

The experimental earthen cottages at Amesbury, England: A long term condition assessment

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Between 1919 and 1920 the British Government, under the direction of the Department of Scientific and Industrial Research, built a series of experimental cottages in Amesbury, England. The experiment was in response to the shortage of available construction materials after the end of World War I. The Cottages were built on land purchased by the Board of Agriculture as part of the Land Settlement (Facilities) Act 1919. This act aimed to provide employment and smallholdings for ex-servicemen returning from the war (Parker 2000, 2). Amesbury was a small community located close to Stonehenge in the west of the country. The experiment consisted of the construction of five experimental cottages built on Ministry of Agriculture and Fisheries land. Three of the cottages were built «to test various old methods of construction which had fallen into disuse, and which it might prove desirable to revive». The remaining two cottages were built «to test certain new methods of constructing floors, roofs, and the like» (Jaggard 1921, 1). It is the former of these cottages that is the focus of this paper.

The three cottages built to test «old methods» of construction used variations of traditional earth construction techniques and they are referred to in this paper by their original numbers from the 1921 report (Jaggard 1921, 6). They were:

- Cottage n° 4, Ratfyn. Built of chalk and straw, and with a Roman tiled roof.

- Cottage n° 5, Ratfyn. Built of chalk-pisé (chalk and soil) and with a slated roof.
- Cottage n° 10. Built of chalk and cement and with a pan-tiled roof.

Two of these experimental cottages were considered of such special architectural interest that they were listed by the Secretary of State for Culture, Media and Sport under the Planning (Listed Buildings and Conservation Areas) Act 1990, on advice from English Heritage. Listing a building afforded it some protection; listing ensured that the architectural and historic interest of the building was carefully considered before any alterations; either outside or inside were allowed.

The focus of this paper is primarily on the earthen walls that form the main load-bearing structure of the cottages. The paper sets out how the walls were constructed and evaluates the condition and development of the three cottages at three subsequent points in time: 1927, 1945 and 2002.

THE CONSTRUCTION OF THE EXPERIMENTAL COTTAGES

The three experimental earthen cottages were all based on one of the model plans developed by the Ministry. The model plan chosen was known as C,¹ and all three cottages were a variation of this plan (Jaggard 1921, 5). The Ground and Upper floor plans

for cottage n° 4, Ratfyn were reproduced from the plans in the original report using AutoCAD and are

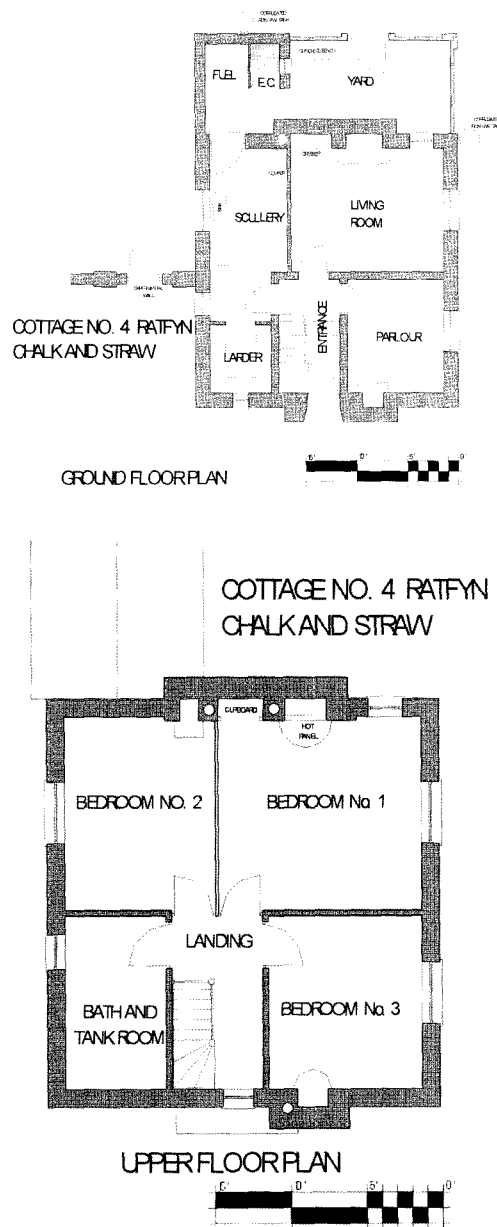


Figure 1
Ground and upper floor plans of n° 4 Ratfyn

shown in Figure 1. Chalk was used as the main walling material for many reasons; it was available on the site and it had previously been used as a building material locally, evident from many surviving cottages in the village (Jaggard 1921, 17). The three cottages used variations of Pisé that utilized a standard form of timber shuttering. The main walls for the three cottages were constructed as follows and are shown in Figure 2.

Cottage n°4 Ratfyn

The main walls of this cottage were built of a mixture of chalk, straw and water. The larger pieces of chalk were broken down to about 2 in. in diameter. Chalk and straw were then mixed together with enough water to make the mixture plastic. The moisture content of the water was 8% by weight. This mixture was then placed in the wooden shuttering in 3 in. layers and rammed using wedge and heart-shaped rammers. Subsequent layers were added and consolidated to a depth of approximately 18 in.. The shuttering was then removed and the walls were allowed to dry. This process was repeated until the full height of the wall was reached (Jaggard 1921, 20).

The chalk walls were built on a concrete foundation that was 1ft. 9in. deep and 1ft. 6in. wide. A 1 ft. high wall consisting of a half brick internal face and unsnapped flint facing was formed upon the concrete foundation and a double course of slates was used as a damp-proof course. The damp-proof course was positioned 9 in. above the finished ground level (Jaggard 1921, 16). The walls were built 1ft. 5in. thick for the ground floor and this was reduced to 1 ft. 2in. for the upper floor. Rectangular pre-cast reinforced concrete lintols were used over the openings and the window cills. They were formed using an oversailing brick course topped with a double course of plain tiles. The internal surfaces of the wall were finished with a two-coat-lime-sand plaster and the external surfaces finished with a thin coat of lime wash (Jaggard 1921, 9).

Construction of the main walls began at the end of August 1919 and was finished by late January 1920. Most of the work was therefore undertaken in the autumn and winter. The report notes that in ordinary circumstances this type of work should be done in the summer months (Jaggard 1921, 22).

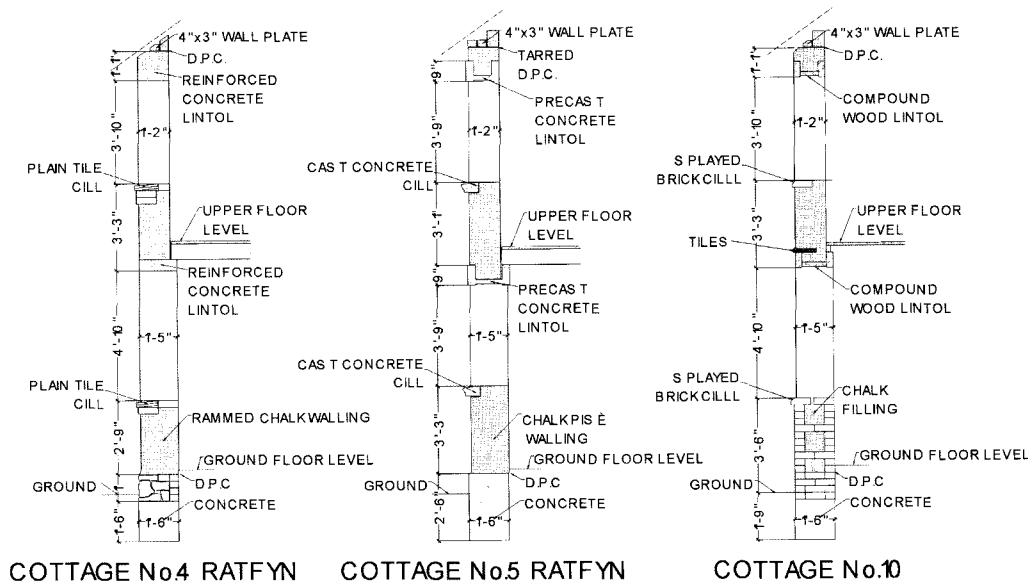


Figure 2
Construction of External Walls of Experimental Cottages

Cottage n° 5 Ratfyn

The main walls of the cottage were built using chalk pisé. Chalk pisé is a mixture of approximately 30% fine soil located underneath the top soil and 70% chalk. No straw or water was added. The mixture was thoroughly mixed together by hand, placed in the shutters, and rammed in a similar manner to the previous cottage. However, this time, the height of the chalk pisé layer was increased by 9 in. to 27 in. (Jaggard 1921, 26).

The chalk walls were built on a concrete foundation that was 2ft. 6in. deep by 1ft. 6in. wide and extended approximately 9 in. above finished ground level. A damp-proof course of two coats of hot coal tar was laid on top of the concrete foundation (Jaggard 1921, 16). The external walls were of a similar thickness to cottage n° 4. Channel-shaped-precast-reinforced concrete lintols used over openings and window cills were formed using a cast concrete cill. The internal and external surfaces were finished in the same manner as cottage n° 4.

Construction of the main walls began in the middle of April 1920 and was finished by the end of June

1920. Most of the work was therefore done in the summer months, and the time taken to construct the walls was approximately 10 weeks as opposed to four months for cottage n° 10 and five months for cottage n° 4 (Jaggard 1921, 27).

Cottage n° 10

The main walls of the cottage were built using a variation of the mixture used for cottage no. 4. Portland cement substituted straw. The chalk was broken down after digging so it would pass through a 1ft in. mesh. The chalk was then mixed dry with 1/20th of its weight of Portland cement. No water was added as the chalk already had a moisture content of about 20%. The mixture was thoroughly mixed together by hand on a boarded platform, placed in the shutters, and rammed in a similar manner to cottage n° 4 (Jaggard 1921, 23).

The chalk walls were built on a concrete foundation 1ft. 9in. deep by 1ft. 6in. wide. Four courses of brickwork on top of the foundation and extended approximately 9 in. above finished ground level. Two courses of slates were laid on the

brickwork for a damp-proof course. The brick walling then continued up to height of 3 ft. 6 in. above ground level using English Garden Wall bond with 4fi in. thick inner and outer walls. The 9 in. void between the two walls was filled with well-rammed chalk (Jaggard 1921, 15). External walls were of a similar thickness to cottage no. 4. Strips of 1fi in. mesh wire netting were laid on top of the brick walling at 3 ft. 4 in. vertical intervals in an effort to reinforce the wall. Channel-shaped-compound-wood lintols were used over the openings. Window cills were formed using a splayed brick cill. The internal and external surfaces were finished in the same manner as cottage n° 4.

Construction of the main walls began in early December 1919 and was finished by the end of March 1920 (Jaggard 1921, 25).

THE CONDITION OF THE COTTAGES IN 1927 & 1945

In the summer of 1927 officers of the Building Research Station based in Garston, Herts carried out inspections on the experimental cottages. In the introduction to the report attention was drawn to the fact that the tenants of the cottages were «of a superior type to the normal occupier of small-holdings and of a superior type to the normal occupiers of cottages of local construction; in several cases the present occupiers are the owners and these owners have accordingly been better cared for than the average cottage of the class». The position of the cottages on high ground some 300 ft. above sea level was also noted and the cottages were exposed to heavy driving rain from all sides; the inspectors suggest that the condition of exposure was considered as very severe (DSIR 36/2197 1927, 1). The report was broken down into the main building components such as foundations & damp-proof courses, external walling, floors and flooring etc. The focus of this paper is the external walling materials and their condition is described using written accounts, photographs and drawings. The main findings of the 1927 report for the three earthen cottages are set out below.

Cottage n° 4 Ratfyn

The 1927 report contains sketches of cracks on this cottage. These sketches were copied, scanned and imported into AutoCAD. The cracking was then traced onto AutoCAD drawings of the elevations. The

cracking to the four elevations of the cottages are shown in figure 3. The report states the cracking was quite extensive and the cracks have penetrated below the roughcast in nearly every case. The cracks were reported as being approximately 4 in. deep. The cracking had penetrated through internal plaster in two places: in the wall of the outbuilding on the northeast elevation, and over the lintol on the first floor, although the exact position was not noted. The horizontal string-course below the first floor windows was also cracked on the northeast and southwest elevations. The report states the cause of the cracking as was «due to the shrinkage of the mass of the wall following the evaporation of the water». The report also makes note of some leakages through «straight joints» at the junction of brickwork and chalk and on the northwest elevation where the roof purlins pass through the gable (DSIR 36/2197 1927, 6).

Cottage n° 5. Ratfyn

The report states that the walls of this cottage were «generally more satisfactory than any of the monolithic walls». Some cracking was reported, but was not shown on any of the sketches or photographs. The cracking was considered not as deep or continuous as in the other cottages. There was some concern over the lime slurry peeling away from the main wall with some pieces of the wall attached to it, however, in general, this wall was reported in excellent condition. Note was made in the report that the water content of this mix was lower than the other cottages (DSIR 36/2197 1927, 7).

Cottage n° 10

The report stated that the walls have cracked badly in places, but the cracks were not as numerous as cottage n° 4 Ratfyn. The cracking to the four elevations of the cottages are shown in Figure 4. Cracks were described as starting at the corners of cills and lintels and running vertically. Some of the cracks were described going through to the inside, and, in some cases, the cracks were as much as 1/20 in. wide. The walls of the cottage were described as being dry except where moisture had penetrated through cracks. One damp patch in particular on the southeast wall was caused by bad walling material and a suggestion was made that this was due to bad

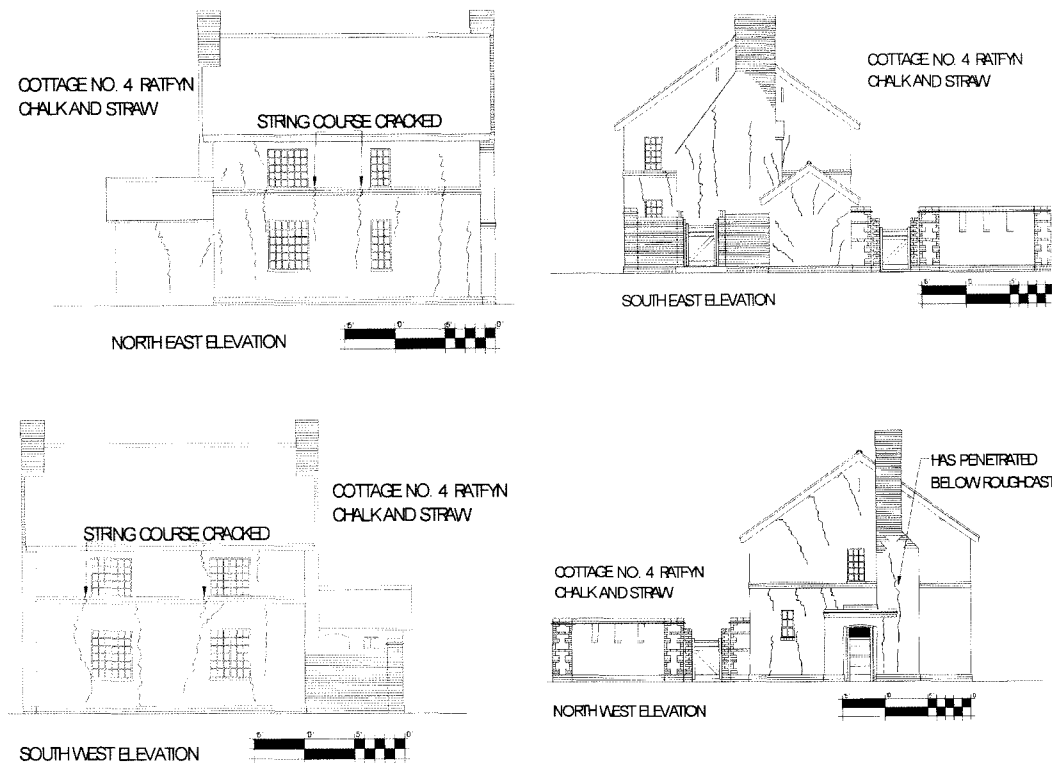


Figure 3
Cracking to cottage n° 4 Ratfyn. Summer 1927

ramming. It was again suggested that the cracking was due to the shrinkage of the walling material and that the wall failed along its weakest planes, between openings. A number of reasons were suggested for the shrinkage. The suitability of wire netting reinforcement to check the cracking was questioned. It was also suggested that a greater bulk change occurred to the wall due to moisture changes in materials used, particularly, the chalk which had a moisture content of approximately 20%. The report suggested that the cracking had finished and any further movement would be taken up by the cracks (DSIR 36/2197 1927, 5–6).

In a general conclusion to the 1927 report there was acceptance of chalk as a walling material. However, there was concern that considerable shrinkage occurs when a chalk wall dries out. The success of cottage n°

5 Ratfyn suggested that using chalk with low water content was the best practice (DSIR 36/2197 1927, 28).

The Cottages in 1945

In 1919, the British Architect, Clough Williams-Ellis, published his masterwork on earth buildings: *Cottage Building in Cob, Pisé, Chalk and Clay*. The book was written, in part, to show how to build rural cottages in materials other than bricks- in short supply after the ending of the First World War. After the ending of the Second World War, a similar situation existed and he republished the book under the title: *Building in Cob, Pisé and Stabilized Earth*. This new edition was expanded and contained a chapter devoted to the experiments at Amesbury under the title *A Successful Experiment*. The Chapter included a description of

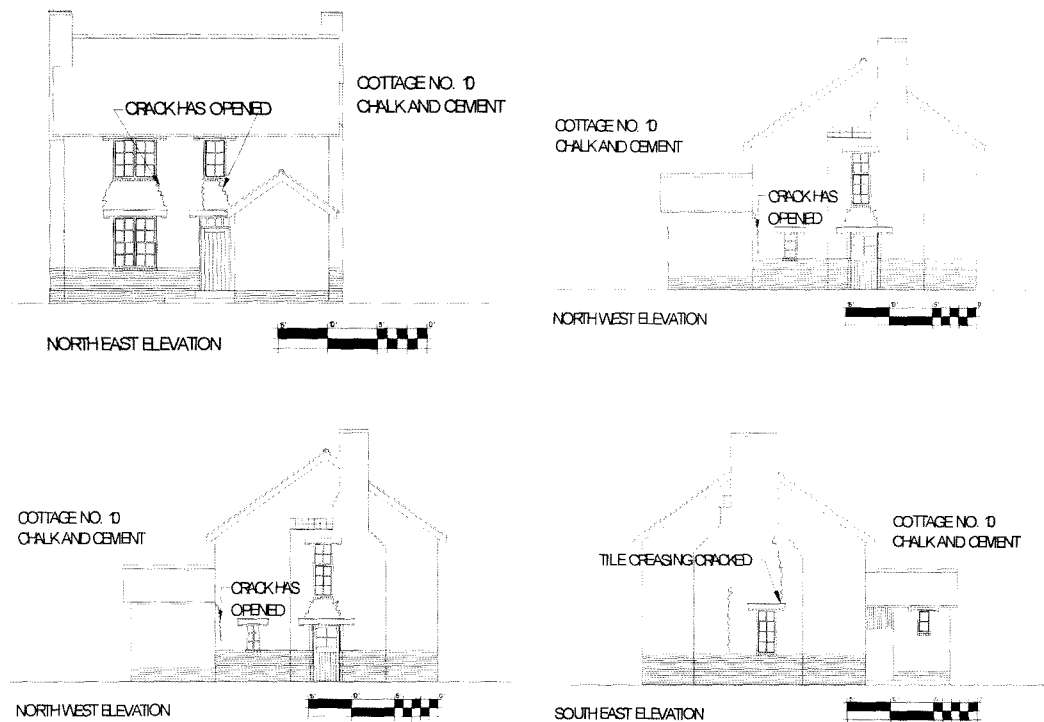


Figure 4
Cracking to cottage n° 10. Summer 1927

the experiments and mentioned examination of the walls in 1927 and 1945. It was assumed that the 1927 examination was the report carried out by the Building Research Station mentioned earlier. The source for the 1945 examination was not made specific in the text. The chapter contained many reproductions of drawings from the Jaggard's original 1921 report, but it also included a number of contemporary photographs showing some of the cottages and specific details.

This additional information about the condition of the three cottages resulted from the 1945 examination. The condition of Cottage n° 4 Ratfyn was reported in a similar condition to that of 1927. It was noted that both the external rendering and the internal plaster was satisfactory. Occasional condensation was noted and this was attributed to the slow warming up of the walls (Williams-Ellis 1999,

129). Cottage n° 5 Ratfyn, considered the best of the monolithic walls in the 1927 report, was again reported as being free of damp and having few cracks after 25 years (Williams-Ellis 1999, 130). Sometime between 1927 and 1945 the external lime wash was replaced with cement roughcast, and, in some places the roughcast came away from the Pisé backing. The cracks present in Cottage n° 10 at the time of the 1927 report were no worse than those reported in 1945. A plate of the exposed outhouse walls of Cottage n° 10 shows, and the text confirms, that the walls have not suffered from attrition, even though they have been exposed for 25 years (Williams-Ellis 1999, 131).

THE COTTAGES IN 2002

This author inspected the cottages in the summer of 2002. The objective of the inspections was to identify

any changes that had been made to the properties and to ascertain the current condition of the cottages

Cottage n° 4 Ratfyn (Avonmeads)

This cottage has undergone the most extensive changes since 1945. It is interesting to note this was the only one of the three cottages that was not a listed building. This cottage underwent two major phases of extensions and alterations. In 1979 a two-storey pitched roof addition was added to the northeast elevation. This addition can be seen to the left of the main cottage on figure 5 and the right of the main cottage on figure 6. It contained two garages at the ground floor level and a bedroom, sitting room and bathroom at first floor level. The extension was of cavity masonry construction with a white-painted-cement-render finish. Between 1979 and 1988 a conservatory was added between the cottage and the original outhouse, this can be seen in the center of figure 6. In 1988 a second two-storey-pitched roof extension was added to the southwest elevation. This addition can be seen to the right of the main cottage on figure 5 and the left of the main cottage on figure 6. This extension contains a new study, and dining room and a garage on the ground floor, and three bedrooms and a bathroom on the second floor. This extension was also constructed in cavity masonry with a cement-render finish.

Among the records that the current owner has of the property were the sales particulars of the house



Figure 5
Cottage No. 4 Ratfyn - Northwest Elevation in 2002



Figure 6
Cottage n° 4 Ratfyn. Southeast Elevation in 2002

when the house was purchased in 1978. The particulars include a photograph of the cottage that shows the northwest and northeast elevations. The photograph shows the cottage with a small single-storey flat roof extension on the southwest elevation (this was replaced by the 1988 addition). What was also of interest was the existence of a portion of the experimental wall between the two cottages. It would appear that some of this wall had survived at least until 1978.

An inspection of the earth walling materials was also carried out and the walls were found in a satisfactory condition. It was apparent that the original rendering was replaced. Documents in the possession of the current owner would suggest that the cottage was re-rendered in 1969 with a proprietary textured coating called «Thermo/tex». The owner expressed some concern about the internal plaster adhering to the chalk walling and showed the author an area of damp walling adjacent to the fireplace in the living room. It was apparent that the wall was very damp and further inspection of the wall on the outside revealed that a new patio had bridged the damp proof course.

Cottage n° 5 Ratfyn (Millmead)

This cottage has undergone some changes since 1945. However the changes have generally been at a lesser scale and have not affected the character of the

building to the same extent as additions to cottage n° 4 Ratfyn. This cottage has undergone three phases of additions. In 1972 a single story flat roof addition was added to the southwest elevation. This addition can be seen to the right of the cottage in Figure 7 and to the left of the cottage in Figure 8. This extension was constructed using cavity masonry with a roughcast-cement-render finish. In 1982, the fuel store on the southeast elevation was extended by several feet using cavity masonry to form a utility room. This extension was consumed by a much larger two-storey-pitched-roof extension on this elevation in 1993. This again, was built using cavity masonry with a roughcast finish and contained a sitting room at ground floor level and a dressing room at first floor level. This extension is shown on the right of Figure 8. This addition was much more in keeping with the original cottage in terms of scale and details. Many of the details such as the timber verge details and lintol details, were copied on the addition. This attention to detail and scale was a result of the cottage being

designated a grade II listed building on 10 October 1988. Listing a building aims to ensure that any alterations to a building respect the character of the building.

The original chalk pisé walls were re-rendered in 1999. This was done to a high standard and care was taken to identify a suitable render for the property. The new render consisted of a lime-based base-coat, a butter-coat (with roughcast) and a 3-coat lime-wash finish. The local authority who provided approximately 10% of the cost of the work approved this work. An inspection of the cottage revealed it to be in excellent condition and it was noted that the external ground level was kept well below the damp proof course.



Figure 7
Cottage n° 5 Ratfyn. Northwest Elevation in 2002



Figure 8
Cottage n° 5 Ratfyn. Southeast Elevation in 2002

Cottage n° 10 (26 Holders Road)

This cottage remains the least unaltered of the three cottages. Figure 9 shows the southwest elevation that remains almost unchanged. The only changes were a small-pitched roof porch that has been added to the northwest elevation, to the right of the cottage in figure 10, and a small flat roof conservatory between the cottage and the fuel store, to the left of the fuel store.

This cottage was also a grade II listed building. An inspection of the cottages walls revealed that they were in a satisfactory condition. The original external finish was still on the cottage as the outlines of some



Figure 9
Cottage n° 10. Southwest Elevation in 2002

of the cracks shown in the 1927 report (Fig. 4) were still visible. Figure 11 shows evidence of one of the shrinkage cracks between ground and first floor windows.

CONCLUSION

Various government publications and Williams-Ellis's book have given us a rare opportunity to



Figure 10
Cottage n° 10. Northeast Elevation in 2002

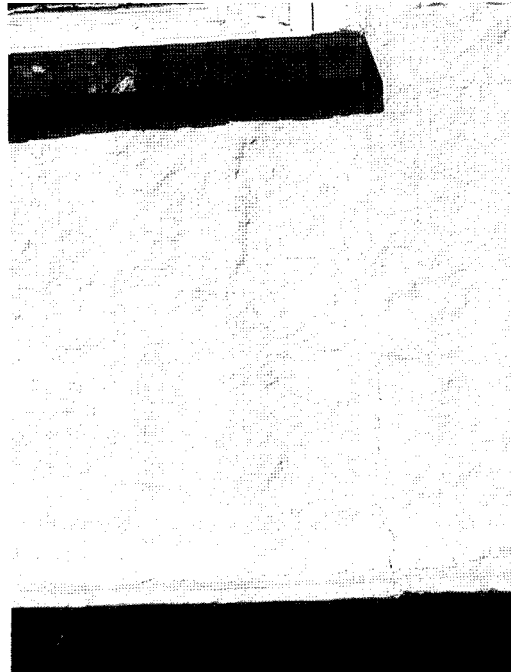


Figure 11
Cottage n° 10. Cracking between ground and first floor windows

evaluate the experimental cottages over a period of 80 years. Clough Williams-Ellis claimed the experiment was a success when writing about the cottages in 1945. After inspecting the cottages in the summer of 2002, this author can only concur with Clough Williams-Ellis. All three of the cottages were in a satisfactory condition and two of the cottages have undergone substantial alterations and additions. This was typical of many cottages of this period and it would appear that the experimental nature of the wall construction has not hindered the adaptability of these cottages. The listing of two of these cottages in 1988 should help ensure the conservation of these cottages in the long term.

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