

Anglo-Saxon Lengths and the Evidence of the Buildings

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THIS SURVEY of recent research on measurements of Anglo-Saxon buildings reviews three papers in this volume, and also a paper by Peter Kidson which relates medieval metrology to that of the Roman Empire. It concludes that the English foot may have a much more ancient origin than previously supposed.

Like any aspect of the past the history of lengths is worth studying for its own sake, but within this study the history of buildings has a very particular part to play. On the one hand there is copious documentary evidence to the effect that the majority of buildings in antiquity and the Middle Ages were designed using units of length or geometrical systems or both, so that the study of lengths contributes to our understanding of architectural history, while at the same time a study of buildings can help establish the distribution and use of different lengths in different parts of the world.

For both these reasons the recent increase in work on the measurements of Anglo-Saxon buildings is to be welcomed, not least in the form of the three accompanying articles by Peter Huggins, Anne and Garry Marshall, and Fred Bettess. However, as anyone who has involved themselves in it knows, there are two diametrically opposed assessments of the value of studying the dimensions of buildings and the units of length used in their construction. One is entirely sceptical, holding that the exercise is not worth the effort as it is doomed to produce false conclusions. (An awful warning of how justified this scepticism can be is provided by Flinders Petrie's study of Stonehenge, from which he extracted the Roman foot and hence the conclusion that the structure was no more than 1,600 years old.) The other, which seems to me to be the only reasonable stance, starts with the fact that both proportional systems and units of length were used in the designing of buildings, and concludes that they must therefore be studied, whatever the difficulties.

METHODS

These difficulties place a particular responsibility on scholars to apply disciplined methods in their analyses. Bettess's article provides an excellent critique of

weaknesses in past studies and a set of rules for the handling of data. The most important points, including Bettess's, can be outlined as follows.

The study should only deal with actual measurements. Dimensions scaled off plans or aerial photographs, unless they are of the largest scale and the very highest quality, will suffice for generalizations about differences in overall sizes (as in Marshall and Marshall), but they are never trustworthy enough for use in the study of lengths.

Measurements should be taken consistently between the same kinds of points; an analysis which allows itself to choose between the interior, exterior or centre of a wall for different measurements will always find an answer, which is no answer at all.

A study should not be restricted to a single building as the one selected might meet the criteria purely by coincidence.

An attempt should be made to establish the way in which the building was designed in order to extract the most important dimensions.

Subsidiary measurements, that is those which are derived from the main dimensions, should not be taken as corroborative evidence for the use of a length.

Reconstructions should never be used to help establish the use or frequency of a particular length (though they can be used for interpretation, or prognostication if there is to be excavation).

Only documented lengths should be accepted, such as the perches of 5.03 m and 4.65 m in Huggins's paper, since allowing odd lengths again increases the chance that the investigation will always produce an answer.

Finally a sharp distinction needs to be drawn between systems of length on the one hand and absolute lengths on the other. The mention of inches or perches, for example, in documents from two different places does not permit one to assume that the units referred to are of the same length, only that they are likely to bear a similar relationship to other named units, such as the foot, in both places.

THE 5.03 M ROD

This length is fully attested back to the *Statutum de admensuratione terre* in the 13th century in the form of the 16½ ft. English perch, that is, one quarter of the width of an acre and one fortieth the length. Given the close link which surveying provides between the measuring of land and the practice of architecture it is not surprising that the length has been found in a number of buildings from halls at Yeavinger in the 7th century to Ely Cathedral in the 11th.¹

Marshall and Marshall provide evidence for a preference on the part of Anglo-Saxon builders for lengths of 3.5, 5, 7, 10, 14 and 20 m (their Fig. 6). This set of figures has an interesting set of properties. Presumably the 5 m figure represents the 5.03 m perch. While this bears no obvious relationship to the figures of 3.5 and 7 immediately above and below it, doubled and doubled again it gives the 10 and 20 m lengths; exactly the same applies to 3.5 in relation to 7 and 14. The two sets in fact form part of a single sequence formed by the doubling of the area of a square, that is by using the diagonal of the smaller square as the side of the larger. This is a design formula which is well attested in Roman and medieval buildings, as well as in

sketchbooks of the later Middle Ages, so that it is no surprise to find it echoed in the figures for the commonest widths and lengths in the buildings surveyed by Marshall and Marshall.²

THE 4.65 M ROD

Huggins quotes evidence for this being a common length among perches in use in north Germany in the 19th century. Given the traditional and conservative character of measures it is possible that its use in Saxony goes back to the first millennium, and that it could have been brought to England by the earliest Anglo-Saxon settlers. It has no documented existence in an English context, but its presence is supported by the Burghal Hidage. This supplies figures for guard duty which imply the use of a perch of 5.03 m in the calculations for Winchester, but not for Wallingford, where the relevant figure works out at 4.62 m.

FRACTIONS OF PERCHES

As with the major units themselves so subdivisions should only be assumed where there is documentary evidence to support them. There are thus some grounds for accepting Huggins's suggestion of a perch of 15 ft. with three units of 5 ft., on the basis of the common division of north German perches into 15 ft., the use of a *klafter* in Austria which was one third of 5.03 m, and the modern British surveyor's hinged rod of 5 ft. Yet it is worth noting that the British 5 ft. length is not a third of the perch of 16½ ft. For sixths of a perch on the other hand there is much less evidence.

Turning to absolute lengths, a perch of 5.03 m divided into 15 parts produces a foot of 335 mm. This figure is very close to the *pes Drusianus* described by Hyginus (fl. c. 100) as being an inch and a half longer than the *pes monetalis*, the standard Roman foot, that is 296 mm divided by $12 \times 13\frac{1}{2} = 333$ mm. It is thus acceptable as a unit, but there is no evidence that it had a Drusian perch of 5.03 m to accompany it.

A perch of 4.65 m divided into 15 ft. produces a foot of 310 mm. Huggins suggests that this is the origin of the English foot of 304.8 mm, but the difference of 5.2 mm between the two, though slight, is none the less significant. This becomes evident if one takes its yard measure (which in the form of the king's iron elne is what the *Statutum* uses to define the whole English system): this would be 930 mm long, or 16 mm longer than the English yard of 914 mm, which is clearly too great a discrepancy to stand. 310 mm is closer to the Rhenish foot of 313.5 mm which was popular across northern Europe and which can be traced back at least to the 17th century.³ Once again, however, it is not close enough, as 15 ft. of 313.5 mm produces a perch of 4.702 m, within the range of north German perches cited by Huggins, but too different from 4.65 m to carry conviction.

The foot of 280 mm which Bettess extracts from St Paul's at Jarrow has an immaculate pedigree as far as the method by which it is established is concerned. It remains the case, however, that it is a unit unattested elsewhere and derived from only one building, and hence cannot be accepted as a historical length at least until it has been established in a number of other structures. (It is unfortunate that the

281 mm unit which Hope-Taylor proposed for Yeavinger is according to Bettess as subjective as all the other measures which he criticizes.) In addition, even if documentary support and parallel examples were to be forthcoming, it would be wrong to claim it as 'the' Anglo-Saxon foot: it might be one of a large number, and it might only have been used in the earliest centuries of the Anglo-Saxon period.

Finally there is the English foot of 304.8 mm itself. I have argued elsewhere that this must be earlier than Grierson's date in the early 12th century, and that there is architectural evidence for its use shortly before the Conquest.⁴ The next section provides some evidence for a considerably greater antiquity.

RELATIONSHIP OF THE MEASURES TO ANTIQUITY

A recent article by Peter Kidson is a seminal addition to the study of the history of lengths.⁵ By introducing mathematical ratios into the analysis he has established clear links between medieval systems of length and the well attested systems of Roman antiquity, and in so doing has altered the context of all future discussion. From being a welter of differing units, habitually used by historians as a shorthand for archetypal confusion, medieval metrology becomes one in which it is possible to discern the work of disciplined and creative minds providing solutions to specific problems. One of the neatest of Kidson's contributions is the relating of the perch and the acre to the Roman system of field measures.

He has firstly pointed out that the 5.03 m length of the English perch is equal to a Roman perch of 17 ft. of 296 mm each, an observation which suggests the existence of a more extensive link between the two systems. This he provides in the form of a derivation of the acre itself from the main agricultural units of the Roman period. These were the *actus*, 120 × 120 ft., the *iugerum*, 120 × 240 ft. (equal in area to a square 170 × 170 ft.), and the *heredium*, 240 × 240 ft. These form part of a sequence of squares extending to units with sides of 340, 480 and 680 ft., and 680 Roman ft. equals 201.28 m or 40 perches of 5.032 m, the length of a furlong and the side of an acre. Further, the 13th-century *Statutum* also mentions a square land unit called a *quarantena*, consisting of 10 acres, a form which would be exactly the same in shape and area as the 680 ft. Roman measure.

It is therefore possible that both the English perch and the English acre are of Roman rather than Germanic origin. There is, however, one potential weakness in this otherwise convincing case: if, as Kidson argues, the 17 ft. perch was introduced only in the 4th century or later, it is difficult to imagine that it was widely used in Britain before the Roman withdrawal after 410, and even more difficult to imagine it, as a new system, surviving in sufficiently robust form to be taken up by the Anglo-Saxons in the 6th century. Failing this, the route would have to be via the Roman missionaries of the late 6th century. In this case the use of a perch of 5.03 m at Yeavinger becomes a matter of some importance, because if it can be shown to occur in buildings earlier than 597 (or even, to be realistic about the speed with which influence would travel, the second quarter of the 7th century) then the length in early Anglo-Saxon England will have to be separated from a Roman source and returned to a Germanic one.

Kidson also proposes a Roman source for the English foot via another mathematical link. He points out that the fathom of 6 English ft. or 1.829 m is related to the Roman 10 ft. perch of 2.96 m as the proportion 1:1.618, which is the golden section. Stated baldly like this the idea may seem little more than a coincidence, but set in the context of all of his arguments it is anything but arbitrary, and if it is to be rejected it requires a considered response. The chief ground for questioning it is the lack of any obvious need for it in the context of the Roman system. The beauty of the argument concerning the acre is that the observation simply provides a geometrical home for the form in an already existing sequence; here, however, we are confronted with the creation of a parallel system with no obvious necessity for a revaluation of old units. To quantify the objection, what advantage was to be gained from moving from the Roman system, with a foot of 296 mm, a perch of 10 ft. or 2.96 m, and a land measure with a side of 680 ft. or 201.28 m, to a new system with a foot of 304.8 mm, a fathom of 6 ft. or 1.829 m, and a land measure with a side of 660 ft. or 201.17 m? This question on the contrary seems to imply the pre-existence of a system using a foot of approximately 304.8 mm which had to be reconciled to the 10 ft. and 17 ft. perches and 680 ft. land measure of the Roman system, an implication which has the consequence of considerably extending the age of the English foot.

NOTES

¹ Unless otherwise specified, the documentary references for this paper will be found in E. C. Fernie, 'Anglo-Saxon lengths: the "Northern" system, the perch and the foot', *Archaeological Journal*, 142 (1985), 246-54.

² For the use of the diagonal of the square in medieval documents and buildings see, for example, L. Shelby, *Gothic Design Techniques* (Carbondale, 1977).

³ K. Zevenboom, 'Theorie over de ontwikkeling van de Nederlandse voet en ellematen', *Verhandelingen der Koninklijke Nederlandse Akademie van Wetenschappen, Afd. Letterkunde, New Series*, 70.3 (1964), 19; J. C. Eisenschmidt, *de ponderibus et mensuris veterum Romanorum, Graecorum, Hebraeorum* (1708), 93-94: the London foot has 1,350 parts of the Parisian, the Rhineland foot has between 1,391 and 1,392 parts, which by calculation produces a length of 314 mm.

⁴ Fernie, *op. cit.* in note 1.

⁵ P. Kidson, 'A metrological investigation', *Journal of the Warburg and Courtauld Institutes*, 53 (1990), 71-97.