Estimations of the Survival Rates of Historic Bridges

In the course of 2021, the methodologies for estimating the survival rates of historic bridges, and interpreting the results have been fully developed. Documents in the 2021 version of the website, and the pamphlet, ISBN 978-1-7399648-0, otherwise, https://drtomsbooks.files.wordpress.com/2021/11/some-recent-investigations-of-the-historic-bridges-of-the-british-isles-final-draft.pdf, were interim progress reports, and this is the finalised version.

Studies of old maps have suggested a way of estimating the likely survival rates of bridges standing at certain times in the past. The British Library, and the National Library of Scotland have digitised these maps, and placed them on free to access web sites, thereby rendering a massive service to all antiquarians, other interested parties, and in my case making possible the analysis which follows. Large numbers of bridges are marked on some of these maps, and a methodology has been developed to decide which of them are represented by coherent remains today. In the case of England and Wales, the starting point was the compendium, from which individual bridges dating from the 16th century or before, and still standing in coherent form in each county, were identified, and listed. Then, reference was made to the maps of those counties produced by Christopher Saxton, in c1583, or occasionally, where Saxton dropped below his normal level of detail, recourse was made to the equivalent maps produced by John Speed in c1610, and the bridges marked in each county were identified, and listed. Comparison of the two lists, identified the bridges standing in the late 16th century, which stand in some coherent form, now, enabling the %age survival rates to be calculated. The process sounds simple but was complicated by understandable inaccuracies in the early maps, by changes in place names, and such things as inconveniently placed folds and blots on the early maps, so errors will certainly have been made, but hopefully not too many of them. Nothing could be said in this context, about bridges missed by the early map-makers, though I will return to them, but the survival rates were for a sample of bridges, i.e., those not missed, and as shall be seen it was a large sample.

As I proceeded, county by county, it became clear that at that scale, there are wide variations in survival rates, which is no surprise given the elapsed time of over 400 years, and the many factors which could lead to the disappearance of a bridge, collapse, and replacement, amongst them. However when the results were agglomerated into the 6 regions/country used for the data sets, patterns emerged, which can be seen in Table 1. For Scotland, there were no comprehensive 16th century maps, though Timothy Pont provided some coverage. However, there are useful digitised maps of 17th century Scotland, produced by Jean Blaeu in c1650, and John Adair in the 1680s, though with variable coverage of the whole country. David Simpson, creator of the website https://scotlandsoldestbridges.co.uk/one.html, has skilfully pulled together that information, and I include a row for Scotland, in Table 1, which follows. I also present, with minor alterations, the analysis of the results given in the aforementioned pamphlet, issued in September 2021, which I qualify with a few comments, made in December 2021.

Table 1. Survivors of Bridges identified on early Maps

Region/Country	No. of Bridges standing in 16th C	No. of Survivals	Survival Rate %age	Variation in County %ages	Survivals of 'non-Saxton' Bridges
Northern England	245†	55	22%	11% - 52%	35
Eastern England	244†	44	17%	0% - 50%	40
West Midlands & Marches	135†	21	16%	4% - 34%	16
South & South-East England	254†	39	15%	0% - 36%	35
South-West England	194†	35	18%	12% - 37%	70
England, Total	**1072†**	**194**	**18%**		**196**
Wales	**107†**	**11**	**10%**		**13**
Scotland	**285 ‡**	**48**	**17%**	**11% - 27%**	**44**

† These numbers are of bridges shown on maps due to Christopher Saxton dated within the 1580s, save in a few counties round London, where maps due to John Speed, and dated to 1610 had to be used to provide additional information; with a certain amount of fuzziness, I call them late 16th century bridges.

‡ These numbers are of bridges shown on maps due to Timothy Pont, Joan Blaeu, and John Adair produced between 1583 and 1682, so with similar fuzziness, I refer to them as 17th century.

Notes:

1. I am well aware of the uncertainties and inadequacies associated with these numbers, but taken together, they enable estimates to be made. Rather that survivability being purely a matter of speculation, it is now possible to say, based on a sample size of 1179 bridges standing in the late 16th century in England and Wales, that c17% of them have left coherent remains which can be observed today. The figures for Scotland appear the same, c17%, though it should be remembered that they apply to bridges standing in the 17th century, so have survived for nearly a century less. In case clarification is needed, we are not considering bridges built in the late 16th or 17th centuries, but those standing then, whenever built.
2. The variations in survival rates between regions/countries are substantial, but perhaps not so great as to cast doubt on the methodology. It might be surmised that lower survival rates in South East England result from the need to knock down bridges causing obstruction, to flow of water or traffic, in a densely populated region, while the higher survival rates in Northern England, might be in part attributable to the greater durability of bridges made from granite, millstone grit, or old sandstone, but these are speculations. I have already stated that viewed county by county the variations are so great as to render the numbers unusable. (One contributary factor might be sensitivity to decisions on allocation of bridges on the border between two counties; Buckinghamshire has a survival rate of zero, but if I had allocated to it 2 bridges on the county border, the number would have been close to 10%). Column 5 presents the range of variation by county or county grouping, in the region/country indicated.

3. Column 6 shows the number of bridges in each region, identified as standing pre-1600, and included as such in the compendium, but **not** marked by Saxton or Speed. Their failures to mark them could have many explanations, e.g., sites on smaller streams, distance from important routes, or indeed because they did not actually exist, when surveys took place, albeit that they might have done before and after; it is also possible that my date estimates are wrong for some of them. This is very speculative, but if survival rates were similar for bridges missed, and those marked by the mapmakers, there might have been over 2000 pre-1600 bridges in England, and 400 in Wales. Of course many were no doubt of wood rather than of stone, and so almost guaranteed not to survive to the present day. In Scotland, the numbers might imply on the basis of similar assumptions, that more than 500 stood in the 17th century. There is another puzzling fact to be taken into account in Scotland; the compendium contains few pre-1700 bridges, north and west of the 'Highland Line' (roughly linking Glasgow, Stirling, Perth, and the Moray coast). Given that the population in that sector of Scotland was relatively far larger than now, it is speculation but perhaps likely that there were a significant number of bridges there, which have not survived conditions, harsher than elsewhere in Britain.
4. I hope to be able to present comments regarding the survival rates of Irish bridges on the web site, at a later date.

Qualifying Comments for the 2022 Review

I think the above comments are correct, but some further consideration is appropriate.

1. Relatively few medieval bridges still stand, but conclusions are drawn about the whole built population, as regards features thought to characterise bridges in this group. Considering any one of the features found on surviving medieval bridges, say the Gothic (pointed) arch shape. The justification for believing on the basis of small sample sizes, that the building of Gothic arches peaked in the 14th and 15th centuries and declined thereafter, comes from the divergence of this pattern from that of sample size, which increases for less-old bridges. Otherwise, the proportion of Gothic arch bridges in the surviving sample, decreases after the 15th century, and this can be regarded as a real effect, reflecting the change in the proportion of Gothic arch bridges being built.
2. There is a problem if an attempt is made to change the direction of the argument. Hood moulds, (semi-circular projections above the arch ring), are relatively common on pre-modern bridges in the outer parts of Great Britain, (South-West England, Wales, North-West England, Scotland) and absent elsewhere. They do not seem to be found on medieval bridges in those regions or elsewhere, but it would be dangerous to draw conclusions, which are too firm, because the sample sizes are small. It remains more likely that the null result is correct, but with very small samples, the chance of one or more bridges with hood moulds being amongst the large population of bridges, which have not survived cannot be discounted.
3. There is insufficient information to plot the relationship between the %age of bridge survivors at any date, against those dates, but it is possible to perceive the form such a graph must take. No bridges in England and Wales survive that stood before the 12th century, but 17% survive which stood in the late-16th century, and we know that most bridges, standing in the past century survive. This just about defines an S-shaped curve, rising slowly at first, then taking off in the 17th, and 18th centuries; by the

end of the latter, the survival rate is probably c90%, so the curve flattens out again to reach 100% in the mid-20th century, after the 2nd World War. In Scotland, no bridges survive from before the 14th century, and the 17% survival point is reached in the mid-17th century, so the Scottish curve lies below the English one but takes the same form. These curves are not of great practical importance, but they should be borne in mind when considering the likely applicability of evidence, gained from any old bridge.

4. In the aforementioned pamphlet, I expressed the hope that it would be possible to look at survivability of historic Irish bridges but I have been unable to find any equivalent maps, to those used for English, Welsh, and Scottish surveys, so I shall not be able to do this. I would expect another S-shaped curve if the %ages of bridge survivors from those standing at given dates are plotted against those dates.