. 25.

The southernmost stretch of the road, from Whinney Hill to Dere Street, was notably direct – although not absolutely straight – apart from branching off for the last 1¼ miles (2.8 km) from near Ryal to meet Dere Street at Beukley. Despite the road's tendency, along this southernmost stretch, to waver from a completely straight line, it appeared to have been following a Long-distance Alignment with an overall length of some 17 miles (27.2 km). Since it can be expected that the road, as built, would be likely to have followed this potential alignment most accurately at its end points, and since the alignment's southern end point was clearly not at Beukley, the line of the road was extrapolated southwards for the first two miles (3.2 km) from what appeared to have been the northern end of the alignment, on Whinney Hill. This extrapolation of the alignment made a good fit with the course of the

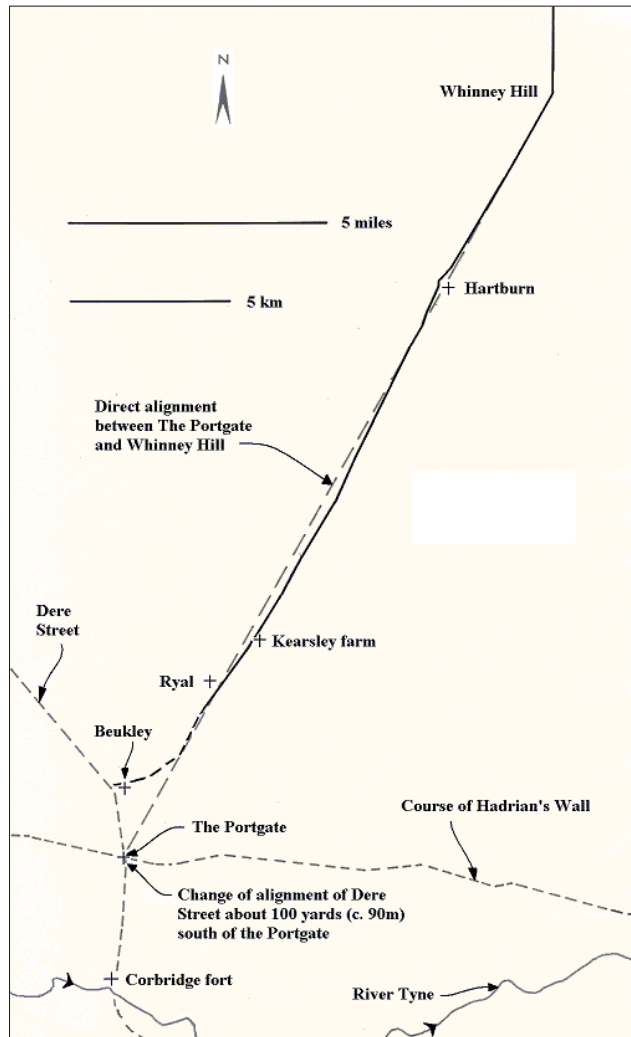


Figure 26: Course of the southern part of the Devil's Causeway.
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road from there southwards, but it was somewhat startling to find that the line appeared to terminate exactly upon the Portgate on Hadrian's Wall. The Portgate was where Dere Street passed through Hadrian's Wall, and if the location of this termination point should have been correct, it meant that the Devil's Causeway could not have been set out, let alone built, before Hadrian's Wall had been laid out across the landscape. This contradicted the received opinion, based upon circumstantial evidence accumulated elsewhere, that the Devil's Causeway had been built somewhat earlier and then probably abandoned when Hadrian's Wall had been built. See Fig. 26.

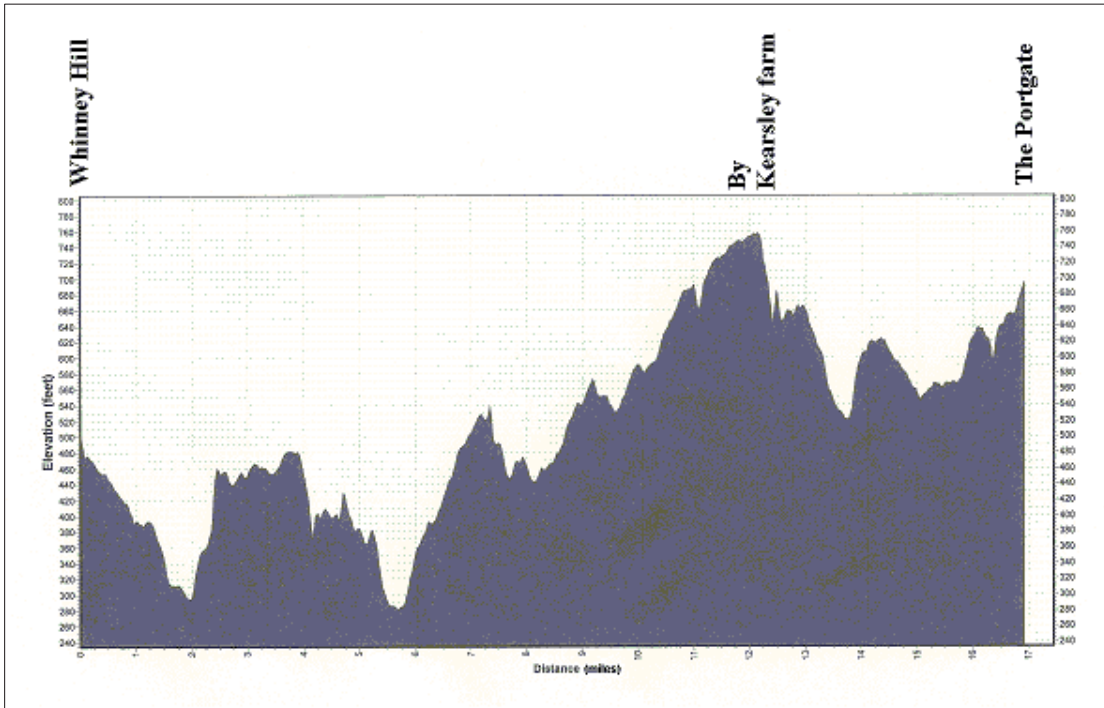


Figure 27: Profile of the landscape between Whinney Hill and the Portgate. Reproduced with agreement of BAR Publishing, www.barpublishing.com.

Since the Portgate would not have been visible from Whinney Hill, it was wondered how such a Long-distance Alignment could have been set out, and so the profile of the intervening landscape was examined. Again, slightly to the author's surprise, it found that there was a single high point, near Kearsley farm, from which both the Portgate and Whinney Hill would have been visible. Therefore it would have been easy for the Roman surveyors to have set out a single straight alignment between these two end-points. However, because of the distances involved, lights at night would need to have been used. See Fig. 27.

In support of the aforementioned received opinion, both Nick Hodgson and Humphrey Welfare (*pers comms*) suggested that the Portgate would not have been the southern end point of the alignment. Instead, they proposed that a position about 100 yards (100 m) south of the Portgate, where Dere Street breasts the rise coming up from Corbridge, was more likely to have been the terminal point. See Fig. 26 again. If the Devil's Causeway had indeed been set out before Hadrian's Wall had been built, this location could certainly have formed a suitable point from which to branch off an alignment to Whinney Hill, and the method for setting it out via the farm at Kearsley would have been just the same. The difference between the two alternative alignments is less than $\frac{1}{2}^\circ$ and this is well within the bounds of cartographic and judgemental error, so either possibility could have been viable. To the author it seems that the Portgate, especially if under construction at the time, would have

made a more obvious target to prompt the Roman surveyors to adopt it as an end-point for their Long-distance Alignment, but it has to be agreed that Hodgson's and Welfare's suggestion is entirely plausible and that it does fit in better with other evidence which has been gathered about the Devil's Causeway. Either way, there appears to be little doubt that a Long-distance Alignment had been used to set out the southern part of this Roman road.

Evident purpose of the Long-distance Alignment: road planning, worked out on the ground.

Example 12: The Devil's Causeway: Dere Street to Tweedmouth, northern end

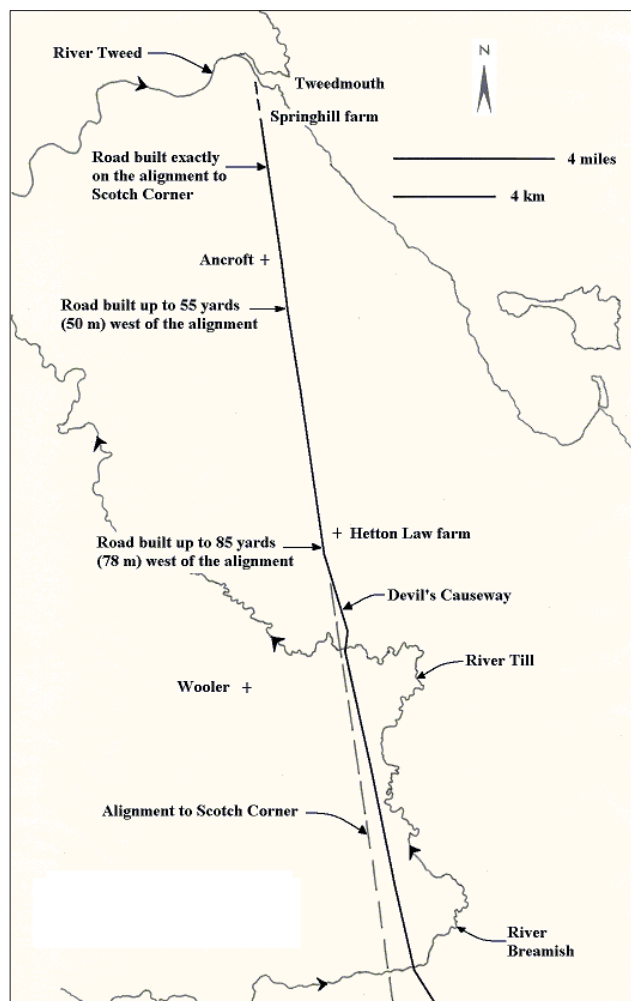


Figure 28: Course of the Devil's Causeway at its northern end.
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The central part of the Devil's Causeway was set out, in typically Roman fashion, in a series of relatively short-length straight alignments designed to cross rivers and ridges at convenient points and to service the Roman fort at Low Learchild along the way. However, on reaching a point near Hetton Low farm, to the north-east of Wooler, the Roman road, as built, gradually falls upon a line which was then discovered to be exactly aligned upon Scotch Corner. At first the assumption was that this had to be a coincidence, but after careful assessment it was observed that the final $3\frac{1}{2}$ miles (5.6 km) of the road to Springhill, just before Tweedmouth, fell so exactly upon the alignment that there can be little doubt that this had been a deliberate choice on the Romans' part. See Fig. 28.

The question was: how had the Romans managed to set out such an alignment? The distance between Springhill, where MacLauchlan's survey ended, and Roman Scotch Corner is more than 91 miles (145 km), and there are far too many hills in between to have made practical any intermediate surveying of the kind achieved between Whinney Hill and the Portgate at the southern end of the Causeway. Theoretically, the Romans might have created a scheme of centuriation up to the mouth of the Tweed, and this could have allowed them to set out such a Long-distance Alignment accurately, but this too seems quite unlikely. There are several archaeologists who do not believe that centuriation existed in any part of Roman Britain, and even its greatest recent advocate, the late John Peterson, only claimed that a small number of areas in Britain had been subject to centuriation, and, even then, not to a common orientation – and, of greater relevance, that none of them were near Tweedmouth.

One possibility is that the Romans had originally set out a survey line from Scotch Corner simply in order to explore the countryside to the north, knowing that it would hit the coast somewhere, and had found, by good fortune, that the line not only went close to the mouth of the River Tweed but that it would also have been suitable to use for the final part of a road up to that point. This possibility seems strengthened by the bearing of the alignment from Scotch Corner, which is 8.5° west of north. This is almost exactly the bearing which would have been achieved by the same manipulation of 3:4:5 and 8:15:17 Pythagorean triangles that the Romans had, as already described in Example 7, exercised on Whittlestone Head.

Another possibility is that the Roman surveyors had been able to establish the alignment by an extended process of triangulation, in which the angles between each survey point would have been recorded in terms of vertical and horizontal measurements rather than degrees. The author is indebted to correspondence with Mark Willingale (*pers comm*) for this suggestion.

Whatever, the match between the Roman road and the alignment as they approach Tweedmouth leaves little doubt that the latter had indeed been a Long-distance Roman Alignment.

Estimated purpose of the Long-distance Alignment: initially created, possibly, as an exploratory survey line from Scotch Corner, which was later used to direct the course of the Devil's Causeway on the ground as it finally approached Tweedmouth.

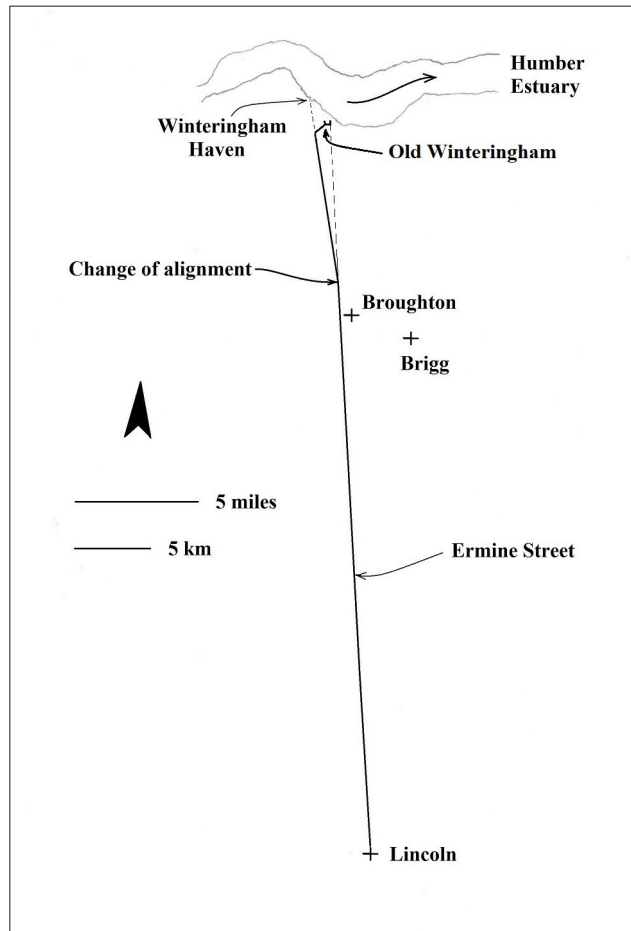


Figure 29: Course of Ermine Street between Lincoln and the Humber Estuary.

Example 13: Ermine Street: Lincoln to the Humber

Until recently this Roman road (Margary RR2), known as Ermine Street, appeared to follow two Long-distance Alignments, with scarcely any deviations from either of them along its entire length. The first alignment, from the Newport Arch gate at Lincoln to near Broughton, just west of Brigg, was seen to be about $23\frac{1}{3}$ miles (37.6 km) long, and the second, from Broughton to Winteringham Haven on the Humber Estuary, to be $7\frac{1}{4}$ miles (11.6 km) in length. See Fig. 29.

From this perspective it would appear that the Romans had not carried out a preliminary survey to establish the location of Winteringham Haven before setting out the line from Lincoln. Instead, it would seem that they had adopted the more basic tactic of just heading north until the Humber Estuary was in full view and then turning to run to the Haven.

However, correspondence with Mike Haken, including the use of lidar and aerial photography, has shown that the picture is not as simple as this.

Firstly, the only ancient causeway or jetty which has been found at Winteringham Haven appears to have been post-Medieval in date, not Roman. Thus the supposition that there had been a Roman ferry terminal at Winteringham Haven rests upon the course of the alignment from near Broughton which appears to be heading for it, and this is, of course, a circular argument. In fact, there is no sign on either lidar or aerial photographs that the Roman road, as built, ever ran to the Haven. Rather, precisely at the point where the alignment meets the modern A1077 road, the Roman road turned off north-eastwards to run to the Roman settlement known as Old Winteringham. See Fig. 29 again. At Old Winteringham, lidar shows that the Roman road forked, one branch heading northwards and the other more easterly. There is no indication that the northern fork ran to the Haven, but the more easterly branch continued until it met the Long-distance Alignment coming up from Lincoln, at which point it appears that the road may then have turned north along the alignment to head for what are slight indications of a depression. Mike Haken suggests that this might just be part of the Roman harbour. If so, then it appears that the Roman ferry terminal at the Humber had been at the end of the initial alignment coming up from Lincoln, not at Winteringham Haven.

As it happens, Winteringham Haven is not visible from the starting point of the second alignment near Broughton. The view from Broughton is blocked by slightly higher ground near the Haven, at about SE 940 209. Thus, if the Roman surveyors had wished to aim for the Haven, a colleague would need to have been stationed at this higher position in order to enable the straight alignment to be set out.

Instead, as it approaches the Humber, the initial alignment from Lincoln runs across extensive low-lying and probably wet and marshy land in Roman times, and it seems likely that avoiding this unsuitable ground had been the reason for the new alignment from near Broughton. This means that this second alignment, to Winteringham Haven, would therefore simply have been a deviation from the initial alignment from Lincoln, and the fact that it happened to aim for Winteringham Haven is probably just a coincidence.

This is an illustration of how an apparently simple and straightforward explanation can be overturned by new evidence, especially when emanating from lidar and aerial photography, and the author is indebted to Mike Haken for much of the detail of this revised interpretation. It would now appear that Ermine Street to the north of Lincoln had followed only a single Long-distance Alignment to near Broughton, and that it had then adopted a deviation as it approached the Humber in order to avoid wet ground over the final 6½ miles (10.6 km) to the coast.

Apparent purpose of these Long-distance Alignments: table-top road planning and direction, completed on the ground.

Example 14: Fosse Way: Leicester to Cirencester

The Fosse Way as built (Margary RR5e) leaves Leicester south-westwards to run to High Cross on Roman Watling Street, but it then (as Margary RR5d) turns more southwards to run

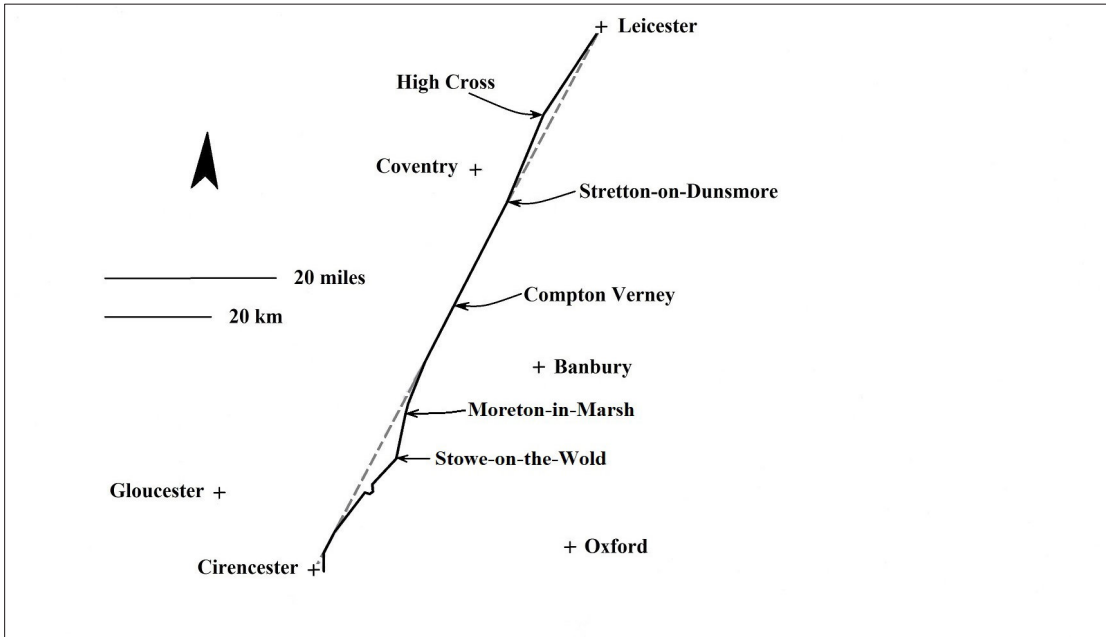


Figure 30: Course of the Fosse Way between Leicester and Cirencester.

to Stretton-on-Dunsmore in Warwickshire. There it takes up a new alignment which, on the map, can be seen to be exactly aimed at Leicester. It therefore appeared likely that a Long-distance Alignment had existed in this direction from Leicester, and that the course of the Roman road to High Cross had been a deviation from it. From Stretton-on-Dunsmore southwards the Fosse Way could be seen on the map to follow this new alignment as far as Compton Verney, near Stratford-upon-Avon, after which it then began to deviate from it to run through Moreton-in-Marsh and Stow-on-the-Wold. Even so, the length of the alignment from Leicester to Compton Verney extended to more than 36 miles (57.6 km), which was considerable, and this remained the perception of the author and Entwistle for quite some time. See Fig. 30.

Then, it was thought to explore the alignment even further to the south-west, and, remarkably, it was found to run exactly to Roman Cirencester, a distance of more than 73 miles (116.8 km) from Leicester. See Fig. 30 again. Whereas Leicester had already been in existence as an important Iron Age centre when the Romans arrived, excavations have shown that Roman Cirencester had been founded by the Roman army. It therefore appeared that this Long-distance Alignment had been set out from Leicester and had been used to fix the location of Roman Cirencester, in much the same way that it appears that the location of Roman Chichester had been fixed by the alignment of Roman Stane Street from London (Poulter and Entwistle 2016, 17). In many ways, too, this seemed similar to the ways in which the Roman forts of Piercebridge, Ebchester, and possibly Cappuck appeared to have been fixed by the Long-distance Alignments underpinning Dere Street, as described above in Examples 2 and 5.

Estimated original purpose of the Long-distance Alignment: strategic planning from a table-top, possibly to demarcate a Roman administrative boundary, and later used to underpin the course of the Fosse Way between Leicester and Cirencester.

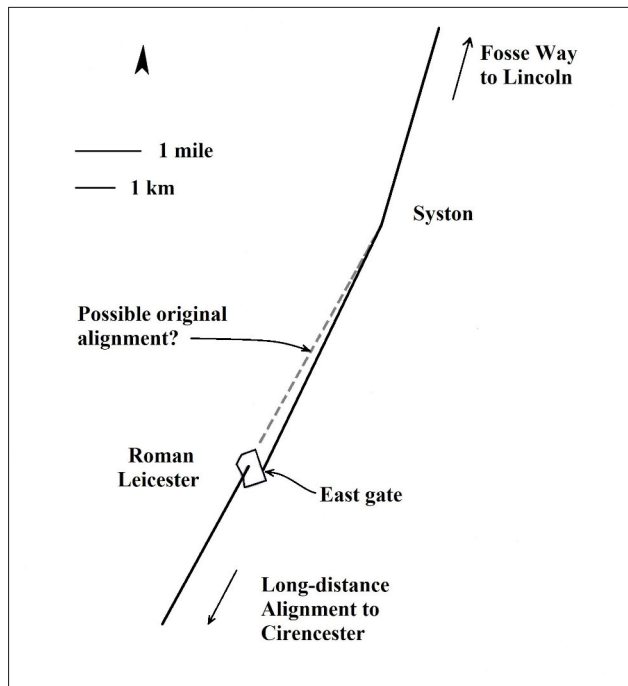


Figure 31: Course of the Fosse Way leaving Leicester to the north.

Example 15: Fosse Way: Leicester northwards

Neither Entwistle nor the author has yet undertaken a search for any Long-distance Alignments along this part of the Fosse Way (Margary RR5f) to the north of Leicester, but it should be noted that the initial stretch of this Roman road northwards from Leicester does not line up with the Fosse Way to the south. Instead, the first stretch of the Fosse Way northwards starts at Leicester's Clock Tower, which is where the eastern gate of the Roman town had been, and it continues without any deviation for $4\frac{1}{4}$ miles (6.8 km) towards the village of Syston. See Fig. 31.

Thus this initial stretch does not appear to have been a short-distance divergence from an earlier alignment, but clearly it could not have been set out before at least the location of the Roman east gate had already been decided. This is curious because although Leicester appears to have been part of the Romans' earliest strategic planning in the area, excavations indicate that the major building programme of the Roman town did not begin until the second century AD. It is possible that the Romans had already laid out their grid for the town from the start of their occupation, so that it was known where the east gate was going to be. If not, then it would appear that what is today the initial stretch of the Fosse Way to the

north of Leicester had been a replacement for an earlier course of this Roman road running northwards from the town, which remains as yet unknown.

Estimated purpose of this alignment: to resume or possibly replace the northwards course of the Fosse Way so as to depart from the east gate of the Roman town.

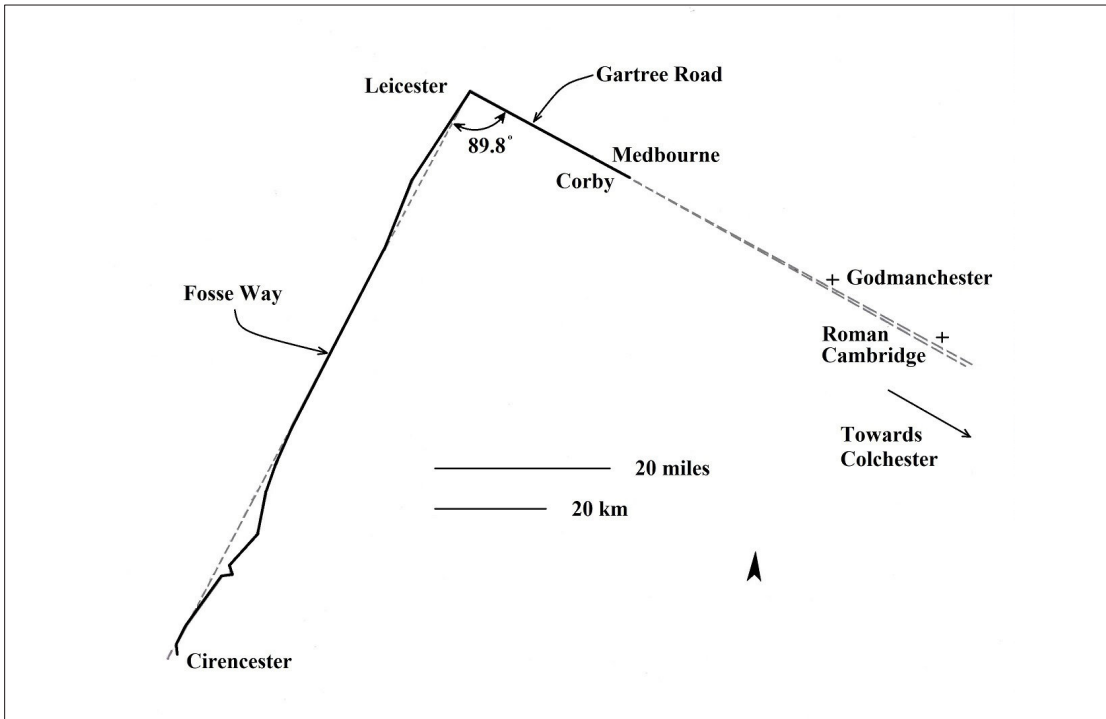


Figure 32: Course of the Gartree Road from Leicester towards Colchester.

Example 16: Gartree Road: Leicester towards Colchester

A Roman road, known locally as the Gartree Road (Margary RR57a), ran south-eastwards from Leicester towards Colchester. The alignment of the first 14½ miles (23.2 km) of this road from Leicester is at an almost exact right angle to the Long-distance Alignment of the Fosse Way coming up from the south, and where these two alignments meet is where Leicester's Roman forum later came to be sited. See Fig. 32.

There are complications, however. Near the village of Medbourne, shortly before the crossing of the River Welland, the Roman road makes a fractional change of alignment northwards, and then follows this new line through Cottingham and Corby. Beyond this point there may be no clear indications of either alignment all the way to Colchester itself, which is puzzling. For instance, beyond the crossing of the River Nene, the Roman road from Godmanchester through Cambridge and on towards Haverhill (Margary RR24) often seems to be taking the same general direction as either of the two alignments, but it deviates widely both to the north and south of them and, according to the author's estimation of the

alignments, at no point does it run exactly upon them. In addition, neither of the Roman sites at Godmanchester and Cambridge stands upon either alignment. See Fig. 32 again.

However, working independently, Entwistle has produced his own assessment of the line of the alignment from Leicester to Colchester and this differs very slightly from the author's. Since the only secure course of the alignment – which extends to more than 100 miles (162 km) in total – has to be determined by extrapolation from just the first 14½ miles (23.2 km) from Leicester to Medbourne, such a slight variation in assessment cannot be unexpected. Entwistle's alignment is fractionally more southerly than the author's and in his case the RR24 road does briefly fall upon the alignment just to the north of Linton in Cambridgeshire. Nevertheless it pays only a glancing visit, and elsewhere the RR24 road appears to show little interest in the alignment, even though, as indicated above, for some distance it is heading in broadly the same direction. This is in striking contrast to the closeness with which the Gartree Road follows the alignment from Leicester.

Nevertheless, since both Entwistle's and the author's alignments from Leicester to Colchester run directly into the site of Roman Colchester, albeit slightly apart, it is scarcely credible that this could have been a coincidence. Thus, despite the absence of indubitable evidence of usage south of Corby, there can be little doubt that a Long-distance Alignment had existed between these two Roman towns.

Estimated purpose of this Long-distance Alignment: as with the Long-distance Alignment to Cirencester (see Example 14 above), strategic planning from a table-top, possibly to demarcate a Roman administrative boundary.

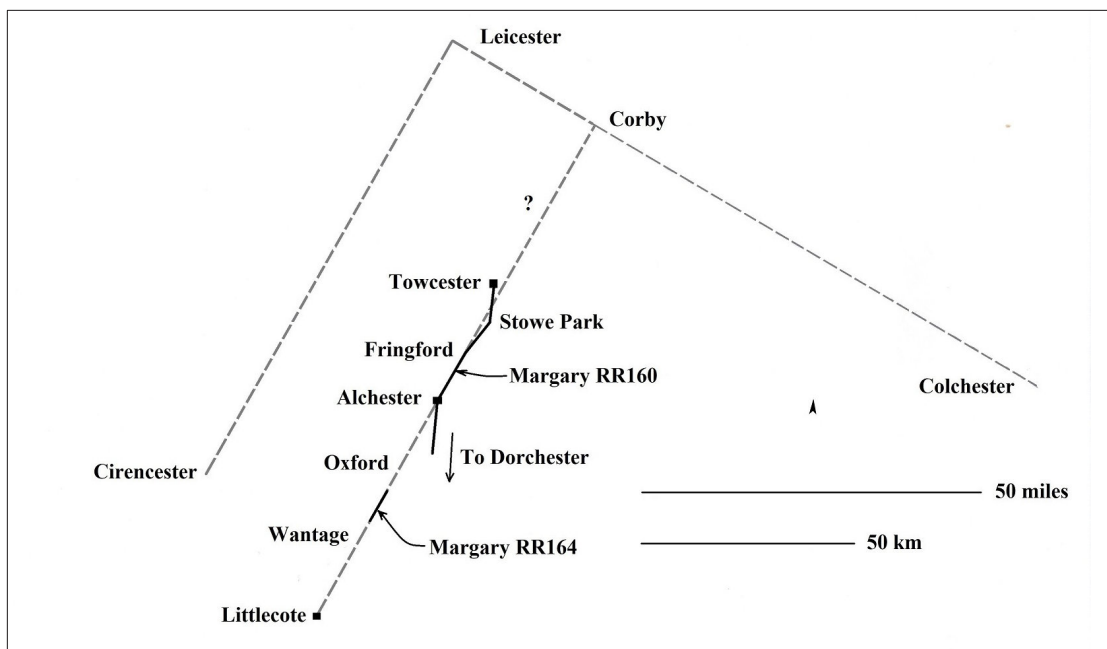


Figure 33: Long-distance Alignment from Littlecote to Fringford and possibly on to Corby.

Example 17: Littlecote to Fringford

Possibly starting at the Roman site of Littlecote, by the River Kennet to the west of Hungerford, this alignment seems to have run from there for some 40½ miles (64.8 km) to the south-east of Fringford, some 3½ miles (5.6 km) north of Bicester in Oxfordshire. Along the way it passes through the known Roman site at Alchester, and its line is also followed for some distances by two known Roman roads: the A338 from Wantage to Frilford (Margary RR164), which lies to the south-west of Oxford, and then by the A4421 from Bicester to Fringford (Margary RR160). As such there can be little doubt that this had been a Long-distance Alignment. North of Fringford, the RR160 Roman road adopts a new alignment slightly more to the east, running for some 8 miles (12.8 km) to the Park at Stowe, before then turning more northwards again and heading for the Roman settlement at Towcester on Watling Street, some 6½ miles (10.1 km) distant. See Fig. 33.

Examining the profile of the landscape between Littlecote and Fringford offers little indication of how this alignment could have been set out. However Entwistle has observed that it runs exactly parallel to the Long-distance Alignment from Leicester to Cirencester. These two alignments are 24.6 miles (39.4 km) apart, but this distance does not equate to a round number of Roman miles. In Roman miles, the distance would have been 26.6 miles. It does closely approximate to a distance of 1110 *actus*, though. The *actus* was the Roman unit of length which was normally used for centuriation, but this would imply the existence of an enormous scheme of centuriation in the area, which seems improbable. Since, however, the Littlecote to Fringford alignment is parallel to the Leicester to Cirencester alignment, and this, as noted above, lies at an almost exact right angle to the Long-distance Alignment to Colchester which was discussed in Example 16, one possibility is that this Littlecote to Fringford alignment had been set out from the Colchester alignment too, not far from Corby and at the same angle. If so, this overall alignment to Littlecote would have been at least 93¾ miles (150 km) in length. See Fig. 33 again. It may even have extended beyond Littlecote, but this has not been tested so far.

Possible purpose of this Long-distance Alignment: as with the Long-distance Alignment to Cirencester (see Example 14 above), strategic planning from a table-top, possibly to demarcate a Roman administrative boundary; process of setting-out uncertain.

ANSWERS

Before considering how to identify Long-distance Alignments it is appropriate to try to define what they are. Since the recognition and identification of Long-distance Alignments has developed somewhat informally over recent years, it is perhaps not surprising that there is no set definition for them. However, rather than stipulating that they must possess a minimum length, or extend over one or more horizons, the author prefers to see them as straight alignments which are connected in some way with Roman long-range planning, which could take many forms.

Thus the alignment from Leicester to Cirencester, which appears to have fixed the location of the latter site, qualifies as a Long-distance Alignment, whereas the two largely straight

lines of the Fosse Way from Leicester to High Cross and then back to Stretton-on-Dunsmore are not. Although they possess lengths of some 12 $\frac{1}{2}$ miles (19.4 km) and 10 $\frac{1}{3}$ miles (16.5 km) respectively, they seem to be simply deviations from the Long-distance Alignment. See Fig. 30.

In contrast, even though its length of 15 miles (24 km) is not much greater, the alignment from Healam Bridge to Scotch Corner was clearly intended to set out what became the final line of Dere Street to Scotch Corner and therefore qualifies as a Long-distance Alignment. See Fig. 2. As it happens, this alignment also required Dere Street to take a deviation from its course and run via Catterick. This was because of the nature of the intervening flood plain. It is not necessary that Long-distance Alignments should be furnished with deviations in every case, but in practice those which are known often do possess them. This is because the Roman roads which follow these alignments have to deal with stretches of unsuitable ground (as above), excessively steep inclines, and river crossings, etc., and also the necessity at times to reach forts or settlements which do not lie on the alignment – such as, for instance, the fort at Risingham in Example 4.

In that there is no rigid definition for a Long-distance Alignment, there is no set formula for identifying one. Its existence or otherwise comes down to assessing a combination of indications, typically witnessed on a map or on an aerial view, such as Google Earth. Entwistle has proposed the following features as good indicators for the existence of a Long-distance Alignment:

- a: A substantial road alignment pointing accurately towards a (possibly distant) Roman site (usually of the First Century) to which the road does not directly go.
- b: A road returning to an alignment from which it had previously diverted (e.g. for reasons of topography or other practical requirements). This may happen once or many times. Such behaviour demonstrates two phases of surveying, the final course of the road being influenced by a pre-established alignment.
- c: Potential turns or branches from the straight line of the alignment being characterised by one of four ‘set’ angles, found in the 3:4:5 and 8:15:17 triangles. Angles should be accurate to within a degree.
- d: A sudden change in direction for a road, where it meets and swings onto a pre-existing survey line. The road may similarly swing abruptly away from the line at a later stage, when it returns to an independent course.
- e: Two quite different roads, possibly separated by many kilometres, following an identical alignment. (Where this is the case, there can be little doubt about the existence of a Long-distance Alignment.)

In each case, judgement should be exercised about whether or not the apparently positive indications could just be coincidences, and thus a balance needs to be struck between probabilities and probably-nots. For those who might welcome it, some advice about how to detect possible Long-distance Alignments and how to recognise where changes of alignment occur is offered in Poulter 2011, 134-36.

It can help greatly if more than one person should be making an assessment of the indications at the same time, especially if they happen to be using different sources, e.g. Ordnance Survey data versus Google Earth images ³. In this way, each person's attitude towards each item of evidence can be questioned and if necessary debated, so as to try to ensure a properly considered verdict. It can also be helpful to consider if there could be a good reason why the Romans might have wanted to create a Long-distance Alignment in the particular circumstances in question.

As can be seen from all of the foregoing examples, it has also happened to be very important to the author that he should understand how each Long-distance Alignment could have been set out. Quite often this can involve visiting sites to make physical inspections of the possibilities. Not everything can be deduced from maps and profiled sections of landscapes. It has to be recognised that such interpretations of the possible planning processes might not necessarily replicate how the Romans had actually set out the alignment, but they offer satisfaction that it would have been practical for them to have done so. Coming from a professional career in information systems and process design, this personal concern might not be so surprising, but the author always remains uncomfortable about any proposed Long-distance Alignment about which the practicality of setting it out remains unclear. For a long time, for instance, the author had harboured doubts about how the alignments at the northern end of the Devil's Causeway (in Example 12) and between Leicester and Colchester (in Example 16) could have been set out. This was until he came to understand how the Romans could have conducted triangulated surveys over long distances, even though it appears that their surveyors did not measure angles in degrees (Lewis 2001, 226-29).

Since the outcomes of all of the foregoing examples were positive, it is felt that it might be helpful to outline at least two examples where the outcome has proved to be negative.

As was stated in Example 4, no signs of long-distance planning could be identified along the course of Dere Street coming south from the Cheviot Hills until the Roman road had reached Blakehope farm. However, just to the north of the Roman fort at High Rochester, which lies between the Cheviots and Blakehope farm, Dere Street does adopt a straight line beside the Sills Burn for nearly 2½ miles (4 km), from NY 826 993 to NT 817 032. Entwistle has pointed out that the angle between this stretch and the Long-distance Alignment from Lancaster to High Rochester is close to that of an 8:15:17 Pythagorean triangle. For the latter alignment, see Fig. 22. Hence the question arises: might this stretch beside the Sills Burn have been part of another Long-distance Roman Alignment?

Extrapolation on the Ordnance Survey map showed that the alignment of this stretch beside the Sills Burn would have met the Long-distance Alignment from Lancaster at the north bank of the River Rede. See Fig. 34.

An examination of the profile of the landscape from that position showed, though, that there would have been no view up to the Sills Burn from there. The Roman surveyor would have needed an assistant located on a nearby ridge to help set out such an alignment at a Pythagorean angle. Against this, it was not obvious what advantage this would have brought in return for the added complication and effort. In contrast, the northern end of the straight stretch of the road, at NT 817 032, is a brow, from which there is an excellent view all the way

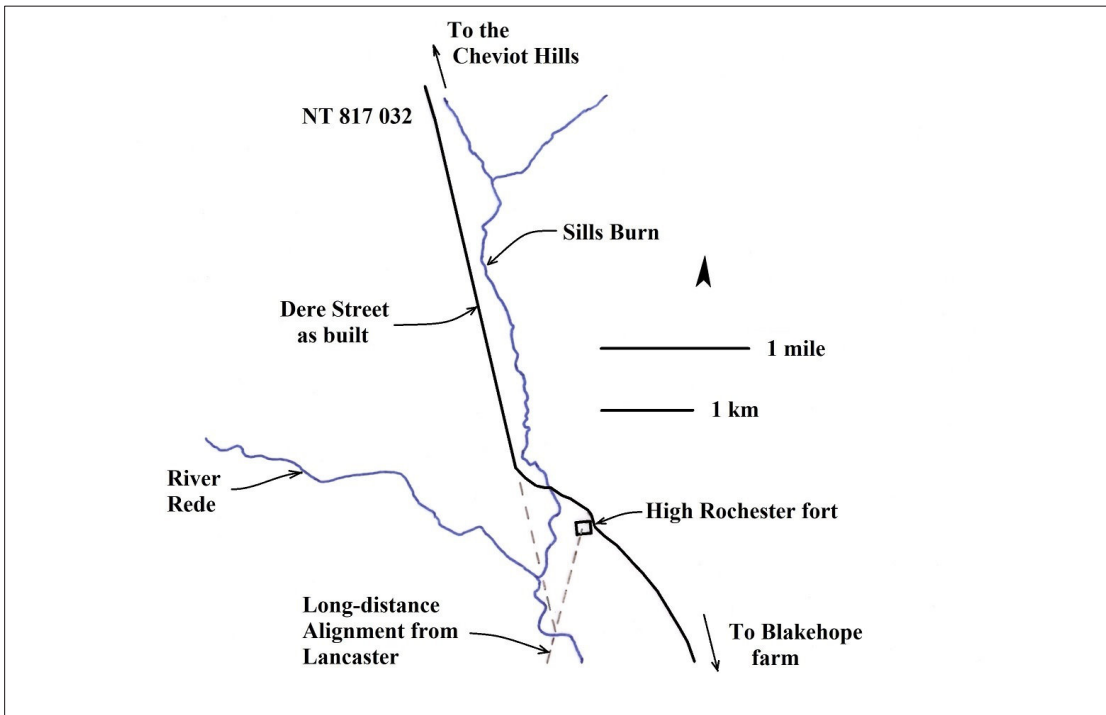


Figure 34: The course of Dere Street beside the Sills Burn.

down the gentle slope beside the Sills Burn to the termination of the stretch at NY 826 993. Thus it seems much more likely that this was what had inspired the Roman surveyor to set out what is, in fact, the sole example of a significant straight line between the Cheviots and Blakehope farm. To double-check, the line of this stretch was extrapolated far to the north and to the south, to see if it might line up with any known Roman site, and the result was negative. Hence the conclusion was this this had not been part of a Long-distance Roman Alignment.

The second example has already been largely covered in Example 6, above. However. It will be instructive to review the thinking process. The late Raymond Selkirk had spotted that the alignment of the 4¼ miles (6.8 km) of Dere Street from Beukley to the Dry Burn would, if extrapolated backwards, run exactly to the Roman fort at Ebchester. In fact, this was later recognised to have been part of the Long-distance Alignment from the village of Esh to the Dry Burn, as described in Example 2. Bill Trow and his colleagues in the Northern Archaeology Group had noted that Dere Street, after departing southwards from Ebchester, had not however headed for Esh but had taken a slightly more southerly course through Leadgate, a little to the south of Ebchester. See Fig. 12. Prompted by Selkirk's claim that the Romans had built a 'Proto Dere Street' directly from Ebchester to Beukley, Trow had therefore postulated that this possible road would have followed an alignment from Leadgate to Beukley, and that at Beukley its alignment would have met Dere Street precisely at the point where the Roman road turned after climbing up from its deviation through Corbridge.

However, at this turning point the view to the south-east is blocked by higher ground close by, so that setting out the projected alignment from there would have been difficult. If, on the other hand, the projected alignment had been set out from the south, then the question would have been: how could the Roman surveyors have set out the alignment so as to run so exactly to the turning point when they couldn't see it? Although it is not impossible to find answers to these questions, doubt was raised in the author's mind, and so the course of the alignment through Leadgate was examined more scrupulously, with the result that it was judged that the actual alignment being followed by Dere Street at that point was a degree or two more northerly. When this new alignment was extended northwards to Beukley, it was found to run exactly to Beukley farm, which happens to stand on the highest point around and which would have made an ideal location from which to have set out a Long-distance Alignment to the south. Moreover, when this new alignment was extended southwards from Leadgate it was found to touch the Roman fort at Lanchester, whereas Trow's postulated alignment would have run at some distance past it.

It therefore appeared that the new alignment was more likely to have been the Roman one. This likelihood was enhanced when it was observed that a large number of the excavations conducted by Trow and colleagues had, albeit quite unwittingly, been located on this new alignment. Entirely correctly, Trow had not allowed his postulated alignment to dictate the locations of his excavations. He and his colleagues had excavated where probing and visible indications had suggested that their road might really be. Hence it appears that Trow's projected alignment had not been correct, even though it had certainly been a serious proposition to be considered.

What might have appeared to be a third example with a negative conclusion has turned out to be an excellent illustration of how new evidence can swing a verdict. Example 7 describes the long-distance planning of the Western Main Roman Road from Manchester up to and into the valley of the River Lune, whilst noting, along the way, the complex geometrical manipulations which had taken place at Whittlestone Head and Jeffry Hill. See Fig. 16. It was Entwistle who observed that the alignment north-eastwards from Jeffry Hill, if extended all the way across the Pennines, would run to the Roman fort at Greta Bridge and there meet at a right angle the alignment of the Roman road coming up from Scotch Corner towards Penrith.

At the time the author felt that this observation, although undoubtedly an exciting prospect, was more likely than not to be a coincidence. After all, the Western Main Roman Road had only used the alignment for 5½ miles (8.7 km) from Jeffry Hill before turning off to climb into the Bowland Forest via Croasdale. Therefore it is possible that this alignment might have been set out as no more than a road-planning exercise. Thereafter, across the more than 53 miles (85 km) of moors and hills of the Pennines, the projected alignment passed through or by no Roman site, with the somewhat peripheral exception of the Roman fort at Bainbridge in Wensleydale. Then, in 2013, the late Hugh Toller published a lidar image of a previously unknown Roman road heading north-eastwards out of Wensleydale, and Entwistle found that this road lay almost exactly upon the alignment from Jeffry Hill. Two entirely different Roman roads using the same possible alignment several miles apart can scarcely be a coincidence, and so the author's verdict was reversed. Entwistle had been right, and, as it

happens, this had led to the identification of one of the most significant of all Long-distance Alignments, in terms of understanding what the Romans' long-range planning intentions had been for this part of northern England.

New evidence can also sometimes provide gratifying endorsements of previous verdicts. With Example 2, for instance, the discovery that the change of alignment at Esh measured 36.5° was entirely unexpected and, at the time, a rather startling vindication of Entwistle's contention that the Romans had made much use of Pythagorean angles between their Long-distance Alignments. In Example 4, the discovery that the Rudgate Roman road appeared to swing on to the alignment from Tadcaster to Sinderby Services helped to confirm the latter as a Long-distance Alignment. In Example 8, the author had noticed that the Western Main Roman Road had curved onto the Long-distance Alignment from Lancaster by Crosby Ravensworth Fell, but had accepted the prevailing view that the Roman road had then turned off the alignment to run to the Roman fort at Brougham, near Penrith. Just as the author was writing this up for publication in the BAR 598 monograph (Poulter 2014), news came through from Hugh Toller that lidar images had shown that the Roman road had not turned off but had continued instead to the Roman fort at Kirkby Thore, which was where the Long-distance Alignment had been pointing. Moreover, this made it appear as if the Roman road known as the Maiden Way could be a continuation of the Western Main Road northwards from Kirkby Thore, and further inspection revealed that the course of this road had indeed swerved in places onto the same Long-distance Alignment from Lancaster, at least as far as the Roman fort at Whitley Castle. Finally, with Example 14, the Long-distance Alignment of the Fosse Way south-westwards from Leicester had, early on, been recognised as far as Compton Verney in Warwickshire, but it was only later that that it was realised that it had extended all the way to Cirencester. Moreover, it seemed likely to have been instrumental in fixing the location of the latter site. Again, this provided welcome confirmation that the original recognition of this as a Long-distance Alignment had been correct.

PURPOSES

It remains to consider what the purposes of these Long-distance Alignments had been. The Roman surveyors seem to have been very good at setting out precisely straight lines over considerable distances of land and across multiple horizons, and it appears that they put these skills to use for a number of different purposes. In addition, there are frequent instances where a Long-distance Alignment may have been created for one purpose and then – or at least part of it – re-used for other purposes. Thus an alignment may initially have been set out to guide the course of a campaign trail and its associated supply lines before later being re-used to direct the course of a fully-built Roman road. Moreover, there may have been an interval of several years or even decades before such re-use occurred. It is often only where such Long-distance Alignments have been employed to guide the lines of surviving Roman roads or to fix the locations of known Roman forts that we can recognise them today. Thus there are likely to have been more Long-distance Alignments straddled across Roman Britain than we appreciate today.

The possible purposes to which Long-distance Roman Alignments appear to have been put have been examined in detail in the BAR 598 monograph (Poulter 2014, 24-38). They include facilitation of:

- 1) reconnaissance of landscapes and populations
- 2) decision-making about the locations of roads and forts
- 3) relaying instructions to the troops on the ground
- 4) setting overall directions on the ground for supply lines and roads
- 5) creating areas of centuriation,

and to these Entwistle has recently added the possible marking-out of administrative and political boundaries (Entwistle 2019, 48-75; Entwistle 2022, this edition of *Itinera*). It should be stressed that by no means all Roman roads in Britain were set out using Long-distance Alignments. As noted in Example 4, for instance, in the area where Roman Dere Street passes from England to Scotland through the Cheviot Hills, there is no sign of any long-distance planning. However, as discussed in Example 5, it is possible that from that point onward a Long-distance Alignment might have been in place, directed at the fort at Newstead and possibly also used to fix the location of the intermediate fort at Cappuck.

It seems that purposes 1) to 3) were particularly prevalent in the early stages of the Roman conquest – or possibly even before – and that at that time they were part of table-top decision-making remotely, at headquarters. The sequence of processes being pursued in such situations can be envisaged as follows:

- Roman planners needed to know about the territory and the people to be or being conquered
- in order to gain this information, they would send out parties to survey both aspects and report back
- in order to be able to record this information spatially at headquarters, the surveyors would need to have followed straight lines at set angles, which could readily be reproduced on a table-top⁴.
- decisions would then be taken at headquarters about where the forts, roads and other installations should be located for long-term control, and also to conform with operational policies, e.g. to keep the trunk roads well inland
- these decisions would then be relayed to the forces on the ground in relation to the survey lines, since these would be the only common frames of reference

It would not be necessary that the forts and roads should lie upon the survey lines of course, but sometimes locating the forts along them could have seemed as good a place as any other, and in which case it would have been easy to know where the roads should go between them. This would explain why a number of Roman forts and roads do seem to lie upon Long-distance Alignments.

As the Romans became better acquainted with their conquered territories, the signs are that fewer directives were issued from table-top planning, so that Long-distance Alignments then began to be set out more by working on the ground. The Kirkham to Aldborough alignment described in Example 10 may be an example of this. Later still, Roman road planning may have paid less attention at all to Long-distance Alignments and simply have worked out how to cover the ground in shorter-length stretches more akin to the style in which turnpike and other roads in Britain were set out in the 18th century. In Appendix 5 of his book *The Secret History of the Roman Roads of Britain* (Bishop 2014, 163-78), Mike Bishop identified ten possible Roman roads in the south-east of Scotland, none of which the author would recognise as Roman, when judged solely on the grounds of their setting-out. Since the lengthiest duration of Roman occupation in that part of Scotland had been in the Antonine Period, it is therefore possible that, if these roads should have been Roman, that they had been set out in the middle of the second century. A similar shift in emphasis from an addiction to straightness can be witnessed with the 18th-century Military Roads of Scotland. Whereas the roads planned under General Wade sometimes took straight lines through unsuitable ground (for instance, in Glen Cochill, south of Aberfeldy), the later roads planned under Major Caulfeild, although still very direct, exhibit a more flexible approach to the landscape.

A similar move towards working out the lines of structures on the ground can be seen in the cases of the two Roman walls in Britain, Hadrian's Wall and the Antonine Wall in Scotland. However, these two walls differ in that the line of Hadrian's Wall (except over the crags) was largely set out in a series of line-of-sight straights, with deviations where the turrets and milecastles spaced out along it needed to be elevated to signal to where the troops were located. In contrast, along the Antonine Wall, it appears that the alignments were used to set out the locations of the forts first, with the Wall then left to adopt the best – and frequently sinuous – defensive lines between them. The course of Hadrian's Wall was probably planned in around AD 120, and the Antonine Wall at around AD 140, but neither of them could have been set out from a table-top, even though the planning procedures themselves would almost certainly have been dictated from above.

With reference to the list of possible purposes above, the examples of Long-distance Alignments which have been described could be classified as follows:

Reconnaissance of landscape and people	Example 9	Lancaster to Scotch Corner
	Example 12	Scotch Corner to Tweedmouth, later used to align the northern end of the Devil's Causeway

Table-top planning, followed by top-down directives	Example 2	Scotch Corner to Esh, and Esh to the Dry Burn, possibly to define the course of a campaign trail and supply lines, and later used to guide the course (with some difficulty) of Dere Street, albeit with a deviation to cross the River Tyne at Corbridge
	Example 3	Tadcaster to Sinderby Services, possibly to define a campaign trail and supply lines up the Vale of York, but later used by Dere Street north of Dishforth, and also, briefly, the Rudgate south of Whixley
	Example 7	Manchester to Whittlestone Head to Jeffry Hill to Greta Bridge, for the Western Main Roman Road to use up to the entrance to Croasdale in the Bowland Forest, and also later used by the recently-discovered road climbing out of Wensleydale to the east of Bainbridge fort
	Example 14	Leicester to Cirencester, probably used to fix the location of the latter, and adopted for much of the way in between by the Fosse Way
	Example 16	Colchester to Leicester, used by the Gartree Road south-east of Leicester
	Example 17 (Possibly)	Littlecote to Fringford, later used to align parts of the courses of the A338 and the A4421

Table-top decisions, worked out on the ground	Example 1	Healam Bridge to Scotch Corner, possibly initially to define a campaign trail and supply lines, later used by Dere Street, although with a deviation via Catterick and Catterick Bridge
	Example 4	Dere Street from Blakehope farm to the Dry Burn
	Example 5 (Possibly)	Blackhall Hill to Newstead, possibly used to site Cappuck fort
	Example 8	Lancaster to High Rochester, used by the Western Main Roman Road from Crosby Ravensworth to Kirkby Thore and then, more loosely, by the Maiden Way from Kirkby Thore as far as Whitley Castle
	Example 10	Kirkham to Aldborough through the Craven Gap, used in places by the road from Ribchester to Ilkley and then the road from Ilkley over Blubberhouses Moor towards Aldborough. Possibly also used to orient an unfulfilled scheme of centuriation in the Vale of York
	Example 11	Whinney Hill to the Portgate, required for the southern part of the Devil's Causeway
	Example 13	Used by Ermine street from Lincoln to the Humber estuary, via a deviation from near Broughton to Old Winteringham, close by the shore

Initiation and setting out of long-distance directions on the ground	Example 6	Cut-off alignment from Beukley farm to the River Deerness, used by Dere Street from Ebchester via Leadgate to Heugh farm, south of Lanchester
	Example 15	Leicester northwards to near Syston, used by the Fosse Way so as to run from the east gate of the Roman town

ACKNOWLEDGEMENTS

Rob Entwistle's contribution to the discovery and interpretation of Long-distance Alignments has been immense, and the author is very grateful to have been working with him on this subject for more than ten years now. Many of the Long-distance Roman Alignments described in this article were first discovered by him, and it was he who felt it was timely to pose the question: how do you identify one? This article, which has sought to address this question from the author's experience, has greatly benefitted from many queries, comments and suggestions made by Rob during its creation, and it has also substantially benefited from a number of questions, comments, suggestions and valuable new information provided by Mike Haken and Dave Armstrong of the Roman Roads Research Association. Their help and encouragement has been much appreciated.

ENDNOTES

- 1 When the alignment was extended south-eastwards from Beukley it crossed from one Ordnance Survey map to its neighbouring one. A digital version of the Ordnance Survey's maps was not available at the time and so the two printed maps were taped together so that their margins were in line, and then the alignment was extended across them. This was later discovered to have been a mistake, because the margins of neighbouring Ordnance Survey printed maps have slightly different orientations to the compass. When the alignment from Beukley was extended in an unbroken line via digital mapping, it was found that the point of intersection with the alignment coming up from Scotch Corner was at the highest point in Esh, and not on the north-facing slope which had originally been observed. This would still have been a suitable position at which to change direction, though, and so the conclusions about the two alignments and the directions in which they had been set out remained unchanged.
- 2 The author's analysis of the course of the Devil's Causeway was conducted between 2012 and 2014. At the time, Bryn Gethin had reported that little of the course of the Roman road could be detected on lidar, but Mike Haken has recently communicated (*pers comm*) that the road now shows up well on the latest lidar, to the extent that the line presented on Ordnance Survey maps can be corrected in places. It is not considered that these occasional adjustments, though, affect the analysis of the road's Long-distance Alignments.
- 3 This has been a great advantage in the working between the author and Entwistle. Quite often there have been very slight differences in the bearings of our alignments, where Entwistle has calculated them from geographical coordinates whereas the author has taken them from the figures provided by the Fugawi software which he uses. In addition, there can be minor differences in judgement about the optimal line for an alignment. The Long-distance Alignment between Leicester and Colchester, described in Example 16, is a good instance of this. These differences are a strength not a weakness in arriving at a verdict. For the avoidance of doubt, and for the sake of consistency, all of the angles quoted in this article have been derived from the author's Fugawi software.
- 4 A similar process appears to have been followed by William Roy, when undertaking the Military Survey of Scotland from 1747 to 1755. He and his surveyors worked along sets of traverses using basic theodolites to measure angles, and iron chains to measure distances. The basic theodolite was not unlike the Greek *dioptra*, except that it was also equipped with a magnetic needle and had its circumference etched into 360 degrees. Surveying took place during the summer months, and through the winter the results from the separate traverses were collated into a single map. By this process, both northern and southern Scotland (except for the Islands) were covered within a period

of eight years. See Anderson and Fleet 2018, 118-23. In the 1850s the military authorities in the USA seem to have employed a similar approach to exploring the territories from the Mississippi to the Pacific coast, except that their traverses were set out along the lines of latitude, which had by then become established. See Poulter 2014, 34-36.

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