

## **Contents**

1. Introduction and General Remarks
  - 1.1 Project Description and Development of the Compendium
  - 1.2 General Remarks
    - (i) River Bridges
    - (ii) Moat Bridges
2. Glossary of Frequently Used Terms
3. Bibliography

## **1. Introduction and General Remarks**

### **1.1 The 2022 Review**

This document introduces the latest version of a compendium which has been developed over several years. Firstly, attention is drawn to the changes since the 2021 review, during which the information sheets for 903 bridges have been examined in detail, and though the amendments to most have been relatively minor, some better photographs have been found, and some inconsistencies have been resolved. The format is unchanged, and each package of information sheets accessible from the home page is accompanied by one or more of Alastair Robertson's sketch maps, which together show the locations of 903 bridges. Apart from making each bridge reasonably easy to find, using first the map and then the Grid Reference, the maps show interesting features of bridge distributions, which will be discussed in the future. Further work has been carried out on the data gained from the analysis of old maps produced by Christopher Saxton in the 1570s, and John Speed in c1610. The Addendum contains a more comprehensive overview, including a considered assessment of how much can be concluded about past populations by examining surviving bridges, thus quantifying, to a degree, my oft-repeated statements, that we can only look now at a sample of what once existed.

The Addendum contains also 26 information sheets for previously unconsidered bridges, which have come to my attention in various ways. At a future date, probably in a 2023 review, they will be embedded in the body of the compendium, along with the information sheets for any additional qualifying bridges which come to my attention before then. A third part of the Addendum begins a more detailed consideration of how arch forms evolved between the 12<sup>th</sup> and the 17<sup>th</sup> centuries. Data is presented for bridges built in the 12<sup>th</sup> and 13<sup>th</sup> centuries, which will be extended to later build-dates. This is a follow-up to the work, which has demonstrated that there is no simple link between build-dates and arch spans, but that there is a very strong link between arch spans and location. Finally, the Addendum will be augmented with a listing of those bridges in the compendium, about which available information is less than desired, whether this is photographic, dimensional, or dating; the hope is that this might be picked up by readers interested enough to try to fill some of the gaps.

Parts of the compendium have been untouched by the 2022 review, namely the tabulations of bridge data, by region (country), and the overview. A pamphlet, also available on the website, was issued in the autumn of 2021, describing the project and the compendium. Results were presented in this document, which derived from the 2021 versions of the tabulations and overview. Both of the latter could have been updated on the basis of the 2022 review, though not to an extent that would have altered any conclusions, but this would have reduced

the alignment between the compendium as it appears on this website, and the pamphlet, a few months after its publication. It was decided that this was undesirable, so the updating of the tabulations and overview have been deferred to the next review. There now follows the general introduction to the project and compendium, largely as it has appeared previously, though the opportunity has been taken to add to the bibliography.

## **1.2 Project Description and Development of the Compendium**

The compendium had its origins in some years of making casual observations around the country, which had become a bit more focused after retirement yielded greater time and opportunities to search out old bridges. I brought no professional expertise to the pursuit as I am not an architect, civil engineer, or surveyor, but a physicist who spent a working life managing industrial research and development, so my standpoint is that of a reasonably well informed layman, disinclined to speculate. About 8 years ago, I decided to change what had remained an intermittent pursuit into a structured project, which had the objective of viewing and recording the surviving old bridges in Great Britain as they are now, and understanding the changes to them which had occurred since they had been built. The end product was to be a document posted on my website, and I anticipated spending a fair amount of time on the project for two years, a reflection of a gross underestimate of what I had taken on. I began by exploring the information, including photographs, about old bridges available in the 'literature' and developed a definition of old bridges. This desk-based exercise enabled me to produce a long list of bridges, which might satisfy the criteria I would choose. Thereafter it was a case of working out itineraries which allowed them to be visited in a fashion as economical as possible in time and distances covered, knowing that I also had to find sensible ways of presenting the information I was assembling.

I turn first to the 'literature'; no-one considering old English and Welsh bridges can get very far without accessing the work of Edwyn Jervoise who over a decade around 1930 produced four volumes which identified old bridges, described them, and searched out documentary evidence of their antiquity and vicissitudes over the years; the acquisition of two of his books, and the realisation that no-one had attempted to repeat his survey in almost a century, was an important influence on my deciding to systematise my own efforts. Though his focus was narrower than that of the great Tudor traveller, John Leland, he can be seen as creating a modern version of the famous 'Itineraries', at least with regard to bridges and rivers. Alongside descriptions of standing bridges, he dealt with bridges which had disappeared but occupied important sites in the past. Rightly or wrongly, and it is unlikely to have been possible anyway, I have felt no need to consult most of Jervoise's sources directly because where I have done so, as with Leland for example, I have been more than satisfied about his trustworthiness, competence, and thoroughness; he did make occasional mistakes, but they were few and far between. A volume of slightly different format covering Cornwall was produced in the same period by different authors, Henderson and Coates who maintained similar standards, before Jervoise completed the picture for England and Wales by producing a volume dealing with the many old bridges in Devon, based on work carried out by the aforementioned Henderson, who unfortunately had died, before he could publish his results.

Jervoise was commissioned to produce his books for a purpose, which was to identify a national cultural resource, and to encourage those charged with the preservation of historical artefacts to appreciate the importance of old bridges and act accordingly. In a sense, the timing was opportune, because the upsurge in motorised road transport of the previous few decades, though vastly less than was to come, had already resulted in characterful old bridges being seen mainly as obstructions to both traffic and river flow, which would have to be drastically modified or replaced. Unfortunately, for some outstanding examples, Jervoise's survey had come

more than a hundred years too late. The great age of turnpike road development which began to make possible long-distance travel, within reasonable timescales, in the late 18<sup>th</sup> and early 19<sup>th</sup> century had encompassed demolishing or reconstructing some fine medieval bridges, on major routes between towns and cities. Concurrently, in towns and cities across the land, rocketing populations and corresponding increases in urban horse-drawn traffic meant that the barriers to local communication imposed by other old bridges had to be circumvented, and this, along with increased maintenance costs to ensure safety under heavier loads, had spelt the end for some of the finest medieval bridges, some of which are briefly documented in the sets of information sheets here. Thereafter, Victorian attitudes to old bridges tended to replicate their ruthless modifications of churches to contemporary needs and tastes, so there were more casualties.

Fortunately, matters have proceeded differently in the modern era, and preservation of the 'built heritage' has moved up the agenda, not least because of the seminal Parliamentary Act of 1913 which realised earlier pleas for protection of 'ancient monuments', a responsibility taken on by Charles Peers and his successors, the Inspectors of Ancient Monuments. If Jervoise had lived past 1955 and had been able to view the contents of this compendium, I think he would have been pleasantly surprised. Relatively few of the bridges which he listed have collapsed, been demolished or even been greatly altered during the ninety plus years since he identified them. Many have been bypassed, and now carry only pedestrians or light local traffic. Either by design or serendipity, a good proportion of those, which have been modified in a major way, and this applies as much before as after 1930, have been left relatively untouched on one of the upstream or downstream faces, so that the main features of the original bridge can still be viewed. (It is usually easier and cheaper to extend at one face, since only a single new structure is required, either an adjacent parallel bridge, or an extension corbelled out, or supported on cutwaters, though approaches have to be realigned.) There are also cases where a main river bridge has been dismantled or totally rebuilt, but flood arches remain, and they, especially when viewed alongside prints or even old photographs, can allow the original configuration to be divined, though it would be wrong to pretend that such relics usually answer all pertinent questions about the original bridge.

Often, a bridge viewed from the level of the carriageway appears to be a completely modern reconstruction, but descent to the river bank can yield a view of the original arches and soffits, perhaps with ribs and multiple arch rings, but now enclosed and extended by parallel arches or cantilevered beams. Indeed, I would go so far as to suggest that the different methods of modification sometimes furnish an added level of interest, though it is unarguable that there are also too many examples of unsympathetic reconstructions which have removed any real link with times past, and frankly ruined a historic artefact. Unfortunately, this is very often true of the parapets, practically always rebuilt in modern times, sometimes decoratively, but not necessarily in the style of the remainder of the bridge, sometimes functionally under the time pressure imposed by safety considerations, after a heavy vehicle has ploughed into them, and sometimes it seems, according to an architect's whim of little obvious merit. Rightly or wrongly, my response has been to devote little space to this aspect of most of the bridges described, in spite of the temptation to provide a list of the worst examples!

I am not sure if Jervoise would have seen his books as 'popular works', though in my view they have been almost indispensable to the enthusiast who wants to find and view old bridges, and learn a little about their history and most notable characteristics. Quite simply, there has been nothing to approach them as an accessible, nationwide survey, though they do have their limitations such as the uneven quality of the photographs and inconsistencies in the amounts of information supplied about different bridges. They have

been out of print for years, but it is still easy to obtain second-hand copies at reasonable prices. There are a growing number of relatively recent publications which consider bridges from different standpoints; by implication, there has been a growth of interest and especially, a realisation by some, though by no means all, local bodies responsible for tourism that an impressive old bridge can be a draw. Some books deal mainly with the aesthetic pleasures to be gained from viewing bridges in their settings, and depend heavily on the high quality of their photographs, or other depictions like old engravings and paintings. Others focus on the history and anecdotes associated with bridges, with 'the devil' occasionally a prominent actor. Entertaining as the latter may be, they can also frustrate when it transpires that a well-told tale refers to a bridge which was knocked down a few centuries ago.

At the other extreme are civil and mechanical engineering manuals, standards and text-books which deal with bridges as working structures. Some books attempt to bridge the gap in a manner of speaking, by seeking to explain the principles of design in a basic way. It is likely that the masons and other craftsmen who erected ancient bridges were little better equipped with theoretical engineering knowledge than readers who absorb and comprehend the information so presented, though the former were usually blessed with the wisdom of experienced craftsmen; certainly the medieval masons and civil engineers as illustrious as Thomas Telford would be confounded by the structural models and finite element solving techniques, which can underpin the designs of today. Usually, if not always, such analyses guarantee stability and longevity, while at the same time allowing the bridge members to be matched more closely to the duty which will be placed on them, so yielding economic and sometimes aesthetic benefits. For example, many ancient masonry bridges are supported on piers which we would now regard as un-necessarily massive, and apart from extra costs of construction and diminished elegance, (though that is a matter of opinion), the resulting obstruction to river flow made flooding much more likely, and rendered the waterway less navigable. Accounts of Old London Bridge, stress the hazards of passage beneath the carriageway, i.e., shooting the bridge, in the greatly accelerated water flow confined by 18 massive piers resting on protective plinths called starlings, intended to reduce scouring around the foundations.

In the bibliography there are brief comments on many of the publications and web sites I have found helpful, but several in addition to those produced by Jervoise, deserve special mention. First, I will highlight two fairly recent volumes, one authored by Harrison which addresses general questions about medieval bridges, such as those concerning their locations, funding, fabric, and designs, in an illuminating, if sometimes controversial, fashion. He provides an overview absent from the writings of Jervoise who described individual bridges as he found them, rather than devoting much space to wider considerations, such as why they had certain features. I would caution that some of Harrison's theories about bridges built before the Norman Conquest are speculative, as there are no survivals, and that he draws some conclusions about later periods, which have little relevance to some areas of England. The other recent book worthy of special notice is an Encyclopaedia of British Bridges, authored by McFetrich, which contains over 1500 concise descriptive entries and illustrations of bridges of all ages and types. It ranges much wider in that regard than I do, though there is considerable overlap, but my focus on a narrower old population means that my compendium is more exhaustive for its subject matter, and I have the luxury of far more space. Jervoise and Harrison confined their attentions to England and Wales, and there are no comparable volumes for Scotland, but there is an excellent web-site, named appropriately enough 'Scotland's Oldest Bridges' which more than fills the gap. Its developer, David Simpson, lists those Scottish bridges identified in a survey carried out by Roy in the mid-18<sup>th</sup> century, and on older maps produced by Pont and

Blaeu, (the earliest available sources). There are brief descriptions, photographs, and links to other relevant websites; exact locations on a map of Scotland are also given, and provide entry to the other information. Anyone interested in Scottish bridges should also be aware of a series of papers produced by H.R.G Inglis, best known as a map-maker, just over a century ago, because he, even more than Jervoise, should be viewed as the pioneer of modern studies of old bridges. Dealing with a much smaller population of bridges, though he did not confine himself to Scotland but made comparisons with bridges in England and the rest of Western Europe, he set himself to understand the requirements and constraints in the minds of medieval bridge-builders, and the resulting impacts on designs. It can be argued that some of his conclusions go further than his evidence allows, but it is disappointing that his work goes unacknowledged by many of those, who have written on the subject in the last few decades.

For Scotland, and more for England and Wales, there are books which focus on old bridges in different regions and counties; they are of variable quality and I reference only those which enhanced my knowledge or appreciation, but the best are excellent. I include in that category a recent publication describing old bridges in Buckinghamshire, produced by Marshall Hall. Also, there are a few web sites which ambitiously itemise all the bridges, regardless of age, in single counties, (including Cumbria and Somerset) and provide photographs and information culled from many sources, including the Listed Buildings and Heritage Gateway (formerly Pastscape) web sites, also indispensable references. (The problems in using these latter websites arise from the quantity of entries, amongst which those dealing with bridges are a very small proportion, and the sometimes unpredictable even quirkily-chosen bridge names which register with their search engines.) British History online is another valuable source of information and photographs, though again location of relevant items in the vast repository can be difficult. I should also mention Hinchcliffe's excellent compendium of packhorse bridges, though I wish he had been able to make a selection weighted less heavily towards the North of England, where I think he was based. Unfortunately, he ventured, (in print at least), into neither Scotland, nor Wales. I have had to modify plans to extend my survey to Ireland in a seamless fashion, by dropping most site visits, so the data I present comes mainly from the desk based exercise to which I refer above. For it, I depended heavily on Irish equivalents of the Listed Buildings site and the remarkable book on Irish Stone Bridges, produced by O'Keeffe and Simington, though more narrowly focused documents have also been of assistance.

I must now deal with another source of information about old bridges, namely old maps, many of which have been digitised in recent years, and made freely available on line by the Scottish National Library, Welsh National Library, and the British Library (the websites are in the bibliography). It is right to emphasise the service performed by these bodies to all interested in historic artefacts. I was slow to realise fully the value of this resource, but certainly do now. Maps taken on their own, rarely date bridges conclusively, but with other information, they can provide valuable confirmation that a bridge thought to be present at a certain time was indeed there. They also show how many bridges were standing in a river catchment, county, or region at specific dates, so allowing bridge survival rates to be estimated. The maps are remarkable for their time though inevitably there are inaccuracies and omissions with well documented bridges unmarked, especially those on lesser, more remote, streams, but the majority of the expected population are marked, along with many others.

Some bridges are marked on the famous Gough map of England, (highlighted by Harrison) which was produced in the 14<sup>th</sup> century, (though experts think that it was probably a copy of a 13<sup>th</sup> century predecessor) and this is relevant to their dating. However, from my standpoint, which as will be seen was to consider pre-1700 bridges,

the important maps were those of England and Wales, published by Christopher Saxton, around 1578, by John Speed, in 1610, and by John Blaeu, in c1650. John Blaeu also published useful maps of Scotland, based to some degree on surveys made by Timothy Pont in the late 16<sup>th</sup> century, while maps published by John Adair in 1682 were another key resource, though sadly he did not cover much of the country. As regards the evaluation of individual bridges, I am still of the view that the maps are best regarded as providing confirmatory evidence (or not) of build-dates estimated from other documentation and observations on site, but they are indispensable for anyone trying to estimate how many bridges have survived from an early period.

Finally, I must highlight the help I have received from some of the authors of documents mentioned above, of whom I must single out David Simpson, mentioned as the creator of the Scotland's Oldest Bridges website, with whom I have had many valuable discussions. Friends, including of course my brother, Alastair Robertson, have visited bridges and passed on photographs and other information.

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Having discussed the sources from which I was able to compile lists of old bridges that I proposed to consider, I must now deal with the evolution of the criteria which constrained my selection process. I will start by making explicit the fact that I deal mostly though not exclusively with bridges built to allow passage over flowing water, i.e., rivers and streams, even if occasionally changes in the flow path have left a bridge 'high and dry'. Jervoise included some bridges built in the 19<sup>th</sup> century as 'ancient' (hardly a century old at the time), dealt, sometimes at length, with bridges long vanished, and though I have not done a full count, must have mentioned upwards of 2000, and there are at least a couple of hundreds more, in the Devon and Cornwall companion books. Knowing that I was intending to deal with Scottish, and possibly Irish bridges as well, I would have been contemplating a task of visiting over 2500+ bridges if I had decided to follow his example. I began with the idea of dealing only with medieval bridges, which would strictly have meant a cut-off date close to the end of the 15<sup>th</sup> century. I soon realised that this was unhistorical and unworkable, because there was continuity in bridge design into the Tudor age (in England), even if preferred arch shapes changed a bit, and Leland's survey, carried out during the first half of the 16<sup>th</sup> century acknowledged no break-point at 1500, so included some Tudor bridges, and his brief descriptions served as important evidence for the existence of many of the oldest bridges in something like their present forms. Similar, if weaker, considerations led me to vacillate as regards the 17<sup>th</sup> century as well.

However, the clinching arguments for making 1700 my break-point came from the other direction, working back from the Georgian age during which great divergences from the past as regards bridge design and construction methods and materials occurred. It is also true to say that bridges were built in the 18<sup>th</sup> century and later, under the supervision of professionals, be they engineers, or architects, whereas before then with occasional exceptions like a couple linked loosely to Inigo Jones, projects were in the hands of artisans like masons, and amateurs like squires and churchmen, (which of course makes some of them, all the more remarkable). So my selection is probably best described as comprising 'pre-modern' or 'pre-industrial age' masonry bridges, though the composite 'medieval and sub-medieval' would also be appropriate if clumsy, with the latter seen as including the 17<sup>th</sup> century; however, terms like old or oldest remain true enough if more vague, and I have often stuck with them. I have not been absolutely rigid in observing the 1700 cut-off, especially as regards Scottish bridges because as will become clear, developments were later there, and I have shown a small amount of flexibility in other regards as well, which I shall come to next. Nonetheless, my decisions caused me to omit such as the

Turnpike road bridges, Telford's great road-building projects, and the Wade and Caulfield bridges on the Military Roads in the Scottish Highlands, together with all canal and railway bridges. I thought then that I had reduced my programme of visits to easily manageable proportions, with an over-optimistic estimate that there would only be a few hundred qualifying bridges.

However, other decisions had a contrary effect. I had started with the intention of focusing on substantial river bridges, as opposed to smaller packhorse and foot bridges, but this was a stand-point I quickly found to be untenable. Any selection criteria would have been arbitrary, because there is a continuum of key dimensions such as arch-spans, and widths. There would also have been a problem in dealing with substantial bridges which had originated in much smaller guise. So, smaller bridges of all types appear, including clapper bridges, which in modified and strengthened form have also graduated in some cases from footbridges to road bridges. Unfortunately my date-based criterion is far harder to apply for bridges which have remained small, than for larger river bridges, for two reasons at least. One is the scarcity of documentary evidence for such relatively inexpensive bridges, many of which were built on the initiative of a single person, who had no reason to communicate much on the matter. The second is the inherent simplicity of many of them; this means that they often have few if any distinctive attributes, related to their ages, and especially lack decorative features, which can greatly aid dating. A majority of surviving packhorse bridges are thought to have been built between 1650 and 1800, but differences in design and fabric over that period are small and haphazard, rather than following a time-line. My solution to this problem, which was arguably even greater for clapper bridges, is to include those which hint at predating 1700, and to include a category of 17/18<sup>th</sup> century bridges, where there no clear pointers in design or documentary evidence. Nonetheless, I know that in areas like the Lake District (Cumbria) for packhorse bridges, and especially Dartmoor (Devon) for clapper bridges, I missed bridges, which might have been included, though some of these omissions have been rectified.

The project was well advanced before I gave serious thought to another category of old bridge, namely those crossing moats, wet or dry, associated with castles, mansions, farmhouses, religious establishments and other buildings. They are of interest because some at least conform to the structural and stylistic patterns of their times, and provide a few of the finer examples, though others are best described as pierced causeways. However accessibility is more of an issue with them than the other bridges considered here, because a significant proportion are on private property and cannot normally be viewed; they make up a disproportionate share of the bridges I have failed to visit. I have included the letter 'M', in the identifying number for all such moat bridges. I will return to this topic briefly at the end of the introduction. So far, it can be seen that most decisions as to whether or not to include a class of bridges went in the direction of increasing the number of target bridges, but at this point I drew a line by excluding the bridges on medieval town walls where walkways crossed arterial roads at gateways; there are fine examples in towns like Caernarvon, but they are not for this compendium.

Yet another category of old bridge, is associated with watermills of a certain type, and has not been properly considered. Watermills in Scotland and the North of England usually derive their power from fast-flowing streams and most often sit on one bank. A proportion of the water is drawn off through a lade, and brought to a waterwheel. There are few fast flowing streams in the South of England, and many watermills sit across more sluggish streams, utilising the whole water flow which is channelled past waterwheels sitting below the mill. Associated with the mill buildings, a road normally spans the channels downstream of the waterwheels; it is

effectively a bridge. I have investigated watermills of this design in Norfolk, guided by an excellent website, [norfolk Mills.co.uk](http://norfolk Mills.co.uk); it seems that the great majority of these watermills with the associated bridges were built or rebuilt in the 18<sup>th</sup> century, but whether this is the pattern elsewhere, I do not know. I should like to pursue this topic, which might result in some additions to the compendium, but so far I have been unable to do so.

It is unarguable that almost every bridge surviving from before 1700 has been refurbished, or reconstructed to some extent since then, and a few are almost unrecognisable, as what they once were. In this regard, my criterion for inclusion is that any bridge, even if much modified, must survive at least in part as a coherent structure built before 1700, retaining enough as-built features to permit an observer to form a mind picture of its original appearance. When in doubt, I have settled for inclusion, while making reservations clear. So, by searching the sources, and applying the criterion, as described, I built up a list of old bridges. The list has been refined up to the present time, and in that intervening period, bridges have been added, and removed, either on the basis of observations on the ground, or the acquisition of additional documentary information; most often I have concluded that a bridge does in fact date from the 18<sup>th</sup> century or later. As mentioned earlier, uncertainty concerning a considerable number of bridges, which cannot be dated more accurately than '17/18<sup>th</sup> century' by any means, has been addressed by including them. (To avoid their presence skewing distributions by build-date excessively, I have counted them as ½-bridges in some of the quantitative estimates in the overview of results). As of now, the compendium includes 932 British bridges, with 26 added in this review. It is worth noting that 72 bridges identified by the first stage, desk top exercise, were removed following visits. Around 850 (over 90%) of the bridges in the compendium have been visited. As for Irish Bridges, 80 were identified by the desk exercise, but only a few have been visited, so some may yet be discarded.

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With decisions taken on how to select bridges to go on the list, it remained to decide how to organise and order them so as to develop itineraries for visits, and logical presentations. My first idea of grouping the bridges in clusters found its way into earlier versions of the compendium. Each cluster, centred on a town or city, included bridges in fairly close proximity regardless of whether they crossed the same or connected water courses, or were found in the same formal geographical divisions; this was largely a response to my difficulties in using Jervoise's books to develop itineraries. He ordered the bridges he described according to the rivers they crossed, which although logical, means that bridges fifty miles or more apart can be on the same page, while bridges relatively close to each other are to be found chapters or even books apart. For so long as the focus was on visiting bridges and collecting information, thinking of the bridges as grouped in clusters, and using sketch maps to relate their locations, to others nearby, worked well enough, and the same mode of ordering was at first used to present the information. However, I decided some time ago that the clusters had outlived their usefulness, and that I should change to a more conventional ordering. Accordingly, each bridge, is now listed in either its region in Scotland and Wales, or its county in England. The regions or counties are then grouped to provide 29 points of access to nested sets of information sheets; (the set for Devon is divided in two alphabetically, because there are so many bridges in that county). A really important recent change was the inclusion of Alastair Robertson's accurate sketch maps in each nested set of information sheets; they show the location of every bridge in the compendium, The aggregation of these groups of regions and counties into 7 larger regions/countries covering all of Britain provides the framework for tabulations of bridge parameters and characteristics, which also now appear in nested documents. **All are accessible from the home page.** Irish

bridges are treated similarly in an addendum.

Each of the 29 sets of information sheets commences with an alphabetically ordered list of the bridges in its county/region with 'moat bridges' separated out, and each bridge is given a unique identifier. There follow the maps and the OS Grid location of each bridge, and an estimate of its build date. The information sheets for the individual bridges then follow, also in alphabetical order. Photographs play important roles in these sheets; obviously they allow the general form of the bridge to be shown in its setting, but views of the underside or soffits of masonry arch bridges often yield the most important clues to their ages and historical development. I present many more of these than have appeared elsewhere, even although shining sufficient light into these shadowy regions, often compromises the aesthetics of a photograph by saturating other parts of the structure. In those cases, there will usually be another photograph which presents a better picture of the bridge as a whole. Wherever possible the text provides the dimensions, such as spans, and carriageway widths, before and after widening exercises; many of the measurements are my own with tape and range-finder, while many come from the referenced sources, which I feel entitled to trust. It is also possible by various means to derive estimates of spans and widths from satellite views, as on Google Earth; for example, if a car happened to be on a bridge when their images were obtained, its known dimensions can allow quite accurate scaling of width and arch span.

Other issues treated are accessibility and visibility. There have of course been great changes since Jervoise gathered his information 80 odd years ago, as roads have become busier, trees have grown, and buildings have been erected. He may have formally requested and been granted access to private property, as his task was semi-official, whereas I have deliberately stuck to public paths and byways, except on a few occasions when a casual enquiry or invitation has allowed a better view to be obtained; my aim has been to act only as an interested member of the public, who does not hold much with trespass. It has sometimes been very difficult to find somewhere near-at-hand to leave a car, or to access the river bank to view either or both faces, and the underside, of a bridge, or to see through and around bushes and trees. It is perhaps stating the obvious to point out that bridges may be best seen during the winter months when obscuration by foliage is at a minimum, but unfortunately immediate access is likely to be poor then, with flooded paths and slippery river banks. Inclement weather and bad road conditions might be another issue; perhaps the best compromise is to observe bridges in March and April.

The greatest frustration, other than failing to find a bridge altogether, which is a far from unknown experience, has been to be able to walk across a bridge but to be unable to get any sort of view of its structure, other than by looking over the parapets. This occurs sometimes because a river is running in a gorge, but more often because the banks at each face of the bridge are private property. In such cases, I have trawled the internet in the hope of finding a decent representation of the bridge concerned, sometimes successfully thanks to the activities of canoeists, fishermen, and others, or even because an adjacent property is for sale, and a bridge is portrayed in the documentation. In this context, I acknowledge here an omission in that I have not referenced formally all the photographs I have used, though I have usually named the photographer. I derive no pecuniary advantage from the website, nor do I have any intention of doing so in the future, so anyone concerned will hopefully be assured that their efforts have not been exploited unreasonably, but used only to provide an accessible resource. If this acknowledgement is insufficient, I can be contacted through the site and asked to remove an offending item, which I shall reluctantly do.

I mention in the relevant information sheets some specific difficulties I have encountered in gathering information in order to spare others from experiencing my exasperation and wasted time. (In this context, it is unfortunate that responsible bodies, even those acting positively by providing access, direction signs and information boards, rarely seem able to organise the cutting back of scrubby undergrowth which all too often obstructs views of bridges.) I give details of roads carried and streams crossed in individual bridge information sheets, and as already mentioned, I have provided 8-symbol OS Locations for every bridge. Other useful tools are the relevant OS map(s), and car satellite navigation systems, though even with such aids, old bridges can still prove elusive, as evidenced by the fact that I fairly recently failed to find a way of getting anywhere near a bridge, alleged to be on a public right-of-way. Sadly, it is also true that even when a route to a bridge is clear enough on paper or computer screen, failure to maintain a right of way as regards such things as stiles, can prevent access, and I have also had to make more than one attempt to reach a couple of bridges, because rights of way went through fields contained aggressive cows nursing calves.

My criteria for including old bridges seemed unlikely to mitigate against any particular class of bridge when they were chosen, but I have belatedly realised that this is not quite true. What I shall call the great town bridges of the past, some of the most impressive artefacts of their era, were almost all demolished during the decades around 1800. Some like the Old Tyne Bridge, and Shrewsbury Old Welsh Bridge have left some masonry traces, so I have had justification enough for adding them to the compendium, but others were too thoroughly destroyed, to allow me to do that without drastically changing the rules. Since this group includes some of the most impressive old bridges built in Britain, like Old London Bridge and Ouse Bridge in York, I have compromised by including brief accounts, accompanied by prints, in the notes which appear at the beginning of each set of information sheets, though I have done nothing further with any of the information presented.

The information sheets are the essential core of the compendium, but as mentioned I have extracted data from them to create tabulations covering 7 larger regions/countries, in which I have grouped the county/region sub divisions. For each of the 7, I have provided 3 tables, one which locates every bridge, on the OS grid and by river and catchment area, and also itemises key dimensions such as width before any modern extension, and span of the largest arch; a second table lists additional features, like fabric, and where relevant, arch ring number and design. The best estimate of build-date for each bridge is also provided in these tables, and a third table summarises the dating information, and gives the state of play as regards the numbers of bridges visited to-date. To my knowledge, this amount of information has never been made easily accessible before, though I would acknowledge some debt owed for the format to Inglis, mentioned earlier, and to O'Keefe and Simington's book on Irish Stone Bridges. The purpose of making this data, acquired from many of the acknowledged sources, as well as my own observations, more easily accessible, is to allow comparisons to be made, and trends to be identified, both within the 7 geographical divisions and between them. Along with the tables, are given the list of those target bridges visited but excluded afterwards, and some conclusions are presented which are specific to the bridges in each of the 7 regions/countries. The same course has been followed for Irish bridges; information sheets are grouped in the historic Irish provinces, Ulster, Connaught, Munster, and Leinster, and data is tabulated for Ireland as a whole. I should mention the Overview document, which pulls together the information in the tabulations, presenting tables, which allow comparisons between frequencies of occurrence of features like specific arch forms, large arch spans, types of arch rings and many more, in different regions, and to an extent in different periods. The tabulations amount to a very large data base, and I have only exploited it to a limited degree as yet.

### 1.3 General Remarks

#### (i) River Bridges

I begin this discussion with some thoughts on the engineering problems faced by those charged with building masonry bridges carrying roads and tracks over rivers and streams. I start with the obstacles which confronted those charged with building larger bridges, namely the rivers which had to be crossed; the tabulation below lists lengths and discharge rates for many of the rivers mentioned on the information sheets.

**Table 1. River Lengths and Discharge Rates**

River	Comments	Mean Discharge m <sup>3</sup> /s	90% Discharge m <sup>3</sup> /s	Length miles	River	Comments	Mean Discharge m <sup>3</sup> /s	90% Discharge m <sup>3</sup> /s	Length miles
<b>SCOTLAND</b>					<b>ENGLAND</b>				
Almond		6.2	14.2	28	Inney		2.9	6.6	20
Ayr		16	42	40	Lea		5.5	8.5	42
Clyde		48.2	112.3	106	Lugg		10.9	26	45
Dee	Aberdeen	47.2	95.1	87	Lune		36.2	88.5	44
Devon		4.7	9.8	25	Lynher		4.4	10.5	21
Don	Aberdeen	21.2	41	80	Medway		10.8	24.7	70
Doon		7.6	15.7	23	Mersey		37.4	79.9	70
Eden	Fife	4.1	8.2	29	Nidd		8	18.4	59
South Esk	Lothians	4.5	9.4	23	Piddle		2.4	4.8	18
Findhorn		19.7	43.6	65	Ribble		33.4	81.8	75
Forth		47	113.8	29	Rother	Sussex	4.5	10.2	33
Luce		6.2	16.8	17	Soar		11.9	25.5	59
Nairn		5.6	12.3	38	Stour	Dorset	13.7	31.1	61
Nith		27.9	67.9	71	Swale		20.7	48	73
Spey		65.9	124.2	107	Tamar		22.3	55.1	61
Tay	With R. Earn	199.5	401.9	117	Taw		18	47.2	45
Tweed		82.1	179.6	96	Tees		19.6	45.2	85
Tyne	E. Lothian	3	6	30	Teme		17.9	41.4	81
Urr		6	15.1	30	Thames		65.3	161	215
<b>ENGLAND</b>					<b>WALES</b>				
Aire		34.8	78.2	71	Torridge		15.5	39.3	48
Avon	Bristol	21.2	48.5	75	Trent		89.2	179.8	185
Avon	Warwicks	17	40.8	96	Tyne	Newcastle + Ouse	46.2	104.2	73
Avon	Hants	20.1	39	60	Ure		21.5	51.5	129
Bure		2.4	3.7	50	Warlegan		0.83	1.72	8
Calder	Yorks	19.8	40.7	45	Wear		14.7	32.4	67
Camel		6	13.2	30	Welland		3.7	8.7	65
Derwent	Yorks	16.9	34.5	72	Wensum		4.1	7.5	44
Derwent	Derbys	17.4	36.3	66	Wey		7.2	13.7	34
Don	Yorks	16	33	70	Wharfe		17	40.5	61
Dove		14	28	45	Conwy		19	46	34
Eden	Cumbria	53.3	117	90	Dee		33.8	89.4	70
Exe		15.9	38.3	59	Severn		106.5	255.6	220
Fowey		4.8	10.7	31	Teifi		29.2	66.9	75
Frome		6.6	12.5	30	Tywi		39.8	92.5	68
Glen	Lincs	1.2	2.8	18	Usk		27.9	64.4	63
Gt. Ouse		15.7	33.7	143	Wye		73	173	135
Horner W.		0.46	1.05	7					

I went to school at a time when pupils had to learn many facts by rote, and one was the lengths of major British rivers; that parameter was important historically in the context of transportation because it has a large bearing on the extent of the obstruction a river creates. Usually its length bore a direct relation to the distance over which a river constituted a significant barrier to medieval travellers. In the absence of a bridge, and with crossings by small boat often hazardous, a long river could require a substantial detour upstream to find a ford, except when the river was 'running low'. However we heard nothing much at school of discharge rate, which in the context of bridge building and survival is probably at least as important an influence. The figures presented are the largest measured by the Department of the Environment for the river concerned, so are normally those obtained at their

furthest downstream metering station, though that is sometimes a fair way upstream from the mouth. The normally-quoted unit of discharge rate, the 'cumsec' or m<sup>3</sup>/s is very large; 1 m<sup>3</sup>/s is equivalent to 13,245 gallons/minute, or the discharge of the contents of the largest road tanker in just less than three-quarters of a minute. Britain's biggest river, (as opposed to longest), the River Tay, thus discharges, on average, the equivalent of 274 tanker-loads of water each minute; (the Amazon, incredibly, 1000 times more!) Of course, most rivers increase their rates of flow as tributaries join them, (though abstraction is a factor for rivers like the Thames). It is sensible to think of the upper reaches as seeing an increase towards 1/3 of the quoted flow rate, the middle reaches, a further doubling, and the lower reaches, the attainment of the full discharge rate. Of course, the locations of meeting points with large tributaries can skew these rules of thumb. The 90% figure in the table is a flow rate exceeded for 10% of the time only, so is effectively the discharge rate when a river is running high, and invariably represents something like a doubling of the mean flow rate; any bridge would be expected to cope easily with those conditions, either by dint of its height, or because flood arches have been incorporated in the approaches.

However, it was almost impossible for medieval bridge builders to provide adequately for the most extreme flooding events, perhaps one or two a century, during which discharge rates might more than double again. Inglis is maybe pessimistic in suggesting that few medieval masonry bridges could have survived much more than a century without going through a cycle of collapse and at least partial, rebuilding, but the records are peppered with instances of such events, involving the fall of one or more arches. On a number of occasions every bridge along a large rivers was either swept away or severely damaged, as on the River Tyne in Northumberland in 1771, a fact which should give pause for thought to anyone who thinks that extreme weather events are only a present-day phenomenon, even if they seem more frequent now. As is obvious from this document, masonry bridges on large rivers were not flimsy structures, though one response to potential collapse, which was to make arches smaller and piers broader, was likely to be counter-productive because the blockage to flow would be increased as would be the danger that the bridge would be over-topped with fatal consequences.

The impact of the 'normal' discharge rates on bridge design is obvious if it is considered that the quantity is obtained as the product of width, depth and speed of flow. Fast flowing rivers like the Spey and the Lune have carved out well defined deep and relatively narrow rocky channels, so single arches were usually viable in the upper reaches, and their abutments could be fixed securely to rock. However multiple spans were necessary in the lower reaches and the piers were made bulky and robust to withstand the drag forces on them, but as mentioned already, this meant that the obstruction to the flow was significant especially when the river was running high; this scenario dictated high bridges to attempt to avoid over-topping which would impose sideways forces which could not be withstood. Scouring around the piers was an ongoing hazard in fast flowing rivers, and/or, where the river bed did not allow anchorage in rock. Upstream cutwaters were intended to accelerate the flow smoothly into the channel beneath each arch, so reducing general turbulence and disturbance. Sufficient attention was not always paid to the flow downstream of the bridge piers, where recirculation and vortex shedding produces greater disturbance of the river bed; downstream cutwaters would at least have shielded the most vulnerable area, and they were not always provided. Starlings, which were built by sinking piles at a distance around a pier, and then packing the space with rubble, gave added protection, but further narrowed the water channels, with effects already mentioned at Old London Bridge.

Demanding conditions were found in all tidal reaches; sometimes the peak flows there owed much more to the

sea during high tides, than the river discharge rates. Most often the task of bridging estuaries was simply beyond the capabilities and purses of medieval communities, especially where the passage of ships into major ports also had to be accommodated. Recourse was usually made to ferry-boats, but their operation in estuarial waters was hazardous, as famously illustrated by the fate of King John's treasure, and fords subject to tides and the shifting of the river-bed might be equally unsafe. The least risky option was to trek inland, to cross the river at the bridge nearest the sea, even if a day or more was added to the journey time. The relatively short lengths of British rivers, compared with those on the continent, made this a viable if still frustrating course of action. Slow moving lowland rivers like the Great Ouse and the Nene are wider than would be expected given the flows they carry, and often have large flood plains in which pools and marshes are prevalent, so bridges crossing them had to be multi-span, and long causeway approaches were essential if the bridge itself was to remain accessible in anything other than dry, low water conditions; at least the problems arising from obstruction of the water flows and scouring around the piers were normally less. So, the figures in the table, together with information as to whether a bridge is at the upper, middle, or lower part of a fast or slow flowing river, give some idea of the range of problems the bridge builder was likely to have encountered, and should go some way to explaining the bridge configuration, that the visitor sees.

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Whether there is an old bridge at a likely place, say crossing a river separating two ancient centres of population is to some extent a matter of chance. Harrison addresses fundamental questions concerning where, why and how bridges might have been built in medieval times, explaining that need was an obvious determinant, so bridges carried important routes over large or treacherous rivers, but that they might appear only if money enough could be raised, and organising capacity found, often in a nearby town or abbey. In circumstances of lesser need or absent resources, the construction of a bridge was sometimes delayed until relatively modern times, while small boats or fords filled the gap. In addition, it is only comparatively recently that it has become less than prohibitively expensive and time-consuming to transport heavy building materials long distances, so if suitable stone could not be quarried near to a proposed bridge site, the masonry option was usually ruled out. Although wood was often a serviceable and economical alternative, such bridges were less robust, and their lives could normally be measured in decades rather than centuries, so frequent rebuilding was inevitable; eventually if the need remained, a stone bridge was built, but sometimes this did not happen until the 18<sup>th</sup> or 19<sup>th</sup> century, by which time transportation of quarried stone was easier. It has been suggested that this scenario applied especially to South-East England, where local rocks were more likely to be soft and crumbly, but although it may be true for rivers like the Thames in its lower reaches, excluding Old London Bridge of course, many stone bridges were actually built in the region through the medieval period. Brick was another alternative much used in the South-East England, and though more costly than a wooden option, such bridges were comparable in durability to oolites and newer sandstone, if not to granite, basalt and old sandstone. Given that an old bridge was built, the major influence on whether it will have survived, apart from natural events like floods and crises like wars, is the pressure placed on it by demand, undoubtedly greater in the South of England round London for at least a couple of centuries.

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Just as modern roads and bridges are built to accommodate a minimum of two lanes of traffic, made up of cars, lorries and buses, with usually some provision for cyclists and pedestrians, so the pre-modern bridge-builder

was most often designing for carts, whether pulled by one or more horses or pushed by men. The idea that there was near-uniformity in the wheelbase of carts from an early date is surely fanciful, just as is the attempt to trace the standard rail gauge of 4 feet 8½ inches back many centuries before George Stephenson lived, but the span of human arms, and the beam width of a draft horse, suggest that a dimension around 1.5m (5 feet) may have become normal. It follows that a bridge width of approximately 2.5m would be a minimum, if a cart was to be able to cross a bridge without continually bashing the parapets as it moved over a rough track-way. Narrower bridges were built and it can be assumed that they were for pedestrians and packhorses only, with low parapets a sign of consideration for the latter. The narrowest bridges mainly spanned small streams in rural locations, often alongside fords which would have been used by carts and farm animals. Even those wide enough just to accommodate a cart were most often found in such situations, because one-way traffic generated too many delays even for pre-modern times, if a bridge was long, or a main artery in a large town. So the greater river bridges were rarely less than 4m wide, which just about allowed carts to pass, and they usually had refuges above the cutwaters to allow pedestrians to avoid wheeled vehicles.

Nowadays, we expect to move onto bridges which more or less match the connecting roads in width, but before 1700, what passed for important roads, were often far wider than now, except in towns where the exact opposite was true. Typically, in rural areas, routes were 60m wide and had been kept relatively clear of trees and other obstructions, to allow travellers to pick their way around ruts, pools and rocks on totally unprepared surfaces. As in many other spheres, improvements were made before 1700, but gathered pace thereafter. Enclosure of land had incentivised the narrowing of roadways to release land for cultivation, at least where the soil was fertile, and the development of long-lasting smoother road surfaces using the methods of Macadam and Telford facilitated the process, but also gave another incentive to keep widths to a minimum to reduce costs of road-building material and labour. Nonetheless, Telford still allowed more than 8.5m of width on his London to Holyhead route to enable fast moving stagecoaches, with wheelbases of around 1.5m, to pass each other. In the same period, bridge-widening became common on important routes, especially those 'Turnpiked', though many of them were surprisingly narrow, certainly much less than 5.5m which was probably a minimum to allow stagecoaches to pass, even at slow speed, on a smooth surface, if also constrained by parapets. Many other bridges in towns and elsewhere were widened at this time, obviously to ease traffic flow, but perhaps also because methodologies had been developed and such public works had acquired prestige. Unfortunately, adaptation was not always seen as the answer and a number of historic bridges were pulled down and replaced, culminating in the demise of Old London Bridge in 1831.

In the years since then, the number of vehicles using the roads has increased massively, but the majority are not very much wider than the carts and stagecoaches of earlier times; for example, my previous car was 1.82m wide, and the present one is 0.2m narrower. However, buses and trucks are markedly wider (and longer and heavier) with legal width limits set between 2.55m and 2.75m, dependent on type. To allow a smooth flow of such vehicles, carriageways on modern roads are normally at least 7m wide (for 2-way, single-lane traffic), and to avoid the creation of bottlenecks, some old bridges have been altered accordingly in recent years, while many more have been bypassed. For those still in use, changes in width, made in two, three, or even more stages over a period of centuries, can frequently be confirmed by looking at the variations in the textures and colours of the soffits (the stonework beneath arches); the ingenuity of the engineers is often displayed in such modifications, though sadly heritage and aesthetic considerations are sometimes less in evidence. Not all old bridges have survived in the modern era of course, and not only because they have been unable to cope with

the size of lorries or the volume of traffic; sometimes entirely contrary factors have come into play as patterns of movement have changed and routes have fallen into disuse. In such cases, there are usually two issues which determine whether an old bridge will survive, even in our more enlightened times. Firstly, the money has to be found to keep the bridge in a safe enough condition, for light traffic or pedestrian use. Secondly, all but single-arch bridges have piers which obstruct the water flow, and old bridges often have more, wider, piers than would be found in modern designs; in flood conditions the blockage is often increased by trees and other debris washed downstream and if there is any tendency to flood it is increased by the presence of the bridge. In such situations, bridges no longer performing an essential function are indeed vulnerable. This very brief account of some of the issues which have affected river bridges over the years can be amplified by referring to the book already highlighted, written by Harrison, and another on roads written by Davies.

## **(ii) Moat Bridges**

In a learned paper published in the 1970s, it was estimated that there were more than 5000 sites in England and Wales which had at some time been moated, and that number was raised to over 8000 in a researcher's recent PhD thesis. The great majority were constructed in the later medieval period (between 1200 and 1500), and comprised a platform of no set shape or dimensions, but normally of area greater than 1000 m<sup>2</sup>, wholly surrounded by ditches, which were most often water-filled. Usually, the platform accommodated a dwelling together with the ancillary buildings deemed necessary by the well-to-do of the time, (only those with substantial wealth, most often derived from land-holdings, could afford to construct these sites) and was accessed by one or more bridges. Though there is often no consensus as to why any individual site incorporated a moat, it is I think accepted that security was the usual motivation. Of course, the threats being addressed were of different orders; the moated castles in borderlands and those acting as the regional power-centres of great nobles were built to withstand sustained assault by armies, whereas the defences of moated houses owned by manorial lords could have been expected to do no more than thwart opportunistic attacks by small bands of thieves and outlaws. The same was true for a few abbeys and other secular public buildings which were also provided with moats.

One thing was true for all, namely that the weak-point would have been the entrance, including the access bridge, unless counter-measures had been put in place. The latter ranged from castle defences like gatehouses with portcullises, outlying barbicans, and elaborate drawbridges which could be raised at need, to the simpler expedient of incorporating within the access bridge, a section which could be lifted away by hand. The great majority of the bridges were of wood, whether complex drawbridges or simpler structures. However, at a few sites the moats to be spanned were so wide and deep that hybrids comprising stone arches, together with one or more movable wooden sections were put in place; a few fine examples of such medieval stonework survive.

The years around 1500 were a period of transition in England and Wales, with war and general lawlessness becoming less of a factor thanks to the ruthlessness and efficiency of the Tudor state. The owners of great castles when faced with a decision between maintaining defensive strength, and enhancing comfort or incorporating decorative features, had begun to favour the latter, where they did not just desert the castles and build new mansions. They were perhaps over-optimistic since a number of rebellions were to come in the 16<sup>th</sup> century, followed by Civil War in the 17<sup>th</sup> century, when ironically some castles saw their only action in five centuries; even a hundred years later, Carlisle, Stirling, and Blair Castles were all besieged by the Jacobite army. Nonetheless, the die had been cast, and the changes put in train affected moated manor houses to an

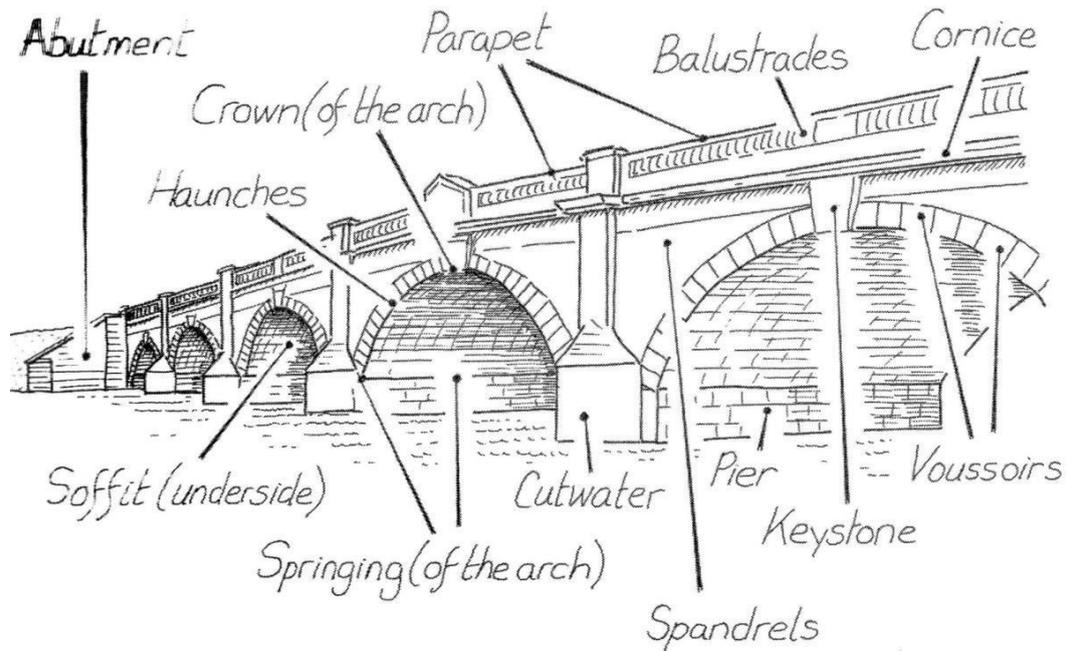
even greater extent. In particular, if a moat was no longer needed as a defence, the question of whether it had any other value or should simply be filled in, needed an answer. Although fish in a moat were still an important winter food source, like pigeons in the dovecots, which were also usually maintained through the period, I think the preservation of all or part of a water-filled moat, as often depended on its decorative qualities, and on the perception that it was, as now, a status symbol.

If a moat was to be kept, then the access question came next, remembering that convenience and the ornamental contribution rather than security were by then, priorities. The easiest and cheapest option was one or more causeways, the most expensive but visually most satisfying and status-enhancing option was a decorative stone bridge, as part of a ceremonial entrance. The compromise seems to have been a causeway pierced by one or more plain small arches or culverts allowing flow between the arms of the moat, which was certainly desirable if it was spring-fed, and to make it less prone to clogging with plants and algae. So, by 1700, my cut-off point for this project, the great majority of moats had been filled in; over those which remained, access was usually by causeway, but for a minority there were bridges, some decorative, some functional. Since then they have had a good chance of surviving, and for the sake of appearances maintenance has usually been a priority, at least until recent years, when money has sometimes run short. Over the period, the main danger to them has probably been the whims of owners, and their architects and landscape designers; I believe that Lancelot 'Capability' Brown demolished more than one bridge, that would otherwise have featured here.

The definition of a moat is drawn quite wide, in that it can include natural deep dry gullies which have been bridged to give access to castles built on crags, as well as the artificial trenches, dry or water-filled which may surround or part-surround a manor house. I have so far identified c70 pre-1700 moat bridges, but many are more or less inaccessible on private land, and not visible from boundaries or rights of way. Some can be viewed on occasional open days, but I have not been in the right place at the right time very often, and others are at private wedding and conference venues. As a result, they form a disproportionately large cohort amongst the bridges which have not been visited, and those for which information is hardly adequate.

## 2. Glossary of some frequently used terms

The useful diagram below is taken from Yorke's book, though it portrays a modern masonry bridge, the terminology applies generally to stone bridges. I strongly recommend the Penguin Dictionary of Architecture, as a more comprehensive source of information about relevant terms than I can provide.



Some other relevant descriptors are not in the diagram.

Arch, 3-centred (Tudor) and 4-centred	An arch shape made up of intersecting arcs of different radius, usually dated to the late-15 <sup>th</sup> century or after
Arch, Gothic	Pointed arch shape, most often made up of two intersecting arcs of a circle, rather than triangular
Arch, Segmental	An arch shape which is a simple arc of a circle, not extending to a full semi-circle,
Arch, Semi-circular	Self-explanatory, can be a sign of great antiquity 'Norman Arch'
Arch Rings	Comprise the voussoirs, but can be doubled or tripled in layers for decorative purposes, and the lower ones can be recessed, or mounted 'in two or three orders'
Ashlar	Masonry-type, stone blocks cut to uniform size, dressed and laid in regular courses
Chamfering	Applied most often to ribs and arch rings, the removal of corners for decorative purposes, often a marker for a medieval bridge
Clapper Bridge	A bridge comprising one or more flat slabs laid across the tops of abutments and often one or more piers forming rectangular water channel(s) (The term clam bridge is used in some areas where there is a single slab)
Flood Arch	An arch designed to accommodate flood water only, often in an approach causeway

Hood Mould	A protruding band of thin stones on the bridge face immediately above, and following the shape of an arch ring
Impost	Ledge on a pillar or abutment from which an arch springs
Intrados	Also soffits, and vault, the under-surface of an arch
Jambs	Vertical walls in the lower part of an arch
Packhorse Bridge	A bridge which is on a pre-19 <sup>th</sup> century route, and is often too narrow for carts to cross (< 1.5m)
Pilasters	Shown in the diagram, but not labelled, they are mini-columns often rising above the cutwaters, usually found in post-1700 bridges
Refuges	Outward protrusions in the parapets, enclosing side extensions of the carriageway, usually triangular or rectangular, and most often upward extensions of the cutwaters
Ribs	Common in the soffits of larger medieval bridges they protrude downwards, but follow the arch shape, and can be the main support members
Rise	Can refer to the height of a single arch above the impost, or the difference in level between the ends and centre of a bridge carriageway; where the latter is significant, the bridge is termed 'crowned', 'humped', or peaked
River Arch	An arch spanning a water course
Rubble	Masonry type made up of individual stones or blocks which are non-uniform, but can range from regular layers of roughly squared blocks to completely random arrangements of stones varying in size and shape
Stilted	Refers to a bridge in which arches spring from high above the water level, supported on long jambs
String Course	A horizontal row of protruding tiles or thin stones, found above an arch, for purely decorative purposes

### 3. Bibliography

Such is the importance to any investigator of English and Welsh old bridges of the five books produced by Jervoise, one, utilising information collected by Henderson, and a sixth on Cornish Bridges written by the latter, that I begin my listing with them, and then revert to the normal alphabetical ordering by author's name. There is an eclectic mix of books and published papers dealing generally with the subject; some consider bridges in a county or along a river, and some describe single bridges. I have referenced only documents, which I have found worthwhile, or specifically useful, so there are omissions which might surprise. Many books follow the course of a river, and mention or picture old bridges crossing it, but they rarely contribute much detail, so I have omitted them. There is an excellent series of regional books on the Civil Engineering Heritage which have useful entries on bridges amongst much else, but I do not make specific references to them as they mainly carry information obtainable elsewhere. I include a number of web sites which I have found useful, and would highlight especially those for Listed Buildings, Heritage Gateway and the Scottish and Welsh equivalents of the latter.

BOOK/ PAPER TITLE	AUTHOR(S)	DATE	PUBLISHER	COMMENTS
The Ancient Bridges of Mid and Eastern England	Jervoise E.	1932	The Architectural Press	Everything published since on the topic owes a large debt to the 'Jervoise books', though the absence of maps, the poor quality of the photographs and the quirky nature of the information presented, mean that they do not represent a last word. Also, they date back c90 years.
The Ancient Bridges of Wales & Western England	Jervoise E.	1976 reprint	EP Publishing Ltd	
The Ancient Bridges of the North of England	Jervoise E.	1973 reprint	EP Publishing Ltd	
The Ancient Bridges of the South of England	Jervoise E.	1930	The Architectural Press	
Old Devon Bridges	Henderson C, & Jervoise E.	1938	A. Wheaton & Co.	
Old Cornish Bridges & Streams	Henderson C. & Coates H.	1972 reprint	D. Bradford Barton	
Bridgend Bridge, Dundrennan – A Monastic Structure	Anderson A. & Williams J.	2007	Learned Paper, Dumfries and Galloway Natural History and Antiquarian Society	
Historic Bridges of Shropshire	Blackwall A.	1985	Shropshire Libraries	The first chapter is relevant
Spanning the Centuries – The Historic Bridges of Northamptonshire	Bowsher J.	2017	Northamptonshire County Council	
The Bridges of Wales	Breese G.	2001	Gwasg Carreg Gwalch	The book reads like a critique of Jervoise, but there is useful information, even if it is hard to access
Walking on Bridges	Bray R.	2009	Hayloft Publishing Ltd.	Locates Lake District Bridges
The Medieval Bridge & St. Gabriel's Chapel, Bishop's Clyst	Brown S. W.	1982	Devon Arch. Soc: Proc. No. 40	Good description of important old bridge
The Exe Bridge, Exeter	Brown S. W.	2010	Exeter City Council	Informative, good photographs
The Medieval Larkbeare Bridge, Exeter	Brown S. W.	1981	Devon Arch. Soc: Proc. No. 39	Excellent account of a remarkable survival
Bridges of the River Wear	Cockerill K.	2005	The People's History, Ltd.	Describes all river bridges, including the medieval ones.
Medieval Bridges	Cook M.	1998	Shire	Excellent summary
Bridges on the River Wye	Crow A.	1995	Lapridge Publications	Descriptions and photographs of over 70 bridges, workmanlike
Bridges of Breconshire	Davies D.	1992	Cambrian Printers	Interesting details

<b>BOOK/ PAPER TITLE</b>	<b>AUTHOR(S)</b>	<b>DATE</b>	<b>PUBLISHER</b>	<b>COMMENTS</b>
From Trackways to Motorways	Davies H	2006	Tempus	Sets bridges in context
The River Bridges of Northumberland, 3 booklets	Dickens T	1975 - 1981	Various	Describes the few medieval bridges on the Rivers Coquet, Aln and Till
Medieval Bridges in Northamptonshire	Goodfellow P.	1985/86	Journal of the Northants. Record Society	Comprehensive Gazetteer
Bridges in Hampshire of Historic Interest	Grayling B.	2000	Hampshire County Council	Shows the few pre-1700 bridges in Hampshire and many others
Historic Bridges of Buckinghamshire	Hall M. G.	2021	Windgather Press	Beautifully presented descriptions
The Bridges of Medieval England	Harrison D.	2004	Oxford University Press	Scholarly, very informative, not afraid to theorise
An illustrated Guide to the Packhorse Bridges of the Lake District	Hartwell M.	1994	Ernest Press	Good sketches of 21 bridges, and access information, little detail about the bridges
Swarkeston Bridge and the Stanton Causeway	Heath G.R.	1994	Footprint Press Ltd.	Clear history
A Guide to the Packhorse Bridges of England	Hinchcliffe E.	1994	Cicerone Press	Excellent. Describes and locates 190 bridges, most complete for the north.
The Historic Crossings of the River Eden at Stanwix .....	Hogg R.	1952	Trans. Cumb'land & West'land Antiquarian & Archaeological Soc. V52	
Excavation of a Medieval Bridge at Waltham Abbey, Essex in 1968	Huggins P.J.		Learned Paper, Medieval Archaeol 14, 1970 (1971) 126-47	
The Ancient Bridges of Scotland and Their Relation to the Roman and Medieval Bridges of Europe.	Inglis H.R.G.	1912	Society of Antiquaries of Scotland, Learned Paper	Interesting general survey in introduction.
The Roads and Bridges in the Early History of Scotland	Inglis H.R.G.	1913	Society of Antiquaries of Scotland, Learned Paper	Pioneering collection of information and analysis
The Most Ancient Bridges in Britain	Inglis H.R.G.	1915	Society of Antiquaries of Scotland, Learned Paper	Extends analysis from Scotland to Northern England
Cornwall's Bridges & Viaducts Heritage	Kentley E.		Twelveheads Press	Adds little to Henderson save some better photographs but nicely produced
The Bridges of Britain	Maré E. de	1954	Batsford	The best 'popular' account I have read, though the author is unashamedly more interested in bridges post-1700
Old Bridges of Snowdonia	Marshall D.	2021	Gwasg Carreg Gwalch	Good collection of bridges
Jaggermen's Bridges on Packhorse Trails	McEwen C.	2008	Sledgehammer Engineering Press	Describes over 70 Packhorse Bridges in the North of England. Good B/W photographs, chatty accounts, some measurements. A really nice book
An Encyclopaedia of British Bridges	McFetrich D.	2010	Priory Ash Publishing	Unique source, though smaller old bridges, mainly absent; accounts of 1650 bridges and much else
Discover Dorset - Bridges	McFetrich D. & Parsons J.	1998	The Dovecot Press	Good descriptions and photographs of medieval bridges in Dorset
Ditchford Bridge, Irchester, Northamptonshire	McKeague P.	1988/1989	Northamptonshire Archaeology 22	Good account
Discovering Bridges	Metcalfe L.	1970	Shire	Much information in a small space
The Brig of Ayr and Something of Its Story	Morris J. A.	1912	Stephen & Pollock	Focus on 18 <sup>th</sup> and 19 <sup>th</sup> century history of a famous bridge
Irish Stone Bridges – History and Heritage	O'Keeffe P. & Simington T.	1991	Irish Academic	A wonderful book, comprehensive and inspirational.
Some Yorkshire Bridges of Beauty and Romance	Patchett A.N.	1992	The Pentland Press	Idiosyncratic, but informative, describes a good proportion of Yorkshire medieval bridges

A Heritage of Bridges between Edinburgh, Kelso & Berwick	Paxton R. & Ruddock T.		The Institution of Civil Engineers	Informative, but mainly chooses better known bridges
Cam Bridges	Pierpoint R.J.	1976	The Oleander Press of Cambridge	Interesting, but bridges are mainly post-1700
Fords, Ferries, Floats and Bridges near Lanark	Reid T.	1913	Learned Paper obtained from Internet	Eccentric, but informative
The River Wey Bridges between Farnham and Guildford	Renn D.F.		Learned Paper reprinted from Research Volume of the Surrey Archaeological Society	Good detailed engineering account of unique set of medieval bridges
Clopton Bridge	Ribbans M.	2005	RFP	Comprehensive account of famous Stratford-upon-Avon bridge.
Medieval Bridges	Salter M.	2015	Folly Publications	Very brief accounts of c500 bridges in the UK with some small photographs & a good introduction
Bridges of Bedfordshire	Simco A. & McKeague P.	1997	Bedfordshire County Council	Excellent county survey of historic bridges, no other comparable
Monnow Bridge and Gate	Rowlands M. L. J.	1994		
The Bridges of Lancashire and Yorkshire	Slack M.	1986	Derek Doyle & Associates	Informative, if by no means comprehensive, a good snapshot
The Clapper Bridges of Dartmoor and Some Myths and Tall Tales of the Moor	Stuart J.		Orchard Publications	Excellent pictures, not over-informative
Bridges on the Teign Rivers	Thomas D.L.B.	1997	Trans. Devon Ass. 129 ps. 145-183	Comprehensive data on bridges of R. Teign & its tributaries. Excellent
Dorset Bridges - A History and Guide	Wallis A.J.	1974	The Abbey Press, Sherborne	Written by bridge maintenance engineer, good descriptions
Moulton Packhorse Bridge	Watkins A.A.	1932	Learned Paper, PDF Suffolk Institute	Some useful general and local information
The Long Bridge of Bideford through the Centuries	Whiting F. E. & Christie P.	2006	Lazarus Press	
The Town Gates and Bridges of Medieval Leicester	Wilshere J.	1982	Chamberlain Music & Books	Unfortunately none of those dealt with have survived
'The Fairest Arch in England' Old Ouse Bridge, York and its Buildings	Wilson B. & Mee F.	2002	York Archaeological Trust	Another lost bridge
A Century of Bridges - An Illustrated Guide to all the Bridges that Cross the Severn	Witts C.	1998	River Severn Publications	Sketches and brief notes on all, though only one, at Bridgnorth falls tenuously into my domain
Crossing Places of the Upper Thames - A History and Guide	Woolacott A.	2008	Tempus	Idiosyncratic, but informative, some important bridges not photographed
Bridges of Britain, A Pictorial Survey	Wright G.N.	1973	D. Bradford Barton Ltd.	Excellent photographs
The Bridges of Wiveton	Wright J.	2001	Learned Paper, PDF from The Glaven Historian	Much about an important Norfolk bridge
Bridges Explained	Yorke T.	2008	Countryside Books	Principles underlying the construction of masonry bridges simply explained

**Amongst relevant web sites are;**

<a href="http://www.britishlistedbuildings.co.uk">www.britishlistedbuildings.co.uk</a>	Indispensable but not infallible, and the names by which bridges are known are sometimes a puzzle
<a href="http://www.heritagegateway.org.uk/gateway/">www.heritagegateway.org.uk/gateway/</a>	English Heritage site, successor to Pastscape
<a href="http://www.transportheritage.com">www.transportheritage.com</a>	Brief accounts of many old bridges
<a href="http://www.engineering-timelines.com">www.engineering-timelines.com</a>	Similar entries to above
<a href="http://www.scotlandsoldestbridges.co.uk">www.scotlandsoldestbridges.co.uk</a>	Information on old bridges in Scotland
<a href="http://www.rcahms.gov.uk/">http://www.rcahms.gov.uk/</a>	Official Scottish buildings site
<a href="http://www.oldroadsofscotland.com/index.html">http://www.oldroadsofscotland.com/index.html</a>	Places some old Scottish bridges in context
<a href="http://www.british-history.ac.uk">www.british-history.ac.uk</a>	Variable, with not all areas covered, and some county authors seeming less interested in bridges, but some excellent accounts and pictures
<a href="http://www.somersetivers.org">www.somersetivers.org</a>	Every bridge in county
<a href="http://www.bridgesonthetyne.co.uk">www.bridgesonthetyne.co.uk</a>	Most on main rivers in England north of Tees
<a href="http://www.ceh.ac.uk/index.html">www.ceh.ac.uk/index.html</a>	Centre for Ecology and Hydrology, gives river discharge rates
<a href="http://www.geog.port.ac.uk/webmap/thelakes/html/topics/bridgef.htm">www.geog.port.ac.uk/webmap/thelakes/html/topics/bridgef.htm</a>	Bridges in Cumbria, locations, dates and relevant Listed Building entries.
<a href="http://www.coflein.gov.uk/">http://www.coflein.gov.uk/</a>	Official Welsh buildings site
<a href="http://www.riverchew.co.uk/index.htm">http://www.riverchew.co.uk/index.htm</a>	About a river near Bath with old bridges
<a href="http://wantage-museum.com/wp-content/uploads/2013/04/Medieval-Bridges-in-Oxfordshire.pdf">http://wantage-museum.com/wp-content/uploads/2013/04/Medieval-Bridges-in-Oxfordshire.pdf</a>	Useful listing of Medieval bridges in Oxfordshire
<a href="http://www.glen-johnson.co.uk/cardigan-bridge/">http://www.glen-johnson.co.uk/cardigan-bridge/</a>	Informative History of Cardigan Bridge
<a href="https://maps.nls.uk/">https://maps.nls.uk/</a>	Access to old Scottish and other UK maps held by the National Library of Scotland
<a href="https://www.old-maps.co.uk/">https://www.old-maps.co.uk/</a>	Access to old maps held by the British Library
<a href="https://www.library.wales/discover/digital-gallery/maps">https://www.library.wales/discover/digital-gallery/maps</a>	Access to old maps held by the National Library of Wales
<a href="https://happypontist.blogspot.com/">https://happypontist.blogspot.com/</a>	Some interesting descriptions of bridges