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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.

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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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Roman Roads: Status Quo and Future Prospects

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Translated from the Spanish by M.C. Bishop

ABSTRACT

Roman roads are demonstrably high-tech highways, but a failure to acknowledge this allowed them to become invisible to us. Misconceptions concerning the supposed structure of Roman roads spread for decades without any critical appraisal.

But now, with the application of new criteria, the perceived large number of 'Roman' roads and bridges in Spain is gradually falling, with analysis of structural characteristics correctly assigning such structures to their correct period of construction.

By contrast, traces of other previously unknown Roman roads are now being discovered, some in a good state of preservation and worthy of future preservation. This gives grounds for optimism, although, unfortunately, we are already too late to identify some Roman roads that only fifty years ago remained in place. Over this time there have been major changes to the landscape, with nobody having been aware of their existence.

The technology of Roman land transport

The Roman world stood out in all areas related to transport, as in other fields of science. As in these other fields, their achievements remained unsurpassed after the fall of their civilisation.

Roman roads were proper constructions made by engineers (Moreno 2004 and 2010). Although it was not the Romans who invented roads, since we now know that the Persians and Greeks made them in a similar manner (Moreno 2011), it was the Romans who extended them to the ends of the known world. They were able to do so because it was a world that they had conquered and for which they required systems of communications. Never had there been so much travel, nor had so many materials been transported, so that the development of roads and factors relating to transport saw unparalleled evolution.

First published in Spanish in: Sociedad de Ciencias Aranzadi, 2017: *Jornadas sobre las calzadas romanas en la Antigüedad: 2013 - VIII-19/21 Auritz-Burguete (Navarra)*, Aranzadi Zientzi Elkartea, Donostia-San Sebastián

Chariot racing in circuses was the test track for design of light, fast, safe vehicles, for high performance harness and tack, and for the selection of strong, fast draft animals.

Horses were not shod in Roman times. It did not occur to anyone to do so in a civilisation where road surfaces were perfectly adapted to animal hooves. Small granular material was best for the purpose, and always used on Roman roads as metalling.

The first horseshoes nailed to animal hooves appeared well into the 5th century. They were probably used initially by the Franks, and a horseshoe was found in the tomb of their King Childeric who died in 481. Even so, these items did not become widespread in the West until the 9th century.

Likewise the stirrup was not used by the Romans. Horses for riding were little used on journeys, even less so on longer trips. The function of the horse in warfare was well understood and was important for certain forms of combat. However, the horse was not a crucial weapon for Roman armies, nor was a device as fundamental as the stirrup used by those who did not need to stay on horseback for long periods.

It was barbarian peoples, who had long moved around the continent, and even 'lived', on horseback, who used this aid, an unsophisticated and anonymous invention made many centuries before.

In fact, Rome was the civilisation of the cart. The stirrup's absence shows us shows that hardly anybody travelled on horseback, and only the most disadvantaged travelled on foot on Roman roads, as is the case today.

However, horseshoe and stirrup became widespread in the ancient world when Roman roads deteriorated to an unimaginable degree. Bridges disappeared, the layers of surfacing that no one maintained any longer exposed the larger foundation stones. Road traffic by drawn vehicles began to be a memory, with travel on exposed bedrock, off-road, or cross-country. Horseshoes and stirrups became a necessity, and a symbol of the technological and administrative misery of the post-Roman world.

The carriage

The information we have on Roman vehicles comes mainly from graphic representations of these, as well as classical texts, the latter very sparing with this type of detail. Archaeology has thrown a most interesting shaft of light on the technology of passenger vehicles and their suspension. Thanks to the discoveries of the Kozàrmislény *carruca* (Kiss and Bökönyi 1989), from ancient Pannonia, reconstructed in Augusta Raurica museum (Switzerland), and the Wardartal *carruca*, in Bulgaria, now reconstructed in Cologne museum (Röring 1983), we know that the suspension system was truly revolutionary. It would be so even today, considering that the problem to be solved in passenger transport is speed and comfort.

There is no damping as we know it in these carts, based on leaf springs or components bending to absorb the impacts of the wheel. They nevertheless possessed true suspension. The cabin, the passenger compartment, was suspended from the chassis at the four points directly above the wheels. Thus, in the Wardartal cart, impacts upon the chassis were not

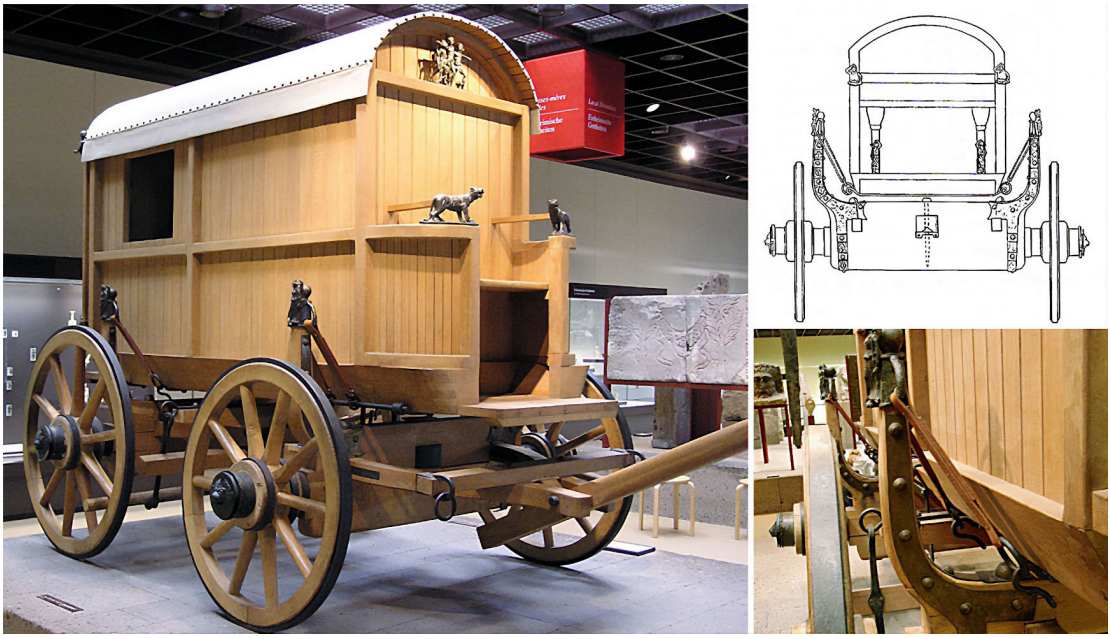

Figure 1, *Carruca dormitoria* from Wardartal (Bulgaria), reconstructed in Cologne museum. Details of the suspension by means of leather straps

transmitted directly to the cabin. A wheel falling into a pothole did not translate into an immediate drop on the corresponding side of the cab, which was still suspended from the other three points.

These components, together with the excellence of road surfaces, made for comfortable suspension far superior to anything else that has existed in passenger vehicles up to our own time.

The passenger carriages correspond to a passenger car model that evolved considerably in the Roman world. Their ornaments became very luxurious and sophisticated, including precious metals (Pastor Muñoz 2012, 72). Carriages were frequently used for nocturnal journeys as sleeper cars, as was the case with the well-known bedroom *carruca*. Now we can understand how these high-tech vehicles facilitated the comfort of the traveller while they slept, an issue that of course would have been impossible on the paved roads that are presented in textbooks to this day.

Even so, the operating mechanisms of the different types of vehicles remain largely unknown, except for honourable exceptions where archaeological discoveries have made it possible to reconstruct an entire chassis, permitting us to confirm their remarkable and advanced design (Crouwel 2010).

The two-wheeled *cisium* and *essedum*, and the four-wheeled *raeda* and *carruca*, were the vehicles most commonly used for passenger transport on Roman roads. The *plaustrum* and *carrus* were for carriage of goods, and probably other unknown and much larger ones were kept for the specialised transport of large loads.

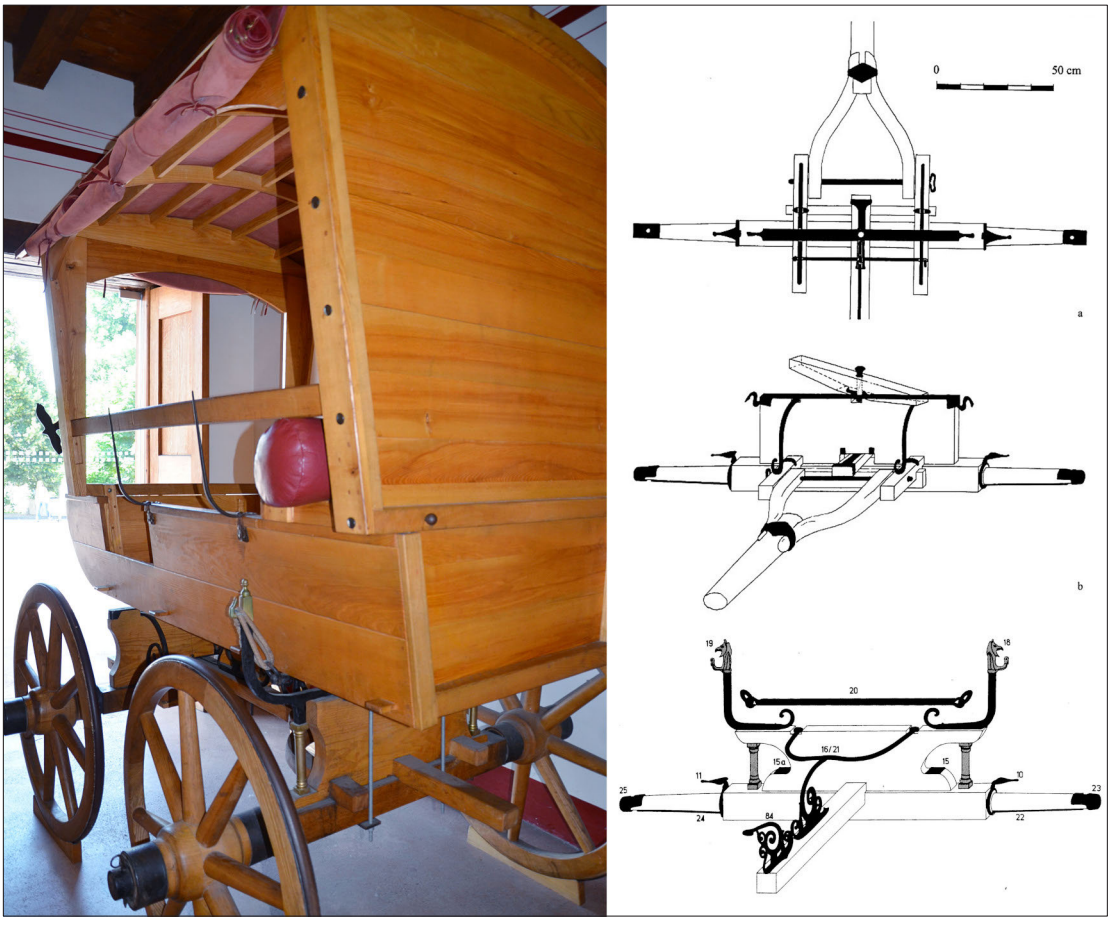

Figure 2, Kozàrmislény *carruca*, from ancient Pannonia, reconstructed in the museum of Augusta Raurica (Switzerland). Drawings of the front axle, according to Zsolt Mráv, and rear axle, according to Kiss

Representations of freight wagons that have survived also provide us with most interesting technical detail. Braking systems to control loads on slopes are key to the proper functioning of these vehicles. In the case of uphill slopes, they may require the opposite, that is additional animal traction on specific sections.

A good example of all this can be seen in the vintner's cart from Langrés (France). This wagon, controlled by a driver wearing a rain hood, has a large central brake shoe, with a central mechanism that connects downwards to a braking system on the two rear wheels. Ahead of him, a muleteer walks with an extra pair, yoked and attached to a chain, capable of being hooked up to the yoke of those pulling the cart from a shaft or pole, here elevated above their heads.

This is one of the cases where it can be observed that tandem harnessing was common in the Roman world.

Figure 3, Idealised reconstruction of a carriage galloping along a Roman road. The unfeasibility of this type of journey is evident from the minimal safety measures

Therefore, we see that different models of vehicles were extremely well suited to the transportation requirements of this powerful civilisation: heavy goods carts with good control systems, and light passenger transport vehicles capable of the speed required of them.

Until very recently, draft harness and trappings from the Roman period have been poorly studied. The information available on this in Spain is disappointing and, as will be seen, radically in error. Fortunately harnesses were not so absurdly ineffective as Menéndez Pidal (1951, 43) suggests: '*in ancient harness, the collar was placed on the neck of the horse, whereby the trachea and the major vessels were more compressed the greater the degree of effort, the effect being*

Figure 4, Relief of the Langrés vintner

so disastrous that, as we have seen, the maximum load that a Roman road could support was about 500 kilograms.'

This text, published in 1951, is based mainly on the writings of Lefebvre des Noëttes (1931), whose unfortunate works ridicule Roman technology without any basis or substantial proof. He had many followers in Europe and, among them, M. Pidal in Spain.

This matter of the harness was already being refuted by Spruytte in 1977 (1983) through experiments based on representations in various Roman reliefs. Ultimately, this question was definitively dealt with by Judith A. Weller (1999), who spares no criticism for the trend in historiography that absurdly opposed progress in this area of research through repetition of Noëttes' theories *ad nauseam*. Furthermore, in the last decades of the 20th century, several archaeological discoveries such as those at Wange in 1989/90 (Lodewijckx 1995), have brought to light the Roman yokes themselves, and those of Neupotz, Germany (Alfoeldy 1993), and many examples of the collars.

In addition, analysis of the iconographic representations that have come down to us allow us to conclude that the Roman harness barely differed from the most effective forms found into modern times.

Yokes and collars are very common in Roman iconographic representations. Attachments with a central pole or beam, or by means of shafts, occur in ancient reliefs. There are hardly any differences in harness and other devices for attaching and controlling the horses.

Therefore, they must have been entirely efficient for the transport of large loads, only requiring the harnessing of as many animals as necessary for traction.

An unavoidable issue is that of large indivisible loads, very common on Roman roads. These greatly increased freight weights reported by many authors, based upon the *Codex*

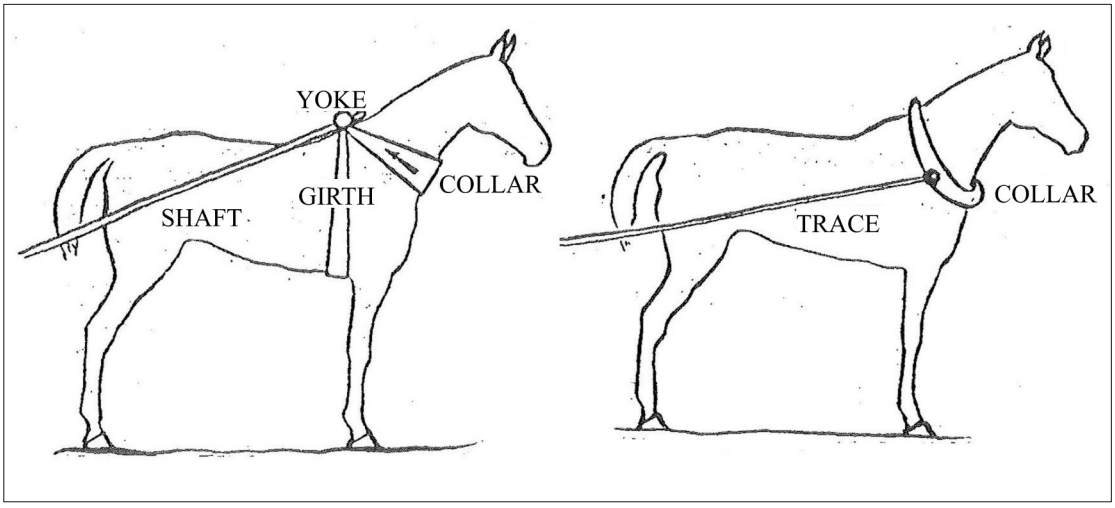

Figure 5, The asphyxiating collar from Lefebvre des Noëttes, mentioned by Menéndez Pidal, and the 'modern' collar, according to this author

Theodosianus. This data is sometimes extrapolated to earlier imperial times, in my opinion with little foundation.

The weight limits specified in *De Cursu Publico* (8.5.8) are, according to the types of vehicles (Sirks 2007):

Angaria	1,500 Roman pounds	492 kg
Raeda	1,000 Roman pounds	330 kg
Carrus	600 Roman pounds	198 kg
Vereda	300 Roman pounds	99 kg
Birota	200 Roman pounds	66 kg

However, many vehicles already had a minimum unladen weight substantially higher than 500kg, so that when monolithic items, sometimes weighing many tons, were frequently transported on Roman roads, they had to exceed what was stipulated in this legislation, even in the times of Theodosius and later.

Although some authors speculate that the origin of these limitations lies in the damage caused to Roman roads by the heavy loads (Weller 1999), this can only be defended by those in total ignorance of the structure of Roman road surfaces. A new interpretation of these regulations would be welcome, or at least awareness of exceptions to it. We must suppose that the very economy of the empire would be paralysed by such legal limits. Despite the many dire decisions impacting upon the future of civilisation made by Theodosius II in his Codex, we should not assume him to have been guided by irrational intolerance.

Figure 6, *Cisium* on a night journey next to a milestone. The traveller carries a lantern. Trier (Germany)

Figure 7, Comparison between the harness of the magistrates' carriage of the Calvet Museum (Avignon-France) and a modern stagecoach. Both show percheron horses with collars, girths, traces, etc

In any case, collars can be seen in many representations, harnessed or not, depending upon whether two or more horses were to be used. A simple collar for a small vehicle (*cisium*) is visible in the relief from Trier, and that of the mosaic of the *cisarii* at *Ostia*.

Double collars are visible in the small painting in *Pompeii*, in the tavern on the *Via de Mercurio*, where a carriage stands by a large vat of wine, and upon the sarcophagus in the museum of the Baths of Diocletian, showing a *raeda*.

Figure 8, Small painting in the tavern on the *Via de Mercurio*, in *Pompeii*

More complex mechanisms, with triple collars, can be seen on the bas-relief that has been reconstructed in colour in Trier Museum, taken from a badly-damaged original on the Igel column.

In this representation we may additionally see most interesting details of harnessing components, including a series of rings that could be for the passage of the straps, a kind of saddle, a girth pad for protection against rubbing, etc.

For fast passenger transport, required by the *cursus publicus* express courier service (*cursus velox*), and other exceptionally fast movements of individuals about whom information has survived, we must think in terms of very light vehicles, similar to those used competitively, or even the same models seen in races. Thus, for example, the *biga,* a very light two-horse carriage not necessarily of the *cisium* type, lends itself perfectly to this purpose. They are vehicles in which one must travel standing, possessing a very light cabin, reduced to the bare minimum. Contrary to what is familiar from Hollywood movies, where we see huge ineffective boxes with the driver almost hidden, these vehicles barely exceeded the knee height of those who drove them.

Figure 9. Sarcophagus in the museum of the Baths of Diocletian, with a *raeda*. It not only provides us with information about the harness. A *raeda* with trotting horses, on a well-preserved Roman road, was a vehicle safe enough to travel with a babe in arms

Figure 10, A coloured reconstruction of the column from Igel, a village near Cologne, in the Roman Museum in Trier (Germany). It clearly shows the three draught mules, two of which are harnessed

Figure 11, Patera from Otañes (Cantabria) with a medicinal water cart. Detailed collars of the mules, of the same model as the one in the Igel relief

Where information has survived of the distances travelled daily using Roman posting stations (*mutationes*) for relief of the draft beasts, these are impressive. Such journeys would not otherwise be viable.

Thus, for example, Suetonius (*Life of Caesar* 57) tells us that Caesar sometimes 'travelled long distances with incredible speed, without luggage, in a rented cart, thus travelling up to one hundred miles per day' (about 150km/day). It is not uncommon for these episodes to be recounted in history books, with the latter proposing horseback riding. No buttocks could endure such feats without stirrups.

Figure 12, On the left, metal parts of horse collars found in Neupotz (Germany) (Alfoeldy-Thomas 1963). In the centre, a wooden and iron collar from Le Rondet (Switzerland) and on the right, a coloured relief from Neumagen (Germany) with a detailed representation of this type of harness made up of three mules, two of which carry a yoke and the third a pompom on the head

Figure 13, Infographic showing the type of draught of three mules, based on surviving reliefs and existing archaeological remains on this subject

The normal journeys of ordinary people, in a private vehicle or passenger stagecoach, were also much faster than has been assumed, since they have been assumed to be on foot, or in ox carts, and similar nonsense. The information that we have for them confirms that distances of 40 or 50 miles per day (60–75km) were regularly possible.

An epigram by Martial describes a journey by sea from Rome to *Tarragona* and then to *Bilbilis* by land: '*... and with an easy voyage driven by favourable winds, you will reach the heights of Spanish Tarragona. From there a vehicle will take you quickly and perhaps on the fifth day you will see high Bilbilis and your Jalón.*' (Martial, *Ep.* X, 104). Taking into account the usual route at the time, through Lérida, Huesca and Zaragoza, we get 69 km/day. Ammianus Marcelinus describes another trip of this type (*Rerum Gestarum libri qui supersunt* 14, 6), with a daily average of 70km/day.

However we also have evidence of exceptional journeys using the *cursus velox*. In the *Secret History*, Procopius (XXX, 3.7) tells us about the *cursus publicus*, saying: '*Since the best horses were frequently changed, those who were entrusted with this task would sometimes end up making a journey of ten days in one day.*' When considering a normal day's travel, made in no particular hurry and perhaps with some load, we should not expect journeys greater than 35km. Even so, the information from Procopius would indicate journeys of about 350km! If we assume 12 hours of travel, interrupted only by the change of horses at the posting stations, that is an average of about 30kph. Although that figure is truly impressive, it would be perfectly possible on Roman roads, with their known structure, and of course, using fast carts with horses at full gallop. Only the fatigue of the beasts, which should be relieved approximately

every hour (30km), imposes limitations upon such feats. The best horses have a limit of 30kph at a gallop, and no more than one hour's continuous endurance.

One last piece of information is found in Plutarch, in his work *Parallel Lives*, where he talks about the life of Galba. He tells us how the news of Nero's death reached him, from Rome to where he was in *Clunia*, in just seven days. That is a journey of almost two thousand kilometres, or about 280km a day, confirming that such trips might not only be possible, but common.

However, heavier vehicles could also travel very long distances on a daily basis, also allowing the traveller to rest. Such is the case with those vehicles in which one could even sleep.

A sleeping *carruca* would be like the one Tiberius probably used (Valerius Maximus, *Facta et dicta mirabilia* V, 5, 3), when his brother Drusus fell seriously ill in Germania. He travelled for more than two days in a row, day and night, to see him before his death, resulting in days of up to 300km/day on this journey, between *Ticinum* (Pavia), in Northern Italy, and *Mogontiacum* (Mainz), where Drusus died. All of this, through the passes of the Alps, with only an indigenous guide for company.

Figure 14, *Biga* in a race in the stadium. Sarcophagus in the Museum of Ancient Arles

Figure 15, Relief from *Ostia Antica* showing a chariot, with the tack and bridle of the horses

The road

Regarding the construction quality of Roman roads, it is a question that I have already written about at length. These roads provide excellent infrastructure, constructed to accommodate horse hooves and cartwheels, and to withstand enormous loads and good speeds.

All of this is made possible thanks to the nature of the surface layers, composed of small-grained materials, preferably rolled so as not to injure the feet of the beasts and to provide the best grip for hobnails and wheels. Hard rock aggregate grains would be used to withstand wear and tear and maintain the roughness of the road surface for a long time.

The very thick stone materials, conferring a bearing capacity much higher than that of many current roads, were necessary for the transport of enormous loads which could sometimes not be divided up. The load almost always had to be transmitted to the ground through the four small surfaces formed by the wheels of large transport carts.

The impeccable geometric layout of the roads, using shallow inclines and a minimum width sufficient for two vehicles to pass safely, rounded off the factors necessary to allow comfortable and safe transport on the imperial road network.

Roman road engineering was a well-developed science, inherited from previous civilisations that practised large-scale road building, such as the Persians. Rome knew how to extend the network across her domains for commerce and the exchange of products and ideas, reaching ultimately to the limits of her empire.

The construction

Constructional techniques for roads, which the Romans undoubtedly perfected, required an 'industrialisation' of the process allowing them to extend networks with admirable speed. They endowed vast virgin territories with cities supplied with water, structured the

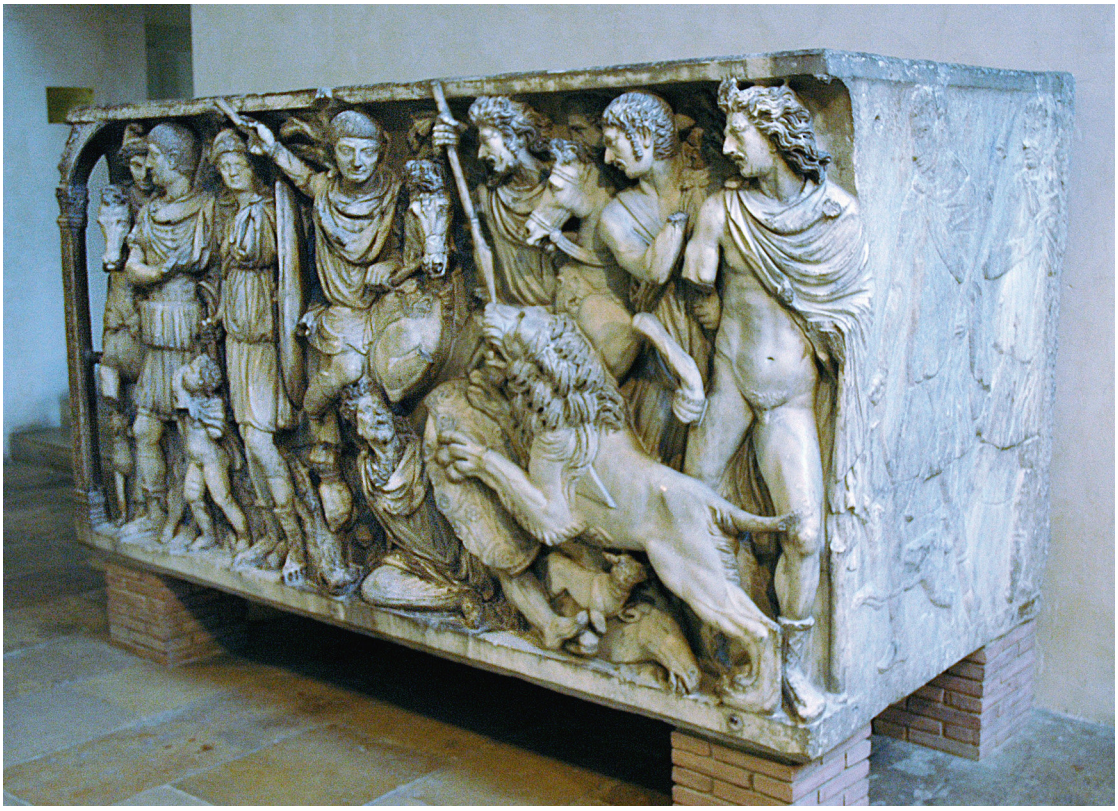

Figure 16, Sarcophagus of Flavius Jovinus, General-in-Chief of the Roman army in Gaul under Valentinian I. Famous for his victories over the Alamanni, he was appointed Consul. A native of Rheims, he died there, where his four-ton *Carrara* marble sarcophagus is found. Monoliths like this one can be found all over the Empire, randomly distributed from the most varied sources, giving an idea of the amazing road network which made such things possible

annexed territories to prepare them for agricultural and industrial production, and provided extraordinary communication routes that made it possible to commercialise production, quickly and over extended distances.

In less than a hundred years – unprecedented, at least in the West – the entire known civilized world was endowed with an endless network of high-tech roads that laid the necessary foundations for the development of territories, fragmented between ethnic groups that, in many cases, hardly knew who their neighbours were.

By the time of Augustus, the Romans had built more vehicles than had ever before existed in the known world. Their successors had to build many more, and above all continuously repair everything previously built, an issue that is unavoidable for the functional maintenance of any road network at any time.

Figure 17, Structure of the roadbed of the road from Italia to Hispania in *Hurones* (Burgos) www.viasromanas.net

Despite widely reproduced reconstructions, where we see Roman legionaries with all their military equipment placing large slabs on the surface of Roman roads, we should rather think of such scenes producing gravelled roads. Roads could also be built by specialised companies. This is what Chevallier tells us (1997, 40): in an analysis carried out on all the surviving text of Livy, he finds seven mentions of road construction by civil magistrates, and only one referring to construction of a road (probably a military way) by the army.

Thus, thousands and thousands of kilometres were achieved in just one or two generations.

The military did not usually build these roads, nor did they have the means necessary to do so. Neither did the military roads that the army built bear any relation to the commercial routes that formed the road network of the Empire.

When the legions built a 'road' it was to solve a battlefield problem and not to connect two cities which, at the time of conquest, either did not exist or were not Roman. Such construction of a road by the army, accessing particular locations, provided information to the enemy that must be safeguarded with great discretion.

Authors such as Frontinus, in the *Stratagemata*, and Caesar, in *De Bello Gallico* explicitly describe these paths, as follows:

Vegetius, in his *Epitome of Military Institutions* (III, VI), comments: '*... detachments should be sent in the vanguard to occupy the prominent places ... It is better to send men ahead with hatchets and*

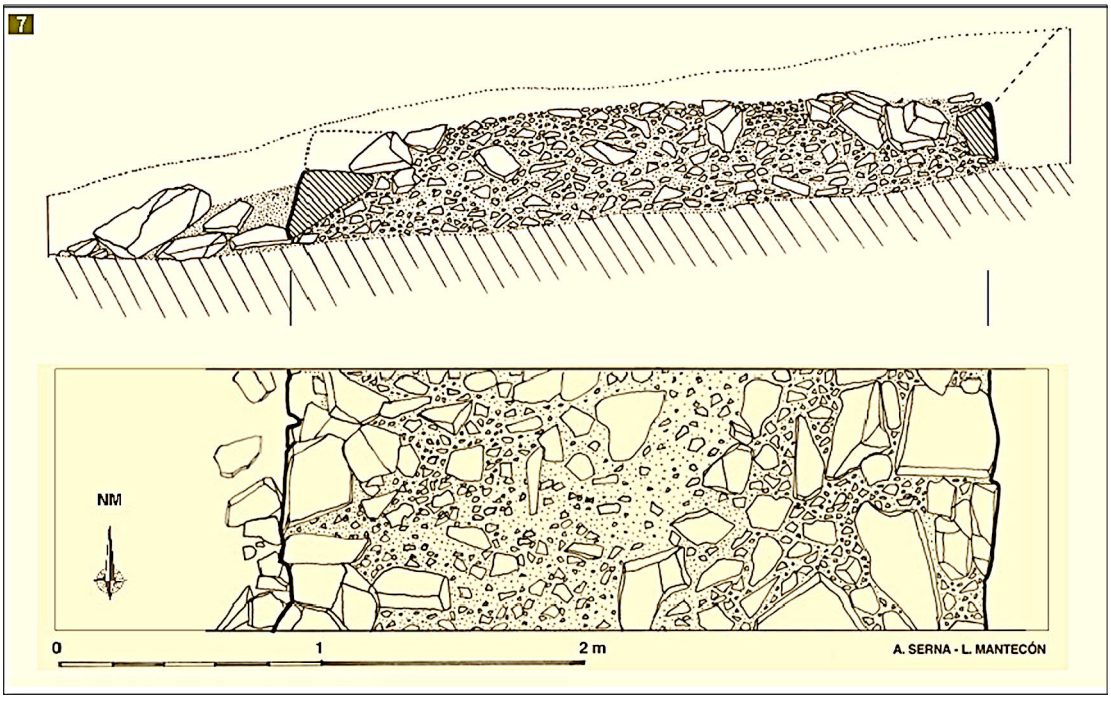

Figure 18, Cross-section and ground plan of the excavated sector of the *via praetoria* at Cildá (Corvera de Toranzo and Arenas de Iguña)

Figure 19, Structure of the Roman road from *Numancia* to *Uxama* in Soria, with the tracks of the construction wagons in the intermediate layers of the roadbed. www.viasromanas.net

other tools to open roads that are narrow but safe, without sparing the work, instead of taking more risks on better roads.'

Josephus similarly describes Vespasian entering Galilee (*Bellum Iudaicum* III–V): '*The sappers followed them to straighten the winding roads, clear difficult passages and cut down the trees that would impede access in advance, so that the army would not have to endure a difficult march.*'

In contrast to the wide highways that are Roman roads, the army moved discreetly along rapidly built roads which, although narrow, served the campaign strategy.

In the camps themselves, archaeology has begun to confirm that streets were narrow (Póo *et al.* 2010, 318). They were, of course, equipped with a road surface capable of supporting loads, as war machines had to move along them, but they were only prepared for a limited amount of traffic where it was not necessary for two wagons to pass each other. The need at such sites was to prioritise the efficiency of the infrastructure.

On Roman roads between towns, huge dumps of bedding material have been observed, with thick stones in the lower layers that serve as a foundation. Successive layers provide the necessary load-bearing capacity to the final structure through adding stones of smaller size to complete the required thickness.

Figure 20, Infographic explaining the construction process of a Roman road and the elements involved

Special attention is paid to the surface layer, both for the hardness of the materials and for fine grain size, necessary for the performance required from these surfaces related to what they must carry: the end users.

Wheels tracks left by vehicles used in construction are very often seen in the intermediate layers, carts heavily loaded with aggregate. Carts passed over the newly compacted and still wet layers, waggons tipping and spreading a new layer of aggregate over their own newly formed tracks, which is why the marks have lasted to this day.

The only practical way to build a road efficiently and quickly with these characteristics is by using available mechanical means. In the case of the Roman world, these are in effect means carts for transporting aggregate and other machines for spreading and compacting the materials. Draft animals and labour rounded off what was needed by construction teams.

A good construction project and good planning are essential for the success of the undertaking. Both factors undoubtedly existed, and the proof is visible in the surviving remains of Roman roads.

The provenance of the materials has also been discussed elsewhere. They almost always came from close to the road itself, but many cases are documented where, to obtain the required aggregates of sufficient quality, enormous distances were covered (Moreno 2004, 107).

The builders were well aware of these problems beforehand and would necessarily take account of them in the project planning. When the state decided on an investment, nothing was left to chance.

But what is left of that amazing road network? What structural characteristics are still to be seen? Are the roads that are promoted as Roman today really Roman roads?

The Identification of Roman roads

The large number of roads, bridges, and other elements of public works considered to be Roman without any objective factor identifying them as such is still surprising. When we examine the process of by which these structures have been 'Romanised', we must conclude that it is the lack of objective evidence that has convinced authors to interpret them as Roman. Absence of proof of modernity appears to have been systematically interpreted as proof of extraordinary antiquity.

However, gradually, evidence has emerged that for such 'Roman' bridges as that in La Rioja (Arrúe *et al.* 1999), and for some 'Roman roads' such as that of Parpers in Argentona (Costa 2012), construction was actually carried out within the last few centuries. That of course does not preclude other constructions being Roman that have nothing either against, or in favour of, their being of that age.

But, when there is no documentation to support the dating of these constructions, because it simply does not exist, we must resort to other factors that can serve us for this purpose. The technique of construction is one such. Buildings, bridges and roads that share technical characteristics, and which demonstrate construction methods of a technological level clearly identifiable to an era, do most likely belong to that era.

Once the characteristics of a structure, and the technological and cultural level to which it belongs, are precisely identified, its dating is greatly facilitated compared to the impossibility of doing so when reliance is placed upon the lack of documentary evidence.

Methods

With regard to Roman roads that have been shown to be such, without exception they must demonstrate all the basic technical characteristics that make a road a road, without which they would fail to perform properly.

For use of this method, therefore, a good knowledge of these technical characteristics is essential. That enables many preserved roads to be identified as Roman, since between the fall of the empire and the 19th century, roads with such characteristics were, in effect, no longer built. Some roads, however, will fail at this first step, since surviving sections, often the majority on certain routes, do not meet the requirements of this analysis.

Initial indications of the various possibilities for the correct layout of routes should be provided by the direction of cities requiring to be linked, but we must also locate clear

physical remains if we expect to escape from the realms of speculation and not continue to settle for baseless hypotheses.

Search methods based on low altitude aerial surveys are very valuable, as these can be conducted at an appropriate time when soil moisture conditions are appropriate, which is rarely true of modern satellite photos.

Archaeological verification of the structure of the metalling is essential, at least in the sections clearly capable of shedding light on this aspect. Without checking the technical characteristics of the road structure, identification will not be complete or definitive.

Documentary support from medieval manuscripts can provide additional confirmation of the presence of a Roman road in an area (García González *et al.* 2010). Although not essential, such evidence reinforces identification and sometimes documents in a most interesting way the continued use of a road in past centuries, even when it has been completely destroyed today.

Such disappearance is particularly an issue in areas of very broken terrain, especially mountainous areas, where aggressive processes of erosion cause the structures of Roman roads to vanish, by burying them deeply or dispersing their remains.

However, on the plains, this is not the case. Where evidence has been destroyed here, it is not due to natural phenomena, but to human activity in exploiting the land. With the exception of cases where farms have been levelled or dismantled for irrigation, or instances where vestiges have been removed by machinery, roads can mostly be found in situ. Remains of the destroyed structures, and of road surfacing material, may be dispersed along the zone of occupation, but they are nevertheless there.

Vestiges in the plain

In lowland areas of the moors and other plains, roads are destroyed for the most part as a result of ploughing and agriculture irrigated by rain. Fine-sized aggregates, by their very nature, do not travel great distances by the action of the plough. They are only scattered a few centimetres. A six-metre-wide stone-built road barely occupies between eight and nine meters once it has been ploughed repeatedly. The smaller the aggregate, the less the dispersion. In addition, colour contrast with the natural terrain is higher when there is an initial difference in the colour and nature of the aggregates making up the structure. Thus, stones of white quartz or limestone leave spectacular traces that remain for centuries on dark or reddish clays.

On the plain, roads that have managed to remain in use preserve their structure easily. Only the transformation of the foundation layers with heavy machinery degrades them severely, although sometimes even this process fails to destroy the lower layers.

We have found the best remains, the most spectacular embankments, and the most integral surface structures of the Roman road, on the plain.

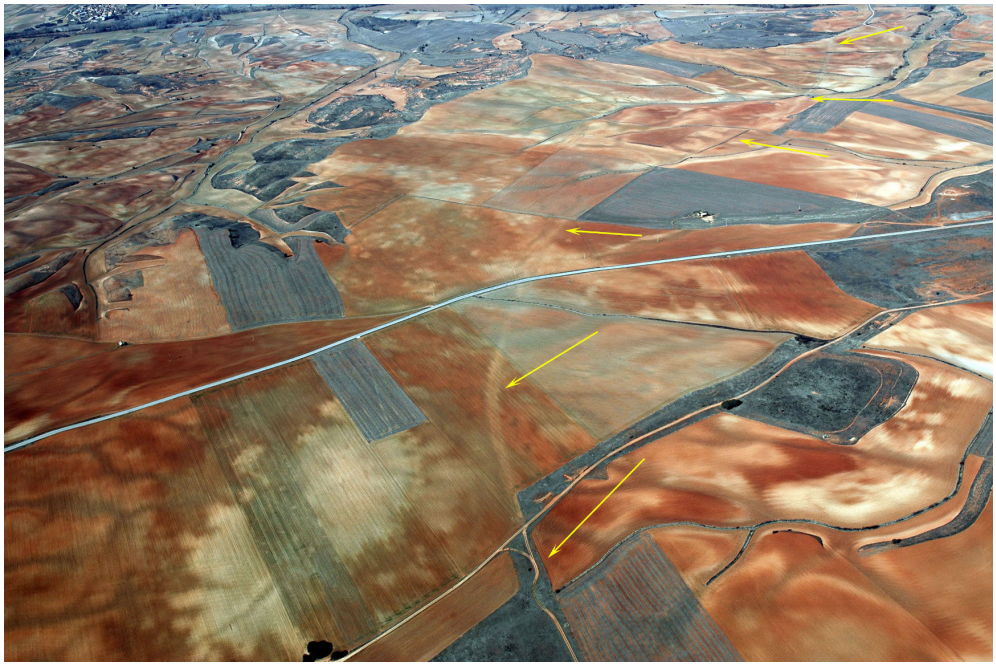

Figure 21, Traces of the Roman road between *Uxama* and *Clunia* in the province of Soria. www.viasromanas.net

Figure 22, Traces of the Roman road excavated between Salamanca and Villalazán, in the pastures to the south of San Cristóbal del Monte. www.viasromanas.net

Here, the processes of erosion and deposition are minimal. Large Roman carts on soft terrain required an extremely thick roadbed, which means that the remains survive relatively well in these zones.

Vestiges in the mountains

The geological instability of mountain slopes, caused by gradients and aided by the erosive forces of run-off, succeeds in destroying infrastructure there in an impressive way. Road maintenance is always very expensive in mountain areas. If terrain is not sufficiently stable, lack of adequate maintenance and subsequent repair can sometimes destroy roads along their entire length. Only the cuttings are providentially preserved by the particular hardness of the rock from which they have been excavated.

The discovery of intact structures on the side of a mountain is not to be expected. Occasionally, the platform on which a road was based, rather than the surfacing, is preserved, in which case it occurs over a short length.

When the qualities of the rock are highly resistant to erosion, traces of ancient excavation can be found. Cuttings through rock for Roman construction works were excavated by hand. In this case, when the nature of the rock allows it, pickaxe marks are visible in the rock walls formed during the construction process.

Few cultures used picks on rock in this way for the passage of their routes, and in the western Mediterranean area these are a good means of identification, as here Roman construction had no rival in this technique, either before or after. New road construction in modern centuries has used gunpowder for such purposes, making pick marks on the rock walls very rare.

Although usually no other traces of the construction of Roman roads can be found in mountainous areas today, in a few cases rock cuttings are preserved. They are undoubtedly Roman due to their technique, and if they do not usually occur over a long stretch, their location may reveal the overall direction of road construction.

In exceptional cases, large ornamental gates that accompanied a Roman road are preserved and can be admired today. For example, the Bons gate, near Grenoble, preserved on a difficult-to-access hillside, on a very hard rock outcrop, constitutes the only vestige marking the course of the Roman road in the entire valley. If it had not been for its chance survival, nothing would be known about the course of this Roman road.

We must therefore consider the discovery of any remains of a Roman road in mountainous areas as purely down to luck, due to chance geological circumstances. And, just as cuttings in rock with pick marks clearly identify the route of a Roman road, so the presence of well-preserved surfacing or structures are indications of modernity, precisely because their state of preservation is untypical of Roman roads. The criteria for the layout of mule trails, medieval and modern, are not those of roads, and the result is therefore very different from what is expected of a Roman road.

Figures 23 & 24, Roman road in a mountain pass, the rock cutting at Bons (Mont de Lans, France)

From error to terror

The greatest errors in identifying Roman roads do indeed occur in mountain areas. The need throughout history to continually establish routes in these places, where the elements destroy all that has been built, leads to a proliferation of visible but relatively new paths.

Paving stones from recent centuries, although merely intended to consolidate paths constructed without engineering criteria, have excited the imagination of many researchers wanting to see in them Roman roads that are not otherwise visible.

In most cases, a Roman road, even if it existed, will no longer be visible. In most mountain passes two thousand years is a long time to preserve a road that the Romans made. Discovery of some small traces of construction on a rocky outcrop is down to Providence, and we should consider ourselves lucky in the rare cases when it occurs.

The truth is that modern interest in historical roads has meant that each mountain pass through which a Roman road used to run 'requires' the discovery of a Roman road in it. If this does not happen, it can always be invented.

Relatively modern paved roads have formed the paradigm of what a Roman road should be. They have been labelled as Roman roads and are visited as such by tourists. Warnings

Figure 25, The technologically poor Capsacosta road, in Gerona. An unengineered mule track, claimed and presented as Roman

against this issue have been published previously (Moreno 2004, 217 et seq.) but it is worth repeating that neither the Puerto del Pico in Ávila, nor the Besaya paved path in Cantabria, nor the Capsacosta path in Gerona, nor the Fuenfría path in Madrid, nor the cobbled road of Ubrique, may be considered to be Roman roads, either in terms of construction method or route. The full list is too long to reproduce here.

Although human error is excusable and universal, these routes should no longer be presented as Roman, since it is known that they are not. Doing so is a cultural fraud perpetrated upon the public. Some such routes are especially significant in this regard: the Camino de Santiago ('the Way of St. James') has been much travelled since it became fashionable some twenty years ago.

The central and western Pyrenean passes, which have always been gateways to the Iberian Peninsula, today constitute the beginning of the Camino de Santiago for thousands of pilgrims each year.

When the 'official' Camino de Santiago was re-established, in an attempt to prevent the proliferation of numerous routes claiming the name, the supposed ancient routes through the passes of the Pyrenees were incorrectly identified.

Figure 26, View of the Puerto del Palo road at the only site with any constructive structure of interest. It is a poorly made retaining wall to support a two-metre wide path. Cuellos de Lenito in the Valle de Echo

As a result of what has been written by some historians, the supposed Roman road representing the Camino de Santiago, was made to pass through difficult places completely inappropriate for the route of a Roman road.

The central pass by the Puerto del Palo has been long advocated and postulated as a Roman road (Casaus 1829 and Blázquez 1918). In the 20th century studies by Beltrán (1955, 127–40) and Magallón (1987, 113–33) declared it to be such. However, attempts have been made in more recent studies to debunk the supposed Roman nature of this pass (Moreno 2009) using structural and technical criteria. It is not only unsuitable as a road, but exceedingly dangerous to traffic due to the high elevations through which it passes.

Fortunately, few pilgrims follow the recommendation to use this 'authentic' route, more because of its difficulty and regard for their own physical safety than because of the information provided for them. The route through this pass is truly horrifying for the reasons mentioned, and promotion of it should be banned.

The Roncesvalles pass, situated in the western Pyrenees, has always been supposed to be Roman, apart from some bizarre claims that see the ambush of Charlemagne as having taken place in Puerto del Palo, in Aragon (Ubieto and Cabanes 1993). For good reason Roncesvalles has been seen as the best of the passes in all that area to traverse the Pyrenees.

However, traditionally, it is the route named on maps as 'Napoleon's', running through very high altitudes, that has been regarded as Roman. For a summary of those authors who have

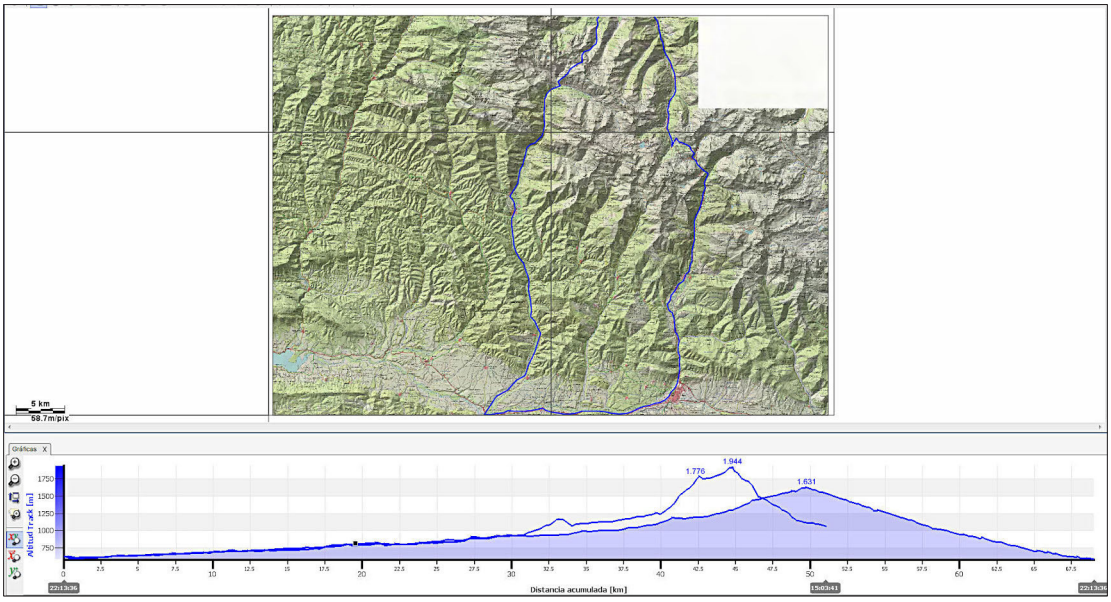

Figure 27, Comparative longitudinal profiles of the Puerto del Palo road and the old Somport road (the Roman road). The former runs on very steep slopes, at much higher altitudes, with snow for many more days a year and, in short, with an elevation profile inappropriate for engineers. The second is the best possible way to cross the Central Pyrenees and practically coincides with the current road

postulated this route as Roman, given that they rely on them, reference can be made to Buffières and Desbordes (2006).

This high route, which has no constructional characteristics resembling Roman techniques, rises to the level of 1,300 m. In fact it was built by Napoleon's troops, under the command of Marshal Soult, for the emplacement of artillery pieces to defend the Ibañeta pass, which was the one then commonly used, located much lower at an altitude of 1,050 m (Lacarra 1949, volume II, 78).

It is nothing more than a high mountain route, completely unsuitable for laying out a road. It rises to unnecessary altitudes covered in snow for many days a year and continues high up for some distance before descending again to the Ibañeta pass. If only because of the irrationality of this route, and the lack of any known Roman traces in the area, we have argued that this route could not be Roman, and that the road should have followed a route close to that of the current road between San Juan de Pie de Puerto and Ibañeta (Moreno 2004, 221). This modern road was laid out by engineers, and it was engineers who laid out the Roman road. The possibilities for suitable and rational solutions in the valley are limited.

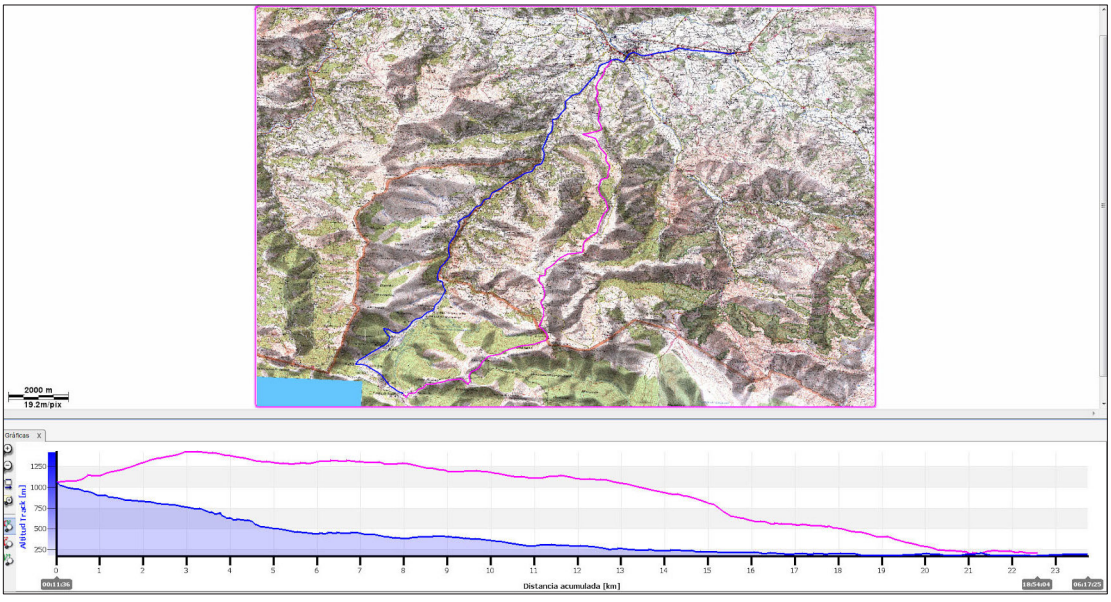

Figure 28, Comparative longitudinal profiles of the Cice and Ventartea passes and the Valcarlos Roman road. The former runs for a long way, unnecessarily, through high mountain peaks, making it particularly dangerous. The latter is excellent, providing the lowest possible route over the Ibañeta pass, the lowest in this part of the Pyrenees

Recently, and using these criteria, the Roman road has been sought in Valcarlos and has been found on a line close to the current road. Significant progress is finally being made in the identification of the Roman route in this area, but for some pilgrims it is too late.

It will take many years to achieve acceptance that the road via the heights of Ventartea and Cice is not the old pilgrims' road, much less the Roman road. Every year thousands of

Figure 29, One of the many cuttings, made with a pickaxe, for the passage of the Roman road in Valcarlos

pilgrims follow this route, highly demanding in terms of energy and unnecessarily endangering their physical safety. So much so, it is a rare year in which no-one loses their life on this journey. It is a case where error has turned to terror.

With roads to Santiago now being promoted from all over Spain, another pass, unforgiving at hard times of the year, is now also promoted as such. The Puerto de la Fuenfría in the Sierra del Guadarrama is the pass between Madrid and Segovia.

A milestone was found in Cercedilla showing that a Roman road passed through that valley, the logical passage over the hill of Fuenfría. The surfaced remains of a road dating from the time of Philip V excited the imagination of many road scholars in the 20th century, reflected in numerous publications which described it as the Roman road through the valley. Its irrational layout as a highway led to a review of this question, and the Camino Viejo de Segovia was opted for as the best candidate (Rodríguez *et al.* 2004, 63–86), although its deteriorated state has not allowed us to identify structural remains which can be unquestionably assigned to the Roman period.

This route is now being promoted, although it is only a path (and not even a good one on some difficult stretches) which takes an illogical line through the Madrid foothills unsuitable for a road. Few traces along it – in fact none – can be assigned as Roman road structures.

Figure 30, Supposed Roman road, promoted as such, in Ubrique (Cádiz). The flagstones uncovered on this Camino Real have led to claims that it is Roman, due to their resemblance to the paved streets of Roman cities

This bizarre proposal fails to conform to any criteria, either scholarly or remotely logical and reasonable, and yet is what users unfamiliar with Roman road studies must settle for. Not only are they being deceived from a cultural point of view, but they are also given misleading information on the nature of Roman roads, including how they were laid out and built.

Briefly, the proposed route continues on the Segovian side, despite the fact that there are clearly no Roman structural remains anywhere through the entire pass. Just a few small embankments in the ancient Venta de Santillana could be suggested as indicative of a Roman road, yet there is an intention to promote the whole line as such, kilometre upon kilometre of high mountain pass. Here surely, once again, travellers who have already had this cultural disaster foisted upon them, now have their physical safety put at risk by the horror of bad weather, all sponsored by large quantities of public money.

Other mountain roads with no indications of Roman origin, but which also receive some bizarre degree of support, are proposed in the Cantabrian mountain range. This includes the supposed Roman road in the Camin Real de la Mesa, between León and Asturias: it runs continuously through the highest areas, quite unnecessary for an efficient Roman route, and always dangerous.

The list of bad roads through dangerous terrain for which Roman origins are claimed, would be too long for the scope of this work. Such roads in the Alps and elsewhere have already been referred to in other works (Moreno 2004, 220 et seq.). The examples provided above, particularly significant, must suffice.

Towards an understanding of the road network and its builders

In recent years many sections of Roman road have been discovered due to the significant technological level of Roman engineering that it has been possible to confirm for them (Moreno 2011). This should make us reflect on what has been ignored up to now on the subject, because of the general lack of knowledge about the Roman road network. It should also make us reflect upon how the mistaken impression we had of these roads leaves so much more still to discover, and upon how much has been lost to major transformations in the landscape over recent decades, while we were unaware of what we were losing.

Until a few years ago, the identification of Roman roads was fundamentally based on historical sources informing us about those roads: sources that were always partial, difficult to interpret, full of transcription errors, and which actually led to the discovery of very few Roman roads.

The sources and the road network

Up until now, surviving ancient documents that have come down to us have been of disproportionate importance in investigating of the Roman road network. However they have provided no new data of interest for many decades, and in the light of current knowledge are now sterile sources.

The so-called Antonine Itinerary (Roldán 1975) describes routes along Roman roads. What up until now seems to have been the Bible for investigating Roman roads suffers from the following characteristics:

1 In many cases the routes present evident gaps in the data. Cities which existed and whose sites are well known are inexcusably omitted, with errors in the total distances of routes which force us to suspect the loss of more than a few intermediate lines of text. The routes from Caesaraugusta to Benearno, and from Caesaraugusta to Asturica via Celtiberia, are examples among many others.

2 Simple errors in the recorded distances, deriving from either from the original source or from successive transcriptions, tempt the researcher into considering incorrect routes that conform to what has been described.

3 Many of the routes linking well-known Roman cities for which we have clear evidence (probably the majority) do not appear in the Itinerary. We can cite networks known today with some precision which have limited representation among roads described in the Itinerary (www.viasromanas.net).

To expect significant advances based on this type of documentation is to persist in an area of study in which progress has never been made, when truly effective alternative techniques were lacking. This demonstrates a curious belief assigning absolute literal truth to anything said in the document.

Another of the documentary sources often used to try to 'discover' the routes of Roman roads is that by the so-called 'Anonymous of Ravenna'. The *Cosmography* of the Anonymous of Ravenna was written between AD 670 and 700 (Pinder and Parthey, 1860).

According to the authors who have studied it, this document is derived from the transcription of city names represented on a map. It has not been proven that Roman roads were depicted on the map, nor is any type of distance between the cities given, although they tend to be grouped by geographical areas. It is difficult to imagine a document of lesser value to solve the problem of identifying Roman roads, which is what we are dealing with here. However, it continues to be mentioned insistently by those dealing with this type of study.

The Bordeaux Itinerary (*Itinerarium Burdigalense*), is more complete and precise than any other, but does not include any region of Spain. Those who study France are fortunate, but for Spain it is worthless.

The Peutinger Table (*Tabula Peutingeriana*) is a map made with highly deformed scales so that its format could be accommodated on a rolled parchment. Cities, roads, and the distances between them are represented, but the parts dealing with *Hispania* and *Britannia* were not preserved. Nevertheless, despite this complete lack of utility for our geographical area, some authors, in their ignorance, rely on this map to demonstrate alleged Roman road routes (Grande del Brío 2007, 67 et seq.).

In short, there is little value in the documentary sources that have survived for the geography of Roman roads in Spain, and use of these sources will see little future identification of Roman roads throughout the Mediterranean area in general.

Today we have found a new weapon based upon the comparison of constructional techniques in physical remains: real evidence and proof of the existence of Roman roads. Fortunately, research into Roman roads is no longer based upon maps covered in lines, various speculations derived from distance measurements, or the strange site associations between bridges, and roads (in that the former, being Roman, automatically date the latter by reason of association).

Now, far more useful, is a comparative study of surface materials and analysis of the arrangement and quality of the various layers of stone customary for Roman roads. Examples have a substantial minimum width and show limited maximum inclines, within the context of a route clearly laid out by topographic survey and transferred to the terrain using intentional geometric characteristics. Using highway engineering to study Roman roads fully confirms Roman-era technology and construction.

The *damnatio memoriae* of Roman knowledge

For people of the present day, Roman roads have until now offered more questions than correct answers. Our lack of knowledge is probably also true for other crucial aspects of their civilisation, with inaccuracy becoming engrained long before it fell. History is written not only by external enemies of a civilisation but also those who hate it from within.

Even those emperors demonised and made the subject of *damnatio memoriae* by their own people had information about them collected in the writings of those who recounted their lives a few decades later (Suetonius). But in dealing with armed conflict, it is hard to find the truth from texts when a ruler or an entire people is destroyed. History is written by the winners with such evident bias that all reality is distorted in favour of the winner. If that is true for contemporary history, it is even more true for ancient history.

Fortunately, the built structures that some civilisations have left behind them speak to us so clearly that, even when in ruins, their excellence is difficult to obscure through misrepresentation in books. Using the guidance of such structures is always the best way to gain understanding of those who created them, because '*by their deeds you shall know them*'.

If the failures of truth about the Roman world are hard to to detect in ancient writings, we are capable of doing better with regard to modern writings.

The excellence of Roman road technology is an important area of concern that I shall not explore further to avoid prolonging this section indefinitely: it is well known today and has already been commented upon in this paper. Misleading information has been published on the subject, to such an extent, that we read statements advocating the exact opposite of what has been shown to be true.

At the beginning of the 20th century, authors appeared who were interested in demonstrating that the level of knowledge that Roman civilisation used on its roads was typical of lesser intelligences. Lefebvre des Noëttes even experimented in 1910 with

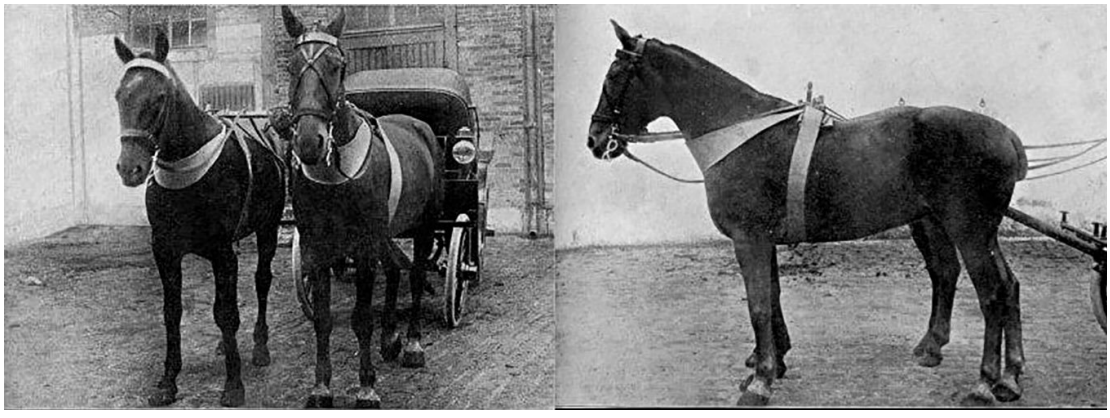

Figure 31, Photographs of Lefebvre des Noëttes' experiment, 1910. The asphyxiating collar that he tried out does not correspond to the reality of the harness that the Romans used

harnesses of a design that prevented the transport of loads (Lefebvre des Noëttes 1931). All this, without thinking to explain how it was that huge quantities of all kinds of heavy loads had been transported to the furthest reaches of the Empire from points of production. He was influential on a good number of other leading European authors, giving rise to a whole host of historical consequences. The failure of Roman technology was taken as the starting point for later medieval and modern developments, thus proposing a process of development that started with very poor-quality Roman practice.

Gonzalo Menéndez Pidal has had an important influence in the Spanish historiographic school, who adopted all the principles of Noëttes, in his work *los Caminos en la Historia*. They adopted further reactionary principles of their own, leading to a bleak view of transport techniques in the Roman world. Pidal pontificates on matters with phrases like these:

- '*... criteria that make modern roads softer and longer, and produce a carriageway that is faster and harder, suitable for walkers and horsemen but not for carriages*' (p. 25).
- '*The superfluous depth of road structure stands out, although it is the main basis of its durability*' (p. 27).
- '*Roman chariots had a narrow gauge of less than one metre*' (p. 31), (despite all the Roman streets in Pompeii, and of other Roman cities in modern excavations, measuring 1.40m. Moreno 2004, 167ff).
- '*Undoubtedly, this low efficiency of the Roman road is due to the poor operation of the harness and the lack of horseshoes*' (p. 31).
- '*It can be said that vehicle construction technique made very little progress under the Romans*' (p. 32).
- '*It can be said that vehicles for transporting people were rare and seldom used; the traveller usually went on horseback*' (p. 32).
- '*It seems that the new harness using rigid collars resting on the breast and shoulders only came into use around the 10th century, which, together with use of the horseshoe, made it possible for defective medieval roads to perform better than the remarkable roads of the Empire*' (p. 43).

If this perception of the Roman harness has been revised in recent work, as summarised by Judith A. Weller, that remains untrue for roads. That author, along with others discussing Roman roads, paints a picture of poor roads and steep inclines, very far from reality.

The *damnatio* imposed on road engineering has still not been overcome. Well into the 21st century, text books (Zarzalejos *et al*. 2010, 390 and 391) continue to recount theories falsely attributed to Vitruvius concerning the construction of Roman roads, although he never deals with the subject.

The level of understanding shown by Spanish historians, even recently, concerning the technical capacity of Romans and their roads, must be summarised in this sentence by Ubieto Arteta (1993):

Around the year 1000, the emergence of merchants in Europe made it necessary to adapt old Roman roads for the transit of freight wagons. Since the pass through the Valle de Echo via the road from Zaragoza to Bearne was unfit for this purpose due to its choice of route, the Puerto del Somport de Canfranc (Huesca), lower in altitude, was adopted.

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