Rammed earth revival: technological innovation and government policy in Britain, 1905-1925

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Introduction

If you go to the town of Amesbury in Wiltshire you will find, close to the former railway station, a settlement originally consisting of 32 houses, a quarter of which were constructed in earth materials. Various kinds of earth construction were used but the main type was rammed earth or pisé de terre (Fig.1). Built in 1919-21, the Amesbury development is the most tangible product of the adoption of rammed earth by the Board of Agriculture for the programme to settle soldiers and sailors on the land after the first world war. As well as Amesbury, the rammed earth revival of the early twentieth century gave rise to a number of publications. Perhaps most notable was the book on earth construction published in 1919 by Clough Williams-Ellis (who for a time was a salaried architect with the Board of Agriculture), *Cottage Building in Cob, Pisé, Chalk and Clay: A Renaissance*, but there were also two government reports published by the Department of Scientific and Industrial Research, one (1921) by W.R. Jaggard specifically on Amesbury and the other (1922) by H.O. Weller on earth construction more generally[1].

Eighty years later, as part of the worldwide interest in low-energy technologies generated by the eco-crisis, earth construction is much in vogue. The electronic catalogue at the RIBA library lists more than 200 publications from the past 25 years. Regular international conferences are held on the subject, including New Mexico (1990), Lisbon (1993) and Torquay (2000)[2]. Recently rammed earth construction has been used by architects for prominent projects such as the Chapel of Reconciliation built by Martin Rauch on the site of the former Berlin Wall and the visitor centre by Nicholas Grimshaw & Partners at the Eden Project in Cornwall[3]. The UK government has even returned to the subject, with a 30-month DTI-funded research project led by Peter Walker at the University of Bath which started in 2002, looking at the viability of rammed earth construction for social housing. As part of this project, rammed earth has reached London, at the Bird in Bush nursery on the Old Kent Road designed by JM Architects and built in 2003-2004 (Fig.2)[4].

Figure 1. Chalk pisé cottage at Amesbury, Ministry of Agriculture, 1920.

For these present-day earth revivalists in the UK, the period around the first world war still forms the benchmark. Rowland Keable – the leading figure in the current rammed earth revival in the UK and the rammed earth contractor for both the Eden Project and the Bird in Bush nursery – has stated that it was the Clough Williams-Ellis book that opened his eyes to earth construction[5]. The editors of the Terra

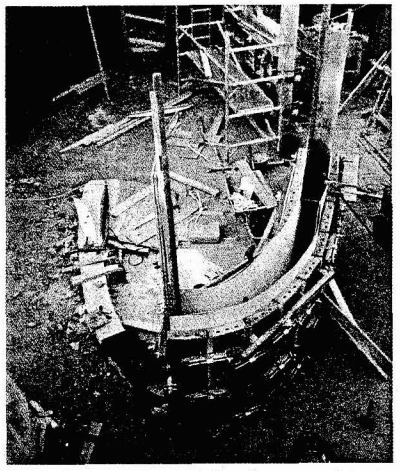


Figure 2. Rammed earth wall under construction at the Bird in Bush nursery, London, 2003 (JM Architects/In Situ Rammed Earth Co).

2000 volume tell us that these publications dating from the early part of the twentieth-century constitute Britain's main contribution to the large-scale investigation of earth construction[6]. Little wonder then that, 80 years after first publication, the Clough Williams-Ellis book has again been reprinted[7].

In today's climate – literal and metaphorical – it is largely assumed that the use of rammed earth, like eco-friendly construction methods in general, is politically progressive and environmentally responsible. It is easy therefore to assume that this meaning inherently attaches to this form of construction. But what led the British revivalists of the early twentieth century to espouse this form of construction? Did earth construction then have the meanings and associations that it has today?

At the outset, it might be useful to clarify what is meant by rammed earth construction or pisé de terre. Essentially pisé is an exotic name for a form of wall construction that has been used for many hundreds of years in various parts of the world, including Africa, Asia and Europe. It differs from brick in that the earth is not baked at a high temperature in a kiln but is used raw. It differs from mud construction in that the material is used in a more or less dry form, rather than wet. It gains its strength not (as with mud construction) from being baked in the sun or being reinforced by a binding agent but from being compacted – ie rammed – using formwork similar to that used for in situ concrete. The usual manner of constructing walls involves making and erecting the formwork (of timber or steel) and laying the earth in courses around one foot deep. The earth is compacted by being rammed (traditionally by hand but today by machine) and the course is then allowed to dry for around three hours before the next course is laid. The earth wall has to be protected from water ingress from above and below by an overhanging roof and a base wall (of brick or concrete) about one foot high. Although the density of the wall offers protection against surface rainwater, in temperate climates such as the UK a 'raincoat' of some form such as lime roughcast or tar is usually considered necessary for habitable buildings [8]. The thickness of the wall required for stability (at Amesbury, 18 inches for the lower floor and 14 inches for the upper) and the thermal mass of the material leads to inherently good thermal performance, keeping the interior warm in winter and cool in summer.

Rammed earth was not an indigenous method of building in Britain, where the only indigenous form of raw earth construction was mud, reinforced with straw or some other binding agent. This was a traditional method used in Devon (and to some extent in south Wales), where it is known as cob; and in Norfolk, where it is known as clay lump. At the end of the eighteenth century however the pisé technique was introduced to Britain. The pioneering textbook on pisé de terre published in Paris in 1790 by François Cointeraux was translated by Henry Holland in 1797 and the technology was taken up by nineteenth-century manuals in Britain, as elsewhere in the world. Unknown to Williams-Ellis and the other rammed earth revivalists of the early twentieth-century, rammed earth construction was also used in practice in Britain, by Holland for some experimental buildings for the Duke of Bedford at Woburn and by others for villas in Winchester and other chalk districts of southern England in the middle decades of the nineteenth century [9].

In the half century before the first world war, on-site materials including earth were employed by a number of well-known architects. At Smeaton Manor in North Yorkshire in 1876 Philip Webb used earth extracted from the site to make the bricks for the house. Lutyens used dressed chalk at the Deanery Garden in Berkshire (1901) and even more spectacularly for Marshcourt in Wiltshire (also 1901) where it forms the main walling material. Edward Prior made rhetorical use of 'found' materials such as flint and pebbles for his 1903 house Home Place in Norfolk. In 1910 Ernest Gimson built a cottage of cob at Budleigh Salterton in Devon, using sand found on site mixed with water and long straw to make walls three feet thick resting on a plinth of cobble stone found in the sand[10].

These however were essentially one-offs. The difference with the rammed earth revival was, first, that earth construction was advocated as the official solution to the crisis of rural housing; and, second, that the method promoted, pisé de terre, was not an indigenous regional method but an imported method initially believed to have originated in the colonies.

From the Cheap Cottage to the rammed earth revival

It was agreed by all involved that the revival of pisé in Britain was due to the efforts of one person. J St Loe Strachey was "the revivalist of the method in England", said W.O. Weller in his 1922 government report [11]. According to Clough Williams-Ellis in 1919, "Mr Strachey himself is certainly the godfather of Pisé building as far as modern England is concerned, and his enterprise and enthusiasm are alone responsible for the present interest in the subject."[12].

St Loe Strachey (1860-1927) was an intriguing and forceful character. The second son of Sir Edward Strachey, he was an ideologue, opinion-former, media-owner and behind-the-scenes political operator: an idiosyncratic right-winger who adopted a series of 'causes' that he promoted through, and that in turn attracted both publicity and readers to, the periodicals that he owned. Of these the most important was the Spectator, reportedly the most widely read political weekly of the time, which he owned and edited from 1898 to 1925; but he also owned The County Gentleman, a less successful title which he acquired in 1901 [13]. According to Professor Hugh Thomas, from 1898 onwards Strachey issued a stream of editorials in the Spectator "providing intelligent rationalizations for conservative attitudes to the Empire.... He made a success of the Spectator and became quite rich in consequence" [14]. While his views were widely seen, as his daughter Amabel stated, as 'reactionary', not least because of his close association with the country landowners' lobby, his social circle was wide and heterodox, including the Webbs and Bernard Shaw [15].

Apart from the empire, the centrepiece of Strachey's political philosophy was his belief in the free market, based on the political economy of John Stuart Mill. In his autobiography of 1922 he recalled that, while a student at Balliol College Oxford in the 1880s, he had been attracted to the socialism preached by Hyndman and Henry George; but he came to the conclusion that logically, before abandoning the market system in favour of something else, first the market system had to be tried in its full unfettered form, ie "real Free Trade" [16].

As regards the housing of the working class it was apparent to Strachey that the market was not working. In his autobiography he recalled:

> "I had always been, and still am, deeply concerned in the housing question. We cannot be a really civilised nation unless we can get good houses and cheap houses for the working classes. Not being a philosopher, I had always supposed that the surest way of getting good and cheap houses was to find some improved system of construction." [17]

Three years earlier, in the introduction to Clough Williams-Ellis' *Cottage Building in Cob, Pisé, Chalk and Clay* he made the point more directly:

> "My connection with the problem of housing, and especially of rural housing, ... has been on the side of cheap material. Rightly or wrongly (I know that many great experts in building matters think quite wrongly), I have had the simplicity to believe that if you are to get cheap housing you must get it by the use of cheap material...."[18]

Strachey's first venture in this regard was the Cheap Cottages Exhibition held at Letchworth Garden City in 1905. In rural areas it was the traditional responsibility of the landowner to provide housing for agricultural labourers; but by the early 1900s the cost of doing so exceeded by far what the agricultural labourers could afford to pay in rent, generally taken to be 3/- per week, which equated to a construction cost of £150 [19]. The answer, Strachey believed, was to follow the precepts of Millite political economy, namely to seek a cheaper method of manufacture through technological innovation. Initially he believed that concrete was the answer and in 1904 in the pages of The County Gentleman he floated the idea of an exhibition of models of cheap cottages. The struggling Garden City company at Letchworth however spotted an opportunity to benefit from Strachey's publicity machine and in December 1904 suggested instead an exhibition of real cottages, which the Garden City would underwrite [20].

Strachey used his connections to establish a formidable list of supporters, headed by the Archbishop of Canterbury, and amidst much publicity, the Cheap Cottages exhibition with its 85 cottages was opened by the Duke of Devonshire in July 1905 [21]. But the winner in the £150 category, designed by Percy Houfton, was not in concrete but brick and the £150 figure was largely notional, because it excluded the cost of the site, the builder's profit and the architect's fee, as well as boundary walls, roads and sewers – and the bricks for the exhibition were supplied at a special price that excluded carriage [22]. Despite its success as a publicity venture, therefore, the Cheap Cottages exhibition failed to demonstrate either that a £150 cottage was achievable in normal circumstances or that concrete was the way to achieve it. In the subsequent cottage exhibition at Letchworth in 1907, new methods and materials were conspicuously absent and Strachey was forced to re-think his advocacy of new methods as the answer to the housing problem [23].

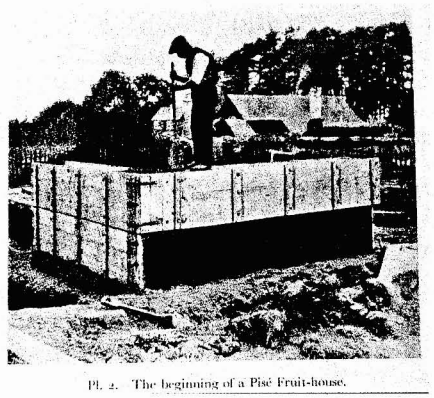
The problem of rural housing however remained; and in the years leading up to the first world war it attracted increasing public attention. While willing to subsidise the production of rural housing in Ireland under the 1906 Irish Labourers Act and giving powers to county councils in Britain to facilitate land settlement under the 1908 Small Holdings Act, with John Burns as President of the Local Government Board the Liberal government had little to offer on rural housing[24]. This allowed the opposition Conservatives to steal the initiative, introducing a private member's bill in December 1911 that included a Treasury grant of £500,000 for rural housing [25]. By 1913 the government had responded with plans for a major rural housebuilding programme to be carried out by the Board of Agriculture [26].

Strachey's contribution, characteristically, was another cheap cottage promotion. In 1913 he announced that he had built a timber-framed house for £150 on a plot at Merrow Common, close to his home at Newlands Corner in Surrey. To show off the house he organised a big opening ceremony, at which he announced a new 'challenge' to architects and other interested parties: build a cottage for £100 (later increased to 100 guineas) on land that he would supply on his estate and, if the building was still standing after a year, he would buy it [27].

Not everyone was impressed by Strachey's new campaign for cheap cottages. The rival publication *Country Life* led the attack. The "latest thing in cheap cottages, the one put up for Mr St Loe Strachey by Mr Arnold Mitchell" for £110 was "little better than a rabbit hutch". To adopt this design "as a standard ... would be to give a fatal setback to the building of adequate cottages", declared *Country Life*'s architectural editor Lawrence Weaver: beauty had to be considered as well as cost and regional traditions had to be respected [28]. In a direct rejoinder to Strachey's cheap cottage, in December 1913

Country Life launched a National Competition for Cottage Designs, which was to be assessed on a county-by-county basis and built by sympathetic landowners in different parts of the country, with a cost limit of £300-400 per pair, ie up to £200 per cottage. The assumption was that, as in Ireland, the portion of the rent that the rural labourer could not afford to pay would be met by a subsidy from the Treasury [29].

Like Strachey's other 'causes', the cheap cottage campaign was heavily promoted in the *Spectator*. On 22 November 1913 the magazine carried a letter from an unnamed reader in Uganda commending its efforts and drawing attention "to a type of building, called Pisé, much used in the colonies". The reader enclosed a cutting from a South African publication, the *Farmer's Weekly* (reprinted by Strachey), in which a certain Harold L. Edwards described both the pisé projects he had undertaken in South Africa and the situation in New South Wales, "where a great deal of pisé building is done'. For Strachey (who had never abandoned his interest in concrete) this new approach to building a house "out of the stuff which is dug out of the ground" exerted an immediate appeal; and the fact that it originated (as he thought) in the colonies only added to the attraction[30]. In the introduction to the Clough Williams-Ellis book Strachey recalled:



Pl. 2. The beginning of a Pisé Fruit-house.

3. Strachey's first building in pisé de terre, the apple store at Newlands Corner, 1915 (from Clough Williams-Ellis and John and Elizabeth Eastwick-Field, *Building in Cob, Pisé, and Stabilized Earth*, Country Life 1947).

> "People who had seen and even lived in such houses wrote to The Spectator, and the world indeed seemed alive with Pisé de terre. I was even lent the 'Farmer's Handbook' of New South Wales [published in 1911], in which the State Government provides settlers with an elaborate description of how to build in Pisé, and how to make the necessary shuttering for doing so. It was then too that I began to hear of the seventeenth and eighteenth century buildings of Pisé in the Rhone Valley. I had got as far as the position described above, when down swept the war upon Europe..."[31]

The war however did not mean that Strachey's interest in pisé came to an end. His wife Amy transformed the family home at Newlands Corner into an auxiliary hospital for troops and the resulting need for additional accommodation gave Strachey the opportunity to experiment with his new discovery. In effect his estate became a private building research station for experimenting with rammed earth. In the summer of 1915 he constructed an apple store in pisé, using simple shuttering he had had made on the Australian model (Fig.3). This was followed immediately by a dining room for the patients, added on to the existing house and designed by the architect Clough Williams-Ellis. For this Strachey "decided to be ambitious and experiment in ... a new form of Pisé, ie Pisé de craie or compressed chalk"[32]. Also in 1915, a drill hut was built for the Guildford Volunteer Training Corps using the shuttering that Strachey had constructed. He wrote to Williams-Ellis:

> "Mr Swayne, an architect in the V.T.C., who has helped me, has made some interesting calculations. The walls, which are about 7 feet high, took a platoon, ie 52 men, 10 hours to build. The cost of 6d per hour works out, Mr Swayne tells me, at about £12.10s. He is going to make an exact calculation of what it would be in brick and corrugated iron – of course at war prices – but he thinks about £30 or £40..." [33].

As we will see, exaggerated expectations of cost savings were to be characteristic of the pisé revival.

Some smaller structures, including a wagon house, farmyard walls (again of chalk) and a large shed, were also built in rammed earth. Characteristically, Strachey did not keep his findings to himself but used his influential connections to promote his discovery. In the "early stages", he recalled, he was encouraged by General Sir Robert Scott-Moncrieff, who apparently issued instructions for pisé walling to engineer companies on the western front, based on the simple Australian shuttering design[34]. By the end of 1917 Strachey felt sufficiently confident to approach Whitehall direct. In December 1917 he submitted a proposal to the Department of Scientific and Industrial Research for them to investigate the problems arising from the use of earth and chalk for building [35].

In these wartime experiments with rammed earth, Strachey benefitted from the specialist architectural input supplied by his new son-in-law, Clough Williams-Ellis. Despite his lack of a conventional architectural training (he completed only one term at the Architectural Association before leaving to undertake his first project), before the outbreak of the first world war Williams-Ellis had built up "quite a substantial practice, mostly concerned with country houses, large and small" [36]. In this he had been aided in part by the friendship forged with Lawrence Weaver at the time of the 1911 Gidea Park competition, which meant that he was able to share in the patronage that, through his position at *Country Life*, Weaver bestowed [37]. In 1913 Williams-Ellis attended the opening ceremony at Merrow Common and was immediately attracted to Strachey's daughter Amabel; to ingratiate himself with the family, he entered Strachey's £100 cottage competition. His pursuit of Amabel Strachey was successful and the couple were married in July 1915, with Williams-Ellis returning from the western front for the wedding [38].

Rammed earth and the postwar land settlement programme

Although in the short term it brought housebuilding more or less to halt, the main effect of the first world war was to enormously increase the political importance of housing, with a succession of policy announcements from the government on its plans for a postwar housing programme, timed to defuse what was seen as the growing threat of social unrest or worse. As well as the pledge to build 'homes fit for heroes', the government also became increasingly committed to giving members of the armed services the direct opportunity to settle "on the land for which they have fought"[39]. What was envisaged was a greatly expanded version of the land settlement programme instituted by the Small Holdings Act of 1908, under which between 1908 and 1914 a total of 14,389 small holdings had been provided by county councils and county boroughs in England and Wales, including 886 with cottages [40]. A departmental committee in 1916 put forward the idea of a 'central farm' to teach settlers how to work their holdings and the Selbourne Report of 1917 proposed land settlement for ex-servicemen as part of a comprehensive policy for agriculture, including a minimum wage and minimum prices for cereals [41].

By the months following the armistice, the land settlement programme ranked second only to the housing programme in its political importance [42]. In some ways indeed it was even more sensitive since it was targeted so precisely at active servicemen. Perhaps this was the reason that the terms of the Land Settlement (Facilities) Act of 1919 were even more generous than those of the Housing Act of the same year, with participating county councils bearing no responsibility for financial loss (unlike participating local authorities under the 1919 housing programme, who had to contribute the produce of a penny rate) [43]. Perhaps also for this reason the government decided that, while the main programme would be conducted through county and borough councils, the government would also act direct, with land settlement schemes undertaken directly by the Board (later the Ministry) of Agriculture. The Board of Agriculture talked of an overall programme to settle 100,000 men

within a year and in January 1919, with the troops on the western front increasingly restive at the slow progress of demobilisation, issued a booklet to the troops entitled Land Settlement in the Mother Country. This summarised the scheme and stated that "any man who desires to obtain, after demobilisation, a Small Holding of not more than 50 acres in England or Wales should fill in the form printed in the middle of the booklet" [44].

The person appointed to take charge of this politically charged programme was Lawrence Weaver. In 1916 Weaver had left Country Life to join the reserves and was then transferred to the Food Production Department – one of the Whitehall success stories of the war – where he proved an administrative 'star', becoming Controller of Supplies and being rewarded in 1918 with the CBE[45]. In December 1918 Weaver was appointed Commercial Secretary of the Board of Agriculture at a salary of £2000, higher than that of the Permanent Secretary and the same as that of the President of the Board [46]. As such he was responsible for implementing the land settlement programme and what was effectively the national rural housing programme embedded within it.

As regards the kind of houses to be provided on the new small holdings, under Weaver the Board was "in complete sympathy with the new attitude towards housing matters in this country, which was manifested immediately after the Armistice"– in other words, the recommendations for a substantial improvement in housing standards made by the Tudor Walters Report [47]. Reversing the policy followed at its wartime development at Patrickton in Yorkshire, with Weaver in post the Board declared that it wanted the houses built for smallholders to be of exemplary character. All were to have a parlour in addition to a living room and scullery and (despite ridicule from some quarters) all were to have a bathroom [48]. But where the Tudor Walters Report and, following it, the Ministry of Health looked to 'standardisation and simplification' as the design credo for the housing programme, for the small holdings programme the Board of Agriculture placed its faith in "using, as far as possible, local materials and traditional methods of construction" [49]. Both the belief in 'good' rather than 'cheap' cottages and the idea of promoting local traditions in design and construction were consistent with Weaver's pre-war position at Country Life.

Prominent among the methods of construction promoted by the Board of Agriculture was rammed earth. Weaver's department was "inclined to plume itself on its early appreciation of the potentialities of pisé" [50]. Following Weaver's appointment, it was decided that the first postwar development – at Amesbury in Wiltshire – should act as a flagship for the programme, not just providing housing in "a rural district on the lines of the Report of the Committee presided over by Sir Tudor Walters" but also undertaking "experiments in the use of local and special materials and methods of construction, at a time when the cost of accepted methods and materials was extemely high." [51] The plan for the Amesbury settlement was to erect a number of cottages in a variety of raw earth methods and compare them, not just against each other, but also against cottages built at the site in concrete (of various sorts) and timber, as well as conventional brick construction.

The Department of Scientific and Industrial Research was also invited to take part in the Amesbury experiment. On his appointment as Commercial Secretary in December 1918, Weaver proposed to the DSIR that it too should erect some experimental cottages at Amesbury, either with local materials using methods which had fallen into disuse, or by new methods [52]. The DSIR was headed by another prominent member of the country landowners lobby, Lord Curzon, who at this stage was blocking the request for a Building Research Board to be established to conduct the research needed for the housing programme. In contrast, Weaver's proposal for research into rural methods at Amesbury was accepted immediately[53]. At the instigation of the Board of Agriculture, the pioneer of reinforced concrete Alban Scott – the source for much of the information being collated by Williams-Ellis for his book – was appointed as consulting architect for the DSIR scheme while W.R. Jaggard – best known as co-author with F. E. Drury of *Architectural Building Construction* – was appointed as architect in charge [54].

If county councils were to build houses of the kind approved by the Board, information and model plans would be needed. A circular letter issued by the Board on 18 December 1918 urged councils to "proceed at once" with land settlement schemes for ex-servicemen and informed them that the Board would provide them with "all possible assistance in regard to the design and plan [sic] of suitable cottages and buildings for Small Holdings"[55]. This meant putting in place an administrative structure with a regional tier of district commissioners (similar to the housing commissioners appointed under the housing programme) and a team of architects in Whitehall who could produce model designs suitable for different conditions and requirements [56].

First of the superintending architects appointed at Whitehall was Clough Williams-Ellis. In his 1933 memoir of Lawrence Weaver, Williams-Ellis gave a characteristically colourful (if not wholly accurate) account of how in late 1918, with the armistice approaching, he got Weaver to request his early release so that he could join the Board of Agriculture. The result was that "within a fortnight of the Armistice I was actually back in London in the guise of a 'Pivotal Man' ... urgently needed by the Ministry of Agriculture for the furtherance of its small-holdings and land-settlement schemes."

He continued:

> "It was over the department concerned with such matters that Lawrence now reigned ... and there, very soon, were congregated a little band of ex-soldier architects, all old friends of his, all devoted to him personally and now filled with his own enthusiasms for a new and better physical England, and all, if one of them may say so, well chosen for the work in hand.
> "Anyway, there we were, Maxwell Ayrton, Oswald Milne, Hugh Maule, and the rest, back at our drawing-boards and all turning out plans of jolly little houses and farm-buildings for small-holders appropriate to this and that acreage and type of family and to this or that part of the British Isles. Jointly, and always under Lawrence's steadying and realistic leadership, we quickly produced an imposing corpus of work – plans, details and specifications – which we condensed into a Government publication that became, as it were, a trade catalogue of the wares and ideas that we had to offer."[57]

Williams-Ellis joined the Board as a superintending architect in January 1919 (two months rather than two weeks after the armistice), followed in March by H.P.G. Maule and O.M. Ayrton and, as assistant architects, F.W.J. Hart, T. Tyrwhitt and H.P.R. Aitchison [58]. The 'trade catalogue'– the *Manual for the Guidance of County Councils and their Architects in the Equipment of Small Holdings: Part I: The Planning and Construction of Cottages* – was issued in May.

Williams-Ellis' period in Weaver's department was short; he says 'three months' but it was more like six – still not long given that he had used it to get early release – and he left in the summer of 1919. By then he had virtually completed his compendium on earth construction, *Cottage Building in Cob, Pisé, Chalk and Clay: A Renaissance*, which in the autumn was published by Country Life with a substantial introduction by St Loe Strachey. Freely acknowledging his debt to those whose work he exploited (and often quoted at length) – including Strachey for pisé, a Mr Fulford of Devon for cob and above all Alban Scott for the "mass of laboriously collected and carefully arranged information" that "made this book possible at all" [59] – Williams-Ellis advanced the case for earth construction with the fervour of an apostle. Given the severe shortages of labour, materials and transport, he wrote,

> "so far as rural housing is concerned, the solution must be sought through the use of natural materials already existing on the site.... It is not so much a question as to whether a Cob or Pisé house is preferable to one of brick or stone or concrete ... but as to whether you will boldly revert to these old and well-tried methods of building, or ... build nothing at all." [60]

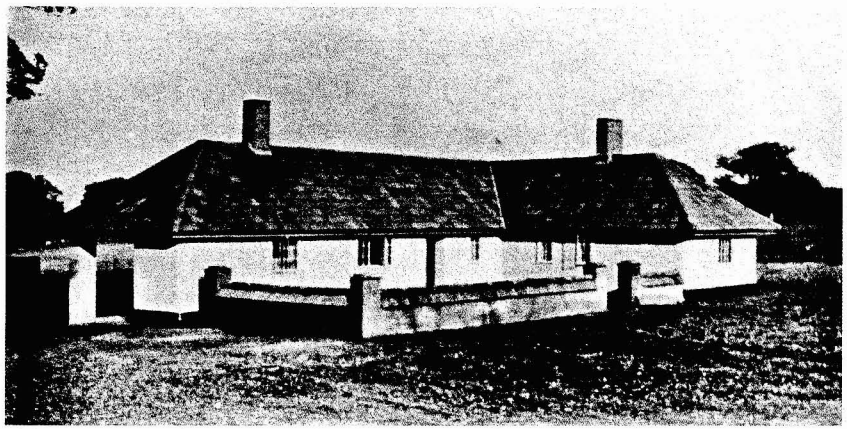


Figure 4. Single-storey pisé cottage built by Strachey at Newlands Corner, 1919 (image from Clough Williams-Ellis and John and Elizabeth Eastwick-Field, *Building in Cob, Pisé, and Stabilized Earth*, Country Life 1947).

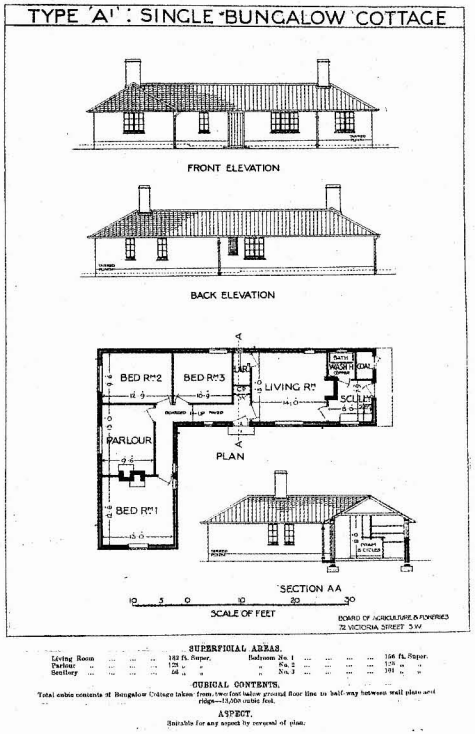


Figure 5. Plan of the Newlands Corner pisé cottage, 1919 (from May 1919 edition of the Board of Agriculture's *Manual*).

Before proceeding to build any rammed earth cottages at Amesbury the Board of Agriculture decided that a prototype should be constructed. This was achieved in collaboration with Strachey, who in the summer of 1919 erected at Newlands Corner a single-storey three-bedroom parlour cottage in pisé (Fig.4). The shuttering was designed by Williams-Ellis and constructed by the Board, the plan was from the Board's Manual (Type A) and supervision was provided by Williams-Ellis on behalf of the Board (Fig.5). At the end of August the building was inspected by a team from the Board including Ayrton and Tyrwhitt, who in a report dated 2 September enthused that "The results of the experiment have been entirely satisfactory." The entire cottage, excluding foundation and base, had taken only 400 man-hours to erect, equivalent to a cost of £20 – and this at a time when the average tender price under the housing programme was £740 [61].

Following completion of the Newlands cottage, the shuttering was sent to Amesbury, so that tests could be

Figure 6. The first pisé cottage at Amesbury, built by the Board of Agriculture 1919-20.

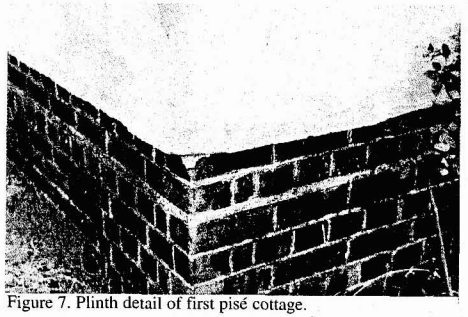


Figure 7. Plinth detail of first pisé cottage.

carried out with the Amesbury soil before starting what was called by the Ministry of Agriculture (incorrectly, as we now know) "the first two-storied pisé dwelling erected in England" (Figs.6-7)[62]. Work on the 2500 acre site (the purchase of which was finally agreed in April 1919)[63] started in May 1919, with construction of the office (for the Board's staff), hostel (for the building workers) and road (Fig.8). Responsibility at Whitehall for construction rested with superintending architect Thomas Tyrwhitt[64]. By November 1920, 25 out of the Ministry's 27 houses were complete and the other two, plus the DSIR's five, were finishing [65]. Of the 32 houses, six were pisé (four in pisé de terre, one in rammed chalk and one in rammed chalk-cement). Two were cob, the argument being that, although by no means indigenous to Amesbury, this method should be tested as well. Four were timber (two timber frame and two re-used army hostels); four were concrete of various sorts, including monolithic and concrete block; and the remainder were brick [66].

By June 1920 the Ministry felt that enough had been learned from the Amesbury experiment to publicise the results. The site was opened one day per week for visits by interested parties [67]. In September an Interim Report was issued, both in the Ministry's journal and as part of a new edition of the Manual. This declared that, although not final or complete, "the data already obtained are sufficiently definite for pisé construction to be embarked upon with satisfactory results" [68]. One caveat, learned from experience of the first cottage, which started in the autumn of 1919, was that construction of pisé walls during winter should be avoided; if the earth became wet, ramming could not be carried out satisfactorily, with consequent waste of time and money. The best shuttering to use was the simple wooden form designed by the Ministry, rather than Williams-Ellis' earlier, more complicated design (Fig.9). But said the Ministry, if properly conducted, rammed earth offered

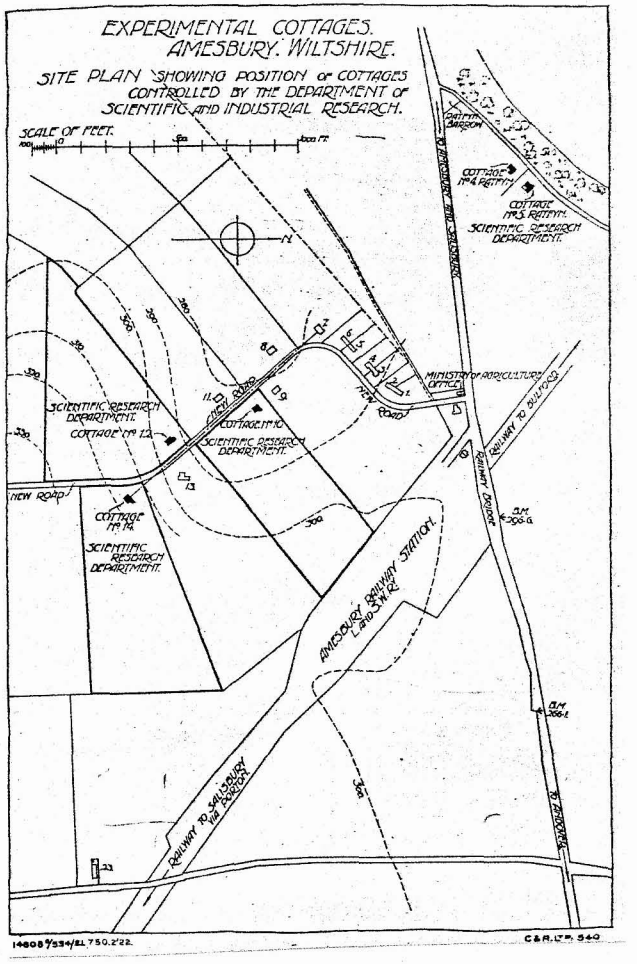


Figure 8. Part-plan of the Amesbury settlement showing location of the five D.S.I.R cottages (from Jaggard's 1921 *report*).

substantial cost savings. The realised cost for the pisé pair, with the usual 18 inch walls to the ground floor and 14 inch to the first floor, was said to be 15 shillings per yard super as against 25 shillings for 11 inch cavity brick walls – a saving of 40% (Figs.10-11)[69].

The advocacy of 'Building in Pisé de Terre' in the Manual of September 1920 can be seen as the highpoint of the pisé revival. Little more than six months later, in April 1921, Weaver gave a lecture at the RIBA entitled 'Building for Land Settlement: A Survey of the Ministry's Work', in which advocacy of pisé was conspicuous by its absence. With admirable sang froid, Weaver simply observed that, "In building operations it has been found that brick has held its own, though most exhaustive experiments have been made with cob, pisé and concrete."[70]

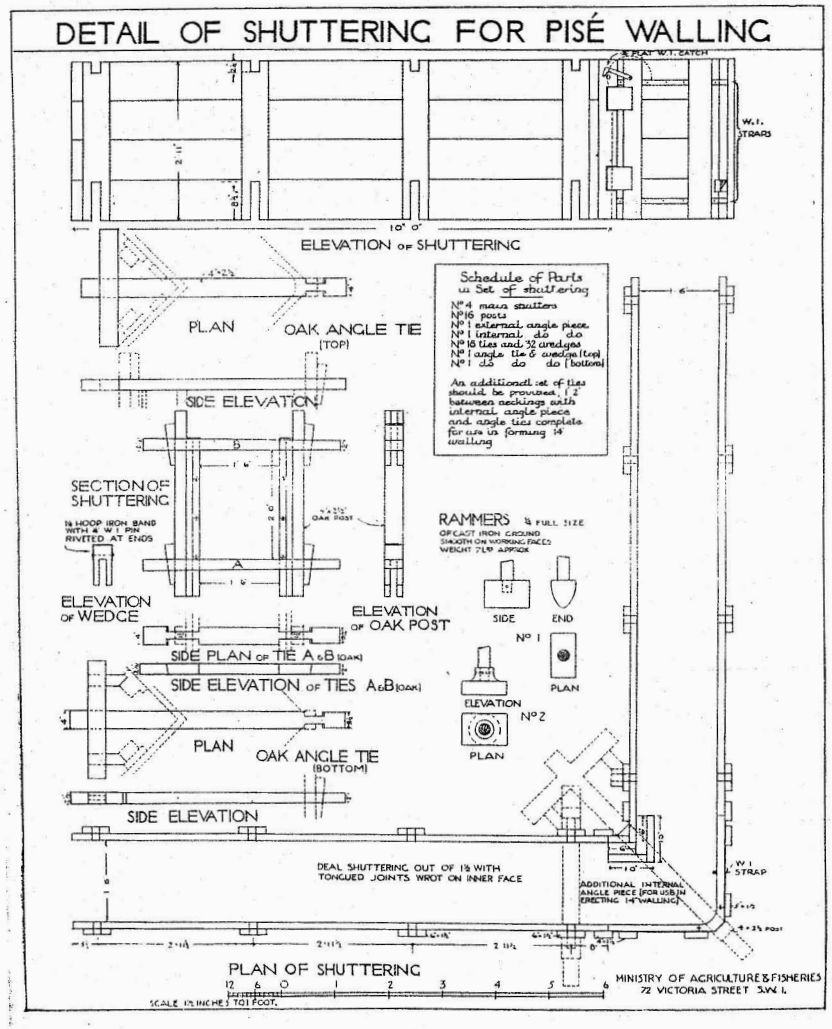


Figure 9. Pisé shuttering details (from September 1920 edition of the Ministry of Agriculture's *Manual*).

Figure 10. The pisé pair at Amesbury, 1920.

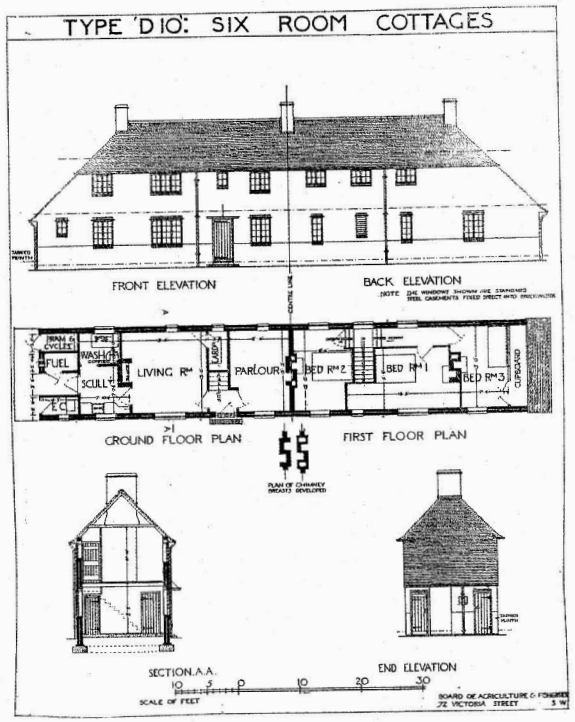


Figure 11. Plan of the pisé pair (from September 1920 edition of the Board of Agriculture's *Manual*).

What lay behind this change of view? In part it was the general change in the economics of building that took place in the winter of 1920-21. With the sudden collapse of the postwar boom, traditional materials and labour again became available and building costs started to fall from the 'monopoly' levels they had reached in 1919 and 1920. In other words, the crisis that the pisé revival had been designed to overcome no longer existed. There was also the reversal in 1920-21 in the attitude of the government towards the social programmes it had instituted in the aftermath of the armistice, as what had seemed at the time prudent measures required to honour pledges to the returning 'heroes' took on the appearance of reckless extravagance, labelled 'squandermania' by the right-wing press.

But more immediately there were the cost conclusions from the Amesbury experiment. Notwithstanding the statements made in the Ministry's Interim Report, the earth methods spectacularly failed to deliver the cost savings which the pisé revivalists (from Strachey, to Williams-Ellis, to the Ministry itself) had claimed. With its primitive technology, the economic viability of rammed earth depended heavily on the plentiful supply of cheap labour. In postwar Amesbury this was simply unavailable; building workers had to be brought nine miles from Salisbury and accommodated on site, "thus adding very considerably to the cost of the works", as Jaggard noted [71].

A memorandum dated 30 September 1920 set out the stark facts. Even setting aside the first cob and pisé cottages, which cost £1495 and £1304 respectively, the pisé cottage then finishing was coming in at £883, as against almost the same amount (£889) for a brick pair. Even the pisé pair, which in the end was by far the most economical of the pisé structures, came in at £1459, more than 60% more than the brick pair [72].

A subsequent analysis of expenditure on all 32 cottages at Amesbury underlined the point. Taking the materials by type (pisé, cob, concrete, timber-framed and brick), the cost hierarchy was almost exactly the inverse of what the pisé revivalists at the Ministry had claimed. Concrete came out the cheapest, with an average cost for the four cottages of £1284. Next came timber framing (both new build and converted huts), at £1395. For the 16 traditional brick cottages the average figure was £1532. Next came pisé, at an average of £1885 for the six cottages, a figure that was topped only by cob, an average of £2281 for the two cottages [73]. However great its enthusiasm for earth materials, the Ministry had little choice but to accept that its experiments had shown that pisé was not economically viable for rural housing.

The DSIR echoed the conclusion. Its annual report for 1920-21 (dated August 1921) noted the completion of the Amesbury scheme during the year and commented:

> "The only general conclusion it is safe to draw from the experiment confirms that of the past year's experience over the kingdom, that substantial, economical progress is to be sought neither in blind reversion to ancient practice nor in the hasty adoption of revolutionary methods, but by steady scientific development of the normal." [74]

Technically, the most positive outcome of the Amesbury work was seen as the success of the 'chalk pisé' method developed by the DSIR's consulting architect Alban Scott, which combined chalk and Portland cement in the ratio of 20:1 (Fig.12)[75]. In a report on Amesbury published in the Ministry's Journal in September 1920, Williams-Ellis noted that for cob "the cost was discouraging, but the chalk and cement method is distinctly promising"[76]. The Building Research Board which, when finally established in 1920, took over responsibility for the DSIR cottages at Amesbury, took the same view, its director of research H.O. Weller telling the board in November 1920 that "the outstanding justification for the expenditure , so far, was the chalk cement walling" [77]. He took the same view in his (less than enthusiastic) report on *Building in Cob and Pisé de Terre*, published by

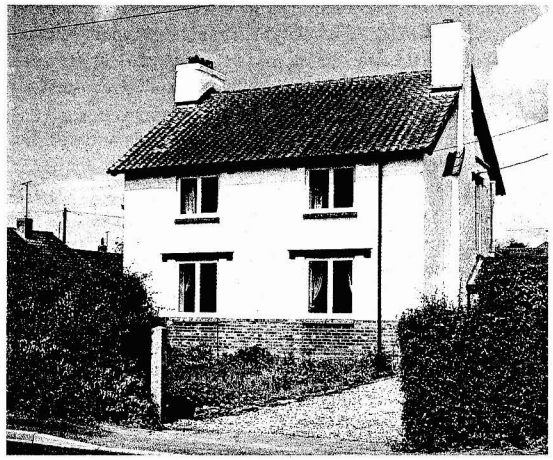


Figure 12. DSIR cottage in rammed chalk-cement at Amesbury, 1920.

the BRB in 1922, suggesting that the future of rammed earth, such as it was, lay in combining "pisé de terre with cement concrete .... to the benefit of both materials" [78].

The story with the land settlement programme overall was rather more positive. Unlike the homes fit for heroes programme, the land settlement programme survived the Treasury-led cutbacks of 1920-21. In the summer of 1920 the Cabinet imposed limits to both the capital cost and annual loss per smallholding, leading to a reduction in space standards, as set out in the September 1920 *Manual* [79]; but the programme itself survived. The architectural work at Whitehall however lost its allure and became largely routine. There were no new editions of the *Manual* after September 1920; the "great majority" of the post-war holdings were occupied by 1921 [80] and after May 1921 the design of houses for small holdings no longer figured in the pages of the Ministry's journal. By 1921 of the original six senior architects at Whitehall – Williams-Ellis, Maule, Ayrton, Hart, Tyrrwhitt and Atchison – only Maule remained and at the end of 1922 Weaver himself resigned, to head up the British Empire Exhibition [81].

The land settlement programme was effectively completed by 1926. Figures given by the Ministry in October 1925 showed that 16,461 ex-servicemen and 2221 civilians were occupying post-war small holdings, a total of 18,682. Up to the end of 1924 county and borough councils had built 2749 houses and it was estimated that the total cost of the building programme would be some £5.5m. It was also estimated that the total capital expenditure on the programme in England and Wales would be £16m, of which half would be written off by the Treasury [82]. While this was a significant achievement, critics might observe that it hardly eclipsed the 14,400 small holdings and 866 cottages achieved between 1908 and 1914 without either a Treasury grant or the elaborate administrative structure established by the Ministry.

Conclusions

In the arguments advanced for rammed earth in the period 1905-25, a number of distinct strands can be identified. First and most crudely, there was the search for a cheap material that would deliver what otherwise appeared unattainable – a cottage that the rural labourer could afford. This was identified most clearly with Strachey, whose search for a cheap cottage at Letchworth and Merrow before the war led directly into the wartime experiments with pisé. In Strachey's case this derived from a right-wing political philosophy that saw the market as holding the solution to social problems and which celebrated what were seen to be the colonial origins of rammed earth. Yet in essence the search for a technological route to cost reductions was one that would arise almost whenever social democratic governments sought to undertake construction programmes for social ends; in the case of Britain this extends from the well-known experiments with steel and concrete

in the 1920s and the 1940s to the endorsement of 'modular', ie prefabricated, construction in the last decade [83]. So far however (notwithstanding the Bath/DTI study) it has not been adduced in the arguments for the present-day revival of rammed earth, for the simple reason that in advanced capitalist economies – where technology is readily available and labour is expensive – rammed earth is not particularly cheap.

Second, in the 1905-25 revival there was the belief in local traditions in architecture: the idea that architecture should work with the materials available to hand in the locality, with the use of earth materials found on site being seen as the ultimate in this approach. The 1914 *Country Life* competition for cottage designs devised by Lawrence Weaver was the clearest expression of this commitment to local materials and methods, which from December 1918 became the official policy of the Board of Agriculture. There were two aspects to this position: what one might term a rational side, which accepts that, other things being equal, it 'makes sense' to use materials already available in the locality; and a romantic side, which sees the use of local materials as a rhetorical device and particularly as a protest against the universalising tendencies of modernity. Both of these aspects were present in the arts and crafts commitment to local materials and as such ran through into the modern architecture of the twentieth century, from Ernst May's explorations of a modern vernacular in 1920s Silesia to Kenneth Frampton's call for 'critical regionalism' in the 1980s [84]. For obvious reasons, the cogency of the 'rational' aspect was greatly increased if one was building in remote areas or at times when transport and conventional materials were unavailable; this the pisé revivalists imagined would be the case in post-1918 Britain, as did the US Department of Agriculture in rural America in the great depression of the 1930s [85]. But in relation to the rammed earth revival of 1905-25 there was always a problem in arguing for rammed earth in regionalist terms. While the material, as at Amesbury, was indisputably local, the method was not.

The third strand was the belief in rammed earth as a modern material. Indicated by the title of Clough Williams-Ellis' 1920 article, 'The Modern Cottage: Experiments in Pisé at Amesbury' [86], this was the position of Alban Scott and the DSIR, epitomised by Scott's development of rammed chalk-cement. By the application of science, it was believed, rammed earth might become a modern material to match or exceed any other in terms of performance, economy and comfort. This was perhaps the most radical vision, for it saw rammed earth not as a material of the past but of the future and, instead of valuing its regional character, embraced its universality. The DSIR saw the combination of chalk and cement as the future of earth materials and in a sense they were right, at least as far as the next 50 years was concerned, for in the colonial context of the 1940s some of the most fruitful applications of earth materials involved mixing them with Portland cement to produce 'stabilised earth'. Thus when Williams-Ellis' book was revised and reissued after the second world war, the title was changed to *Building in cob, pisé and stabilized earth*, a recognition of the role that cement-enriched mixtures now played in rammed earth [87]. This conception of rammed earth, we might note, is entirely alien to present-day revivalists, for whom a key attraction of rammed earth is precisely that it offers an eco-friendly alternative to concrete. Indeed, one of the lessons from the events of 1905-25 is that – far from representing opposed positions, as they often appear to do in contemporary thought – concrete and rammed earth were seen as having much in common, being simply different techniques for turning earth into a usable and useful constructional material.

So of these three strands in the argument for the revival of rammed earth in 1905-25, which if any do we find in the European rammed earth re-revival of today? Rammed earth is promoted today not because it is cheap, nor because conventional materials are not available, nor because it can be combined with cement. Effectively, the only argument from the early twentieth-century revival that we find prominent today is the 'romantic' element of Weaver's regionalist position: the idea that, against the universalising tendency of modernity – in the nineteenth century, it was the national market for building materials; today, it is 'globalisation' – there is a moral obligation to stand up for what is specific to a place and a region.

The main argument adduced for rammed earth today by proponents such as Rowland Keable is primarily ecological, stemming from the transformed outlook on the planet and its resources brought about by the environmental movement: rammed earth uses less energy to produce and transport than almost any other material. In some cases (notably Martin Rauch) this ecological argument is overlaid with an aesthetic appreciation of the special visual and sensory qualities that can be offered by high-quality rammed earth. Neither of these arguments, the ecological nor the sensory, was a factor in the rammed earth revival of 1913-22.

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