

SAXON BUILDING MEASUREMENTS

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Abstract

The medieval English rod of 5.03 m has been shown to have been in use back to the 6th century. The sub-divisions so far detected are thirds and sixths of this rod. Two particular aspects are considered in this paper. The first is whether the rod was divided further into feet; it is suggested that the manupes—the foot measured by hand—at 15 to the rod is the likely contender. The second aspect concerns building data from Mucking. At least 66 Saxon post-hole buildings have been analysed and, provisionally, it appears that 40 were set out using a rod of about 4.65 m and 25 using the 5.03 m rod. Extant rods in the Saxon homeland likewise have a mean value of 4.65 m suggesting this measure was brought over by the original Saxon settlers at Mucking.

Introduction

In a developing subject new ideas are formulated and old ideas rightly questioned and possibly discarded. New data may support established hypotheses or change or add to the picture. At any particular time one or two aspects of a developing subject will appear to be of special importance in a worker's mind. Such is the position at the present time.

The first aspect of current interest is whether or not the 5.03 m rod, used in the Saxon period, was divided into feet. The second aspect concerns a site where two measuring systems appear to have been in use. The object of presenting this paper was to see if the computing fraternity could suggest ways of dealing with mixed data, representing the two systems, so as to extract more from the data than could be achieved by a simplistic graphical approach.

Summary of work to date

The excavation plans of many Saxon ground-level buildings in England have been studied with a view to detecting the measuring system used in their design and setting out. There are published examples from such sites as West Stow, Chalton, Cheddar, Yeavinger, Mucking, Rivenhall and Nazeingbury (Huggins, Rodwell and Rodwell, 1982). It was shown that for buildings represented by lines of post holes, or post pits, it was the post centre lines which indicated the design sizes.

It was concluded from the initial study that a measuring system, based on a rod of 5.03 m, was in use in much of England in the Saxon period. It was also clear that this rod

was divided into thirds and sixths; the former perhaps comparing with the folding surveyor's rod in common use before metrication, this was 5 ft long, hinged at the centre. This 5.03 m rod is the same length as the medieval rod or perch of 16 ft 6 inches in modern terms. It is the rod recorded in the Statute for Measuring Land, for which Grierson (1972, 14) favours an early 13th century date, when:

12 inches	=	1 foot
3 feet	=	1 elne or ulna (later yard)
$5\frac{1}{2}$ elnes	=	1 rod or perch of $16\frac{1}{2}$ feet

There have been earlier metrological analyses at two sites, one in England and one in Denmark. At Yeavinger, Northumberland, Hope-Taylor (1977) postulated the use of a Yeavinger-unit of 11.05 modern inches. It has been argued elsewhere (Huggins, 1981) that, in fact, the same 5.03 m rod was in use at Yeavinger in the 6th century A.D.; Fernie has agreed with this conclusion (Nov. 1982, private communication) and its division into thirds and sixths.

The second independent analysis is of the boat-shaped buildings at the Viking camps of the 11th century in Denmark. Here at Trelleborg, and later at Fyrkat and Aggersborg, that 'reduced Roman feet' were used in the setting out of the buildings which were arranged in squares of four around a central courtyard. However a new model (Huggins, Rodwell and Rodwell, 1982, 39-52) shows that the same 5.03 m rod with its thirds and sixths was the design standard here again. These groups of four houses are of particular interest since it appears that marking-out cords, in the form of a noughts-and-crosses grid, were left in position during the layout of the buildings so that each of the buildings was, therefore, set just inside the cords of the grid. It was the grid which was measured out, so that even the length of the buildings would not retain any fossilised evidence of the measuring system used. A computer treatment (Nielsen, 1979) using, among other dimensions, the length, was bound to fail; the wrong data was fed in so the results, quoted to five significant figures, must be spurious.

The case for dividing the 5.03 m rod into feet

The 5.03 m rod was used, but not exclusively so (see later) in the Saxon period, for building construction, and it was divided into thirds and sixths; this much is now certain. A matter of current interest is whether or not the rod was divided up additionally into feet of some sort or other.

The first point to consider is what sort of feet might have been used. There is a well authenticated example of the concurrent use of two different feet. This is recorded by the Roman Agrimensores (measurers of land) to have been the case in present day Belgium. There was the decempeda of 10

feet of 16 digits each and the pertica of 12 feet of 18 digits each. This latter larger foot was measured ad manus - by hand - and would work out at about 13.1 modern inches. So there was the standard Roman pes monetalis, related in some way, presumably, to the foot we stand on, and there was a second foot, the pes Drusianus, measured by hand. Grierson (1972, 35-37) presents a recent discussion of these measures. Also there are metal ends of Roman rods from Austria (illustrated by Dilke, 1971, 67) which are calibrated in the smaller units of each of the two systems. It seems to have been Petrie (1934, 5) who first used the name Northern for a measure of about 13.2 modern inches and he talked of the pes Drusianus in the same sentence; he romanticised about its distribution in space and time. Petrie must have realised that 15 of these feet equated with the 5.03 m rod but it was Skinner (1967, 91) who perhaps stated it first but without arguments or references; Skinner makes many unsubstantiated statements in the above popular account but he may be right in this case.

There are English references to the manupes and its half measure, the shaftment. The shaftment is the width of the palm and the outstretched thumb, so that a timber could be measured by gripping it with the thumb outstretched and by passing one hand over the other. The earliest reference to the shaftment in England goes back to the 10th century and that of the manupes to the 12th century (for references see Grierson, 1971, 28 and 36). Thus the existence of alternative units to those defined in the Statute for Measuring Land is certain and it is surely likely that the shaftment and manupes are units related to the 5.03 m rod which we assume was retained in the Statute as a well-established measure.

The shaftment and manupes must surely be seen as measures particularly suited to carpenters whereas the feet and elne of the Statute are, as stated there, land measures. Since the 5.03 m rod was divided into thirds, on analysis of the archaeological plans, it is very likely that the number of manupes in the rod would be fifteen. We can, therefore, postulate, as part of a pre-Statute carpenter's system:

6 inches	=	1 shaftment
1 shaftment	=	1 manupes
15 manupes	=	1 rod

so that the sub-divisions detected in the building analysis would be:

third of a rod	=	5 manupes	=	10 shaftments
sixth of a rod	=	5 shaftments		

The relation to modern units being:

1 inch	=	1.1 modern inches (27.9 mm)
1 manupes	=	13.2 modern inches (335 mm)
1 rod	=	16.5 modern feet (5.03 m)

It is interesting that a manupes of 13.2 modern inches is within less than 1% of the pes Drusianus which was also measured by hand.

Fernie points out (1982), while agreeing with the re-examination of the Yeavinger buildings (Huggins, 1981, 150-153), that there is no need for the additional division into feet, however measured. Certainly, as yet, there is no conclusive evidence for the manupes but door jambs at Yeavinger were 20 inches wide of the above postulated system. It may be that the sixth of a rod was itself divided into thirds of 10 and 20 inches. Fernie (ibid, 4) goes further and suggests the 'very flawlessness' of the relation 15 manupes = 1 rod indicates that it 'cannot have been the earlier system, since, if it had been, no reform', as in the Statute, 'would have been necessary'.

However, we must not forget the Statute was for measuring land. Not only was there a need, probably, to standardise land feet but it may have become necessary, for agricultural purposes, where the manupes would be inappropriate, to incorporate these newly standardised feet into the well-established rod. Skinner (1967, 95) quotes the Statute: the 'ulna... contains 3 feet and no more' possibly suggesting the old elne was longer (perhaps because of the longer manupes), and 'the foot must contain 12 inches measured by the correct measure of this kind of ulna'. Therefore there was some other ulna being part of a system involving feet (and inches) differing from these Statute feet. It is noticed above that the manupes is 10% longer than the Statute foot. It will be a surprise to the present author if the postulated pre-Statute system, with the listed equivalences, is not the correct one for most of England in the later Saxon period at least.

It may, by detailed study, be possible to detect some pattern in the smaller dimensions of a building, for instance in timber sizes and in dimensions of joints. It would be interesting to collect this data for the two barns at Cressing Temple, Essex. Although the dating is not precise it is possible that the barley barn is pre-Statute and that the wheat barn is post-Statute (e.g. see Hewett, 1969, 22-32 and 40-47) and there might thus be evidence of different feet and inches in these buildings. On the other hand the manupes and shaftment may have remained in use as carpenter's measures; the shaftment is defined in a 17th century dictionary.

Two measuring systems at Mucking

Mucking, a gravel terrace site on the Thames estuary, shows multi-period occupation (Jones, e.g. 1975 and 1979). Although the site data is not yet fully processed, initial studies suggest that there is evidence for at least 66 ground-level post-hole Saxon buildings. Four provisional

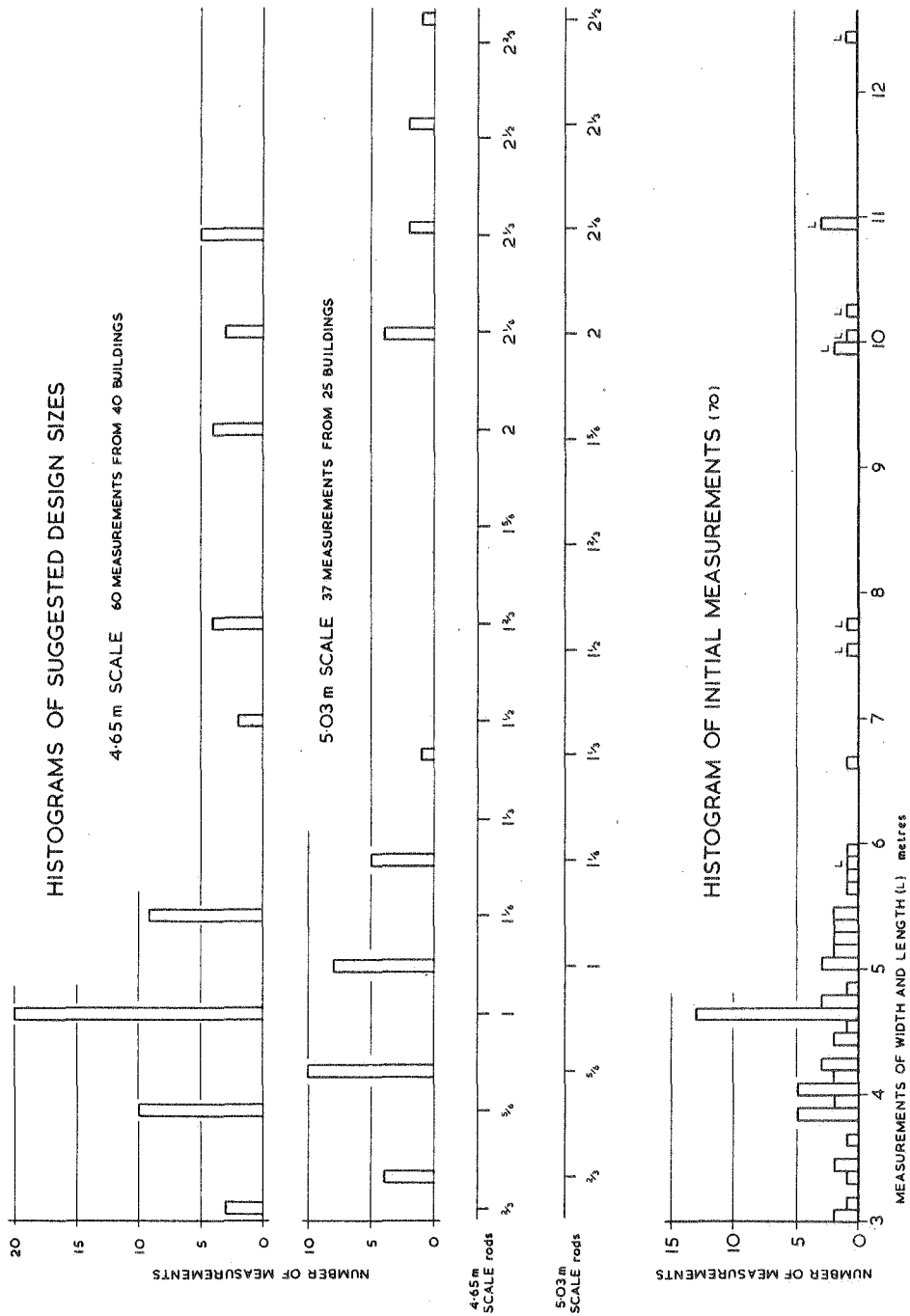


Fig.1. Mucking post-hole ground-level buildings. Histograms of initial measurements and of suggested design sizes.

plans have been published (Jones, 1979, Fig.2.8).

The building plans can be treated in two ways. Those which are particularly clear and regular yield actual measurements of length and/or width, these are based on wall lines through post centres; such readings are primary data (e.g. Huggins, Rodwell and Rodwell, 1982, Table 1, p.28). For less clear groups of post holes, a scaled grid can be set over the holes and additional design sizes can often be suggested, this method yields secondary data (*ibid*, Table 2, p.33). By applying these methods to the four published plans it seemed that three of the plans were based on the 5.03 m rod with its thirds and sixths sub-divisions, but the fourth building, although quite regular, very definitely did not suit this rod; this was the first intimation that there might be evidence here for the use of a smaller measure.

Many more groups of Mucking post holes have been copied from the interim site plans, and, using these copies, some 70 primary measurements can be extracted. These measurements have been recorded as a histogram (Fig.1, bottom). By adding the 5.03 m scale above the histogram it can be seen that the largest column of measurements (13) clearly do not fit this scale. By considering the whole group of 18 measurements between 4.5 and 4.8 m, a mean of 4.65 m with a standard error of the mean of 0.014 m is obtained and there is, thus, an 85% likelihood that the mean lies between 4.63 and 4.67 m. Further study suggests that the 4.65 m measure was the length of the rod with which the larger proportion of the buildings were designed. On the histogram a scale based on a 4.65 m rod is drawn above the 5.03 m scale and it is seen that many of the smaller measurements can be apportioned to one scale or the other whereas, in the case of the larger measurements, mostly lengths (marked L), the data does not enable one to discriminate between systems; however, with the lengths there is usually a reliable width which itself can be shown to suit one scale or the other and, therefore, by association, the length can be apportioned.

To take the study further, grids calibrated in rods, thirds and sixths, to each of the 5.03 and the 4.65 m scales were offered up to the plans and, as a result, it was possible to decide which was the design scale for 65 out of the 66 recognised buildings (some are only part buildings). Thus 40 buildings were judged to have been built to the 4.65 m rod and 25 to the 5.03 m rod. The results are of course provisional until checked with the original feature plans and with depths of individual post holes (which may mean some holes are discarded and others added to the plans). Also finds from the post holes have yet to be processed. Nevertheless the top two histograms of Fig.1, showing all the estimated design dimensions, lengths and widths, are offered with the confidence that they will not be changed substantially.

The two groups of buildings, based on the different rods, do not separate geographically on the site plan. However, the change from one scale to another would, at first sight, suggest some sort of hiatus in the site occupation, but it appears that similar areas were appropriate for building location in each phase.

As mentioned earlier the main reason for outlining the work at this stage is to ask if there are any computer methods which can deal with mixed data from two measuring systems.

It is interesting that in the Saxon homeland there are records of rods still extant in the 19th century (Meitzen, 1895), there are 10 examples from Saxony as it was c.800 AD and another in north Germany which together have a mean of 4.65 m which is exactly the size of the smaller rod identified from the building plans. If any measure is likely to have been brought in by the early settlers it is surely that with which they were familiar at home. Thus it can be suggested that the 4.65 m rod was the first measure used at Mucking, having been introduced by the initial settlers, and, at some time there was a change to the 5.03 m rod which was common in much of the rest of England.

Concluding remarks

In multi-disciplinary work it is impossible for one worker, of limited experience, to cover all aspects of the study. One field of possible advance is the literature. Further references to feet, of one sort or another, or of other units may come to light and hopefully clarify whether or not they were connected with the rod in Saxon times. It would be interesting to know if there are any Anglo-Saxon or other words which might be equated with the thirds and sixths of the rod; for instance, measures called the *klafter* and *miner's perch*, very close to the third and sixth of the 5.03 m rod, were in use into the 16th century in the Austrian mines (Michel, 1967, Fig.24).

It has been outlined how detailed study of the excavation plans of Saxon buildings enables the detection of the measures used by the carpenters or builders. The provisional data from Mucking is exciting. It was extremely fortunate that the 4.65 m scale was, at the lower end, sufficiently different from the 5.03 m scale to allow clear discrimination between the systems. The similarity of the former rod size to the rods known in the Saxon homeland is intriguing. Further rod records by Verdenhalven (1968) are being studied. The validity of a *virga regalis* or Royal pole at 4.70 m (Meitzen, 1895, 554) is uncertain. Göransson (1958, 554) states that it is mentioned in charters of the 9th to the 13th centuries. Meitzen (1895, 553) calls this measure Carolingian. The basis for these statements is not yet clear.

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