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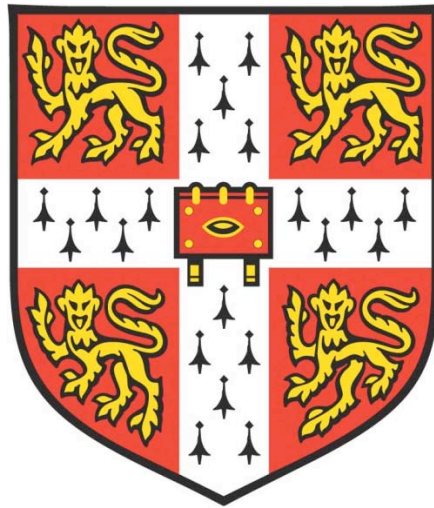
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Wartime Huts:
**The Development, Typology and
Identification of
Temporary Military Buildings in Britain
1914-1945**



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This dissertation is submitted for the degree of Doctor of Philosophy

September 2017

Abstract

Wartime Huts: The Development, Typology and Identification of Temporary Military Buildings in Britain 1914-1945

By,
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The use of temporary, prefabricated buildings in Britain during the twentieth century arose from wartime need to provide better, and perhaps more importantly, portable shelter for troops and equipment. This thesis provides the first comprehensive list of hut designs for the First and Second World Wars. The full lists and descriptions of each hut are given in the appendices. These lists, 20 types for the First World War and 52 from the Second World War, show the huge range and scope of the huts used and is the major contribution of this thesis. The concentration here is on generic types. Some huts were designed as one-offs and there is no possible way to catalogue these. This thesis has focused instead on those designs or industrially-produced types, which were meant to be produced en-masse as generic solutions to the problem: the sort of hut that might justifiably be given a name (such as a 'Tarran', a 'Seco', etc.). This thesis provides essential information enabling historians to be able to identify these types. It uses primary and secondary sources to trace the development of these huts and the effect that wartime shortages had on their design. Beginning with the earliest examples of temporary military building, it then focuses on the huts of the First and Second World Wars followed by a study of huts grouped in chapters by material. This research shows that the wartime period pushed industry to make giant leaps forward with construction methods and materials in just a few short years, where otherwise it may have taken decades. This thesis aims to provide the first overview of this process and to enable future researchers to identify and understand the development of these important wartime structures, many of which survive to this day.

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List of Abbreviations

AM	Air Ministry
ARG	Airfield Research Group
BCF	British Concrete Federation
BL	British Library
BRE	Building Research Establishment
BRS	Building Research Station
DFW	Directorate of Fortifications and Works
IWM	Imperial War Museum
MoS	Ministry of Supply
MoW	Ministry of Works
NA	National Archives
RE	Royal Engineers
WO	War Office

Preface

This dissertation is the result of my own work and includes nothing which is the outcome of work done in collaboration except as specified in the text. It is not substantially the same as any that I have submitted, or, is being concurrently submitted for a degree or diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text. I further state that no substantial part of my dissertation has already been submitted, or, is being concurrently submitted for any such degree, diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text.

It does not exceed 80,000 words in length, including footnotes.

The thesis follows the MHRA style guide, 2nd edition (2009). Building measurements are given in a width by length format. Note that in the period studied within this research imperial measurements were used. It would not make sense to give fractions of meters converted within the text. Therefore, a conversion is provided for reference here:

Imperial to Metric Conversion Chart

Inches	Centimeters
1	2.54
2	5.08
3	7.62
4	10.16
5	12.7
6	15.24
7	17.78
8	20.32
9	22.86
10	25.4
Feet	Meters
1	.30
2	.61
3	.91
4	1.22
5	1.52
6	1.83
7	2.13
8	2.44
9	2.74
10	3.05
20	6.10
30	9.14
40	12.19
50	15.24

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Introduction

This PhD thesis is the first exploration of First and Second World War military huts. It follows from my Master's thesis in which I looked at the requisition of several British country houses during the Second World War.¹ During that research, it became evident that the landscaped parklands surrounding each house had seen the large-scale erection of various types of temporary wartime buildings. Deer parks and gardens were torn asunder to make room for the concrete bases of huts as well as the paved roads and pathways necessary to connect them. These new clusters of buildings, arguably the plainest of the plain, were set up in stark contrast within the shadow of extravagant architectural masterpieces. What emerged were camps, some bigger than adjacent villages, which served as hospitals, training centres, accommodation sites for soldiers and prisoners of war, airfields, and support detachments such as workshops, offices, and even bakeries. In many cases, the physical evidence of their locations can still be seen more than seventy years later.² On other estates, such as at the Duke of Buccleuch's Boughton House in Northamptonshire, wartime buildings were quickly demolished so that the land could be reinstated to its picturesque, pre-war condition.

The idea and value of this study became apparent when reading John Martin Robinson's book *Requisitioned* (2014).³ A chapter is dedicated to the Duke of Westminster's now demolished Eaton Hall in Cheshire. One photograph was labeled with the caption, 'The forecourt in 1945, filled with ugly wartime Nissen huts which over-spilled into the Belgrave Avenue beyond.'⁴ (Figure 1) Upon examination, it was clear that these wartime buildings did not have the obvious corrugated, semi-circular frame of the *Nissen Hut*. They were gabled buildings, and appeared to be constructed of concrete. The question thus arose: what were they? As this study shows, they were

¹ Karey Draper, *The English Country Estate: Contributions and Consequences of Requisition in the Second World War* (University of Cambridge: unpublished masters dissertation, 2013).

² Such as at Lilford Hall in Northamptonshire where concrete bases still mark where the 303rd American Field Hospital huts once stood.

³ John Martin Robinson, *Requisitioned: The British Country House in the Second World War* (London: Aurum Press, 2014).

⁴ *Ibid.*, p. 86.

possibly Standard Army Huts, constructed of precast reinforced concrete and designed by George Coles in 1939.⁵ (Figure 2) It is a reasonable assumption that if a respected architectural historian such as John Martin Robinson could incorrectly identify these buildings, it is probable that many others would as well.

It could be argued that, due to a lack of available research on the subject, the name Nissen seems to have become synonymous for temporary wartime buildings in general, much like the word Hoover is applied to a variety of vacuum brands. This could be how Robinson meant to use the term, and he would not be alone.⁶ The concern with employing this universal term is that it negates a wide range of unique buildings whilst simultaneously excluding credit from the many builders and engineers whose designs contributed in extraordinary measure to the war effort, the morale of troops, and progression within the field of architecture.



Figure 1 Huts as cadet accommodation at Eaton Hall, Cheshire (c. 1944). This photograph features in Robinson's book *Requisitioned*, in which the buildings are incorrectly described as being Nissen huts. © IWM A24549

⁵ For more information on the Standard Army Hut refer to Appendix B.

⁶ The author has had several conversations during the years of this research with people who have mistakenly referred to any temporary military building as a Nissen Hut.



Figure 2 The Standard Army Hut, designed by George Coles in 1939. *The Builder* (17 January 1941)

The study of British military architecture in the past has largely been confined to the oldest, largest, and finest buildings, such as forts and castles. Marcus Binney, architectural historian and president of SAVE Britain's Heritage, has attributed this lack of research into defence heritage of the later centuries to the fact that they were often the work of military engineers rather than architects and thus:

[L]ittle of it appears in the classics of architectural history such as Summerson's Architecture in Britain, Colvin's Dictionary of British Architects and Pevsner's History of Building Types.⁷

SAVE held an exhibition in 1993 entitled *Deserted Bastions*, later published as a report, that highlighted this deficit of understanding, and argued for the historic significance and public interest in defence heritage.⁸ It is presumably in large part due to SAVE's efforts that the following year, English Heritage, recognising the existing lack of scholarship on what they described as military support structures, commissioned a report on barracks in Britain. This research was eventually published as a book in 1998 by James Douet entitled *British Barracks 1600-1914*.⁹ Douet's barracks research is useful to this thesis, especially in Chapter One, as it provides a solid measure of historical foundation to temporary wartime buildings. It identifies this relationship through the origin of the word *barrack*, which stems from the Spanish word *barraca*, meaning an improvised medieval campaign shelter or *hut*.¹⁰ In the introduction, Douet asserts one possible cause for the lack of previous research as being due to the utter dullness of the building type. Douet states:

⁷ SAVE Britain's Heritage, *Deserted Bastions: Historic Naval and Military Architecture* (London: SAVE Britain's Heritage, 1993), p. 1.

⁸ *Ibid.*

⁹ James Douet, *British Barracks 1600-1914: Their Architecture and Role in Society* (London: English Heritage, 1998).

¹⁰ *Ibid.*, p. 1.

*A disparity in statutory protection existed between what the army calls “the Teeth and the Tail” – in other words, the structures of the combat formations, forts or castles, which tended to be well understood compared to those of the support formations, like munitions works, magazines, dockyards, hospitals or barracks, which were not.*¹¹

Huts could easily be added to this under-researched list, as they acted as versatile, multipurpose structures for a range of wartime support functions and could arguably be even more important as a building type than barracks. However, perhaps due to simplicity of form, (or dullness as Douet describes), and original ephemeral, portable purpose, they have fallen through the cracks, disregarded and underrated as a building type of historical significance. This lack of scholarship has also been attributed to the fact that many huts were designed not by architects, but by engineers and builders, and thus not deemed of a high enough standard to qualify for any measure of architectural significance.¹² However, architectural history is changing. The history of prefabrication is becoming more interesting as the subject is once again being put forward as a solution to the housing problem. Wartime buildings have become the subject of a number of monographs, fueling discussion on culture heritage and conservation, such as John Schofield’s ‘Monuments and the Memories of War: Motivations for Preserving Military Sites in England,’ and Jeremy Lake’s, ‘Historic Airfields: Evaluation and Conservation’ in *Materiel Culture: The Archaeology of Twentieth-Century Conflict* (2002).¹³ There has also been a growth in interest in the history of engineering and construction with a growing number of international conferences and journals in these fields.¹⁴ The time seems right for a study of wartime huts.

Research Objectives

The purpose of this thesis is to cast aside the *Nissen Hut* misnomer and fill a critical gap in knowledge by conducting a general survey that identifies the huts most prevalently used in the First and Second World Wars. This research starts from the observation that there was not only more than just one type of temporary military building, but a wide assortment with a complex number of variations, materials and

¹¹ Ibid.

¹² Ibid.

¹³ *Materiel Culture: The Archaeology of Twentieth-Century Conflict*, ed. by John Schofield, William Gray Johnson and Colleen M. Beck (London: Routledge, 2002).

¹⁴ Such as the International Conference of the Construction History Society, The Annual Conference on Construction History, *The Architectural Historian*, *Military History Journal*, *Construction History*, *Antiquity*, etc.

forms. It sets out to provide some guidance to identification of the standard types. It seeks to examine the development of these buildings in Britain, including a study of materials and construction methods. Finally, this thesis seeks to highlight the link between wartime hutting and post-war housing.

Definitions

Within the framework of this thesis, the word *hut* will be employed to describe any variation of temporary military building, unless identifying a specific example. Although some of these buildings could be built to a bespoke design on site, this thesis is focused on those built to be generic, ‘one-size-fits-all’ buildings. Thus, a hut is defined as a structure built to a standard design, often prefabricated and mass produced, allowing for its rapid assembly on site with a minimum number of tools and unskilled labour. It was a building type developed to be able to increase the sheer output and speed of erection, at a lower cost, using alternative materials and construction methods in the face of labour and material shortages.

The term *prefabrication* is a bit more complex, and may have several evolving definitions. R.B. White said in his seminal book on the subject, *Prefabrication* (1965), that the goal of prefabrication:

[H]as been the provision of a greater number of building units at greater speed, with the use of less skilled labour (at least of site labour) and, if possible, at lower cost than could be achieved by traditional ways of building, and this within a given set of conditions at any given period (e.g. post-war scarcity).¹⁵

For the purpose of this work, White’s description of the objective of prefabrication is adopted along with the Ministry of Works 1944 definition, which is ‘the production under factory conditions of components that may be used in building, and of the pre-assembly of such components into complete units of a building.’¹⁶ As White said:

In Great Britain, prefabrication for its own sake has seldom been consciously aimed at. Although never fostered in the interest of a long-term housing policy, it was given its greatest impetus through the accidents of two major wars when almost any house at almost any cost was acceptable so long as it was a functional proposition and could provide a reasonable substitute for traditional materials and labour that were temporarily scarce.¹⁷

¹⁵ R.B. White, *Prefabrication: A History of its Development in Great Britain* (London: HMSO, 1965), p. 6.

¹⁶ As defined by the Ministry of Works in the *First Progress Report of the Standards Committee* (London: HMSO, 1944) and quoted in White, p. 3.

¹⁷ *Ibid.*, p. 4.

A feature of a number of these buildings was that they could be designed to be *demountable*, allowing them to be taken apart and moved to new locations to be rebuilt, an early form of portable architecture. This ability was most valuable on the front lines in France, and many British designs were taken across the English Channel. This made considerations of weight and ease of transport additionally important in hut design.

Scope

Whilst Europe and America had their own temporary military buildings, the scope of this thesis is primarily limited to those huts designed in Britain for wartime use. The only exception might be with the addition of the Second World War *Quonset Hut*, which was designed in America but erected in Britain by American forces. Whilst there was certainly some crossover in the employment of hutting and its uses, this thesis will focus predominantly on those used for military living accommodation, and not other technical or domestic buildings such as bakeries, dining halls, sheds, hangars, etc.¹⁸

Literature Review

Literature on Wartime Construction

The subject of wartime construction has been discussed most recently by Jean-Louis Cohen in his book, *Architecture in Uniform* (2011), but no detail is given on British hut designs.¹⁹ Publications directly relating to huts have tended to be limited to one particular type (namely the American *Quonset* and the British *Nissen*) or to those used by a specific organisation (such as Army camps, Air Ministry airfields, etc.). Julie Decker and Chris Chiei published a history of the *Quonset Hut* in 2005.²⁰ It details how the *Quonset's* design was initially based on the British First World War *Nissen Hut* until, after further study, it was decided that the *Nissen* was not ideal.

¹⁸ During the First World War, the Y.M.C.A. made use of at least one Adrian Hut for their work in France, and had their own line of bespoke timber huts constructed in and around London, especially near tube and rail stations. The Catholic Women's League and the Church of Scotland also used huts to serve as canteens.

¹⁹ Jean-Louis Cohen, *Architecture in Uniform* (London: Yale University press, 2011).

²⁰ Julie Decker and Chris Chiei, *Quonset Hut: Metal Living for a Modern Age* (New York: Princeton Architectural Press, 2005).

*The British had been on the right track but too many gadgets slowed erection; and with no insulation between inner and outer metal shells the Nissen huts were hot in the summer and cold in the winter.*²¹

The only feature they chose to keep was the relative semi-circular shape, and while it went on to be of extreme importance and usefulness in the Second World War, that one decision forever led to it frequently being confused with the Nissen. The invention and development of the *Nissen Hut* is covered in Fred McCosh's biography of Peter Nissen, published in 1997.²² The text is brief and, as will be discussed later, it contains some inaccuracies in relation to the development of huts during the First World War, but it does provide a useful reference to Nissen's life and his contribution to wartime hut design. Those two books are singular in covering one specific hut type. Other published research has focused on the huts used by particular organisations and while useful, do not provide for a wide range of other hut types. In 2006, John Schofield and William Foot put together an English Heritage report and survey on the history and development of Army Camps from 1858-2000. However, it only identifies a few Second World War huts by name, the rest being grouped together as either 'type not decided' or 'Nissen equivalents.' This further highlights the gap in research relating to these structures. Paul Francis provides a good survey in *British Military Airfield Architecture* (1996) in which he dedicates a chapter to military huts and sheds but this work is limited to only those types most prevalent on airfields in the Second World War, and does not include a full survey of other hutting designs or their historical development as a building type.²³ Keith Mallory and Arvid Ottar's *Architecture of Aggression* (1973), provides a useful chapter on the British armed camp again covering some hut designs but not all and again is limited in length.²⁴

Literature on Prefabrication and Portable Architecture

Beyond the scope of military architecture, huts also fall under the general definition of prefabricated and portable architecture and it is not unreasonable to examine how they have appeared in works on the subject. The most notable book in

²¹ Ibid, p. 6.

²² Fred McCosh, *Nissen of the Huts* (Bucks: BD Publishing, 1997).

²³ Paul Francis, *British Military Airfield Architecture* (Sparkford: Patrick Stephens, 1997).

²⁴ Keith Mallory and Arvid Ottar, *Architecture of Aggression: A History of Military Architecture in Northwest Europe 1900-1945* (Hampshire: Architectural Press, 1973).

this genre is Gilbert Herbert's *Pioneers of Prefabrication* (1978).²⁵ It covers the general historical developments of prefabricated building as a technology during the nineteenth century, and the correlation with colonialism, the Industrial Age, and the invention of corrugated iron. Herbert notes, 'In a sense, the history of prefabrication in the early days is the record of a successful response to the challenge of recurring crises.'²⁶ Although nearly forty years old, this book still stands as an essential foundation to prefabrication from which to better understand developments that came in the following century.

R. B. White and the Building Research Station published *Prefabrication: A History of its Development in Great Britain* in 1965, but this focuses only on the science of prefabrication as it pertains to civil architecture such as houses, flats, schools, farms and railway buildings.²⁷ Another notable author who has written several books in the field of portable architecture is Robert Kronenburg. His 1995 book, *Houses in Motion*, dedicates one chapter to military engineering, providing a general history of prefabrication similar to Herbert.²⁸ Kronenburg, however, discusses only the few more commonly known huts then moves on to give a broader assessment of twentieth century developments including German and American contributions, sheds, hangars, bridges, and even floating sea forts.

Finally, Adam Mornement and Simon Holloway's *Corrugated Iron* (2007), provides a chapter detailing that singular material's impact on the design of huts, hangars and hospitals in wartime.²⁹ They call attention to British engineer Isambard Kingdom Brunel who designed a prefabricated hospital with a corrugated iron roof at Renkioi, Turkey in 1855. Also noted are reports following the Crimean War addressing whether the new technology of prefabricated hutting should have been seen as an asset during the conflict and more widely used. The response by military engineers of this period was negative and that these buildings were a risk in the field,

²⁵ Gilbert Herbert, *Pioneers of Prefabrication: The British Contribution in the Nineteenth Century* (London: John Hopkins University Press, 1978).

²⁶ *Ibid.*, p. 2.

²⁷ R.B. White, *Prefabrication: A History of its Development in Great Britain* (London: HMSO, 1965).

²⁸ Robert Kronenburg, *Houses in Motion: The Genesis, History and Development of the Portable Building* (London: Academy Editions, 1995).

²⁹ Adam Mornement and Simon Holloway, *Corrugated Iron: Building on the Frontier* (London: W.W. Norton and Company, 2007).

due to high potential for failure due to missing parts or poor assembly.³⁰ While providing an interesting nineteenth century history to prefabrication, with respect to the First and Second World Wars, the authors only mention those huts that predominantly used corrugated iron, with the focus again being on the *Nissen* and *Quonset* huts.

Government Official Histories

Several official government histories were published that proved useful. The *History of the Corps of the Royal Engineers* released several volumes including both World Wars, which proved somewhat informative although they were written several decades after the events and should not be considered as primary sources.³¹ C. M. Kohan's *Works and Buildings* (1952) is a critical source to understanding the building programmes of the Second World War.³² It was published as part of the government's *History of the Second World War* series, and documents the timeline, politics, economics, methods of control, departmental building programmes, and other facets of wartime construction from 1936.

Primary Sources

By reviewing these published works, it is clear that a specific study and survey of the wider range of huts designed during the period of 1914-1945 was non-existent before the advent of this thesis. To that end, primary sources have been invaluable and varied from fire prevention guides to engineering manuals uncovered at the British Library and the Royal Engineers Museum. The First World War Director of Fortifications and Works, Major General Sir George Scott-Moncrieff, contributed a first-hand account of 'The Hutting Problem in the War' for the *Royal Engineers Journal* in 1924.³³ This proved essential to understanding the wartime building programme. The Institution of Royal Engineers published several official wartime accounts of which the most useful was *Work of the Royal Engineers in the European*

³⁰ Ibid, p. 108.

³¹ W. Baker Brown, *History of the Corps of Royal Engineers* (Chatham: Institution of Royal Engineers, 1952).

³² C. M. Kohan, *History of the Second World War: Works and Buildings* (London: HMSO, 1952).

³³ Major General Sir George Kenneth Scott-Moncrieff (1855-1924). See George Scott-Moncrieff, 'The Hutting Problem in the War', *Royal Engineers Journal* (1924), pp. 361-380.

War, 1914-1919: Work under the Director of Works (France).³⁴ Published in 1924, it contains a full set of various hut plans, available for consultation at the British Library. Another important paper was written by Brigadier General W. Baker Brown and published in five installments between September 1925 and December 1926 in the *Royal Engineers Journal*.³⁵ It gives direct insight into building works and contracts in his role as a chief engineer during the Great War. Similar articles were published during the Second World War, including one in 1940 by Major-General G.B.O. Taylor, Director of Fortifications and Works, which describes the problems of accommodation in wartime.³⁶ The Building Research Station published twenty-one *Wartime Building Bulletins* between 1940-1942 that provide an understanding into the state of materials testing and construction methods during the period.³⁷ The War Office published *Military Engineering: Accommodation and Installations* (1934) as a field guide, which provides insight into camp layout, billeting, materials and hut construction standards prior to outbreak of WWII.³⁸ Architectural magazines such as *The Builder* and *The Architect & Building News* provided a range of relevant articles, reviews, and advertisements from the period. Other primary sources included the individual patent applications, when available. The Airfield Research Group holds an archive of various original manuals, catalogues, documents and photographs in relation to airfields and their architecture that the group has collated over the years, which was invaluable and insightful. The Royal Engineers Museum and Archive in Chatham also contains a rich amount of material pertaining to construction and temporary buildings. Information on several lesser-known hut types was discovered in their collections.

Primary sources were also found directly from the buildings themselves. To this end much insight was gained through working with Great War Huts, a museum that works to save surviving First World War huts and put them on display at their location near Bury St. Edmunds. The opportunity was also taken to independently explore several surviving huts in a wooded area near RAF Molesworth.

³⁴ Institution of Royal Engineers, *Work of the Royal Engineers in the European War, 1914-1919: Work Under the Director of Works (France)* (Chatham: MacKay and Co., 1924).

³⁵ Brigadier General William Baker Brown (1864-1947). See W. Baker Brown, 'Notes by a Chief Engineer During the Great War of 1914-1918', *Royal Engineers Journal*, (September 1925), pp. 417-425.

³⁶ Sir George Brian Ogilvie Taylor (1887-1973). See G.B.O. Taylor, 'The Problem of Accommodating the Army on the Outbreak of War', *Royal Engineers Journal*, (June 1940), pp. 167-179.

³⁷ Building Research Station, *Wartime Building Bulletins No. 1-21* (London: HMSO, 1940).

³⁸ War Office, *Military Engineering: Accommodation and Installations*, 7 (London: HMSO, 1934).

Sources

Patents

Besides exploring the various source material and archives mentioned above, patents were an obvious resource for identifying wartime hut designs. Much time was initially dedicated at the British Library conducting patent searches, as well as exploring the online database of the European Patent Office, Espacenet. However, the patents proved elusive and difficult to ascertain. A patent search requires either the inventor's name or the patent year and number. Without these, one can search the subject indexes held by The British Library, but unfortunately, the term 'wartime hutting' is not offered as a subject name. Other terms were explored such as portable, hut, temporary building and shed. It was finally determined that the closest subject index heading was 'Buildings and Structures, Kinds or Types.' Unfortunately, this resulted in a large amount of information, mostly irrelevant to this research, often with the closest matches being in generic farm or garden shed buildings.

Frequently the only starting point of reference for a type of hut was a brand name or generic description mentioned in an architectural journal or wartime engineering document. Hut designs were also identified through a survey of historic maps, plans and other documents such as engineering manuals. These were frequently referred to only by their design name or description, not the name of their designer. This also obviously assumes that patents were always applied for, which was not always the case. Thus, due to lack of required search parameters, it was nearly impossible to find patents at the British Library for all but just a few. However, perseverance with querying the Espacenet database led to eventual success in tracking down a wider number of designs and inventors, many never before recorded or studied by modern historians.³⁹ This was accomplished by employing a combination search of Google's patent database, which allowed for general search terms such as 'portable hut,' then cross-referencing the resulting patent numbers and names on Espacenet. While Google's patent database does include PDF versions of many patent applications, it was discovered these were most often only for patents filed in the

³⁹ These can be found within the text and under *Patents* on page 300.

United States. For patents filed in Great Britain, it was necessary to search Espacenet, which provided more detail. This method allowed access to scanned copies of the original patent applications, which often contained plans and drawings. These have been included in the appendices, when available.

Research Questions

As previously discussed, there has hitherto been a lack of research into Britain's defence heritage, especially with respect to ancillary, support buildings. English Heritage's decision to commission a report on one type, military barracks, in 1994 only underscores the value of such study, especially in terms of determining historical significance and future statutory protection. Temporary wartime buildings from the First and Second World Wars were numerous and varied in both material and design. The lack of research and knowledge into the various types of huts means that today any study of landscapes or sites which encounters a temporary wartime building is relegated to referring to it in only the most general of terms. This was seen earlier in John Schofield's 2006 report on Army camps. Another example of this can be seen in English Heritage's 2009 archaeological survey of the Royal Military Repository training grounds in Woolwich. Analysis of remaining ground evidence and aerial photographs revealed the locations of 'small, nissen-type huts' and 'two low, flat roofed huts.'⁴⁰ This thesis will assist related research to not only more precisely determine the type of hut using a combination of measurements, site investigation and documentary evidence, but also to help provide further clues to their usage. Thus, this thesis is necessarily in large part a survey, to fill the existing gaps of knowledge about this building type, while concurrently challenging the *Nissen Hut* misnomer being applied to all wartime huts. As such, it is essential in studying this building type to determine how it originally evolved: what factors (political, material, industrial, social, etc.) provided the impetus for this type to develop? (In Chapter One, this line of questioning is followed to address how the invention of corrugated iron in 1829 and the Industrial Revolution, along with Britain's colonisation of distant territories played a large part). This thesis will go further to explore the first examples of prefabricated wartime buildings: how did they proceed to develop,

⁴⁰ S. Newsome, J. Millward, and W. Cocroft, *Repository Woods, Woolwich, Greater London: An Archaeological Survey of the Royal Military Repository Training Grounds* (London: English Heritage, 2009), p. 37.

improve or degenerate in the first half of the twentieth century? Was there a system to internal planning, hut arrangement, and purpose? What materials were used? How did material shortages and restrictions affect design? What factors influenced which hut design was used on site? Were they just the remit of military engineers or did civilian architects and builders make their own contributions? How did wartime prefabrication effect architectural development in the post-war era?

Organisation of the Thesis

This thesis is organised to begin with the earliest examples of temporary military buildings erected in Britain, exploring the foundation these provided for the hutting programmes of the First and Second World Wars. Specific huts are discussed within Chapter Two because the First World War had a smaller number of hut designs. The Second World War hutting programme is covered in Chapter Three, but as there were nearly triple the number of hut designs it was necessary to address these in proceeding chapters by dividing, identifying and grouping huts by their building materials. The last chapter will study the effects of wartime hutting on immediate post-war housing designs. Two appendices provide listings of the huts discovered in the course of this research including any available plans, measurements and further information.

Chapter One will focus on the earliest history of temporary military buildings in Britain. This will begin nearly two thousand years ago with a brief discussion of Roman military architecture, followed by Norman, Tudor and then Georgian temporary military buildings, highlighting how these antecedent developments contributed to wartime huts in the twentieth century. A series of questions are considered. Did the Romans and Normans prefabricate temporary military buildings? What are the general themes surrounding temporary military buildings? What are their advantages? How did these buildings as a type develop and evolve in methods and materials from ancient times through to the Victorian period? Are there similarities between the challenges faced in prefabricating temporary buildings in previous periods and those of the Second World War? When were temporary military buildings first standardised in Britain? When was military hutting first used? How did the invention of corrugated iron affect portable, temporary buildings? This thesis

seeks to answer these questions to lay the foundation for understanding the development of temporary military buildings as a building type before examining their further development during the First and Second World Wars.

Chapter Two will study the hutting programme of the First World War and discuss many of the huts designed during this period. It is hoped to identify the hut designs of this war and trace their development, providing new evidence and understanding of several important huts and their designers. It is also hoped to discover how scales of accommodation were established for huts, if these changed during the course of the war, and how these scales influenced hut layout. How much did a hut cost to build? Who did the work? What materials were used and were there material shortages that influenced hut design? What was an Armstrong Hut and was there more than one type? How were site locations chosen? What happened to wartime huts once the war ended?

Chapter Three will provide a similar analysis but with a focus on the Second World War. It is hoped to learn what interwar developments in materials and research contributed to later wartime hut design. When did the hutting programme begin and what were the main concerns? What materials were used? How did materials shortages influence design? Which materials were controlled by the government? What were alternative materials? How many huts were designed and who did the work? What type of contracts were used to pay builders? Did the Building Research Station contribute to wartime hutting, and if so, how? Did the influx of Americans into Britain during the war period influence hutting? Following this general survey, each of the subsequent chapters looks at a group of Second World War huts.

Chapter Four is the first of these material chapters. It will look at the use of timber in hutting during the Second World War. How was it initially used? In the face of shortages, how was it later applied or adapted in hutting designs? What types of timber huts were developed in the Second World War? What sheet materials were used for cladding?

Chapter Five will study huts constructed of composite materials that came into use primarily as a way of conserving and reducing the use of traditional building

materials. What were the main requirements driving the development of these huts? What materials proved most and least successful? What was plasterboard and how was it employed in hutting? What was wood wool? What were the names of huts constructed of alternative materials?

Chapter Six will study the use of concrete and asbestos as a substitute to timber and steel in hutting. How was concrete employed in hutting? How was asbestos incorporated into hut design? What were the advantages of these materials? Who were the most successful designers of concrete huts?

Chapter Seven will focus on what is perhaps the most iconic temporary military hutting material, corrugated iron. It will revisit its invention in the nineteenth century and discuss its history as a prefabricated material that found success in temporary architecture. It is hoped to learn how early building supply catalogues influenced its use in hutting, and how widely it was used in the Second World War. This chapter will identify a range of huts that used corrugated iron in its construction.

Finally, Chapter Eight will hope to provide insight into the post-war housing crisis and how the development of wartime huts during the Second World War may have influenced the post-war housing programme. How did alternative materials used in hutting translate to post-war houses? Equally, how did research into hutting materials extend to post-war housing? Which hut manufacturers made the leap from temporary military buildings to post-war civilian houses?

Together, these chapters aim to provide a clearer picture of how wartime huts came into existence as a building type, why they were important, and how they continued to develop with relation to advances in technology and materials, through two world wars. It will be necessary to explore ideas of portable versus static hutting, prefabrication, and their advantages over tents as accommodation.

However, to first understand temporary wartime buildings as a building type, one must start at the beginning. Not with the advent of corrugated iron and the Industrial Revolution in the nineteenth century, as one might presume, but at the true beginning where it seems much of British history begins: with the Romans.

Chapter One

Early Examples and the Idea of the Temporary Military Building

Prefabrication is often put forward as a modern solution to building problems. As this chapter will show, prefabrication for military and civilian buildings is neither a contemporary idea nor well-defined as a concept. Ideas of portable, prefabricated military buildings can be traced back to Roman times, whilst military huts as we think of them today seem to be more of a Georgian invention. This chapter will demonstrate that throughout history, what constitutes prefabricated, demountable, portable or reusable has always been more complicated than first supposed; and that wartime hutting of the twentieth century was a product that developed as a result of progress made over the previous centuries.

Evidence for Roman Military Prefabrication and Early Portable Architecture

The earliest widely reported notion of military prefabrication is the idea of portable military forts commonly attributed to the Romans. This idea is often repeated in children's textbooks¹ and commonly discussed among enthusiasts. In fact, it is a myth, supported neither by written nor archaeological evidence, but it does illustrate some useful concepts in military hut provision.

Romans were certainly experienced in using prefabrication for mass production. They are known for prefabricating a range of products, even heavy pieces such as sarcophagi, which were partially constructed and then shipped before being

¹For example, see Jane Chisholm (ed.), *Romans* (London: Usborne, 2009), p. 16.

finished off at their final destinations.² Nonetheless, it is highly unlikely they carried fully prefabricated forts with them, as has been implied in some groups. There is very little on fortification design in surviving Latin literature. The best description of Roman camp construction is in Josephus's *Jewish War* in Book 3, chapter 5 where he gives a lengthy description, but there is nothing in this description that suggests prefabrication. On the contrary, it seems to clearly show that the Romans took craftsmen with them but used locally available materials.³ Archaeological evidence generally supports this interpretation. In Britain, as one would expect, the Romans made use of locally available timber.⁴

As Josephus makes clear, Roman legions included a range of specialists precisely for the purpose of construction and engineering work.⁵ These would have included surveyors, carpenters, stonemasons, engineers, brickmakers, potters and even glaziers.⁶ Timber and turf were the initially-used building materials, which could later be replaced with stone if the site was selected for long-term occupation.⁷ Walling materials in Britain, especially in the first century, were wattle and daub or mud, and supported by timber frames. Archaeologist and professor John Wachter believed this type of building system, which was applied to most internal fort buildings, allowed the Romans the advantage of flexibility, as the building components could be prepared and transferred from one site to another, as necessary, or stockpiled in a central depot.⁸ If true, this would indicate an ancient form of portable, prefabricated architecture. To further corroborate this theory and give scale to the amount of materials required in building a fort, it is necessary to consider this excerpt taken from Wachter's book on the construction of the legionary fortress of Inchtuthill in a remote part of Scotland:

It has been calculated that about 16,000 cu m of structural timber were required for the Agricolan legionary fortress at Inchtuthill, weighing nearly 17,000 tonnes. To this must be added another sum for cladding and nearly a quarter of a million each of roof tiles and shingles, with appropriate supplies of nails and nearly a thousand tonnes of mortar. The question is: where did all this material come from? Tiles could have been made locally, although there is no evidence of their manufacture [...] As for the timber, it could have been

² Anna McCann, *Roman Sarcophagi in the Metropolitan Museum of Art* (New York: Metropolitan Museum of Art, 1978), p. 30.

³ See first section of Flavius Josephus, *Wars of the Jews*, translated by William Whiston (London: 1737).

⁴ Email correspondence with Andrew Birley (through the Society for the Promotion of Roman Studies) dated 25 February 2017.

⁵ Josephus, *ibid.*

⁶ John Wachter, *Roman Britain* (London: J.M. Dent & Sons, 1978), p. 20.

⁷ According to Rob Collins, post-doctoral researcher at Newcastle University's School of History, Classics and Archaeology.

⁸ Wachter, p. 24.

cut and worked on or near the site as needed, in which case it would not be seasoned [...] But it would have added immensely to the overall task of almost completing the fortress in three years. But there is ample evidence to show that, when forts were evacuated, much of the recoverable timber was salvaged, presumably for re-use, and many forts in the Midlands were being dismantled at or before the same time as Inchtuthill was being constructed. Moreover, there is evidence from Caerleon that wood for the first fortress was cut and worked off site and as much as five or six years before it was actually required. This in turn suggests the existence of stockpiles and also allows for a period of seasoning. Indeed, the creation of such stockpiles during the non-campaigning periods of winter, when the wood was in the best condition for felling, would have been ideal employment for the legions. Taking all these factors into consideration, a strong case can be made out to suggest that timber for Inchtuthill had been prepared in advance and was carted to Scotland from dumps further south, possibly from as far away as the Midlands and presumably by sea and river.⁹

Wacher thus concludes that there is a good chance that Inchtuthill was at least made from material imported for the purpose. Wacher's ideas about seasoning are not however accurate. Most Medieval timber was worked green because it is much easier to use timber in that form. If the timber was cut before the fort was constructed it seems likely it was merely because it was useful to stockpile timber so that it could be readily available when required.

Inchtuthill was abandoned a mere three years after construction began. The remaining archaeological evidence has led some historians to suggest that the Romans took the buildings with them. Bent nails left scattered around the existing postholes indicate that the timbers were pulled apart and the nails forcibly removed.¹⁰ Some historians have even raised the possibility that the Romans planned to reuse the timbers elsewhere. The most likely reason was probably more prosaic. Josephus is quite clear that Roman's destroyed their forts (normally by fire) on abandoning them, to avoid them falling into the hands of the enemy, a process that in no way implied re-use.¹¹ In any event salvaging materials from a fort for re-use elsewhere does not imply that the timbers were re-used in the same position or for a similar purpose. Despite what some historians may have been inclined to suggest, Inchtuhill was not in any sense portable or relocatable architecture. The most likely interpretation is that it was made using timber imported for the purpose because the area had timber in short supply and the fort (like all forts) needed to be built as quickly as possible. When it

⁹ Ibid, p. 193.

¹⁰ Ibid, p. 206.

¹¹ Josephus, *ibid.*

was no longer required, the fort was dismantled to prevent it being used against the Romans in the future (which was standard practice at the time).¹²

What seems clear from Josephus and elsewhere is that the Romans, needing to build quickly, were practicing standardisation, rather than prefabrication. A set layout, with everyone clear what task had to be carried out and where, had obvious advantages. However, this standardisation did not necessarily extend to individual buildings and could be easily adapted to local conditions. The fact that it was not rigid has even led some archaeologists to suggest that there was no standardisation at all.¹³ This seems to be taking interpretation too far. Elizabeth Shirley believes that while Roman military buildings did not in themselves follow an identical plan, they ‘do exhibit marked similarities and it is likely that the size, arrangement and spacing of their timbers did too.’¹⁴ In summary, the Romans may have had some buildings that could, to some degree, be demountable, portable and easily transported and they made these camps in a predetermined arrangement to make their erection faster, using standard details, but there is no suggestion that they developed mass-produced huts or fortresses and while they may have transported materials with them when they knew they would be scarce, in general they relied on local resources.

Medieval Examples

Evidence for Norman Prefabrication

While evidence of Roman prefabrication is questionable, the necessity of building swift fortifications remained. There is interesting evidence for truly portable military construction being used in Britain nearly a millennia later. There are claims that William the Conqueror brought three prefabricated castles with him across the English Channel in 1066.¹⁵ The Anglo-Saxon Chronicle describes William the Conqueror’s invasion of England in late September 1066:

¹² Josephus, *ibid.*

¹³ Elizabeth Shirley, *Building a Roman Legionary Fortress* (Stroud: Tempus, 2001), p. 19.

¹⁴ *Ibid.* See also R. Wilson’s *Roman Forts* (London: Bergstrom & Boyle, 1980) p. 14.

¹⁵ A. Wilkes and J. Ball, *Invasion, Plague and Murder: Britain 1066-1485* (Oxford: Oxford University Press, 2008), p. 17.

Meantime Earl William came up from Normandy into Pevensey on the eve of St. Michael's mass; and soon after his landing was effected, they constructed a castle at the port of Hastings.¹⁶

As the Battle of Hastings occurred approximately two weeks later, on 14 October 1066, this would have had to necessitate a swift construction process. The Bayeux Tapestry (c. 1070) illustrates this event, which depicts workers with tools and a mound with a tower behind. (Figure 1.1)



Figure 1.1 A portion of the Bayeux Tapestry depicting the Normans building a fort or castle at Hastings.

The Latin phrase on this panel of the tapestry ‘*iste iussit ut foderetur castellum at Hestenga caestra*’ translates in simplest terms to read: ‘this man has ordered a ditch dug and castle at Hastings.’ Key terms here are *castellum* meaning little fort and *caestra* (*castra/castrum*), a building used as a fortified military camp. Another source, William of Poitiers, a chaplain in William’s household, wrote of these events in the years immediately following the invasion:

The rejoicing Normans, once they had landed, occupied Pevensey, where they built their first camp, and built another at Hastings, providing a refuge for themselves and a shelter for their boats.¹⁷

Writing in 1070, the Benedictine monk William of Jumieges, recorded similarly:

[H]e crossed the sea and landed at Pevensey, where at once he built a strongly entrenched fortification. He entrusted it to his warriors and speedily went to Hastings, where he quickly raised another one.¹⁸

¹⁶ J. Ingram, *The Anglo-Saxon Chronicle* (London: J.M. Dent & Sons, 1914), p. 149.

¹⁷ Stephen Morillo, *The Battle of Hastings: Sources and Interpretations* (Suffolk: Boydell Press, 1996), p. 9

¹⁸ Elisabeth Van Houts, *The Normans in Europe* (Manchester: Manchester University Press, 2000), p. 115.

Whilst historians have debated the veracity and details of these accounts, such as whether the Normans actually landed at Pevensey or near it, they are clear that immediate action was taken to quickly build at least one fortified structure. The evidence in support of these forts being prefabricated comes from the Norman poet and priest Robert Wace, who wrote a historical account of the invasion in his book *Roman de Rou* sometime around 1160. He details that for the invasion the Duke [William] took with him carpenters, engineers, smiths and other craftsmen.¹⁹ When they landed:

*They occupied the advanced ground, next to where the archers had fixed themselves. The carpenters, who came after, had great axes in their hands, and planes and adzes hung at their sides. When they reached the spot where the archers stood, and the knights were assembled, they consulted together, and sought for a good spot to place a strong fort upon. **Then they cast out of the ships the materials, and drew them to the land, all shaped framed and pierced to receive the pins which they had brought, cut and ready in large barrels, so that before evening had well set in, they had finished a fort.***²⁰

Although Wace's account was written nearly a hundred years after the actual events, it is generally accepted to have made use of what could only have been eyewitness accounts.²¹ If indeed true, it would mean that the Normans brought prefabricated building materials with them to England to quickly establish a fort in less than a day. It is likely they would not have wanted to rely on locating and preparing available materials, when war was imminent. A ready-made fort would have given the Norman soldiers many of the same benefits experienced in the twentieth century: a firm shelter from a kit of parts that would allow rapid assembly on site. In fact, if we examine later medieval construction records we quickly realise that prefabrication of timber buildings was more common than might be supposed.

Evidence for Tudor and Stuart Prefabrication

In the Tudor period, timber houses in London were typically manufactured off-site due to space constraints and then transported and assembled on site. There was simply not enough space in the City for the preparing and sorting of materials, let alone construction all in one small area, with everyday traffic and pedestrians to also contend with. While early modern-era construction methods are outside of the scope

¹⁹ R. Wace, *Roman de Rou*, translated by Edgar Taylor (London: William Pickering, 1837), p. 124.

²⁰ Ibid, p. 128.

²¹ See Edgar Taylor's introduction to Wace's *Roman de Rou*, p. xix.

of this thesis, it is worth citing one particularly unusual example: Nonsuch House on London Bridge. (Figure 1.2) This is remarkable for being the very first recorded prefabricated dwelling to be shipped to Britain from abroad. Built in Flanders in 1578, it was floated up the River Thames, and reassembled on the southern end of London Bridge in 1579.²² It was a grand timber construction of at least four storeys, built to replace New Stone Gate, and erected ‘without mortar or iron, only wooden pegs being used to hold it together.’²³ Further, it was then painted to give the material illusion of brick and stone. It was demolished in 1757 when the bridge road was widened to provide greater access.²⁴



Figure 1.2 Two views of Nonsuch House on Old London Bridge. It was the first prefabricated house to be shipped from abroad to Britain for erection on site.

Board of Ordnance and Early Standardisation of Military Buildings

While ideas of prefabrication and standardisation are earlier innovations, the modern notions of barracks and military building were conceived in the Tudor period which was marked by a growth in military construction, specifically Henry VIII's coastal forts and defenses. Most significantly the period saw the further development of and increased responsibilities for the Ordnance Office, later known as the Board of Ordnance. First established in the fourteenth century, the Ordnance Office was initially part of the King's Privy Wardrobe and simply tasked with the management of

²² Liza Picard, *Elizabeth's London* (London: Phoenix, 2003), p. 25.

²³ Charles Knight, *London*, 1 (London: Charles Knight, 1841), p. 81.

²⁴ Peter Akroyd's book, *London: The Biography*, contains an illustration entitled *Seven Phases in the Evolution of Old London Bridge*, which depicts Nonsuch House on the bridge c. 1600, c. 1651-1666, c. 1710, and finally in 1727-1758 when it is noted to be 'much dilapidated.'

weaponry based in the Tower of London.²⁵ This office grew in the seventeenth century to encompass construction and oversight of all defence buildings.²⁶ In the reign of Charles II, the Ordnance Office was run by Sir Bernard de Gomme, who was Chief Engineer (1661-1685) and Surveyor General of the Ordnance. De Gomme believed in employing a standard set of designs for organisational buildings.²⁷ He applied these practices to build new forts and barracks throughout Britain. Historian James Douet has claimed that the earliest use of the word 'barracks' was applied under de Gomme's leadership in 1670 when the Irish Barracks were built in the Tower of London. 'These barracks were timber-framed and weather boarded houses built against the outside of the East Curtain, originally providing 30 rooms.'²⁸ These were not strictly military huts: although standard designs, they were intended as permanent military buildings, not temporary ones, and they were certainly not built to be relocated. However, Douet notes that a temporary lodging building for soldiers was set up in Hyde Park in response to the Great Plague in 1665, probably de Gomme's first attempt at temporary military architecture. This building was built to serve a particular purpose for a set period of time.

In 1676, de Gomme seems to have taken this concept further, perhaps seeing the usefulness of temporary accommodation. He designed and erected temporary lodgings that he described as 'huts' at Sheerness Fort, before embarking on the construction of the permanent barracks, houses and other ancillary buildings.²⁹ De Gomme set out to standardise permanent barracks buildings, including their layout, fixtures and fittings. He was so successful, in fact, that his general specifications and regulations for barracks furniture, established in the 1670s, were still being applied as late as the 1950s.³⁰ It is important to highlight this early connection between the progressive application of temporary buildings and the development of barracks for military use. There is a correlation between military lodging and the need for temporary structures to serve this purpose. De Gomme seems to be the first documented military engineer to employ what is essentially the basic concept of

²⁵ See also Nigel Barker's essay based on his unpublished PhD thesis 'The Architecture of the English Board of Ordnance 1660-1750.'

²⁶ Norman Skentelbery, *History of the Ordnance Board* (London: Ordnance Board Press, 1967), p. 9.

²⁷ James Douet, *British Barracks 1600-1914* (London: HMSO, 1998), p. 9.

²⁸ *Ibid.*, p. 8.

²⁹ *Ibid.*, p. 10.

³⁰ *Ibid.*, p. 25. Douet says the standard furniture was a bed shared by two men, a table, two wooden forms or benches and sometimes cupboards.

standardisation and temporary architecture in an organised military building programme.

Evidence for Temporary Military Buildings in the Georgian Period

The Georgian period saw the rise and expansion of the British Empire both at home and abroad and the increasing size of a standing army. In Britain, the population soared from five million in 1700 to a robust nine million in 1801.³¹ This growth was not necessarily reflected within the military building works until the end of the eighteenth century. The early politics of this period heavily favoured soldiers being quartered upon publicans and innkeepers, with a set reimbursement for service.³²

Throughout the eighteenth century, there was considerable concern that supporting a standing army with their own buildings might create an increase in military power that, in the wrong hands, could be used to overthrow the government. Thus, it was believed that billeting soldiers on private citizens and inns was a necessary evil, a method of keeping the military in check, preventing any possibility of a Cromwellian takeover of government, whilst also reducing expense to the Crown.³³ Douet notes that this was a practice that worked well in peace time when food costs were low, but became nearly catastrophic to towns and villages during wartime when food prices were high.³⁴ Likewise, this scheme was difficult on the soldiers who were required to be constantly on the move, never able to stay in one place for too long for fear of bankrupting the local community.

Military Expansion and the First Military Huts

By the time of the Napoleonic Wars (1793-1815), the conflicting attitudes surrounding military housing began to shift in favour of supporting an organised standing army with purpose-built accommodation.³⁵ The latter half of the century saw the rise of grand Georgian barracks built at Woolwich and the Horse Guards in

³¹ M. White, *The Rise of Cities in the 18th Century* <https://www.bl.uk/georgian-britain/articles/the-rise-of-cities-in-the-18th-century> [online article accessed 13 March 2017].

³² As described in the Mutiny Act.

³³ Douet, p. 38.

³⁴ Ibid.

³⁵ Ibid, p. 67

London, but these were isolated, elaborate cases. From 1792, concern over an invasion by Napoleon sufficiently rallied government and public opinion towards the common purpose of increasing the size of the military, its budget and building works. Douet notes, 'by 1804, half a million volunteers and militiamen were in arms, and the following year it boasted that 810,000 men were serving in the United Kingdom.'³⁶ This rapid increase in Britain's armed forces required an equally swift building programme, circumstances that would later be very similar to those experienced in the First and Second World Wars. Colonel Oliver DeLancey was named Superintendent General of Barracks and immediately commissioned and supervised barracks construction projects in Sheffield, Nottingham, Birmingham, Manchester, Coventry, Norwich and Hounslow.³⁷ However, more accommodation was necessary far and wide, and DeLancey met that need with temporary, timber hatted buildings.

During 1803, when, for the second time, there was a real fear of an imminent invasion, practically no masonry buildings were built at all, as the Department resorted to wooden huts and even to the traditional campaign expedient of sod-walled cabins.³⁸

Douet makes the distinction that these were not prefabricated huts, but would have been built on site of prepared timber.³⁹ This is actually quite reminiscent of the Roman and even Norman building methods mentioned earlier. It is unknown whether these huts were generic and part of a standard scheme based on the same set of plans, or bespoke, the work of an architect and skilled building team collaborating on site. It could even be argued that these Napoleonic huts were an example of prefabricated wartime huts in their earliest form. To do so, it is necessary to compare prepared timber and the process of prefabrication.

Prepared timber is that which has been felled, converted, sometimes seasoned and possibly ready-mortised before use.⁴⁰ If ready-mortised, the timber would be prepared with a rectangular crevice pre-cut to receive the tenon, creating a joint and allowing a far speedier erection process. Importing ready-mortised timbers from the

³⁶ Ibid.

³⁷ Ibid, p. 62.

³⁸ Ibid, p. 69.

³⁹ Ibid, p. 82.

⁴⁰ J.C. Kirk's article mentions how timbers were sometimes ready-mortised as frames to erect houses. See 'The Early-Modern Carpenter and Timber Framing in the Rural Sussex Weald', *Sussex Archaeological Collections*, 142 (2004), p. 98.

countryside was a convenient technique already practiced in cities where building space was tight. Architectural historian Miles Lewis supports the idea that traditional timber framing was easily adapted to the principles of prefabrication because in many ways it was inadvertently already treated as such.

It relied upon a minimum of nailed joints, because nails were or had until recently been expensive. Each joint was virtually tailor-made and effected with mortice and tenon, wedges, dowels or trenails. The members were large and purpose-made. Therefore if the members were numbered the frame could easily be taken apart and moved elsewhere for reassembly, regardless of whether it had been constructed with this in mind.⁴¹

It is important to note that, like Tudor timber framing, such a frame was demountable and portable but its parts were in no way interchangeable. Each number piece had to be used in exactly the right place. It was not until the advent of machine manufacturing that parts could be fabricated with such precision that any part could be used in its corresponding position on any building.

It is logical to think this method of prefabrication would be preferred in wartime, when, as has already been noted in Roman and Norman examples, speed is always essential. Prefabrication is fundamentally the preparation of parts to streamline the shipment of materials and work of building with the goal of reducing time, tools and overall skill needed.

Providence Chapel, located in Charlwood, Surrey, is an extremely unusual surviving example from this period. (Figure 1.3) It was originally erected in Horsham, Sussex in 1797, likely after an event that corresponds with evidence mentioned by Douet:

In August 1796, George III sent a message to his son [the Duke of York], requesting that he order DeLancey to prepare temporary barracks for 2,000 men at Ipswich, Canterbury, Horsham and Ashford.⁴²

Providence Chapel seems to creditably fall into this timeline, and was probably one of the buildings erected in response. The Historic England listing designation describes it as:

⁴¹ Miles Lewis, 'The Diagnosis of Prefabricated Buildings', *Australian Journal of Historical Archaeology*, 3 (1985), p. 58.

⁴² Douet, p. 73.

*A one storey weather-boarded building on a brick base. It has a hipped, slate roof with a brick chimney. The roof forms a verandah to the southeast elevation supported by eight wooden columns. A most unusual building, more typical of New England than Surrey.*⁴³

Douet corroborates a similar scene at the camp at Horsham:

*They were usually weather-boarded timber frames raised on brick footings [...] As well as eight of these barrack huts, there was one for a hospital, an officers' mess and servants' accommodation, stores, a guardhouse, a canteen, three cookhouses and a magazine.*⁴⁴

As the barracks were typically two-storeys, it would be more likely that Providence Chapel was originally one of the other ancillary buildings in the camp.

According to the Providence Chapel Charlwood Trust, the building was purchased in 1815 by a local farmer who had it dismantled and moved to Charlwood. This date corresponds with historic records, which states most of these temporary camps were either demolished or sold off by 1816.⁴⁵ It was re-erected and repurposed as a non-conformist chapel, called the Charlwood Union Chapel, only later being renamed Providence Chapel.

⁴³ Historic England, *Providence Chapel, Chapel Road, Charlwood (Grade II*)*, National Heritage List for England.

⁴⁴ Douet, p. 82.

⁴⁵ Ibid, p. 74.



Figure 1.3 Providence Chapel, originally a military barracks built c. 1797, later disassembled and relocated from Horsham, Sussex to Charlwood, Surrey in 1815. A Grade II* listed building, it was recently the beneficiary of a sizeable Heritage Lottery Fund award to provide for repairs and alterations for its latest repurposing as a school and community building. Photo credit: Hassocks5489, Wikimedia Commons.

In 2015, the Charlwood Society successfully applied for Heritage Lottery Funds to support its restoration and conversion for use as a school and community building. They were awarded a grant of £421,200 for this purpose, the work beginning in 2017.

Barracks of the Napoleonic wartime period were designed by several architects. One was John Sanders, a student of Sir John Soane, who was responsible for some of the work, but apparently never used standardisation of designs because the circumstances involved with each barracks was inevitably different.⁴⁶ Citing the Parliamentary Papers from 1806/7, Douet argues that much was actually built without the architect's drawings. Instead, contractors were issued specifications. In a time of high demand for quick, temporary accommodation, this would make sense. It seems more likely that notes would have been provided, rather than endless numbers of painstakingly copied architectural plans to be delivered to perhaps a hundred or more sites across Britain. Rather than complicated architectural inventions, these were basic

⁴⁶ Ibid, p. 77.

buildings that any contractor would likely have been able to construct with minimum instruction.

The Georgian method of using temporary timber hut construction to quickly solve accommodation demands during the Napoleonic Wars holds several interesting similarities with the circumstances Britain encountered again in the twentieth century. The most important perhaps is the pressure imposed on invention during wartime. In the eighteenth century, as well as the twentieth, temporary buildings were required in quick succession that could be erected with speed and ease, to provide immediate shelter to troops beyond what could be provided from a tent. Just like the Romans and the Normans, the most important factors here were speed of erection (to accommodate large numbers in the least time) and availability of materials. Both the Georgian and the Napoleonic periods were successful in carrying out these ambitious programmes of building works, in large part due to an organised government department specifically dedicated to the task. However, the twentieth century benefited from modern materials, advanced technology, standardisation and inventions not yet known in the Georgian period. It would take the Industrial Revolution of the nineteenth century to move building techniques, including technology, materials, and methods, forward to provide the firm foundation for wartime hutting as a building type in the twentieth century.

Nineteenth Century Examples

Development of Prefabrication and New Materials

The nineteenth century introduces the direct forerunners of wartime huts in the form of temporary prefabricated buildings. Gilbert Herbert's seminal work on the subject, *Pioneers of Prefabrication*, explores the nineteenth century history of prefabrication, asserting that it was colonialism and the demand for exportable and easily erected houses that spurred the concept of prefabrication to new heights. Herbert says that, in a sense, the history of prefabrication is a record of a successful

response to the challenge of recurring crises.⁴⁷ In this, the nineteenth century provided ample opportunity. The first half of the century was dominated by the expansion of the British Empire, especially in Australia, India and Africa. Practical solutions for housing, both civilian and military, were required that could be shipped across the globe. The demand only intensified with the advent of the Crimean War in 1853, which drew upon all of the modern advances of the age including prefabrication. Towards the end of the century, Britain was engaged in the Boer Wars (1880-81, 1899-1902), and further invention and adaptation were required. Indeed, if the Napoleonic Wars of the eighteenth century laid the foundation of utilising temporary barrack huts in wartime, it could be said that the nineteenth century provided the technology for proving they should be a mainstay in the wartime arsenal. While this progression in innovation was powered by colonialism and war, it was strongly aided by a shift to factory production and the invention of a new building material: corrugated iron.

Portable Buildings for Colonial Settlers

As early as 1787, Architect Samuel Wyatt and his nephew Jeffry Wyattville are noted as having designed several prefabricated buildings: cottages, a timber hospital, and a storehouse, all of which were shipped from London to Sydney, Australia to be used in the earliest settlement of New South Wales.⁴⁸ Herbert acknowledges that while little is known of these buildings, it is believed that they were quite basic:

[C]onsisting of precut timber studs, faced externally after erection with horizontal weatherboarding[...] A recent reconstruction of the hospital suggests that it was a frame structure of alternating modules, wide and narrow, filled in with premade wall, floor and roof panels.⁴⁹

⁴⁷ Herbert, p. 2.

⁴⁸ Born Jeffry Wyatt into the great family of architects, he petitioned to have his name changed to Wyattville in 1824. He is known for his work on Longleat House, Chatsworth, Wollaton Hall, and Windsor Castle. See Oxford Dictionary of National Biography. See also, Gilbert Herbert, 'The Portable Colonial Cottage', *Journal of the Society of Architectural Historians*, 31, no. 4 (1972), 261-275 (p. 261).

⁴⁹ Ibid.

Samuel Wyatt wrote in a letter:

*I exhibited the moveable Hospitals to the King [...] by taking down one of the buildings and putting it up again [...] in one hour, which gave general satisfaction.*⁵⁰

It would seem that news of these early prefabricated buildings spread. Shortly thereafter, the Sierra Leone Company ordered a prefabricated church, warehouse, several shops, two hospitals, several dwellings and four canvas houses, ‘described as “patent houses” of oilcloth, made in Knightsbridge’ at a cost of £8,430.⁵¹ These were shipped to Freetown in 1792. It is worth noting that this was just before the start of the Napoleonic Wars. Wyatville was still an apprentice in his Uncle Samuel’s firm where he worked until 1792, after which time he moved to his Uncle James Wyatt’s office. Soon thereafter, James was appointed Surveyor General and Comptroller of the Office of Works. He and Jeffry presumably spent a good portion of the 1790s designing barracks and other buildings during the war. Thus, the question arises: If Samuel and Jeffry were already marketing and shipping early-forms of prefabricated buildings to Australia and Africa from 1787-92, might the Wyatts have also taken the core principles of these buildings and applied them to designs for the Barracks Department, which likewise required buildings of a quick and easily erectable nature? It seems entirely possible. In any case, prefabrication as a building technique appears to have arisen at this point in history, with the demands of colonisation. As Herbert notes, it may not have been prefabrication ‘in its fullest sense, but the manufacture of building components and elements – posts, studs, boarding, and shingles – which could be put together simply, thus reducing the amount of site work needed,’ was a crucial step in its development.⁵²

This practice continued into the first quarter of the nineteenth century with the expansion of the British Empire. Australia and South Africa still retain a few properties from this period.⁵³ These early, prefabricated colonial homes were typically timber-framed with weatherboard. However, it is evident that prefabrication really took flight as a building system with the advent of the Industrial Age when:

⁵⁰ Herbert, *Pioneers*, p. 5.

⁵¹ G. Kubler, ‘The Machine for Living in 18th Century West Africa’, *Journal of the Society of Architectural Historians*, 4, no. 2 (1944), 30-33 (p. 31). See also C. Wadstrom, *Essay on Colonisation* (1794).

⁵² Herbert, p. 6.

⁵³ See Sydney Living Museum.

[M]en sought to devise construction processes that would shift the major component of labor from the crude area of field operations to the controlled, increasingly mechanized, conditions of the factory. This transfer from ad hoc building to planned, multiple production is one of the fascinating break points in the curve of architectural evolution.⁵⁴

The earliest, widely produced example was the Manning Portable Colonial Cottage, which Herbert claims single-handedly pushed prefabrication into an industry.⁵⁵ (Figure 1.4) The inventor, H. John Manning, was a London-based builder and carpenter, whose son emigrated to Western Australia around 1829 bringing with him one of his father's easily erectable and specially packed wooden houses. An advertisement in 1837 proclaimed:

Their usefulness and superiority of construction, either as stationary or moveable residences, as regards durability, comfort, and the facility with which they may be taken down removed, and refixed by the most inexperienced, is now fully ascertained and acknowledged.⁵⁶

Manning himself said of early emigrants:

Many persons who took out only tents, suffered severely in both respects; their tents being frequently blown down in the middle of a stormy night, and their goods being thus not only exposed to the weather, but to pilfering. Provided with a cottage of this description, an emigrant might land from a ship in a new country in the morning, and sleep in his own house on shore at night.⁵⁷

⁵⁴ Herbert, p. 1.

⁵⁵ Herbert, 'Portable Colonial Cottage', p. 264.

⁵⁶ Ibid.

⁵⁷ J. Loudon, *An Encyclopedia of Cottage, Farm and Villa Architecture and Furniture* (London: Longman, Brown, Green and Longmans, 1833), p. 256. See also: Herbert, 'Portable Colonial Cottage', p. 261.

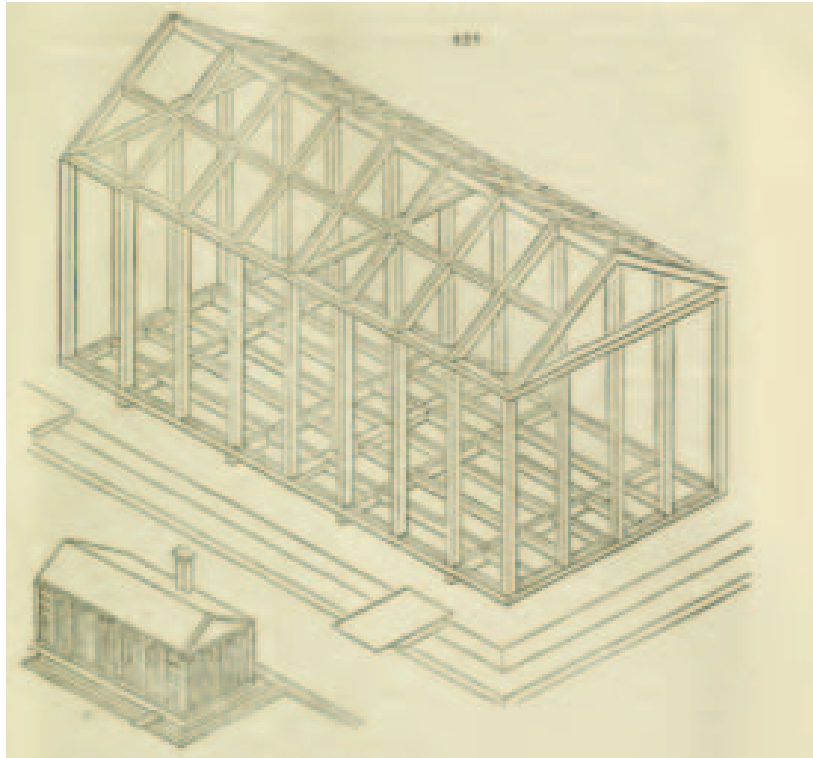


Figure 1.4 Manning's Portable Colonial Cottage as illustrated in Loudon's *Encyclopedia* (1833).

Invention of Corrugated Iron

One of the technological developments that made the manufacture of these early, prefabricated houses, as well as the wartime huts of the twentieth century, possible was the innovation of corrugated iron. Invented in 1829 by Henry Robinson Palmer,⁵⁸ an engineer with the London Dock Company, it was first used in the construction of a dockyard shed in 1830.⁵⁹ (Figure 1.5)

⁵⁸ Palmer is also noteworthy for having designed the first monorail system c. 1825.

⁵⁹ Also known as The Turpentine Shed. See A. Mornement and S. Holloway, *Corrugated Iron: Building on the Frontier* (London: WW Norton & Co., 2007), p. 11.

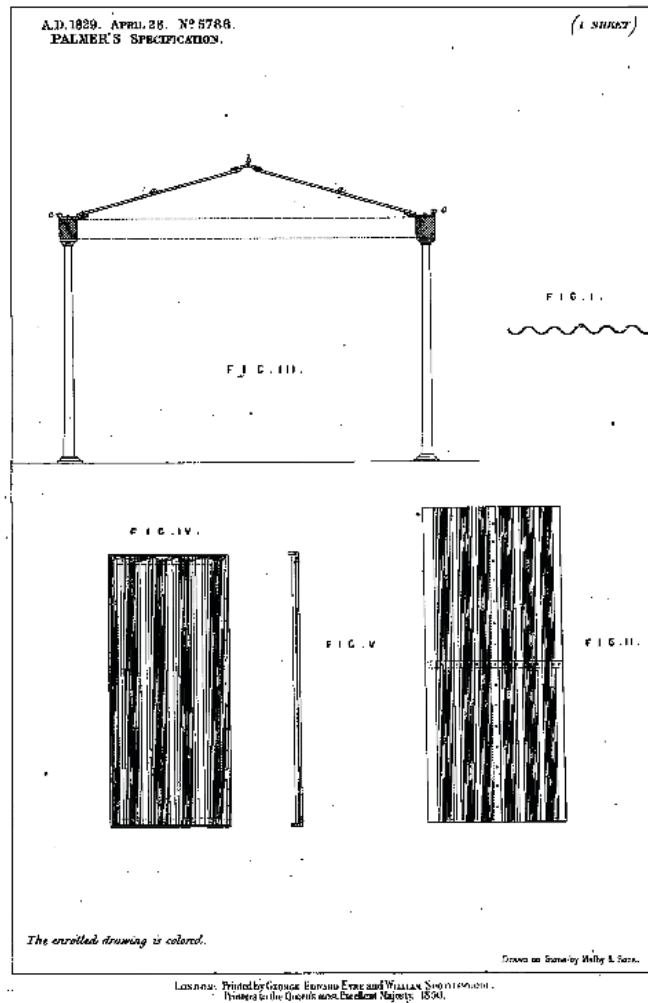


Figure 1.5 Patent number 5786, Palmer's 1829 patent for corrugated iron. (British Library)

Palmer devised a way to take thin, flat sheets of iron and put them through a series of fluted rollers, creating undulating indentions, the end product being useful as a building material, most especially as roofing. However, part of the ultimate genius of Palmer's invention was in how he applied material to design. He exploited the bendability of the material and formed it to create a self-supporting, semi-circular arch capable of covering large areas, held in place by only a series of cast iron columns. The first building Palmer employed this system of pairing material and design became known as The Turpentine Shed at London Docks. (Figure 1.6) It was a method 'that gave buildings a distinctive barrel-shaped roof, a form that has since come to define the material.'⁶⁰

⁶⁰ Mornement and Holloway, p. 13.

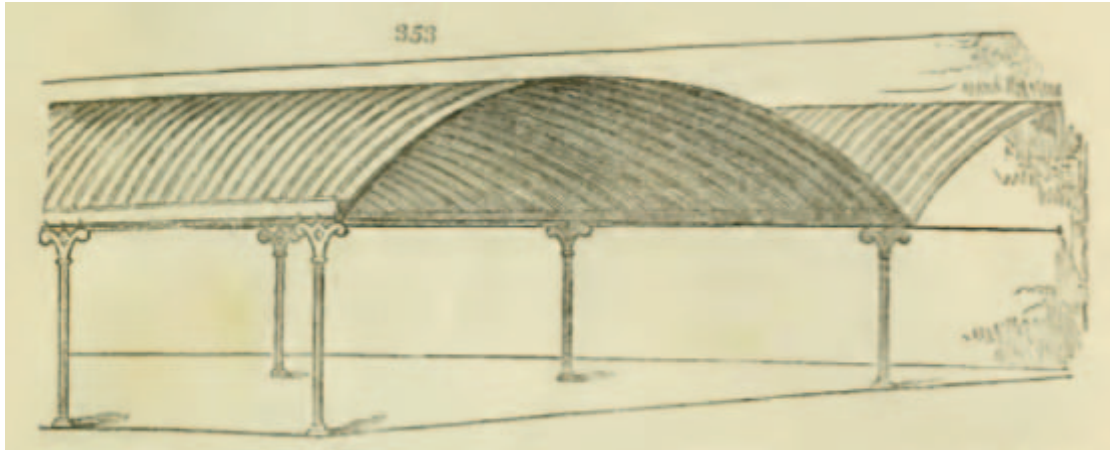


Figure 1.6 Palmer's Turpentine Shed at the London Docks (c.1830) with his patented corrugated iron roof design. Taken from Loudon's *Encyclopedia* (1833).

Palmer's invention was instrumental and pivotal in the progress of materials and engineering design. Besides its adaptability and general usefulness across the building spectrum, it provided the foundation for several of the most successful wartime hut designs of the twentieth century. Somewhat surprisingly, Palmer never capitalised on his invention beyond employing it in engineering efforts at the dockyard. Perhaps he could not fully comprehend or imagine the impact and contribution of corrugated iron in the modern world. Shortly after the patent was certified, he sold all rights to it to his carpenter Richard Walker. It was Walker who, by 1839, was involved in the manufacturing and marketing of corrugated iron and advertised it as a prime material for:

[R]oofs, doors, shutters, partitions, safety rooms, park enclosures, verandas and all kinds of portable buildings for exportation... A sheet of iron so thin that it will not sustain its own weight, will, after this process, bear 700 lbs [...] It is particularly recommended for Portable Buildings for Exportation. The small space occupied in stowing them, when respective parts are separated, rendering their conveyance cheap and easy.⁶¹

Once Walker's ownership of the patent expired in 1843, the material became more widely utilised thanks to mass production methods and relatively low cost.⁶² Indeed, if Palmer had lived beyond 1844, he may have been astounded to see the versatility and widespread use of corrugated iron on everything from roofing for naval shipyards and train stations, like Brunel's Paddington Station (1851-54), to churches, small houses and farm buildings. It was highly regarded by even Prince Albert, who

⁶¹ Ibid.

⁶² Ibid, p. 20.

after seeing it at the Great Exhibition of 1851, ordered a new ballroom constructed entirely of the material at the Balmoral Estate.⁶³ It was designed by Bellhouse and Co. of the Eagle Foundry, Manchester.⁶⁴

Thus, corrugated iron became a lightweight, versatile material that builders employed to meet a variety of demands in the nineteenth century. Possibly the largest was the rising global demand for a range of portable buildings, not just for colonists but also for gold prospectors in the boom for minerals that hit mid-century. In 1849, an article in London's *Daily News* commented:

*The tide of emigration has, it seems set in so strongly of late, that it occasionally sweeps away to the antipodes entire habitations. Hence we find that there are two firms solely employed in building portable houses "for exportation."*⁶⁵

Small houses were required as well as warehouses, churches, shops, offices, barracks and farm buildings. These were, essentially, the core foundational buildings for establishing any new society.

One key British firm in the manufacturing of portable buildings during this period was Samuel Hemmings of Clift House, Bristol. One advertisement from 1852 described these buildings as 'simple in construction, perfect in arrangement, efficient in character, and easy and inexpensive of carriage.'⁶⁶ A typical dwelling made of corrugated iron was comprised of a sitting room (13 ft by 10.5 ft), three bedrooms (each 7.5 ft by 6.5 ft), and a kitchen complete with stove. The house was flat-packed and ready for transport, including all doors, flooring and windows, weighing around two tons and measuring 2 ft by 7 ft. (Figures 1.7 and 1.8)

⁶³ Ibid, p. 29.

⁶⁴ 'An Iron Ball-Room For Balmoral', *John Bull*, 8 September 1851, p. 571.

⁶⁵ Leigh Hunt, 'The Town and its Memorable Characters', *Daily News*, 22 February 1849, p. 2. [Accessed via the British Library Newspaper Archive]

⁶⁶ *Lloyd's Weekly Newspaper*, 24 October 1852. [Accessed via the British Library Newspaper Archive]



Figure 1.7 Hemming's of Bristol shipped this Parsonage House for use by colonists in Melbourne Australia, c. 1853. Image credit: Caroline Simpson Collection, (L2005/8-2b).

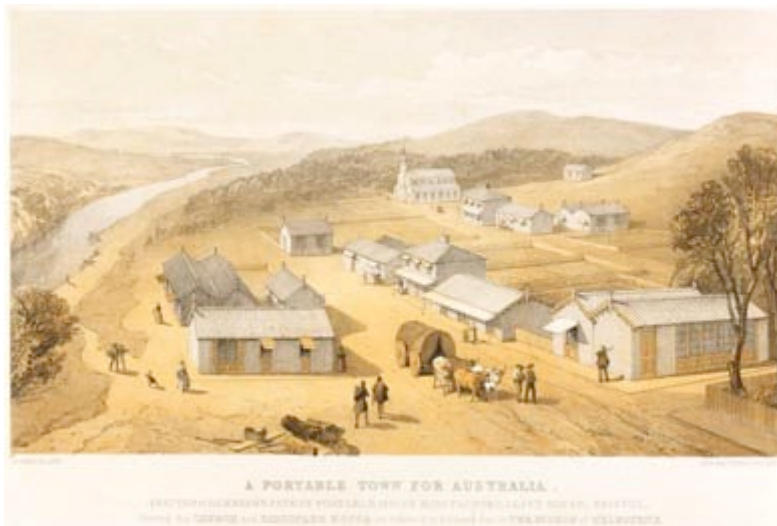


Figure 1.8 Hemming's Portable Town for Australia c. 1853. Image credit: Caroline Simpson Collection, (L2005/8-1).

The Gloucester Hut

By the time of the Crimean War (1853-56), prefabricated buildings were seen as a new solution to provide better shelter to troops, especially through the winter months, both in England's army camps and in the Crimea. It is interesting to note that despite the progress made with corrugated iron, prefabricated timber was predominantly the preferred material for huts during this period. Herbert believes that there is some evidence that corrugated iron huts were employed, and that it is probable that they were purchased from John Walker (son of Richard who bought the patent from Palmer in 1829), as Walker held business dealings with the War Office in

1854.⁶⁷ However, perhaps due to wartime shortages or restrictions of iron, timber was more readily available and thus, timber huts more widely used. When Britain entered the conflict in 1854, the government contracted with the High Orchard Saw Mills and the timber merchants, Price, Walker and Co. of Gloucester for a timber hut. It became known as the Soldier's Hut or Gloucester Hut. Troops were supplied with the materials and directions to erect the huts themselves, in order to secure them 'from the effects of weather in a better manner than tents will do, when it is intended to occupy ground during the wet season.'⁶⁸ It could also be adapted for use as a hospital.⁶⁹ In total, around 1,400 prefabricated huts were shipped to the Crimea between December 1854 and February 1855. Each measured at 16 ft wide by 28 ft long, with occupancy space for up to thirty men, and included a stove for heating and cooking.⁷⁰ There was a door and window at one end, and two sliding windows at the other end. The exterior was made up of timber boarding and a felt roof.⁷¹ (Figures 1.9, 1.10, and 1.11) *The London Illustrated News* described these features and its portability in December 1854:

*The whole are carefully fitted up, taken down, packed into easy, portable packages for the convenience of stowage in the ship's hold, and easy removal afterwards, hooped together with iron, and systematically lettered. The letters and numbers on each package will agree with that on a lithographed plan, which is to accompany each house. A box will also be sent with each house, containing two hammers, two gimlets, two pair of pincers, and 14 lb. of nails, in case the Sappers and Miners, who are to erect them, have not sufficient at their disposal.*⁷²

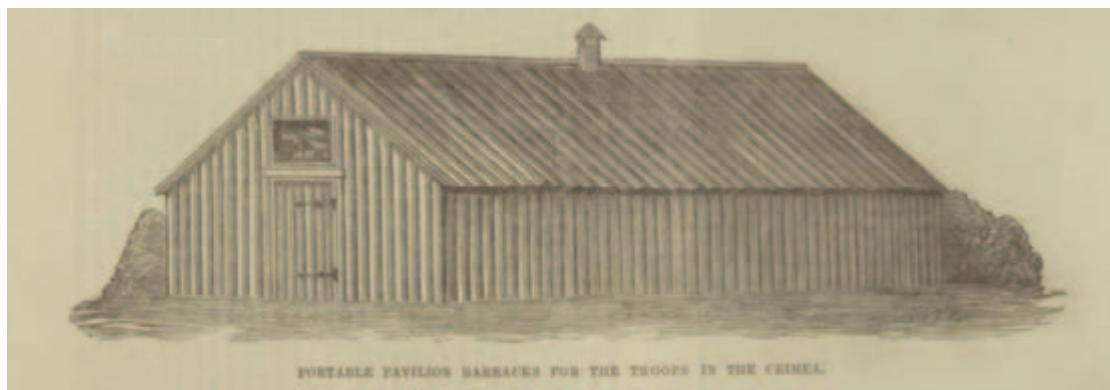


Figure 1.9 A drawing of The Gloucester Hut, a prefabricated timber hut, exported from England to Balaklava from December 1854. *The London Illustrated News*, 9 December 1854.

⁶⁷ Herbert, *Pioneers*, p. 92.

⁶⁸ Corps of Royal Engineers, *Aide-Memoire to the Military Sciences*, 2 (London: John Weale, 1850), p. 291.

⁶⁹ *Ibid.*

⁷⁰ *Ibid.*

⁷¹ Herbert says the Gloucester Hut was 11 feet high at the ridge and 6 feet high at the wall plate. 'The structure consisted of four structural bays with 3"x3" posts, a light collar truss, and a gable-ended roof; the cladding of the walls and roof was 8"x 3/4" boards.' *Pioneers*, p. 77. However, the *Aide-Memoire* published by the Royal Engineers after the war cites it as being 14 feet high to the ridge.

⁷² *The London Illustrated News*, 9 December 1854, p. 575.



Figure 1.10 Photograph of what appear to be Gloucester Huts, next to tents, in Balaklava during Crimean War. (© IWM Q 71191)

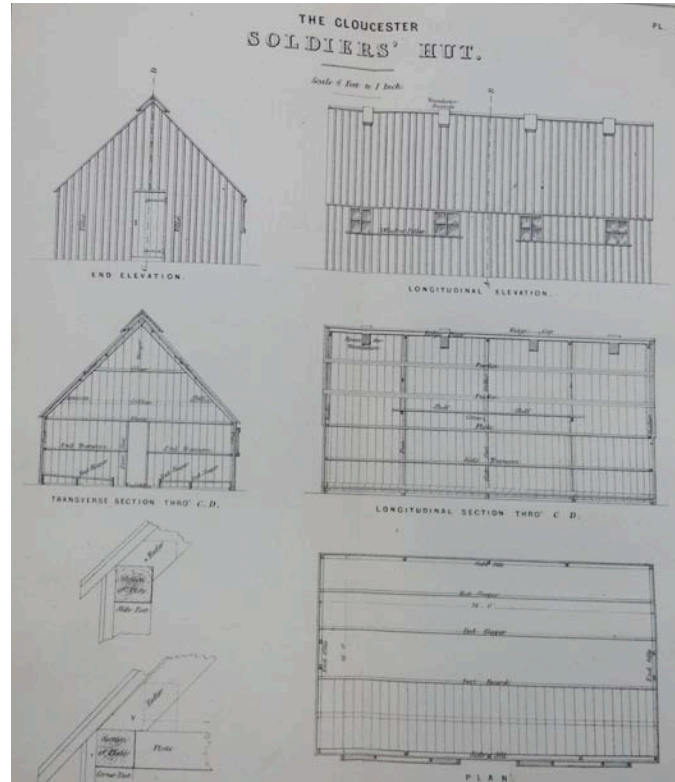


Figure 1.11 'Report on Hutting' by W. Bailey and F. Wakefield, 1856. Includes this plan of a type of Gloucester Hut. (Royal Engineers Museum)

Around the same time at Aldershot Camp, timber huts were erected to shelter twenty thousand men. (Figure 1.12) These were situated in two rows, with twenty-four huts in a row, spaced at twenty feet intervals. Each hut was equipped with a stove. (Figure 1.13) However, these are a different plan than from the Soldier's Hut shipped to the Crimea. The Aldershot huts lack windows at the end and instead have narrow, six light horizontal windows on each side. It could be a variation of the original design. A plan published in an 1855 report on *Different Principles and Methods of Hutting Troops*, shows an entirely new variation entitled *The Gloucester Soldier's Hut*.⁷³ The gabled end windows of the original hut have been removed from this design and replaced with four, four light windows on the longitudinal elevations. Thus, it is possible that deviations in window light and placement may have varied.

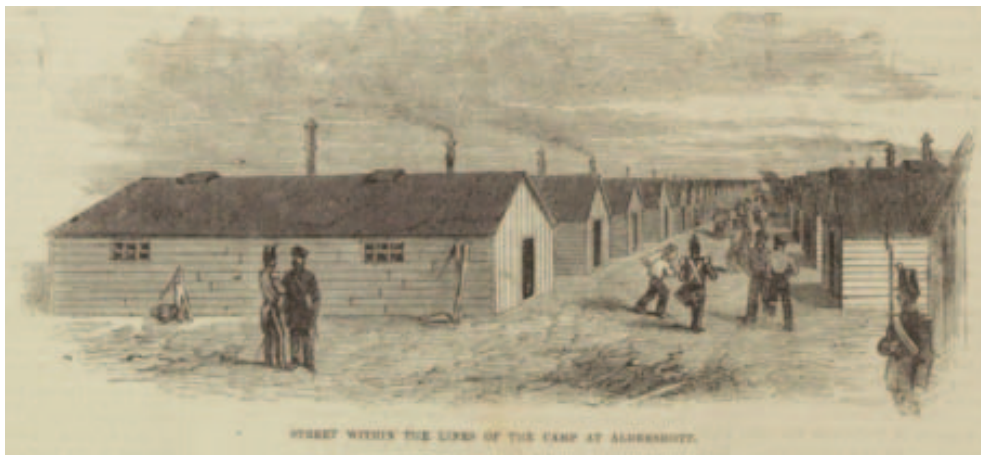


Figure 1.12 Soldier's huts at Aldershot. Image credit: *The London Illustrated News*, 12 May 1855.



Figure 1.13 Interior of a soldier's hut. Image credit: *The London Illustrated News*, 12 May 1855.

⁷³ War Office, *Report on Different Principles and Methods of Hutting Troops* (London: War Office, 1855).

Another important contribution to the development of temporary military buildings during the mid-nineteenth century was the construction of a prefabricated hospital at Renkioi, Turkey to the design by Isambard Kingdom Brunel. (Figure 1.14) Brunel was the architect behind Paddington Station, built between 1851-54, with its impressive corrugated iron roof, spanning 102 ft wide by 700 ft long. He was also a founding member of the Galvanised Iron Company. Brunel believed the hospital should conform to these principles: it must be adaptable to any environment, extendable when necessary to accommodate anywhere from 500 to 1,500 patients, comfortable, portable and constructed of inexpensive materials.⁷⁴ His design met these objectives, but more importantly, it was successfully carried out by plan on the ground when it was constructed during the early summer of 1855.

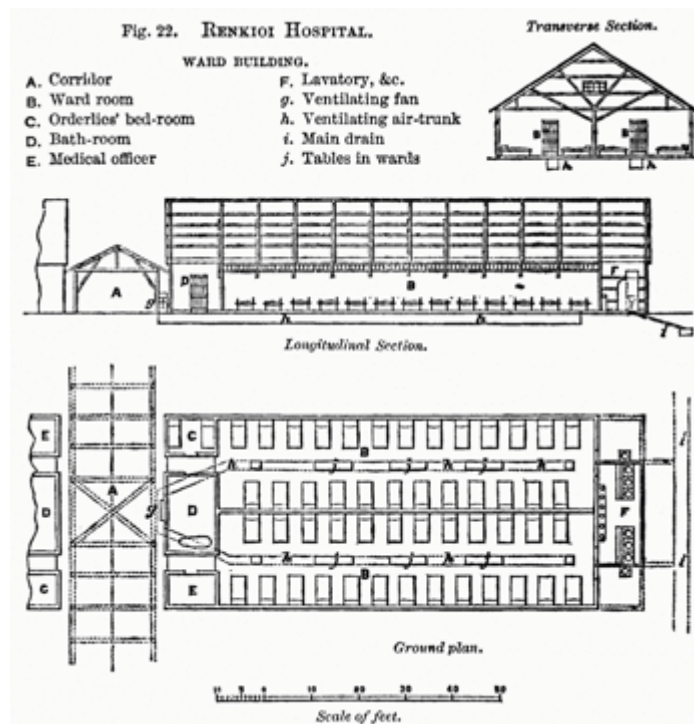


Figure 1.14 Brunel's Renkioi Hospital, constructed of prefabricated timber, 1855.

The second half of the nineteenth century saw the global expansion of the corrugated iron market, increased varieties in its application, and the continued use of both timber and iron prefabricated buildings around the world. For instance, by the 1890s in colonial South Africa, tens of thousands homes were constructed of

⁷⁴ Herbert, *Pioneers*, p. 87.

prefabricated timber and iron. Prefabricated houses were the norm. Herbert says that while the material was never admired for its aesthetic quality:

The ready availability of the necessary building materials and components, ease of construction, and relative economy were all factors in the enduring popularity of the iron house [...] Another factor in its continued use [...] was its lack of “fixedness”, where the land was often only held in leasehold, and where an atmosphere of chance, change, and indeterminacy prevailed, the “portable” quality of the readily demountable iron house was [...] a redoubtable asset.⁷⁵

Despite this progress with prefabrication, and its successful application in the Crimea, the British army still seemed to prefer the use of tents as the most convenient form of ready shelter. This seems to have been the case during the two Boer Wars, which came at the end of the century. The lack of proper shelter, especially for the wounded, is blamed as one leading cause for the conflict’s heavy losses.⁷⁶ It was not until the turn of the twentieth century that strides were made to once again employ prefabricated buildings, in the form of blockhouses and hutted barracks. This job fell mainly to the Royal Engineers and they seem to have used a combination of both iron and timber.

Lessons from the Boer Wars

Whilst British ingenuity seemed to have capitalised on developing prefabricated technology during the Crimean War with the application of temporary wartime buildings such as the Gloucester Hut, they failed to employ them on a large-scale basis during the Boer Wars (1880-81, 1899-1902). There were some prefabricated successes on the front lines, largely by the Royal Engineers led by Major S. Rice, in the form of blockhouses. These were small, guard shelters set up along roads and railway lines. Eight thousand were built by factories throughout South Africa. They were made of corrugated iron with timber frames, entirely standardised into a series of machine-made interchangeable parts, for quick erection on site. Some were gabled, whilst others later took a circular shape, allowing for a defensively beneficial 360 degree viewing area. (Figure 1.15)

⁷⁵ Ibid, p. 141.

⁷⁶ Mornement, p. 110.



Figure 1.15 A blockhouse guarded by members of the 2nd Battalion of Royal Inniskilling Fusiliers in South Africa, 1902. (© Inniskillings Museum)

However, these were small specific buildings and not intended as a general housing solution. According to Major General Sir George Scott-Moncrieff, who acted as the Director of Fortifications and Works for the War Office from 1911-1918, the Army did make use of ‘corrugated iron buildings lined with wood’ to extend existing training centres in Britain during the Boer Wars, but that these were unsatisfactory.⁷⁷ Instead, the British Army reverted to once again using tents. Tents, whilst obviously portable and easy to erect, were recognised as providing little shelter from harsh conditions and an insufficient standard of living, especially during winter. As one soldier recounted of life in a tent:

*We have had continuous rain for over a fortnight and the past week has been far beyond a joke. Our tents will not stop the rain coming in and many nights were spent, with candles lit, in trying to stop the rain from soaking us.*⁷⁸

Over the course of the Boer Wars, this lack of sufficient shelter had a debilitating effect on troop morale and, even more devastating, is believed to have been a key factor that contributed to poor health and a high mortality rate amongst the soldiers. It is interesting to note that shortly after this conflict ended in 1902, Britain

⁷⁷ George Scott-Moncrieff, ‘The Hutting Problem in the War’, *Royal Engineers Journal*, (September 1924), 361-380 (p. 361).

⁷⁸ Letter from Private Alexander Thompson, 9th Northumberland Fusiliers, Bovington Camp, November 1914. See Charles Messenger, *Call to Arms: The British Army 1914-18* (London: Cassell, 2005), p. 113.

spent vast amounts of money on prefabricated barracks to better shelter soldiers assigned to South Africa and other occupied territories.⁷⁹

Early Twentieth Century Examples

Presumably due to the deficiency of adequate temporary accommodation in the Boer conflict, the War Office engineers spent the following years focused on developing designs for inexpensive buildings that could be shipped and quickly erected but could also be highly adaptable to variety of requirements. Time was taken to consult with Army medical staff and the Quartermaster-General, to take all possible necessities and contingencies into consideration.⁸⁰ One result was a temporary building design constructed of steel and concrete. It had the opportunity to be put to the test in response to an earthquake in Jamaica in January 1907. A hospital was needed, and this building was sent along with a skilled construction crew to erect it. It took one month to build, but the end product was a hospital that was of such high quality, the medical staff later turned down offers of a more permanent hospital, as this one thoroughly suited their needs.⁸¹ By this example, it would seem the Army engineers succeeded in producing a new building type that melded practicality and efficiency with prefabricated technology.

The nineteenth century provided Britain with not only an extended range of building processes, materials and constantly advancing technology but also the combined experience of utilising prefabricated buildings in global colonisation and in war, beginning with the Napoleonic Wars, followed by the Crimean War and then, to a lesser extent, the Boer Wars. Although the Crimean provided the first temporary military hut to be produced on a somewhat large scale, it is worthwhile to note that overall, there does not seem to have been a wide variety of design, material, or even application by the Army. Prefabrication was ultimately the dominion of civilian engineers and builders, and dominated by colonial demand. However, this was soon to change. The early practices of prefabrication in Britain along with the firm

⁷⁹ *Pioneers*, p. 145. Herbert notes that by 1905, Britain had spent £2.5 million on building prefabricated barracks in South Africa and in other territories where it wanted to keep a firm presence.

⁸⁰ Scott-Moncrieff, p. 363.

⁸¹ *Ibid.*, p. 361.

foundation set in the eighteenth and nineteenth centuries provided the necessary skills, knowledge, and resources to meet the demands for what came next: Britain's entry into the First World War.

Chapter Two

Huts of the First World War (1914-1918)

Despite the large number of books and research into nearly every facet of the First World War, there is a distinct lack of knowledge into the array of temporary military buildings that were designed, built, shipped, and utilised during this period. If the nineteenth century saw a shift from tented accommodation to the introductory use of huts on campaign during wartime, the twentieth century saw their development as a building type with a huge expansion in diversity.

Wartime proved to be an intense period of progress and rapid production as the escalating demands of war created pressure to solve problems and provide the armed forces with whatever was necessary to win the war. The need to provide better accommodation for troops, especially in winter, was a driving force to new design. Initially, this requirement of accommodation was only a consideration for the home front in Britain during the build up of forces. With the assumption that the war would be short-lived, there was initially an expectation that troops in France would live in tents, billets, empty buildings, open fields or in trenches. As it became clear that victory would not be secured so quickly, it was recognised that better accommodation in France should also be provided. This would require huts that could not only be easily and quickly constructed, as in Britain, but also have an element of portability, packaged compactly, allowing them to be easily shipped across the English Channel and transported to selected sites, and to be moved again if or when the front moved.

August 1914: Declaration of War and a New Building Programme

On 3 August 1914, the day before Britain entered the First World War, Lord Herbert Kitchener was boarding a ship from England to his posting in Egypt, when a message reached him to immediately return to London and meet with Prime Minister Herbert Asquith. Kitchener was a career Army soldier, a Royal Engineer and a distinguished hero of the Boer Wars. Asquith asked him to stay in England and take up the role of Secretary of State for War.¹ It is said that Kitchener is one of the few who recognised this war would last more than a few months, and that it would require a huge investment of manpower. Britain's standing peacetime force was 247,798 men.² With this in mind, Kitchener immediately issued a call to arms across Britain, a recruitment campaign that saw over 100,000 men enlist within the first few weeks, with that figure rising exponentially during the following months. (Figure 2.1) By the end of 1915, nearly two and a half million civilian men voluntarily joined the British Army.



Figure 2.1 Lord Kitchener depicted in a famous wartime campaign poster.

Just as it had done in the Napoleonic Wars (see Chapter One), this massive surge in the Army population quickly necessitated discussions on how to best accommodate and train the new soldiers. Peacetime military accommodation at the various camps was only available to shelter 174,800 men, a figure which provided 600 cu ft (or about 60 sq ft) per man.³ Necessity required fresh measures to be taken

¹ Charles Messenger, *Call to Arms: The British Army 1914-18* (London: Weidenfelt and Nicolson, 2005), p. 20.

² *Ibid.*

³ John Schofield, *Army Camps: History and Development, 1858-2000* (Swindon: English Heritage, 2006), p. 5. See also, W. Baker Brown, 'Notes by a Chief Engineer During the Great War of 1914-1918', *Royal Engineers Journal*, (December 1926), 422-436 (p. 423). Regarding the use of cubic feet shifting to square feet measurements, Baker Brown said, 'It was early decided

to properly support Kitchener's New Army. To understand the magnitude of what was required, the need extended beyond sleeping quarters, but to everything else essential to an actively operating army including hospitals, stables for their horses, veterinary hospitals, dining halls, kitchens, bathhouses, and training facilities, amongst a bevy of others. To begin to meet these needs, the War Office reduced the scale of accommodation standard to 400 cu ft per person, (or about 40 sq ft), so more men could be assigned to each building, then eliminated the provision of married quarters for military families.⁴ (By comparison, for the same reasons in the Second World War, space was reduced from 45 to 36 sq ft per soldier).⁵ These actions increased accommodation capacity for a further 87,000 men.⁶ Bell tents, which had once been standard surplus accommodation for British army camps, were sufficient to relieve short-term requirements, but only as a temporary measure in fair weather, as they were not ideal for winter use.⁷ Obviously, a larger-scale solution was needed. Hutted accommodation that could be erected quickly and meet all of these needs were the obvious answer.

Despite good intentions, 'the problem of hutting,' as Scott-Moncrieff called it, was a continuous issue. Just before his death, he wrote a first-hand account for the *Royal Engineers Journal* in 1924, elucidating the extreme difficulty the War Office had faced during the war in supplying enough accommodation.⁸ That article provides rare insight from a key source and will be utilised in this chapter as one of the main references for understanding hutting during the First World War.

With these early, intense demands, it is perhaps unsurprising that the provision of huts became one of the foremost recurring topics in wartime preparations by Parliament.⁹ In the House of Commons, Prime Minister Asquith, was asked if he was aware of the over-crowding issues that billeting was going to cause in England, and what preparations the Government would take to ensure sufficient housing for the

that the ordinary wooden hut without ceiling might be considered as having a cross section equivalent to an average height of 10 feet, so that in practice the cube might be neglected and we could make all our calculations in terms of floor space.'

⁴ Schofield, p. 5, and Baker Brown, p. 423.

⁵ Kohan, p. 269.

⁶ Schofield, p. 5.

⁷ George Scott-Moncrieff, 'The Hutting Problem in the War', *Royal Engineers Journal*, (September 1924), 361-380 (p. 366).

⁸ *Ibid.*

⁹ Hansard, *House of Commons Debates*, 66 (14 September 1914), cc773-4.

troops in the coming autumn and winter.¹⁰ Asquith responded that a special committee had been formed to 'inquire and regulate' all billeting soldiers. Further, 'a large number of hutments are already in the course of construction, and all training centres will eventually be provided with huts.'¹¹ A few days later, the Under-Secretary of State for War, Harold Tennant, was asked whether huts were being constructed for the use of troops currently in tents.¹² There was a sense of urgency in this request, with special mention made of how many huts would be provided and if they would be available by October 1st, and if not, by what date they would be made available. Tennant replied that huts were currently being constructed to shelter 490,000 men, including many Territorial troops.

As the work of constructing all these huts is one of enormous magnitude, it is obviously impossible to say on what date all will be ready... It is unlikely that all will be ready before the end of November. Work is decentralised as much as possible and every care is being taken to utilize local resources.¹³

It is important to note that the initial quote of accommodation was planned for 490,000 men but it eventually became clear this would be far too few. By the winter of 1914-15, the numbers of enlisted men had surged to over a million.¹⁴ Thus, the issue of accommodation was immense.

The Armstrong Huts

A Hutted Battalion Camp Plan

The remit of hut design, at least initially, fell to the Royal Engineers and to one engineer in particular, Major Bertie Harold Olivier Armstrong (1873-1950).¹⁵ Armstrong, a Canadian by birth, was a Royal Engineer and staff captain in the War Office. Of his personal history, we know very little. What is known is that on August 12, 1914 he received orders to design a set of hutted camps that could be constructed across England to support Kitchener's growing army. (Figure 2.2) In just two days,

¹⁰ Ibid.

¹¹ Ibid.

¹² Ibid, 66 (17 September 1914), cc982-983W.

¹³ Ibid.

¹⁴ Scott-Moncrieff, p. 364.

¹⁵ Ibid.

working around the clock with the help of his chief assistant, J.D. Michel and a small group of draughtsmen, Armstrong produced a complete set of working drawings for a:

[T]ypical hutted camp of a battalion of infantry at war strength, including 17 different designs (i.e. men's huts, recreation rooms, lavatories, cooking huts, officers' quarters and mess, sergeants' mess, etc.).¹⁶

Scott-Moncrieff, who was Armstrong's direct superior at this time, deemed this endeavor a remarkable feat:

[F]or it not only involved the completion, in every detail, of a large number of plans, but it meant the settlement of several very important sanitary and administrative problems, such as the provision of baths, the supply of water, the nature and amount of artificial light, and of interior space and ventilation, the arrangements for messing and cooking, and many other such matters. Indeed, so thoroughly was this done that the result was considered by Lord Kitchener to be unnecessarily good, and after the first camps were far advanced he gave orders to curtail a good deal of what he thought was unwarrantable luxury, in the shape of dining rooms and drying-rooms, etc. Baths, however, were admitted to be a necessity always, both in this country and in the field, and this in itself was a matter of great sanitary importance and a new departure in military administration.¹⁷

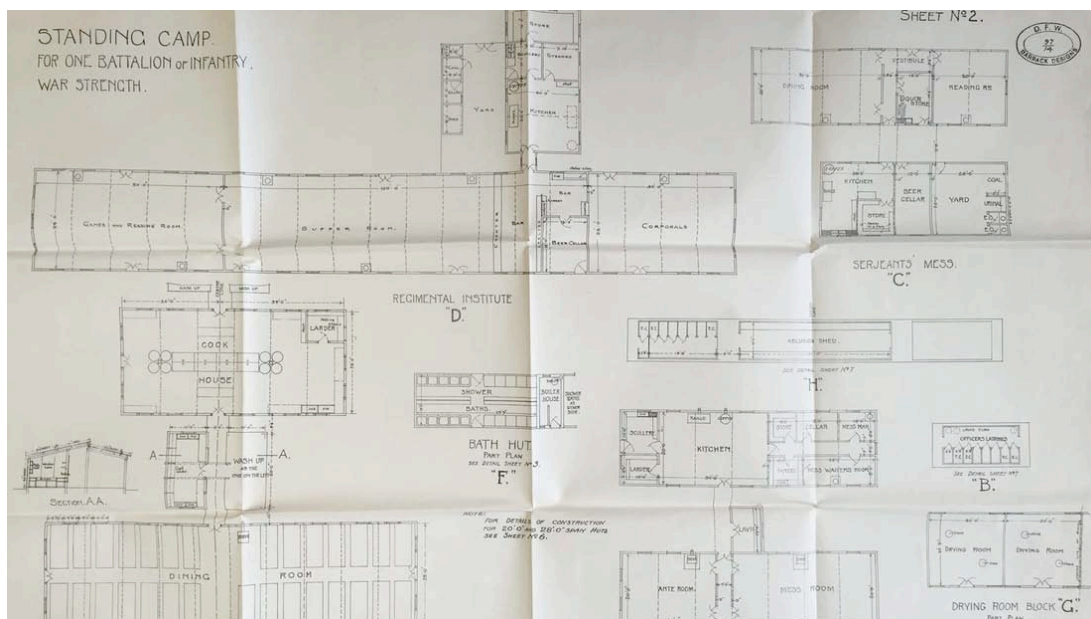


Figure 2.2 Armstrong's Type Plan for a Standing Camp for one Battalion or Infantry at War Strength. Working plans such as these were sent to local contractors throughout England by the War Office. (Suffolk Record Office, archive of R G Hogg)

These first designs by Armstrong consisted of timber frames covered in corrugated iron with an asbestos lining. The huts measured 20 ft wide by 60 ft in length by 10 ft

¹⁶ Ibid, p. 361.

¹⁷ Ibid, p. 362.

in height. (Figure 2.3) Each was heated by at least one small stove, with front and rear entry points and six-light windows along the length of each hut, the top panels opening on a louver to allow fresh air.¹⁸

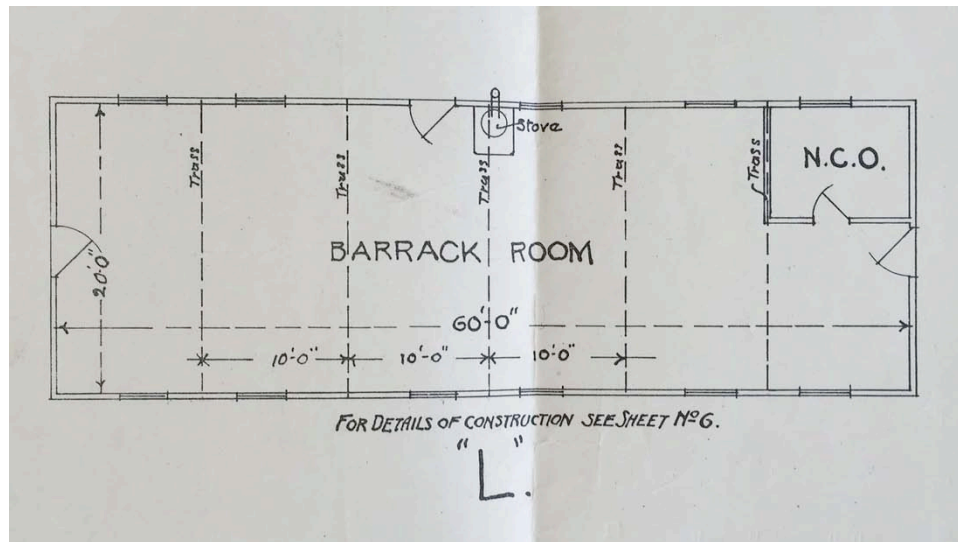


Figure 2.3 Armstrong's Barrack Type Plan (20 ft by 60 ft). (Suffolk Record Office, archive of R G Hogg)

Scott-Moncrieff said they were originally intended to house only twenty-four soldiers and one non-commissioned officer-in-charge per hut in order to better enforce discipline, however it seems these specifications became somewhat fluid depending on the demand.¹⁹ Some reports estimate that more than forty men at a time inhabited one hut, perhaps in desire for better shelter in wet conditions, but overcrowding later became the chief cause of outbreaks of disease and sickness, especially meningococcus.²⁰ The intended space allotment per soldier in accommodation was intentionally set, to allow for proper ventilation and prevent the spread of infection, but these were probably discarded out of necessity. The second design was slightly larger with a twenty-eight foot span and was used for support structures such as offices and cookhouses.

This was the quickest and probably best form for a limited number of huts, and if only the first 100,000 men had been all that needed accommodation, no other sort would have been

¹⁸ Baker Brown (p. 423), says that two stoves were supplied and also tables for meals. Further observations were made by the author from reviewing historic photographs and visiting an original Armstrong Type Plan Hut in Girton, Cambridgeshire, June 2017. See Figures 2.35 and 2.36.

¹⁹ Scott-Moncrieff, p. 365. Baker Brown (p. 423), said these huts could accommodate 30 men each with 4 feet of wall space per bed.

²⁰ J.A. Glover, 'Observations on the Meningococcus Carrier-Rate in Relation to Density of Population in Sleeping Quarters', *The Journal of Hygiene*, 17, No. 4, (October 1918), 367-379, (p. 368).

*necessary. When however, the numbers rose by hundreds of thousands, until the demands amounted to about a million, some other material was required.*²¹

However, at least initially, Armstrong's designs for seventeen building types were hugely successful. They were used to expand existing camps and establish new sites across England.

The estimated cost of a hutted camp for one thousand men was £15,000.²² This would provide forty huts at a cost of roughly £375 per hut, or £15 per soldier. With the additional cost of supplemental services such as water, lighting and roads, the total cost was estimated at £20 per soldier. Of note, Kitchener thought this too expensive and ordered the elimination of anything that could possibly be considered a luxury. As such, camps were often established without dining halls and other auxiliary buildings, rather than the full cadre of 17 designs, which Armstrong initially envisioned.²³

The success of Armstrong's battalion camp designs is that they were adaptable whilst being specialised to purpose. For instance, sleeping huts for the soldiers were deliberately designed to be small, when compared to large barracks of the period. It was felt that smaller huts had much to recommend them above much larger designs. Moncrieff said the decision to keep these sleeping huts small allowed them to more easily conform to whatever environmental circumstances were presented, such as irregular terrain.²⁴ Smaller numbers of men encouraged discipline, whilst also ensuring better fire safety precautions. Finally, the smaller hut size was more conducive to further adaptability, if and when the building was required for a different purpose, a common occurrence throughout the war.²⁵

The Armstrong Hut Debate

Armstrong's initial designs for the War Office were the first to be widely applied during the First World War. These were more permanent structures, made of

²¹ Scott-Moncrieff, p. 364.

²² Ibid, p. 368.

²³ Ibid, p. 362.

²⁴ Ibid, p. 365.

²⁵ Ibid.

timber and clad in corrugated metal, or whatever materials were readily on hand. However, there is evidence that Armstrong also designed at least two other huts, which has created some confusion amongst researchers as to what exactly constitutes an ‘Armstrong Hut.’ Whilst it is likely that many would agree that the first designs he made for the War Office represent what is most commonly known as the Armstrong Hut, there are several others from the war that carry the same name. Two have timber frames, covered in canvas, and were possibly collapsible to allow for portability. (Figure 2.4) Another is called Armstrong Hut Number Four, with the plan published in *Work of the Royal Engineers in the European War* (1924), and differs slightly from the other huts.²⁶ (Figures 2.5 and 2.6) The name alone supports the theory that Armstrong had several hut designs. The mystery is not helped by the fact that in September 1940, a bomb was dropped on the War Office Record Store where it was located at the time on Arnside Street, London.²⁷ Thus, much of what we know necessarily relies on the few remaining primary sources still in existence and these are not altogether clear on the subject.

²⁶ Institution of Royal Engineers, *Work of the Royal Engineers in the European War, 1914-1919: Work Under the Director of Works (France)* (Chatham: MacKay and Co., 1924).

²⁷ NA, WO 363. See online reference <http://discovery.nationalarchives.gov.uk/details/r/C14567> [Accessed 17 September 2017]



Figure 2.4 An Armstrong Hut? Soldiers from the 4th Battalion Yorkshire Regiment referred to this canvas shelter as an Armstrong Hut. (Image from Great War Forum)

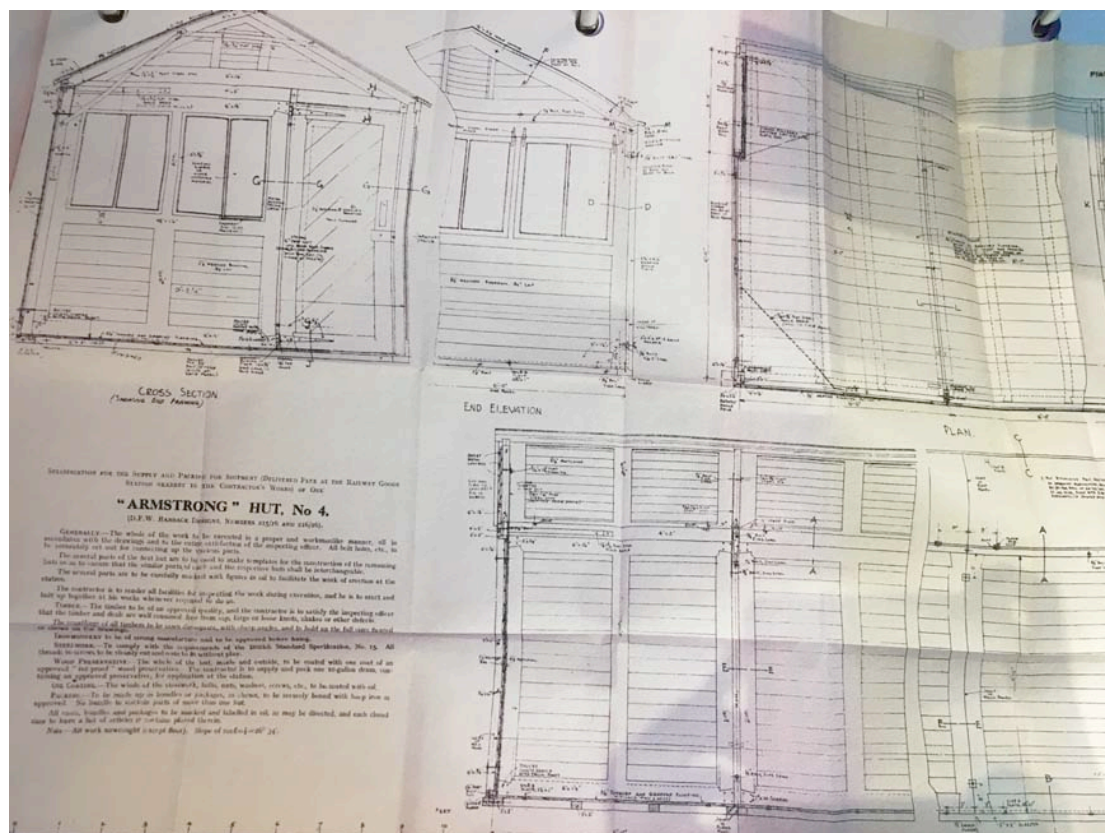


Figure 2.5 Plans for Armstrong Hut, No. 4. Plate XLVI, from *Work of the Royal Engineers in the European War*, published in 1924.

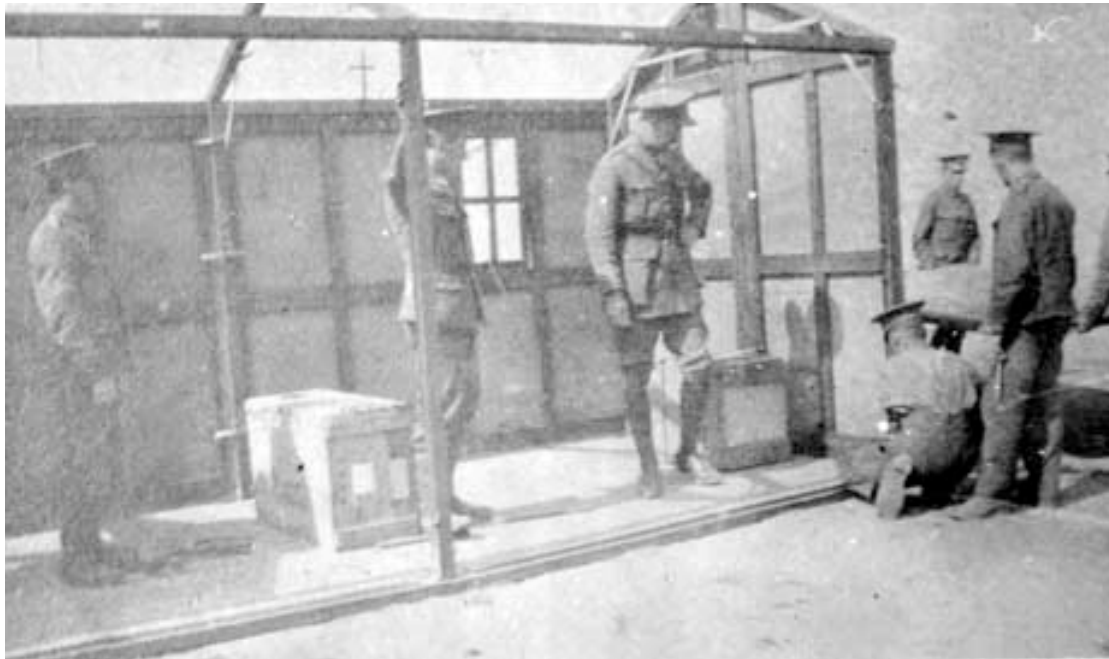


Figure 2.6 Possibly an example of Armstrong's Hut No. 4. Image labeled: 'Men from the King's Own Regiment constructing an Armstrong Hut.' Wareham, August 1915. (Image courtesy of the King's Own Royal Regiment Museum, Accession No. KO1769/01-114)

Several authors on the subject propagate this issue further with misinformation. Mallory and Ottar, in *Architecture of Aggression* (1973), note that there was an Armstrong Hut provided in two sizes, but describe it as being constructed of timber and canvas.²⁸ Mornement and Holloway's *Corrugated Iron* (2007) goes further afield by crediting Armstrong only with deploying Aylwin Huts (timber and canvas construction, to be discussed later) to France.²⁹ It is likely they were misled in their research by the only biography of Peter Nissen, *Nissen of the Huts* (1997), written by Fred McCosh, which they referenced in their work.³⁰ McCosh's somewhat unclear, and often inaccurate narrative, claims:

War with Germany was declared on the night of 4th August 1914 and by August 12th Armstrong had issued orders for the construction of hutted camps with the then official Aylwin huts... One hut type followed another, the Aylwin gave way to the Armstrong, the Tarrant, the Liddell and finally, late in 1918, the Weblee.³¹

²⁸ Mallory and Ottar, p. 77.

²⁹ Mornement and Holloway, p. 112.

³⁰ Ibid, p. 219.

³¹ Fred McCosh, *Nissen of the Huts: A Biography of Lt. Col. Peter Nissen, DSO* (Bourne End: B D Publishing, 1997), p. 87.

He also adds that it is quite likely that Nissen was the first person to suggest hutting, further demonstrating a lack of historic accuracy or knowledge that hutting had been in circulation since the Gloucester Huts of the Crimean War sixty years earlier.³² In contrast, John Schofield's 2006 study of Army camps for English Heritage attributes Armstrong's hut to his original type plans in August 1914, describing them not with canvas but as having a framework of:

*[R]ed fir scantlings[...] the cladding was not specified, but corrugated iron was almost certainly the preferred medium [...] The lining was matchboard and 3 ply; asbestos sheeting was tried at first but found to be too brittle.*³³

He adds that originally, these huts had brick foundations, but shortages in bricks and bricklayers resulted in creosoted wooden piles being used instead.³⁴ Somewhat confusingly, Schofield mentions later that many Armstrong huts were despatched to France.³⁵ These came in two sizes, completely different from the War Office Type Plan designs, so it is clear these were a different variety than Armstrong's first huts. Schofield concludes, 'they were weatherly, but very cold in winter. It is extremely unlikely that any were employed at home.'³⁶ It is possible Schofield is referring to Armstrong's timber and canvas huts. These published works serve to highlight just how wide the gap in knowledge is about huts, and how this thesis contributes to a greater understanding of their history and development.

Based on available evidence from primary and secondary sources, this thesis puts forth the argument that Armstrong designed four different hut models during the wartime period. The first were those constructed of timber and corrugated iron sheeting, or entirely of timber, depending on availability of materials. This thesis will refer to these as Armstrong's Type Plan Huts. He then proceeded to design hospital hutting, which were employed both in England and in France. It is probable that Armstrong then turned his mind to designing a hut that could be more portable in the field than his Type Plan Hut, which was heavy and not easily transported. This resulted in a canvas and timber hut that was an amalgamation of both his War Office Type Plan design and a tent, one that would perhaps be more practical in the field. It

³² See Chapter One.

³³ Schofield, p. 5.

³⁴ Ibid.

³⁵ Ibid, p. 7.

³⁶ Ibid.

came in two sizes, as mentioned by Schofield, with the smaller size more common.³⁷ The Imperial War Museum archive holds an image that, while unconfirmed, may possibly be an example of one of these huts. (Figure 2.7)



Figure 2.7 Royal Engineers move a hut during the Battle of the Somme, Sept. 1916. It is possible this is an example of one of Armstrong's canvas and timber huts. (© IWM Q1204)

Fortunately, clues to untangling the Armstrong Hut debate is provided by Scott-Moncrieff. He writes:

Thus it happened that when Major Armstrong got the word to produce hut designs in August 1914, he did not lose a moment. Later on he produced the well-known "Armstrong hut" which, constructed in sections, was made in workshops and sent out ready made to any proposed site and rapidly erected. But, at first there was no necessity for this, and indeed there was considerable advantage in utilizing local materials and labour. The huts were at first built of a wooden framework with corrugated iron on roofs and external sides, and with asbestos lining inside [...] The reason why a type plan of a battalion hutment was so important is that it furnished a guide to any class of unit [...] The same types of huts were used in all cases, and it is a tribute to Major Armstrong's foresight that practically the same types were used during the whole war, though details were frequently improved as a result of experience, and materials differed with local circumstances.³⁸

Several times in the article, Scott-Moncrieff describes these first designs as Armstrong's 'type plans.' Officially, it seems they were also referred to as War Office Type Plan BD85A/14. These were the standardised hut plans used to establish camps all over England, described by Scott-Moncrieff, as well as by researchers such as

³⁷ Ibid.

³⁸ Scott-Moncrieff, pp. 364-365.

Schofield, Crawford, and others. Huts of this type were constructed near Alnwick Castle in the autumn of 1914.³⁹ (Figure 2.8) Timber was used for the cladding and corrugated sheeting for the roof. However, it would seem they are different from what later became known as the Armstrong Hut. This later model was possibly adapted to be more appropriate to conditions on the frontlines.

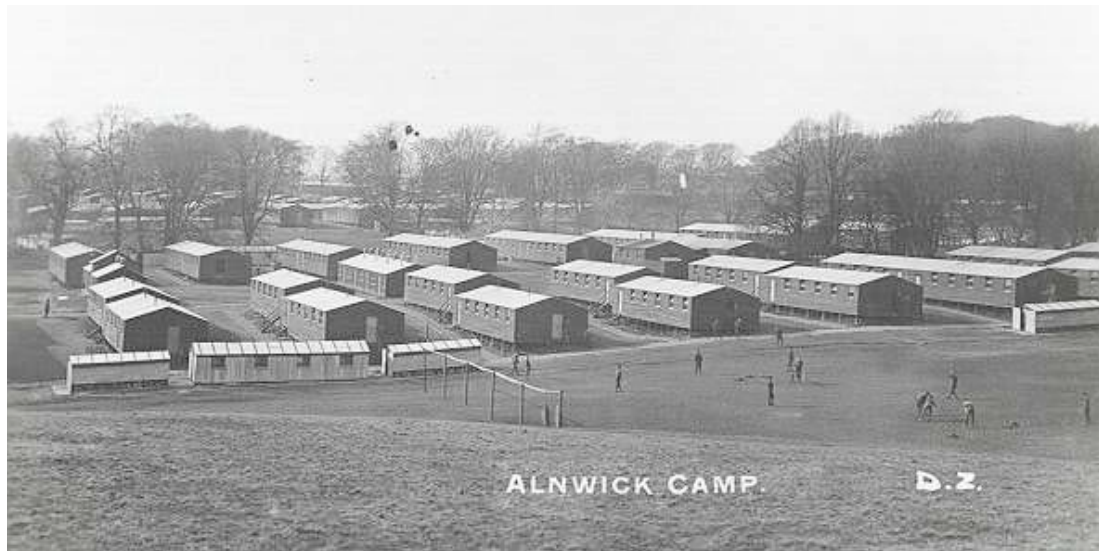


Figure 2.8 Alnwick Camp was completed in December 1914 and seems to make use of Armstrong's type plan designs. (Image courtesy of Cliff Petit and Bailiff Gate Museum).

To further illustrate the variety of Armstrong's hut designs, Scott-Moncrieff reported that by the middle of October 1914, Armstrong had released a set of type plans for hutted hospitals.⁴⁰ Those erected in England were capable of caring for up to 600 patients at a time, while those in France were much larger, some enough wards to provide 13,000 beds. These were built in both England and in France and involved wards, administrative blocks, operating theatres and quarters for medical staff along with mess rooms.⁴¹ Each ward was designed to hold twenty-five beds, a nurse's duty room and store, along with bathrooms and lavatories. Each ward was connected by covered passageways to the administrative and operating huts. The walls were lined with asbestos plaster, often painted.

The effect in the appearance of the wards, especially when these were brightened with flowers and the tasteful care of the nursing sisters, was charming and would compare favourably with any hospitals in the land. Yet the cost of these hutted hospitals was not great, only some £80 per bed, and it is probable that for practical purposes they were as efficient as the permanent

³⁹ Ibid, p. 377.

⁴⁰ Ibid, p. 374.

⁴¹ Ibid.

“palaces of pain” which, in civil life (before the war), cost as much, in some cases, as £1,000 per bed.⁴²

Presumably, once the Army’s camps and hospitals were established with his plans, Armstrong likely turned his attention towards better accommodation for soldiers fighting abroad. Whilst his type plans were well-suited for temporary camps in Britain, they were not meant to be portable. Nor were they manufactured in sections for ease of transport. A prefabricated, lightweight design, which could be easily shipped abroad and quickly erected would have been a likely concept. It is possible this was the Armstrong hut of timber and canvas construction mentioned by soldiers. Unfortunately, unlike his previous type plans, the canvas hut was not hugely successful. There are reports that they were ‘heavy and awkward to construct and transport [...] It also proved extremely cold for the occupants.’⁴³ It would seem likely that this is when Armstrong’s Hut No. 4 was devised. It was more solid than the canvas Armstrong hut, but was packaged in bundles and thus, more portable. Each of Armstrong’s huts, along with several key huts of the First World War, are studied more closely later in this chapter. An essential piece to understand from these developments was that it was this continued necessity for a portable hut that drove contributions from other builders and inventors throughout the war.

Construction Delays in the Winter of 1914/15

It is important to note the challenges faced with camp construction during the first year of the war. Despite Armstrong’s meticulous organisation and swift delivery of working plans, the construction of hatted camps faced several challenges and setbacks. Labour and material shortages, locating adequate sites, and poor weather all contributed to delays. It became clear by the end of November 1914, with winter arriving, that the government would not be able to get enough huts constructed in time to get all of the soldiers out of tents. The tented camps at this point were suffering from overcrowding and poor conditions. There are reports that some men were reduced to sleeping under hedges. As one soldier remarked in October 1914:

⁴² Ibid, p. 375.

⁴³ Mallory and Ottar, p. 77.

*The men were in rags, they were too many to a tent, they had very few blankets, and after two days of solid rain the mud was appalling and the tents flooded out.*⁴⁴

The rain continued unabated for several weeks. As a result of the poor conditions, the newly recruited volunteer soldiers began to show symptoms of illness. It grew to such an extent that by January 1915, the camps in England reported over 1500 cases of pneumonia, of which 301 had died.⁴⁵

Labour shortage

One issue to the delay in building a sufficient number of huts was a lack of skilled labourers. The British workforce was depleted at the earliest stages of the war when experienced men left to join the Army.⁴⁶ This gap was eventually filled by either men too old or too young to join the war, those who did not want to fight, and later, by women workers, an interesting point to be addressed later in this chapter. Another noteworthy contribution was made by retired engineering officers, who volunteered to join the crews as supervisors, their experience proving invaluable.⁴⁷ However, according to some journalists reporting during the period, it was sometimes a less than desirable labour workforce that contributed to wartime construction delays, which simultaneously created a growing resentment among the soldiers in the military camps. It seems that much of this was due to the high rates of pay and the perceived lack of work ethic amongst crews, with some members arriving late, leaving early and/or napping during the workday.⁴⁸ But as labour was desperately required, these issues were often overlooked. In addition, they were paid wages considerably higher than peacetime standards, and much more than the volunteer soldiers were earning. This was an ongoing issue throughout the war and a reason for the resentment between soldiers and work crews.

When war broke out, a carpenter's pay was 7.5d per hour. By December [1914] this had risen to 10.5d. A labourer's peacetime pay of 4-5d per hour had increased to 6.5d per hour. With Sunday work, a carpenter was receiving £3 per week, a labourer 35s, plus free accommodation and bedding. Recruitment posters were offering single men starting pay in the

⁴⁴ Lt. M.J.H. Drummond, 10th Lancashire Fusiliers at Wool, Dorset. See Charles Messenger, *Call to Arms: The British Army 1914-18* (London: Cassell, 2005), p. 113.

⁴⁵ Peter Simkins, *Kitchener's Army: The Raising of the New Armies 1914-1916* (Barnsley: Pen and Sword, 2007), p. 241.

⁴⁶ Terry Crawford, in his book *Wiltshire and the Great War* (2012), says that out of 920,000 building tradesmen working in July 1914, 178,000 enlisted in the Army during the first year of the war.

⁴⁷ Scott-Moncrieff, p. 367, 378.

⁴⁸ Terry Crawford, *Wiltshire and the Great War* (Ramsbury: Crowood, 2012), p. 47.

*Army of 7s a week [...] The soldiers thought it grossing unfair that 'shirkers' should be so much better treated than men who had enlisted voluntarily.*⁴⁹

Materials shortage

The immense quantities of building materials, especially galvanised corrugated steel sheets, timber and asbestos, required for constructing camps across Britain meant a real possibility of shortages if pre-war manufacturing methods and exporting practices were not revised. Foreseeing this risk and hoping to neutralize it, the Directorate of Works and Buildings asked the War Office's Contract Office to consider putting these materials under government control.⁵⁰ To some extent, at least initially, the plan seemed to work. Timber was in such plentiful supply, its control was not deemed immediately necessary by the Director of Contracts.⁵¹ Asbestos was approved for control so it could be stockpiled for wartime building, and British manufacturers who exported corrugated steel out of the country were temporarily halted.⁵² It was this control that chafed the worst, as the growing colonies were their main markets for selling corrugated sheets.⁵³ However, eventually a deal was struck between the steel manufacturers and the government, wherein they were allowed to continue exporting but only to British colonies, and in return they offered to supply the government with corrugated steel sheets, but at a discounted rate. Scott-Moncrieff noted this was accepted and said everything went smoothly until 'suddenly galvanised sheets became unobtainable.'⁵⁴ Apparently, what was not generally realised until after the first few months of the war was that Germany had the corner on the world's zinc market, a necessary element in preventing the corrosion of corrugated metal.⁵⁵ It is the application of molten zinc to the surface of the sheets that galvanises it, making it fairly resistant to corrosion. This was a massive setback for the Works Directorate, which realised it would have to either source a different material for the hut walls and roofs or they would have to find extra men to apply a protectant over the metal sheets, which in itself would be time intensive.⁵⁶ It would appear a combination of the two options was ultimately decided. Armstrong's Type Plan Huts, which initially were

⁴⁹ Ibid.

⁵⁰ Scott-Moncrieff, p. 370.

⁵¹ Ibid.

⁵² Ibid.

⁵³ Ibid.

⁵⁴ Ibid.

⁵⁵ Ibid.

⁵⁶ Ibid.

constructed clad entirely in corrugated sheets (such as at Belton Park), were later constructed almost entirely of timber weatherboarding.⁵⁷

Site locations

Another issue facing the government in the earliest weeks and months of the war was where to build. Initially, two Army officers, by the names of Pell and Cowan, were selected to conduct surveys of suitable land for setting up new camps.⁵⁸ They were responsible for visiting and accepting Belton Park as a camp location in August 1914.⁵⁹ However, the task was enormous and eventually both were pulled to other assignments. From that point, the remit of site location was transferred to the Quartermaster-General, Sir John Cowans, whose decisions on new site locations, Scott-Moncrieff said, at least from an engineering perspective, were not suitable.⁶⁰ (Figure 2.9) By this, it seems that Scott-Moncrieff would have preferred that the Directorate of Works and Buildings had been given the responsibility for site selection, and perhaps reasonably so, for they were ultimately the ones who had to face whatever construction challenges a site presented. (Figure 2.10)



Figure 2.9 Sir John Cowans, (left), Quartermaster-General during the First World War. By Walter Stoneman, 1919. (© National Portrait Gallery, London)

Figure 2.10 (Right) Major-General Sir George Scott-Moncrieff, 1916. (© The Library of Congress)

⁵⁷ Ibid, p. 374. Schofield adds that whilst corrugated iron cladding was preferred it was dependent on local availability. See Schofield, *Army Camps*, p. 5.

⁵⁸ Ibid, p. 369.

⁵⁹ Ibid.

⁶⁰ Ibid, p. 370.

According to Schofield's 2006 Army camp report, four prerequisite points determined the selection of sites.⁶¹ First, the area must provide for year-round open space for training maneuvers and shooting practice. Second, the geology of the area should be either chalk or gravel soil, with good drainage and a sufficient water supply. Third, the sites needed to be within easy distance of railway lines for ease of communication and transport. Finally, that the site was in a location where materials and labour could be procured, and if possible, with existing utilities such as electricity, water and sewage.

The easiest sites were those at or near to established military camps, such as Aldershot and Colchester.⁶² These provided ready access to electricity, water and sewer systems, simplifying matters greatly. However, many more sites were needed and each location came with its own unique set of issues. As Scott-Moncrieff later reported, the difficulty of providing hutting was never an architectural problem, but one of engineering.

Although the typical hut scheme was the same for all places, it is obvious that every place differed in respect of roads, drainage, water supply, and in most cases artificial lighting. These problems, which in some case, were of great difficulty, had to be solved in each case from the local conditions. It was decided that, wherever possible, local water supply and sewerage systems should be utilized, but of course, in many cases this was impossible. If a local gas or electric light supply existed, it was also to be used, but if none was available, then an electric power station, with oil-engine, dynamos and accumulator, was to be built, and a scale of lighting for the various buildings worked out [...] As the hutting programme developed, during the first 12 months of the war, these problems of water, electricity, and sewage became enormous, and it was found desirable to have at the headquarters of each military command a specialist in each of these engineering subjects.⁶³

Brigadier General W. Baker Brown, the Chief Engineer for the Eastern Command from 1915, wrote in 1926 about his experience with establishing hutments during the war.⁶⁴ His account provides the best insight of how sites were selected and arranged. He said that the most vital necessities in order of importance when building a camp were roads, water and drainage. Learning from the experiences of the winter hutting programme of 1914-15, when so many camps were hastily constructed and surrounded by seas of mud, Brown believed roads should be the very first concern of

⁶¹ Schofield, p. 5.

⁶² Scott-Moncrieff, p. 369.

⁶³ Scott-Moncrieff, pg. 366.

⁶⁴ W. Baker Brown, 'Notes by a Chief Engineer During the Great War of 1914-1918', *Royal Engineers Journal*, (September 1925), 417-425; (December 1925), 587-602; (March 1926), 105-111; (September 1926), 422-436; (December 1926), 631-644.

any hutment site.⁶⁵ The construction of a road system prior to building the huts provided a proper surface for contractor's vehicles to haul the large amounts of materials to each site, whilst preventing the grass from being torn up and creating mud. To enable this, Brown advocated for the use of unloading points within the road system at each camp, to protect the grass and allow the constructed pathways throughout the camp to be useable even during winter.⁶⁶ Thus, at least one main road was constructed per hutment with footpaths branching off to connect the huts. Interestingly, one way this was accomplished at reduced overall cost was by crushing old tins from rubbish piles to make bases for the roads, then using leftover cinders from the cookhouse and stoves for the surfacing. The benefit was two-fold, as it also reduced camp waste. In places of severe mud, wooden planks were used to connect huts.

When selecting a hutment site, Brown says the best locations were those on the outskirts of towns, because they were near to roads, water, sewage and electricity.

*Situated as they usually are between the town and the country, they get the benefits of both, as the country gives space for training grounds and rifle ranges, while the town gives accommodation for supplies, as well as water and light, and also some facilities for amusement and recreation, which, judiciously used, help the training.*⁶⁷

The arrangement of buildings was best organised not around a central parade ground as is found in permanent barracks, but on either side of a road. Baker thought it advantageous to make use of already established second-class roads in England, rather than always having to construct new roads. The service buildings themselves were organised with the officers' mess, sergeants' mess and transport lines on one side, and the cook-house, recreation room and quartermaster's stores on the other.

*The officers' huts should be behind their mess, and the men's huts in company groups behind the recreation and dining rooms. Latrines must be placed near the road to facilitate water and drainage connections. The main guard room should be placed on the road at the end from which traffic will usually enter.*⁶⁸

⁶⁵ Baker Brown, (September 1926), p. 429.

⁶⁶ Ibid.

⁶⁷ Ibid, p. 430.

⁶⁸ Ibid.

Brown also described how concrete flooring factories were started at each camp, which allowed them to produce on site concrete slabs measuring 2 ft by 2 ft by 2.5 ft thick. These were used to provide an efficient and quick flooring solution in the huts, cook-houses, bath-houses and latrines.

Belton Park, Lincolnshire

Several of the sites chosen were in country house parklands, such as at Belton House near Grantham in Lincolnshire.⁶⁹ Other sites were requested under the Defence of the Realm Act.⁷⁰ Of note and not widely known, Lord Brownlowe's offering of Belton Park to the War Office in August 1914, seems to stand as the very first example of a country house being voluntarily proposed for wartime use. Construction began on 23 August 1914 and was completed just over two months later using Armstrong's set of designs.⁷¹ Sir John Jackson was contracted to oversee the work. Initially, the camp was used as the headquarters for the Army's 11th Division, with 13 infantry battalions. However, it was later turned into a machine gunnery school.⁷² (Figure 2.11)

⁶⁹ Scott-Moncrieff, p. 369, 372.

⁷⁰ *Supplement to the London Gazette*, (1 September 1914), p. 6968. The Defense of the Realm Act, passed 8 August 1914, allowed the government the legal right to requisition property and to determine new regulations governing personal freedoms that may have impeded the war effort. G.R. Rubin's *Private Property, Government Requisition and the Constitution 1914-1927* (1994), goes into the subject more thoroughly.

⁷¹ Scott-Moncrieff, p. 372.

⁷² *Ibid.*, p. 369.

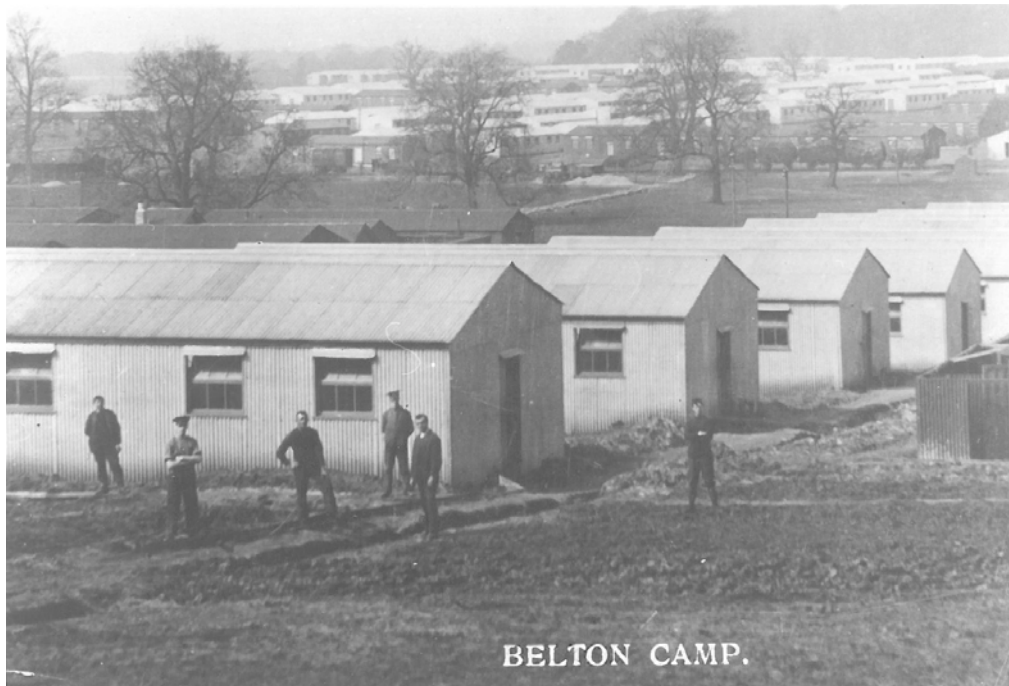


Figure 2.11 Belton Park Camp, Lincolnshire. The first parkland to be offered by a country house owner in wartime, became the training grounds for the Machine Gunnery Corps in 1914. These huts are examples of Armstrong's first set of designs, constructed with a timber frame and covered with corrugated iron sheeting. (With permission of the Lincolnshire Archives, Ref: Pointer 10.1)

Frederick Plimmer, a private in the 17th Machine Gun Company, remembered beginning his stint as a soldier in bell tents at Harwich ('the accommodations weren't nice and the weather was cold'), before moving to Clipstone Camp and then Belton Park.⁷³ His recollections were recorded by the Imperial War Museum in 1986. He estimated that the sleeping huts were 18 ft wide by 30 ft long, 'with beds on both sides and a big fire in the middle, so it was very warm'.⁷⁴ (Figure 2.12) He added that there were about twenty men in each hut, wash-houses with shower-baths and hot water always on tap. There were even flush latrines. While there was a dining room hut, the men frequently ate their meals in their sleeping huts. Plimmer was particularly impressed with Belton Park camp's recreational facilities. 'There was a billiard room [...] The biggest I've ever seen in my life.'⁷⁵

Belton Park was likely a model example of an ideal camp only because it was built so early it was able to take full advantage of Armstrong's plans, without being hindered by the material shortages, which were to follow. Scott-Moncrieff believed

⁷³ IWM oral history recording, catalogue number 9423, reel 2, Private Frederick Plimmer, recorded 1986.

⁷⁴ Ibid.

⁷⁵ Ibid.

the example set at Belton gave false hope to authorities that all camps would be built so quickly.⁷⁶



Figure 2.12 Denton Village Hall, Lincolnshire. One of Major Armstrong's Type Plan designs for the War Office, originally erected at Belton Park and repurposed as a village hall after the war. (© Alan Murray-Rust)

Contractors and Competition

During the war, there were four ways contracts were offered and paid in the construction of hutments. The first was by direct labour, when an engineer is left to independently purchase all materials and employ work crews. Scott-Moncrieff said this was done at Aldershot under the eye of a Chief Engineer and that the huts there were by far the best built for the least amount of expense of any in the United Kingdom.⁷⁷ The second contractual method was to pay based on set prices and measured after completion. Scott-Moncrieff said that due to the unpredictability of wartime conditions, it was impossible to be able to have fixed rates on labour and materials, when costs were constantly fluctuating, thus this method was not ideal.⁷⁸

⁷⁶ Scott-Moncrieff, p. 374.

⁷⁷ Ibid, p. 371.

⁷⁸ Ibid.

The third approach was by requesting a number of lump-sum tenders from a variety of building contractors, wherein they submit surveys detailing all of their costs for conducting the work. The lowest bid was usually the contract accepted. But Scott-Moncrieff said this was rather too time intensive while vulnerable to the instability of the material market as well as the varied site conditions, which oftentimes could challenge the accuracy of the initial plans.⁷⁹ Thus, while usually the preferred method during peacetime, lump-sum tenders were not the best option during wartime. The fourth method was to pay contractors a cost plus percentage. The cost was the sum required to facilitate the work, and the percentage was the net profit required by the contractor to make the project worthwhile. Scott-Moncrieff said this method was:

[O]pen to the obvious objection that the contractor has every inducement to spend money, and no personal reason for trying to be economical. But if, at the elbow of the contractor, there is a responsible engineer who has full power to say what shall be done, and what labour shall be employed, and if there is a departmental accountant who not only scrutinizes every bill as it becomes due, but also sanctions every order that is issued, this system is not only capable of being made most efficient and speedy, but it is the only one which gives satisfactory and economical results in a time of change and fluctuation. The element of competition can be introduced into it (and was so introduced at a later period of the war) with most satisfactory results.⁸⁰

Both small, local contractors as well as big, corporate building firms, of which Sir John Jackson was the very first, were employed by the government to construct the huts.⁸¹ The Institution of Civil Engineers compiled a list of all the many British building firms that were prepared and capable of taking on the construction schemes.⁸² A few of the smaller, independent builders requested consideration by applying directly to the War Office. Then the Works Department visited each firm to ascertain the extent of their requirements and preparedness. Scott-Moncrieff said there was never a lack of willing and capable experts.⁸³

Thus, with plans and builders at the ready, the construction of hutments across Britain began and continued until by the end of 1915, there was enough hutted accommodation for 850,000 men.

⁷⁹ Ibid, p. 372.

⁸⁰ Ibid.

⁸¹ Ibid, p. 373.

⁸² Ibid.

⁸³ Ibid.

In spite of all the delays caused by bad weather, labour disputes and shortages of building materials, most New Army units were able to move out of billets into huts in the spring of 1915, although the soldiers were often called upon to help complete the construction of their own quarters... The accommodation problem became much less severe in the latter half of 1915, as, by that time, many of the earliest New Army units had gone overseas, enabling the War Office to move the later formations into the camps and training centres they had vacated. Even so, the housing of the New Armies remains as one of the great unrecognized achievements of the First World War. Within two years, at a cost of approximately £24,500,000, accommodation had been provided for a military community which was larger in size than the civilian population of Bristol, Cardiff and Newcastle combined.⁸⁴

Hutting in France

Mention must also be made of construction efforts in France. The Director of Works for France was Brigadier-General Sir Andrew Stuart. He arrived with his staff in Havre on 10 August 1914, and immediately set about establishing camps for the arrival of the first troops of the British Expeditionary Force.⁸⁵ The programme was similar to the concurrent work in England in that aggressive preparations were aimed at quickly providing winter hutting and hospitals, however in France, extra accommodation was also necessary for field bakeries, remount depots and veterinary hospitals, among others.⁸⁶ It was also decided that generally the soldiers would sleep in tents, but that all of the other ancillary services would be provided in huts.⁸⁷

During the first few months of war, both French and British contractors were employed in building the new sites. In Orleans, a French building firm by the name of Gilet Frères was contracted for sixty demountable huts that could be kept in stock and used in forward areas.⁸⁸ In Rouen, a French contractor named Chouard was assigned to build a variety of sites using Armstrong's War Office type plans, which included four hutted hospitals, four camps to each accommodate 1,200 men, a remount depot for 2,500 horses and a veterinary hospital that could care for up to 1,000 horses at a time.⁸⁹ In Havre, two English contractors, Harbrow and Company and Tarrant and Company, were hired to construct camps for 9,000 men and 3,600 horses. They were

⁸⁴ Simkins, pp. 251-251.

⁸⁵ Institution of Royal Engineers, *Work*, p. 1.

⁸⁶ *Ibid.*

⁸⁷ *Ibid.*, p. 6.

⁸⁸ *Ibid.*

⁸⁹ *Ibid.*, pp. 6-7.

likewise given Armstrong's designs.⁹⁰ In Boulogne, another British contractor was hired on a lump sum basis, McAlpine and Sons for a similar programme of building works as the other locations.⁹¹ In Etaples, a hutting contract was awarded to Holloway Bros on 7 February 1915 for the construction of a hospital with over 5,000 beds, as well as a convalescent camp and several reinforcement camps that could accommodate 40,000 soldiers. This contract was agreed upon on a cost plus commission basis.⁹² Labour was a continuous issue managed by the Royal Engineers and eventually alleviated by bringing in Chinese workers and prisoners of war to help.⁹³

It is important to note that the predominant designs being employed during this early period of the war were Armstrong's War Office Type Plans and the Aylwin Hut, which many referred to as a hut-tent. These were the most prevalently used during the first year of the war.⁹⁴ It was not until 1916 that the Works Directorate in France was able to meet winter hutting needs with other fresh designs, like the *Adrian*, *Tarrant*, *Somerville*, as well as the *Nissen Hut*, which was specifically considered to be 'ready-made.' These could be sent from England, or were constructed in the many workshops set up in France.⁹⁵ One notable case was that of the British builder, Tarrant and Co., which established its own workshop in a camp three miles from Calais during the war and avoided labour concerns by staffing it with British female carpenters. These women were responsible for the inspiring feat of constructing 37,000 Tarrant Huts by the end of the war.⁹⁶ (Figures 2.13 and 2.14)

⁹⁰ Ibid.

⁹¹ Ibid, pp. 7-8.

⁹² Ibid, p. 12.

⁹³ Ibid, p. 39.

⁹⁴ Ibid, pp. 7, 9.

⁹⁵ Mavis Swenarton, 'W. G. Tarrant: Master Builder and Developer', *Monograph 24*, Walton and Weybridge Historical Society, (1993).

⁹⁶ Imperial War Museum, Q 2467, <http://www.iwm.org.uk/collections/item/object/205078807> [Accessed 17 September 2017]



Figure 2.13 A forewoman at work at the Tarrant workshop. (© IWM Q2461)



Figure 2.14 Tarrant workers in France. (© IWM Q6767)

The Huts

Thus far, this chapter has introduced only the first huts to be used in the First World War. However, over a dozen more were invented and manufactured in the ensuing years of the conflict. (Table 2.1) Several of these will be discussed further in this section, specifically the ones which proved the most successful. All of the huts will be described separately, with plans where available, in Appendix A, which will serve as a relatively comprehensive list of those designed and most prevalently used during the First World War.⁹⁷

<i>Huts of the First World War</i>
1. The Adrian Hut
2. The Air Ministry Concrete Hut
3. The Armstrong Type Plan Hut
4. The Armstrong Hospital Hut
5. The Armstrong Hut No. 4
6. The Armstrong Timber and Canvas Hut
7. The Armstrong Timber and Canvas Tent
8. The Aylwin Hut
9. The Cavanna Hut
10. The Forest Hut
11. The Liddell Hut
12. The Nissen Bow Hut
13. The Nissen Hospital Hut
14. The R. G. B. Standard Light Portable Building
15. The Somerville Hut
16. The Swiss Liddle Hut
17. The Tarrant Dechets Portable Hut
18. The Tarrant Light Portable Sleeping Hut
19. The Tarrant Portable Mark II Hut
20. The Weblee Hut

Table 2.1 Huts of the First World War

⁹⁷ Due to a lack of documentary evidence, this chapter will not go into detail on the Air Ministry Concrete Hut, the Cavanna Hut, the R.G.B. Standard Light Portable Building, the Somerville Hut, or the Swiss Liddle Hut. For what information is known, see Appendix A.

It is worth noting that there are cases where wartime restrictions in material supplies, combined with local ingenuity created huts for which we have no documentation other than when there is a rare survival, or a small reference. These may not have been prevalent, but rather used in only one locality, perhaps due to a modification by an engineer in charge or because of a large supply of a certain material. These were often more bespoke rather than generic huts. For example, this is the case at both the Ripon and Catterick camps, which made use of a type of concrete hut during the war, in an effort to limit timber useage.⁹⁸ Likewise, Schofield notes in his report that at Hipswell and Scotton camps, huts were made from two-inch Winget concrete blocks. The roofs had steel trusses and timber boards covered in felt.⁹⁹ However, this hut does not have a name, just a general description and location. In France, War Office designs were often modified locally.¹⁰⁰ This could mean variations in plan, size and materials. In this respect, the list provided in Appendix A could perhaps never be fully comprehensive. There may always be a rare and unusual hut type, which will continue to spark curiosity and require further research, identification and recording.

The Armstrong Huts

A name applied to any of several designs by Major Armstrong. None appear to have ever been patented. There were five main types.

1. **War Office Type Plan Hut.** (Figures 2.3, 2.4, and 2.15) Possibly also known as Type Plan BD85A/14, which were authorized by Army Council Instruction 352 of September 1914.¹⁰¹ These were extensively used across England and in France from the onset of war in August 1914. Originally, these consisted of a timber frame clad in corrugated metal sheeting with a corrugated roof, however as material shortages ensued, it became predominantly clad in timber. Originally, the accommodation hut design was supplied in two widths: 20 ft and 30 ft at any length. These were later redesigned into a sectional

⁹⁸ Scott-Moncrieff, p. 379.

⁹⁹ Schofield, p. 6.

¹⁰⁰ Institution of Royal Engineers, p. 8.

¹⁰¹ National Archives, WO 293/1. See John Sheen, *Tyneside Scottish* (Barnsley: Pen and Sword, 2014), p. 48.

version of 15 ft and 28 ft, in sections of 10 ft. ‘This width of section is rather large for transport and handling, but otherwise these huts answered well.’¹⁰² Sizes: A. 20/30 ft by 60 ft by 10 ft in height. B. Later redesigned to be narrower at 15/28 ft by 60 ft by 10 ft. The first layout (A) accommodated 30 men each with four feet of wall space per bed. The doors were at either end, and there was a central aisle for tables. When the camp had a dining room, the tables were removed to accommodate more men. It was heated by two stoves, also located in the middle aisle. The later redesigned hut (B) accommodated 22 men each, and were manufactured in ten foot sections. The stoves were placed against the walls, taking the space of two beds.¹⁰³ Generally these sleeping huts were ‘arranged in rows with ablution rooms and latrines in blocks between every pair of rows.’ The dining room plan was initially designed at a standard width of 30 feet, but the later sectional huts were narrowed slightly to 28 feet. Schofield incorrectly says the sectional huts were constructed in England and despatched at the beginning of the war,¹⁰⁴ however, Scott-Moncrieff says the sectional design did not come until much later.¹⁰⁵ It is possible that Schofield may be confusing these huts with the canvas and timber huts, which came later.

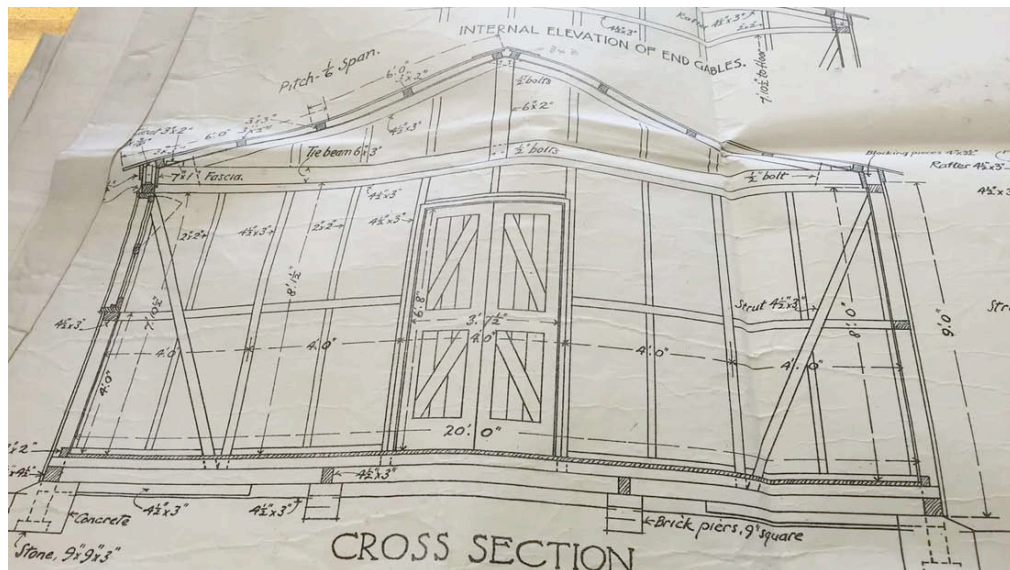


Figure 2.15 Armstrong's Type Plan. Cross-section of a 20-ft wide hut. (Great War Huts, the Suffolk Record Office and the archive of R. G. Hogg)

¹⁰² Baker Brown, p. 425.

¹⁰³ Ibid, p. 423.

¹⁰⁴ Schofield, p. 7.

¹⁰⁵ Scott-Moncrieff, p. 362.

2. **Armstrong Huttred Hospital.** Extensively used in England and France from October 1914.
3. **Armstrong Hut.** Two sizes. 15 ft by 24 ft and 9 ft 3 in. by 12 ft. The smaller huts were more commonly used.¹⁰⁶ Timber frame covered in canvas.
4. **Armstrong Hut Tent.** Light timber A-frame covered in canvas. Very little else is known.
5. **Armstrong Hut No. 4.** (Figures 2.6, 2.7) Introduced in early 1916. Brigadier General Baker Brown refers to ordering ‘1,000 small wooden huts of a new type just evolved by Col. Armstrong.’ He also said that the other huts were supplemented by a ‘very light hut made of flat boards, which was very useful for small detachments.’¹⁰⁷ These measured 9 ft 2.75 in. by 12 ft 2 in. Linen was used in place of window glazing, which would have made sense if employed close to the front lines where explosions would have broken traditional glass windows. The entire hut was shipped as a series of bundles.

The Armstrong huts were quite probably the most successful temporary wartime buildings of the First World War. They were only outshined by the introduction of the more convenient, but perhaps less aesthetically pleasing Nissen Hut. Armstrong succeeded in creating huts that were easily adapted to any unit and he did it in the space of two days, an incredible feat. They were intended to be temporary, but their longevity is evident in the sheer number of Armstrong huts that were purchased from the War Office by local communities and served as village halls from the 1920s through to the 2000s.¹⁰⁸

The Adrian Hut

The Adrian Hut was designed by Augustin Adrian and seems to have been used extensively by the British army and British amenity societies in France.¹⁰⁹

¹⁰⁶ Schofield, p. 7.

¹⁰⁷ Baker Brown, p. 425.

¹⁰⁸ As evidenced by the mass sales in the 1920s and seen in villages like Girton and Drinkstone, mentioned earlier. The village of Wadenhoe, Northamptonshire also had an Armstrong Hut as its village hall until it was replaced by a modern building around 2000.

¹⁰⁹ Institution of Royal Engineers, *Work*, Plate LXX. See also, p. 40.

Patented in the United States on 9 April 1918, the hut has a singular appearance, with angled sidewalls and an overhanging roof.¹¹⁰ It was constructed of timber with pre-drilled boltholes, to allow for quicker erection time by unskilled labour. (Figure 2.16) Measurements are unknown.



Figure 2.16 An Adrian Hut used by the YMCA in France. © IWM Q 5374

The Aylwin Hut

The first of these portable hut designs was introduced in the first few months of the war. However, it was not designed by a Royal Engineer or by the War Office. It was the Aylwin Hut, named after its Canadian inventor Francis Percival Aylwin. He was visiting London as the agent of the Empress Land Company negotiating the sale of land in Saskatchewan, when war broke out.¹¹¹ In September 1914, Aylwin was asked to design a hut for the military.¹¹² He had his plan patented in October 1914 and within a few weeks examples of Aylwin Huts were on exhibition in Green Park, London. Military historian, Terry Crawford, said that by the end of the November, Canadian engineers were erecting these at Hamilton Camp, west of Lark Hill on Salisbury Plain.¹¹³ (Figure 2.17)

¹¹⁰ U.S. Patent number 1,262,156. Filed 5 December 1916. Patented 9 April 1918.

¹¹¹ 'A Debtor's Inventions', *The Times*, 25 January 1916, p. 3.

¹¹² *Ibid.*

¹¹³ Crawford, p. 47.

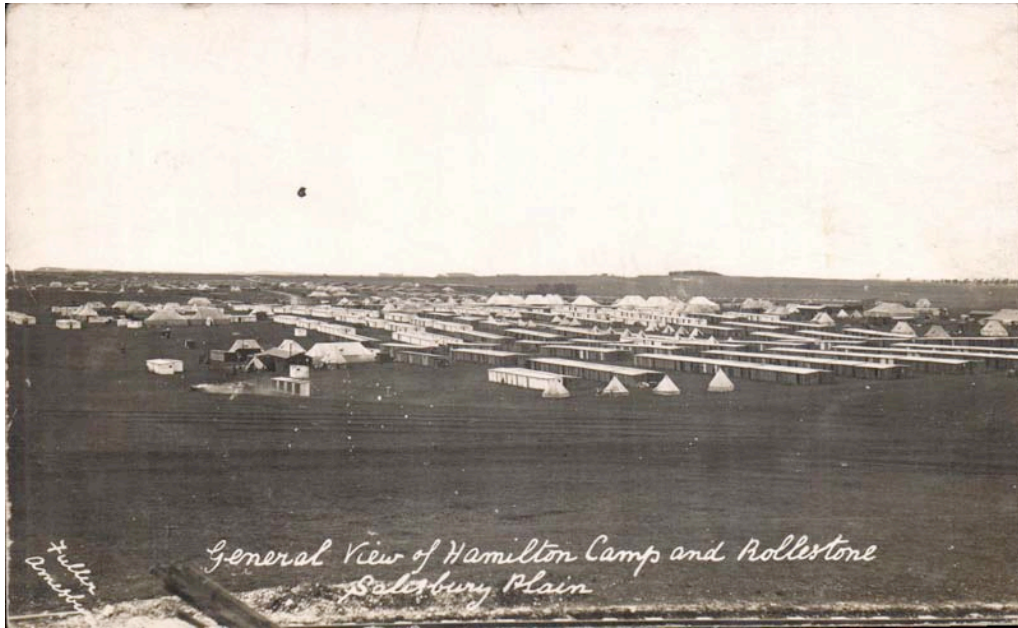


Figure 2.17 Aylwin Huts at Hamilton Camp, Salisbury Plain, Wiltshire, 1915. From the collection of Terry Crawford.

It was a timber frame covered in stretched canvas, with the roof set in a gradual slope upwards to one side, much like a lean-to. The windows were made of mica. Each hut could sleep six men. (Figure 2.18) Crawford said, 'It was claimed that they could be erected in under two and a half minutes and thousands had been ordered for Salisbury Plain and other military centres.'¹¹⁴ Aylwin immediately went into a partnership with the Continever Tent Company and from that point the huts were marketed as the Aylwin Continever Hut.¹¹⁵

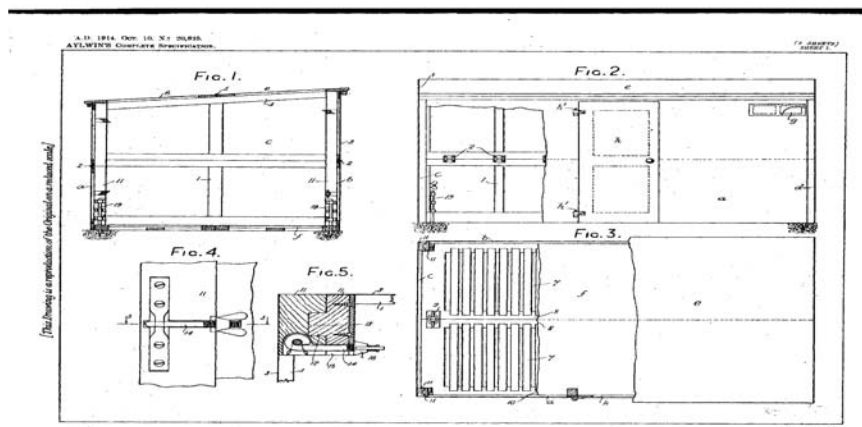


Figure 2.18 Aylwin's patent specification for a portable hut. 10 October 1914. (Espacenet)

¹¹⁴ Crawford, p. 47.

¹¹⁵ Ibid.

While they initially were received with good reviews, they were quickly found to be too primitive, uncomfortable and cold, especially in the winter months. As such, the War Office discontinued using them in 1916.

*The War Office was reluctant to pay Aylwin £40,000 in royalties for the huts and in February 1916 he was declared bankrupt with liabilities of £21,800. Shortly afterwards, the army decided they were not sufficiently weather-resistant and discontinued them, though some remained in use until the end of the war.*¹¹⁶

The Forest Hut

The Forest Hut was designed by Royal Engineer Captain R. G. Brocklehurst to provide accommodation in forested areas. These were built in France, entirely of timber construction, 'to provide living quarters in the forest camps and a large number were made at short notice by French contractors'.¹¹⁷ (Figure 2.19)

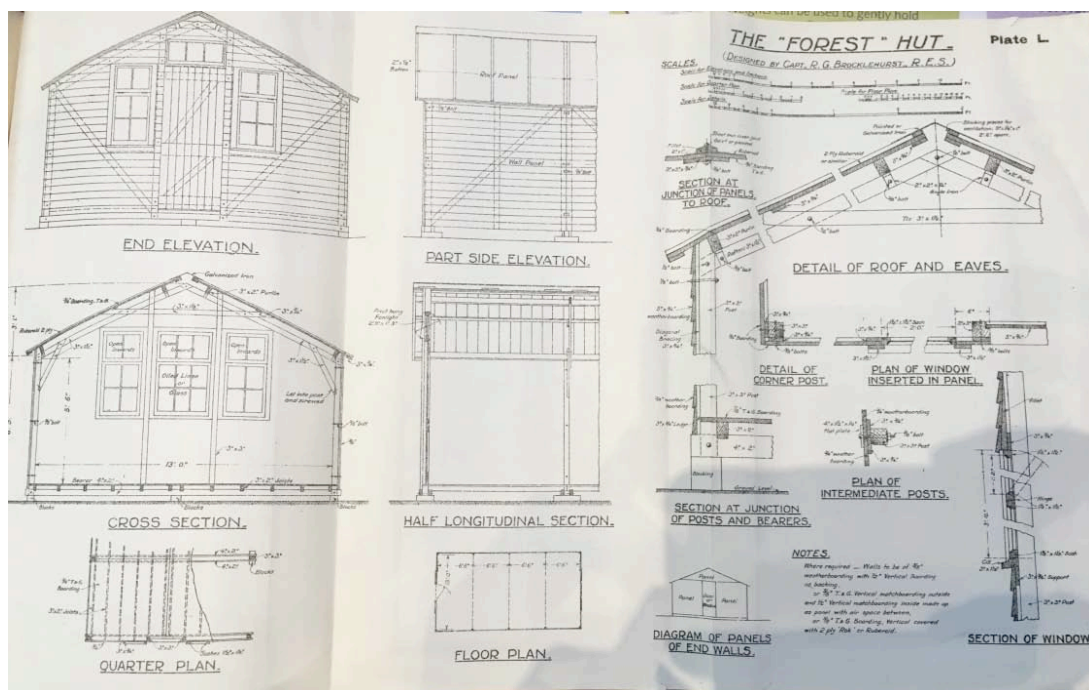


Figure 2.19 The Forest Hut plan. Taken from *Work of the RE in the European War*, (Plate L).

¹¹⁶ Ibid.

¹¹⁷ Mallory and Ottar, p. 77.

The Liddell Portable Hut

The Liddell Portable Hut was designed by Lieutenant Colonel Guy Liddell, a Royal Engineer from Somerset, to meet the needs of soldiers in France.¹¹⁸ It consisted of hinged timber panels that could be easily collapsed, transported and erected again. It appears to have come in two lengths, a 60 ft hut and a 25 ft hut, and at a standard width of 16.5 ft. (Figure 2.20) He went on to have a more developed version of this hut patented in 1934.¹¹⁹ Schofield believes the Directorate of Works ordered 1,800 of these to be manufactured in Switzerland in 1917.¹²⁰

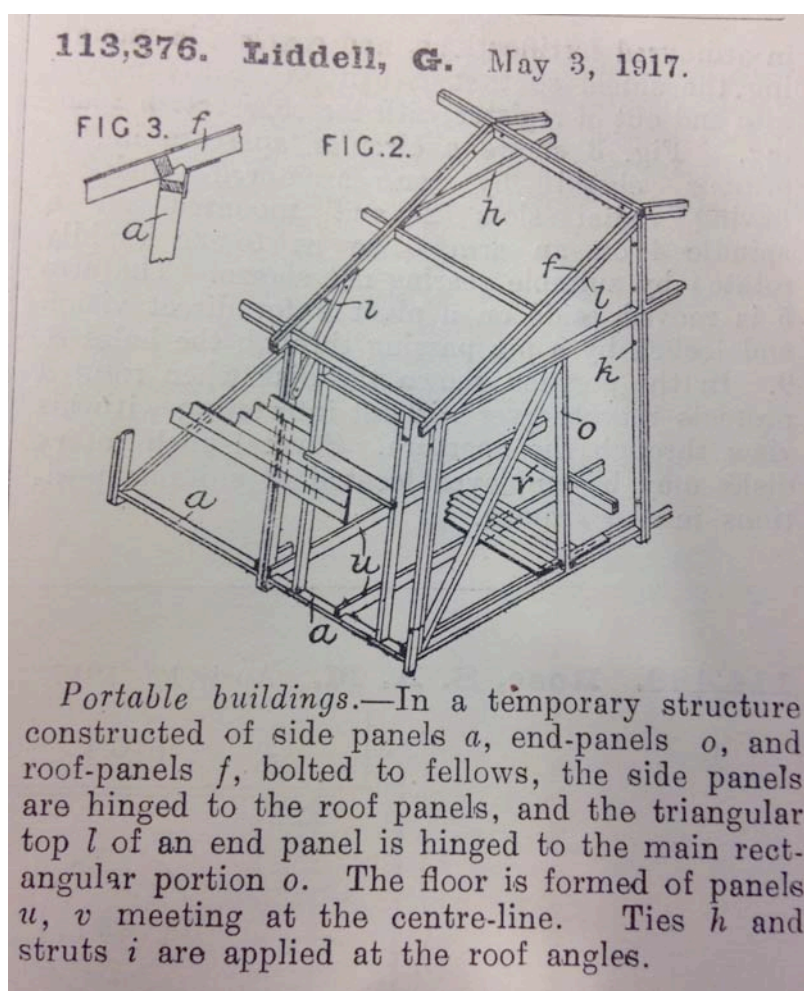


Figure 2.20 Liddell's plan for a portable hut. Patent number GB113376, (3 May 1917).¹²¹

¹¹⁸ Ibid.

¹¹⁹ Patent number GB438911, (30 August 1934).

¹²⁰ Schofield, p. 7.

¹²¹ *Patents for Inventions: Abridgments of Specifications 1916-1920* (London: HMSO, 1923).

The Nissen Bow Hut and Nissen Hospital Hut

Designed by Peter Nissen (1871-1930) in April 1916.¹²² He was an American who spent some years in Canada before moving to England in 1910. His father was a Norwegian immigrant. It is generally assumed Nissen was Canadian, however evidence exists that he was born in either New York or North Carolina, then spent his childhood in North Carolina.¹²³ When war broke out, he volunteered for the British Army but was told he was too advanced in age. Eventually, he was allowed to join the 103rd Field Company of the Royal Engineers in May 1915 and serve in France.¹²⁴ It was while on active duty that Nissen designed his most famous invention, a semi-circular hut constructed of timber and corrugated sheet metal. Nissen said the idea came from a semi-circular skating rink he had once seen at Queen's University in Ontario, Canada. He recognised the soldier's need for better accommodation on the battlefield, beyond what was provided by a standard field tent.¹²⁵ Nissen's design was for:

[A] portable building in which the whole interior space from end to end, side to side, and floor to roof, is free and unobstructed, the parts of which may be standardized and fabricated and when unassembled occupy the least possible space, and which may be repeatedly, quickly and readily set up and taken down.¹²⁶

In essence, Nissen claimed to have succeeded, where other engineers had thus far failed, in designing a truly portable hut. (Figure 2.21)

¹²² McCosh, p. 77.

¹²³ Ibid, p. 23.

¹²⁴ Ibid, p. 76.

¹²⁵ Ibid, p. 77.

¹²⁶ U.S. patent number 1,377,500 (12 March 1917).

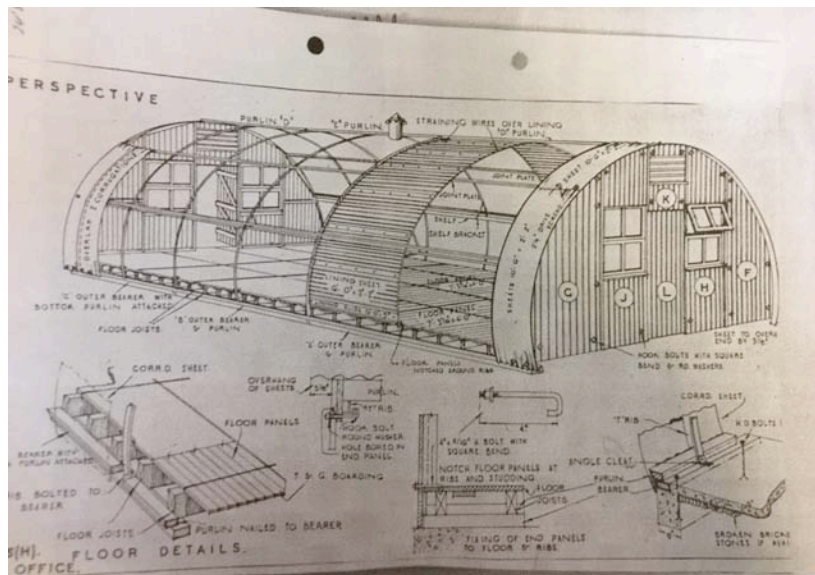


Figure 2.21 War Office plan of the Nissen Bow Hut. (Airfield Research Group)

His simple design that became so iconic used horizontal wooden purlins jointed to steel T-shaped ribs (creating that bow-like frame) with the use of hook-bolts. The exterior of the structure was then covered with corrugated sheeting running in vertical lines, while the interior walls were constructed of either matchboard lining or corrugated iron. The flooring was typically constructed of timber, although later concrete was used. The two ends of the tubular hut were also made of timber. Doors were placed in the centre on the timber end with a window on either side of the doorway. The huts were heated with Canadian stoves.

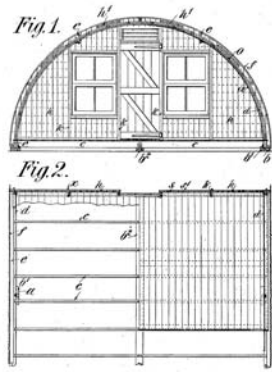
The Nissen Bow Hut was first used in France in September 1916.¹²⁷ The original design was 16 ft by 27 ft by 8 ft high, although in the Second World War a 24-foot and a 30-foot span hut were introduced. It could be built to any length, in 5-foot sections.¹²⁸ This was extended in the Second World War to 6-foot sections.¹²⁹ A typical erection time was just four hours with six men, however a record was once set at just one hour twenty-seven minutes. (Figure 2.22)

¹²⁷ McCosh, p. 89.

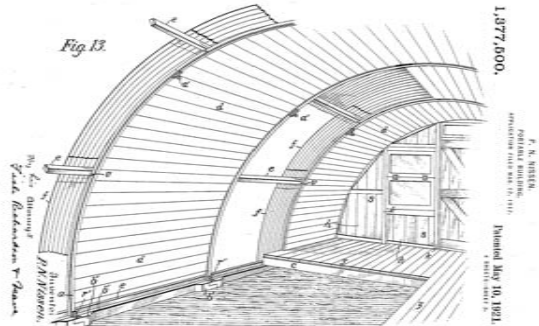
¹²⁸ Patent, *ibid.*

¹²⁹ War Office, *Memorandum Containing Information Concerning Standard Nissen Type Huts* (London: War Office, February 1942).

1,377,500. P. N. NISSEN. PORTABLE BUILDING. APPLICATION FILED MAR. 12, 1917. Patented May 10, 1921. 4 SHEETS—SHEET 1.



INVENTOR.
P. N. NISSEN
By *Robert G. Kelly*
Attorney



1,377,500. P. N. NISSEN. PORTABLE BUILDING. APPLICATION FILED MAR. 12, 1917. Patented May 10, 1921.

Figure 2.22 Patent drawings by Peter Nissen for the Nissen Bow Hut, March 1917. Sheets 1 and 3 of U.S. patent application 1,377,500. Filed 12 March 1917 and patented on 10 May 1921.

The Nissen Hospital Hut evolved from his first design but with the addition of a clerestory along the apex of the room to allow more light and ventilation. It measured 20 ft by 60 ft by 10 ft high. (Figure 2.23) Imperial War Museum statistics calculate that 100,000 Nissen Bow Huts and 10,000 Nissen Hospital Huts were supplied to France and Belgium during the First World War.¹³⁰ (Figure 2.24)

¹³⁰ IWM catalogue number MOD 2. See <http://www.iwm.org.uk/collections/item/object/30018066> [Accessed 17 September 2017]

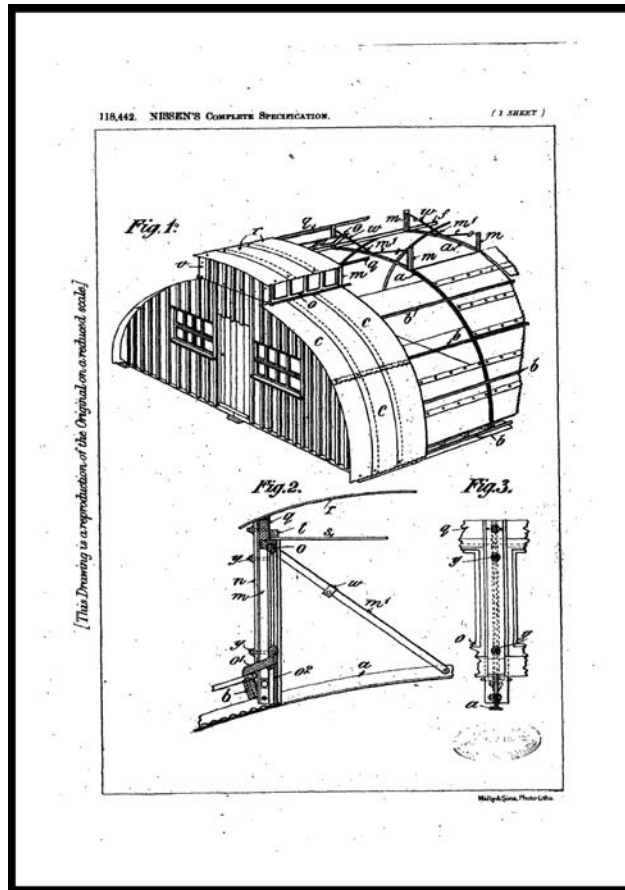


Figure 2.23 The Nissen Hospital Hut. Patent number GB118442, (27 August 1918).



Figure 2.24 Soldiers atop a Nissen Hospital Hut in France. © IWM Q3168

British construction firms such as Boulton and Paul of Norwich and the Thames Joinery Company made the panels, William Baird and Company of Coatbridge produced the steel ribs, and John Summers and Company and Brady and Company manufactured the corrugated iron sheets.¹³¹ One standard hut weighed around two tons, but it was broken down into smaller bundles for ease of transport in a lorry.

The Nissen is now often confused with the American Quonset Hut, developed in the Second World War.¹³² One distinctive difference in visual identification is that the Nissen has vertical corrugations on its exterior and horizontal corrugations with the interior lining. The Quonset has the opposite, with horizontal corrugated sheets on the exterior.

It seems to be generally believed that the Nissen Hut was not erected in Britain during the First World War. A publication by Historic England states:

*In 1916, another Royal Engineers' officer invented the quintessential military building of the 20th century, the Nissen hut, although none appear to have been built in England.*¹³³

John Schofield provides one possible reason for this, stating: 'These were required in France, not England, and it is not known if any were in fact set up in England at the time.'¹³⁴ However, evidence has been found in the course of this research that indicates the contrary. In September 1930, the *Royal Engineers Journal* published an obituary to commemorate the death of Lt. Col. Peter Nissen.¹³⁵ The writer described Nissen as:

*Cheery and humorous, he was a most attractive personality. He brought into all his enterprises the enthusiasm and optimism of a boy, undeterred by occasional failures, of which in later life he had his share...No man was better qualified by experience and technical ability for the special work entrusted to him. He had a genius for design and adaptation combined with a fertile imagination. His personal skill with tools was remarkable, and enabled him to gauge accurately the capacity of machinery and labour.*¹³⁶

¹³¹ McCosh, p. 91.

¹³² See Julie Decker and Chris Chieci, *Quonset Hut: Metal Living for a Modern Age* (New York: Princeton Architectural Press, 2005), pp. 4-6.

¹³³ 'First World War Wartime Architecture', <https://historicengland.org.uk/whats-new/first-world-war-home-front/what-we-already-know/land/wartime-architecture/> [Accessed 18 September 2017]

¹³⁴ Schofield, *Army Camps*, p. 7.

¹³⁵ 'Lieut.-Colonel Peter Norman Nissen, D.S.O.', *Royal Engineers Journal*, 44 (September 1930), 529-531.

¹³⁶ *Ibid.*, p. 530.

Of the Nissen Hut, the writer said:

*[T]he success of the final design was mainly due to his ingenuity, energy and intimate knowledge of workshop practice. Originally intended to provide weatherproof sleeping accommodation and shelter for men in forward areas, Nissen huts were utilised and adapted for every conceivable purpose. Eventually more than 100,000 of them were manufactured at a cost of probably not less than £6,000,000 and were supplied to British Armies on every front and to the American Forces. **They may still be seen standing in many parts of France and in this country.***¹³⁷

By this reference, it seems possible that Nissen Huts were erected in Britain during the First World War after all. It could also be possible that Nissens were brought back from France after the war.¹³⁸

The Tarrant Huts (3)

Walter George Tarrant was a carpenter from Surrey who later expanded his business enterprises to become a builder and property developer. Prior to the First World War, he was best known for his sprawling, exclusive housing enterprise at St. George's Hill aimed at professionals who wanted live in a countryside setting within commuting distance of work in London. He ran a strict business establishment and expected a strong work ethic from his employees who are known to have worked ten-hour days Monday to Friday, and seven-hour days on Saturdays.¹³⁹ Mavis Swenarton, a Tarrant biographer, described Tarrant as 'a man of vision and enterprise. He was an imposing figure, over six feet tall, with abundant grey hair and a thick beard, and is said to have borne a striking resemblance to King Edward VII.'¹⁴⁰ Swenarton noted that by October 1914 Tarrant:

*'was under contract by the Director of Works (France) to build portable wooden huts for the British Expeditionary Force. In 1916, when the shortage of timber and labour in France had become acute, he trained women carpenters at his works at Byfleet to build the huts, which were then dismantled and shipped across the Channel, while the women travelled to France to reassemble them.'*¹⁴¹ (Figure 2.25)

¹³⁷ Ibid.

¹³⁸ Wayne Cocroft of Historic England thinks it is unlikely Nissens were built in England due to a lack of photographic evidence. He says, 'Given the very extensive photographic/postcard documentation of wartime camps it's surprising that none have been captured.'

¹³⁹ Mavis Swenarton, 'W. G. Tarrant: Master Builder and Developer', *Monograph 24*, (Walton and Weybridge Local History Society, 1993).

¹⁴⁰ Ibid.

¹⁴¹ Ibid.



Figure 2.25 Walter George Tarrant, of W. G. Tarrant Ltd., with several of the women carpenters at his camp workshop near Calais, 30 June 1917. © IWM Q2467

Tarrant offered three different huts for use by the War Office. The Tarrant Dechets Portable Hut, (Figure 2.26, 2.27) The Tarrant Light Portable Sleeping Hut, (Figure 2.28) and the Tarrant Portable Mark II Hut. (Figure 2.29) All of these huts consisted of wall panels which:

[W]ere made by nailing a double layer of boarding together, the outer layer vertical and the inner horizontal. By incorporating lattice roof trusses short lengths of timber could be utilized. For assembly special hook bolts, patented under the name of Tarrant Grip, were used in addition to spring-clips which folded over purlins and wall panels.¹⁴²

Despite the similarity in construction, they were all distinctly different in appearance. The Dechets Hut followed a standard gabled appearance. Of note, when timber became scarce, Tarrant's carpenters broke down packing crates and utilised the wood as the main source of building material. The Imperial War Museum estimates that five hundred such huts were built in France during the war, saving a great amount of timber.

¹⁴² Mallory and Ottar, p. 77.

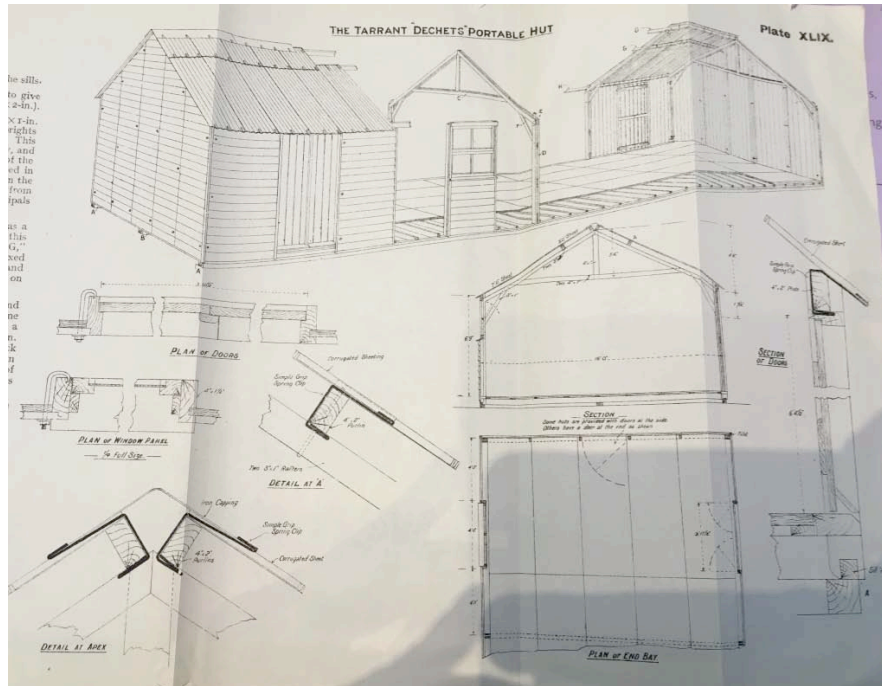


Figure 2.26 Plan of the Tarrant Dechets Hut. (Work of the Royal Engineers in the European War, Plate XLIX)



Figure 2.27 The Tarrant Dechets Hut constructed entirely of used packing crates. Built in France by British women hired to work as carpenters by the Tarrant company. (© IWM Q109797)

The Tarrant Light Portable Sleeping Hut was constructed with:

*[S]loping side walls, vertical end walls, and roof sections supported by a trussed ridge girder...The wall panels are bolted to the sloping timbers and consist of double boarding or single boards and a waterproof covering.*¹⁴³

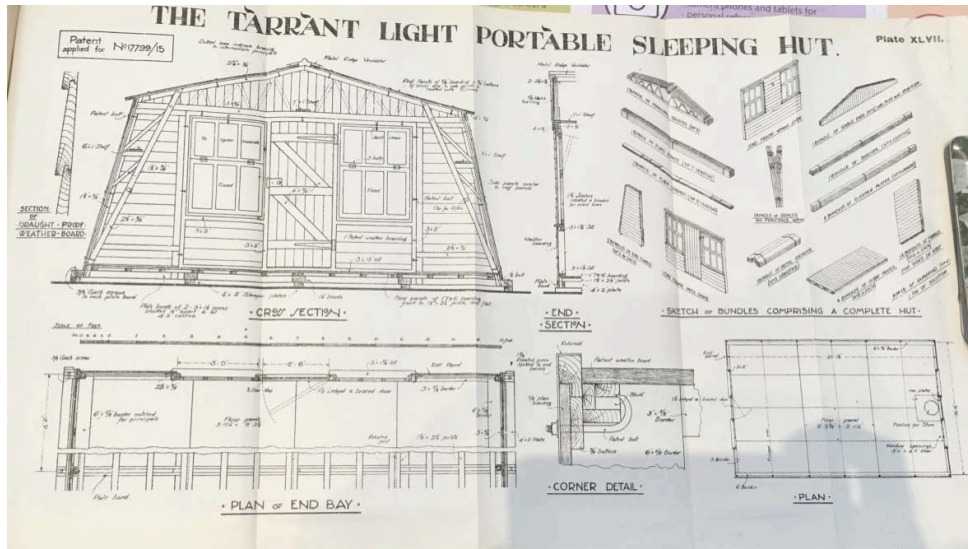


Figure 2.28 The Tarrant Light Portable Sleeping Hut. (Work of the Royal Engineers in the European War, Plate XLVII)

The Tarrant Mark II Portable Hut was a sectional wooden hut purported to be easily transported and erected, whilst retaining structural strength, excellent ventilation, and ‘not liable to harbor fleas or other insect pests.’¹⁴⁴ Its construction consisted of ‘a framework comprising sills on subsills, joists, posts, eaves-rails, and roof beams, and filled in by wall panels secured to the posts by hook or claw headed bolts.’¹⁴⁵ The roof was made from corrugated iron. (Figure 2.29)

¹⁴³ W. G. Tarrant, Patent application GB191517799A, *Improvements in Army or other Portable Huts*, (20 December 1915).

¹⁴⁴ W. G. Tarrant, Patent application GB191507994A, *Improvements in Portable Huts or Similar Structures*, (29 May 1915).

¹⁴⁵ *Ibid.*

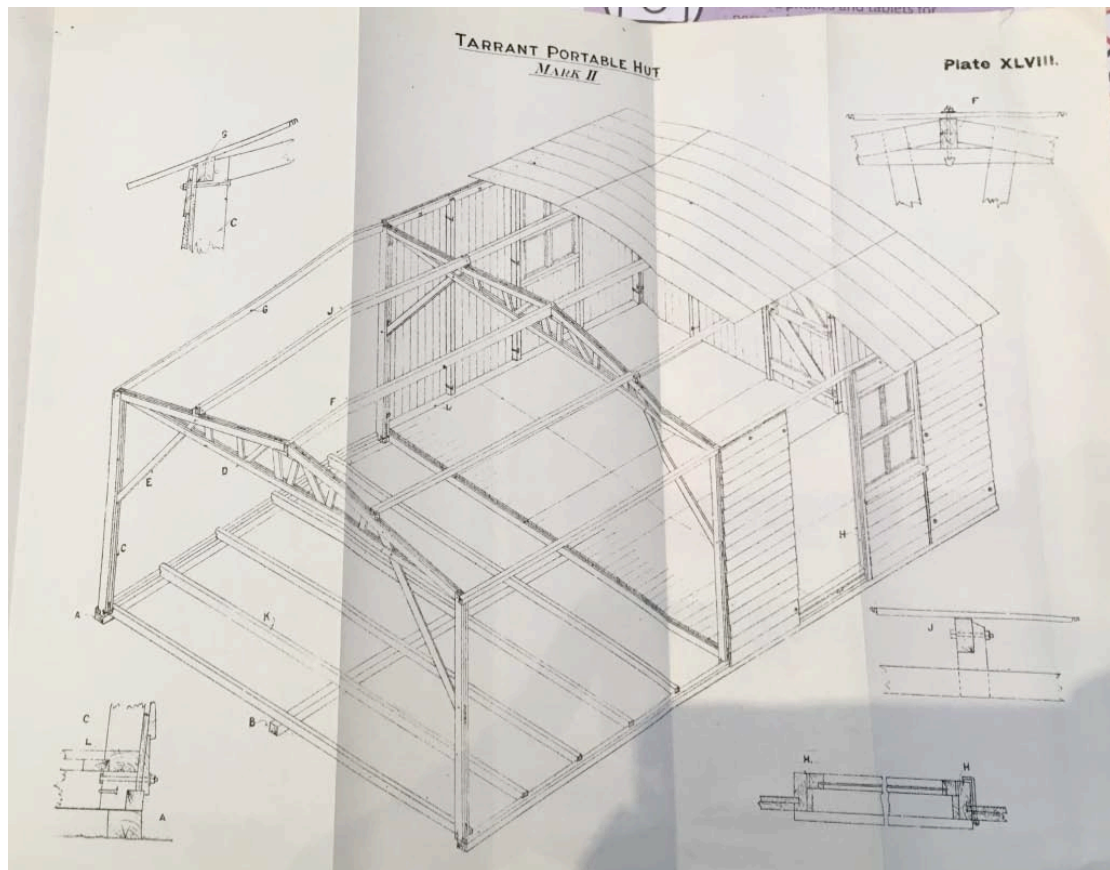


Figure 2.29 The Tarrant Mark II Portable Hut. (*Work of the Royal Engineers in the European War*, Plate XLVIII)

The Weblee Hut

The Weblee Interlocking Hut was a latecomer to the war in 1918. It sought to solve the issue of portability with comfort and ease of transport and erection. It consisted of a series of panels and parts, totaling 68 pieces per hut.¹⁴⁶ It measured 16 ft by 28 ft, but was capable of being extended in increments of 4 ft 8 inches, the basic width of one panel. (Figure 2.30) Initially, other than the fact that it was used in France, very little else could be discovered about the Weblee, including its architect. There are no published accounts that document anything other than this plan and a brief mention. However, further research into patent records proved successful. The hut was the design of two men, Capt. Frederick Webb, a Royal Engineer, and Felix Leather, a builder and contractor from Wandsworth, London.¹⁴⁷ The name Weblee would seem to be an amalgamation of their two surnames. They filed a patent

¹⁴⁶ Institution of Royal Engineers, *Work*, Plate LIV.

¹⁴⁷ Patent number GB122026, (10 January 1918).

application on 10 January 1918. The patent states that the entire construction required only unskilled labour and no tools. (Figure 2.31)

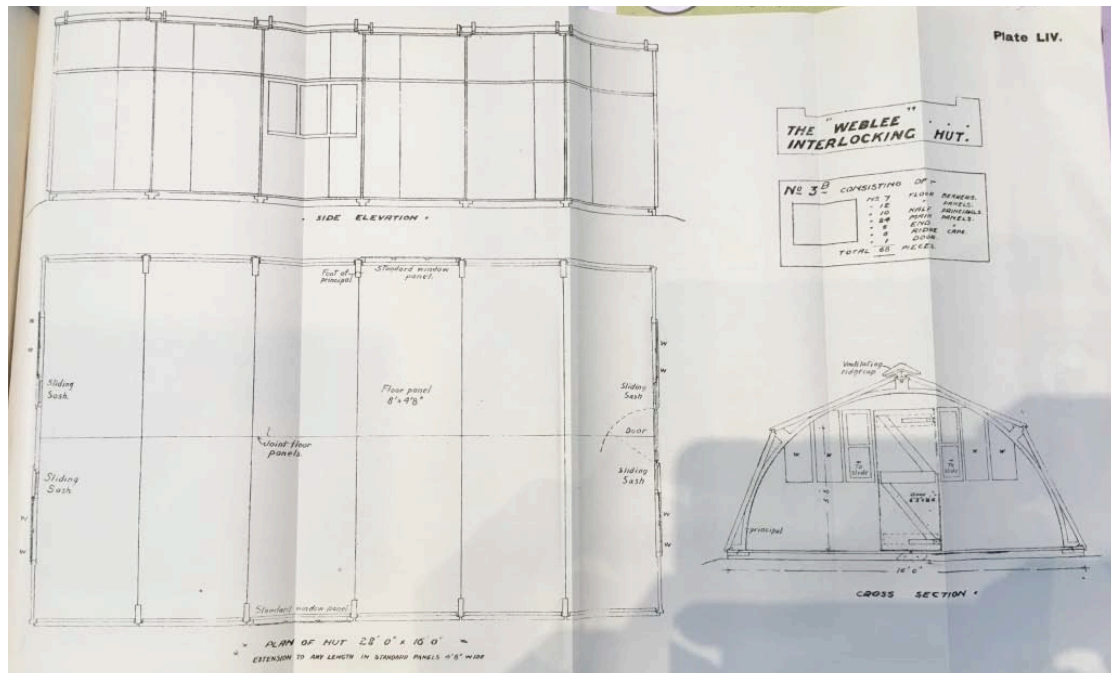


Figure 2.30 The Weblee Interlocking Hut. (Works of the Royal Engineers in the European War, Plate LIV)

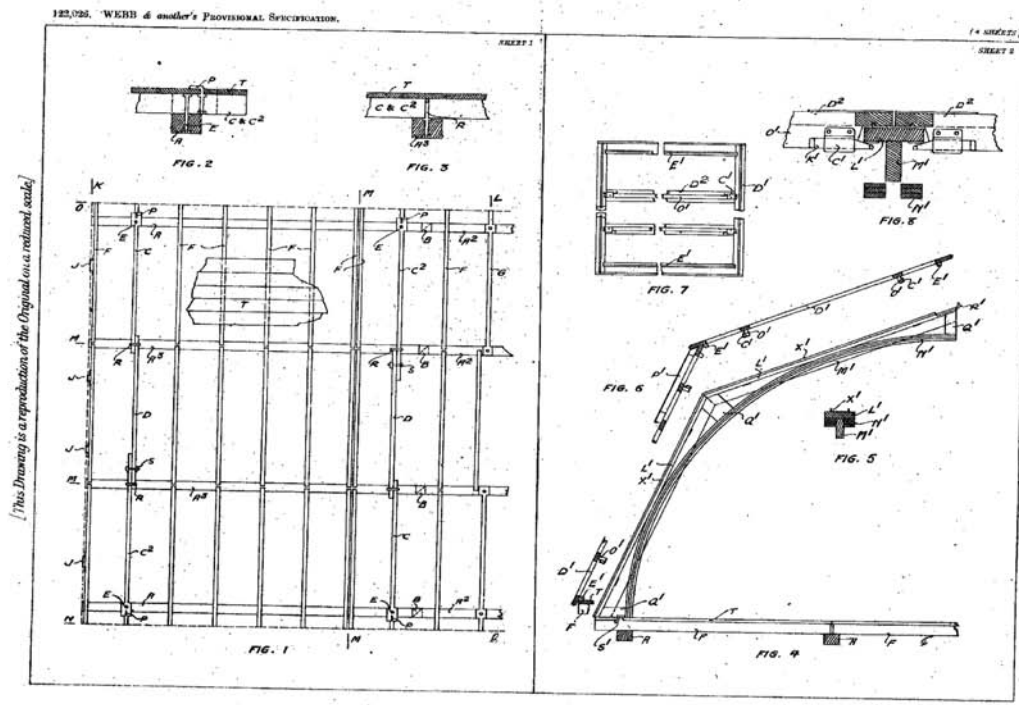


Figure 2.31 The Weblee Interlocking Hut. Patent Drawing for patent application GB122026A dated 10 January 1918. (Espacenet)

During the First World War, a variety of amenity societies, such as the Church of Scotland and the Salvation Army, purchased huts to supply the comforts of a home away from home, with tea, hot meals, showers, beds and recreation space for the troops.¹⁴⁸ The YMCA made use of Adrian Huts in France, but they also hired an architect to execute their own huts. These were erected throughout London, most often near to tube and train stations.¹⁴⁹ The RIBA library holds a set of these plans.¹⁵⁰ They confirm that the YMCA huts were architecturally singular designs. They were not built as a system for replication, but rather to be exemplar. The plans were not constructional, but rather provided space standards, setting how much space was needed to feed a certain number of people, etc. Thus, while interesting, they are not included in this survey as they do not fit the established criteria.

Conclusion

The History of the Corps of Royal Engineers dedicated volumes five and six specifically to their work during the First World War, both at home and abroad. However, due to the outbreak of the Second World War, the volumes were not published until 1952, nearly forty years after the war began. The foreword, written by General Guy C. Williams, acknowledges that historians can struggle with ascertaining how much time is necessary to wait between the end of a historical event and when an account can most accurately be written.¹⁵¹ It relies heavily on the release and availability of official reports and documentation from both allied and enemy sources. Yet to wait too long means to risk the accuracy of the first-hand memories of those involved.¹⁵² There is also the risk of key players dying in the interim and taking their memories with them. Williams implies that this may have been the case with these two volumes. The Second World War disrupted and delayed their publication, thus these volumes are as accurate as could be made possible with the available resources of the time.

¹⁴⁸ YMCA, *Told in the Huts* (Bloomington, IN: YMCA, 2014). Originally published in 1916.

¹⁴⁹ The RIBA Architectural Library Archives holds a large portfolio of YMCA hut designs with their locations around London.

¹⁵⁰ *Ibid.*

¹⁵¹ Institution of Royal Engineers, *History of the Corps of Royal Engineers*, Vol. 6 (Chatham: MacKay and Co., 1952), p. iii.

¹⁵² *Ibid.*

This predicament seems most evident in the historical accuracy of their treatment of hutting during the First World War. With the passage of several decades and another world war, the *History of the Corps of Royal Engineers* records only a fleeting mention of Armstrong's huts (which arguably made the most significant contribution in providing shelter to Kitchener's Army), whilst the Tarrant, Forest, Liddell, and Weblee huts are forgotten completely. The Nissen Hut is discussed as the main hut of the war in France.

*The rapid provision of sufficient huts presented great difficulties. At first supplies were of sectional huts of Armstrong design, but they proved too bulky for shipment. In 1916, the Engineer-in-Chief in France adopted a design proposed by Captain Nissen, for a semi-circular hut constructed of corrugated steel sheets on a wooden foundation. A first order for 27,000 Nissen huts was placed at the end of 1916 and for 20,000 more a few months later.*¹⁵³

This appears to be the beginning of the Nissen misconception. If it was not for Scott-Moncrieff's memoirs of 'The Hutting Problem in the War' for the *Royal Engineers Journal* in 1924 and Baker Brown's recollections in 'Notes of a Chief Engineer in the Great War of 1914-1918,' published in 1925, it is likely that the specifics and history surrounding these other huts would have been lost. This is not to discount the positive contribution made by Nissen Huts to the war effort in France. The Nissen Hut quite feasibly is the most famous because it was the first successfully mass-produced prefabricated wartime building that in its simplicity solved pressing problems of portability and ease of erection. It was so successful it was used again in the Second World War. However, over time the name *Nissen* has come to encapsulate any wartime hut, much as the brand name Hoover is used to describe any vacuum. This takes credit from the many builders and engineers of the period who ingenuity and resourcefulness contributed to a great many designs, which all served a purpose and were widely used throughout the war both in France and in Britain.

It could be argued that the most significant contribution to hutting in the First World War was not Peter Nissen's hut, although it was massively successful. It could be said instead that it was the incredible feat of initiative and skill shown by Major Armstrong in developing seventeen designs for a typical battalion camp in just two

¹⁵³ Institution of Royal Engineers, *History of the Corps of Royal Engineers*, 5 (Chatham: MacKay and Co., 1952), p. 80.

days, under enormous pressure in August 1914. His designs were said to be of such high quality that not even the bevy of professional architects involved with the Barrack Construction Directorate of the War Office could find fault with them.¹⁵⁴ There is likewise a heroic and important story in the female carpenters who were responsible for building 37,000 Tarrant Huts in a camp outside of Calais. The Adrian Hut as well as the Armstrong became mainstays of amenity societies such as the YMCA and the Church of Scotland, providing hot meals and comfortable surrounds to troops both in England and in France. For written history to forget these huts is to forget a significant part of the true history of the First World War.

Of note, many of the engineers who designed huts in the First World War also pursued patents (See Patents and Appendix A). However, the one who is credited with the greatest number of designs and perhaps could have benefited financially from his work but never filed a single patent, was Major B. H. O. Armstrong. As much detail is gleaned from patent applications, including drawings, this unfortunately means that there is limited knowledge not only of the man but also of his designs. Some do not bear his name and are credited only to the War Office.

Post-War Sales of Surplus Huts


In the immediate years following the war, the War Office and Ministry of Munitions held public auctions and sales of wartime equipment. In 1920, *The Times* was full of advertisements for auctions by the government. Items included portable tables, table trestles, dinner plates, blankets, hair pillows, 3-foot wide iron combination bedsteads, Windsor chairs, hurricane lamps, towels, and silverware.¹⁵⁵ It was at this time the government also began the sale of all of its surplus huts. (Figure 2.32) In Ripon, Yorkshire, in May 1920, the government offered for sale by direction of the Disposal Board, 24 corrugated iron huts and 24 wood living huts.¹⁵⁶ These came in various sizes and were designated by their use such as officers' quarters, officers' messes, kitchens, dining halls, cookhouses, and canteens. They were set up

¹⁵⁴ Scott-Moncrieff, p. 367.

¹⁵⁵ 'Auction Sales of Government', *The Times*, 8 May 1920, p. 23.

¹⁵⁶ *Ibid.*

and available for viewing for the week prior to the sale at the Royal Artillery Lines South Camp.¹⁵⁷

G.  R.

MINISTRY OF MUNITIONS.
By DIRECTION of the DISPOSAL BOARD
(HUTS & BUILDING MATERIALS SECTION).
TWO DAYS' SALE OF

HUTS & BUILDINGS
At Nos. 28 and 29 CAMPS, ROYAL ARTILLERY
LINES,
SOUTH CAMP.
RIPON, YORKS.
On MONDAY and TUESDAY,
MAY 10th and 11th,
at 11.30 a.m.
Comprising:—

24 Corrugated Iron and 24 Wood LIVING HUTS,
61ft. x 21ft. x 10ft. 6in.
Wood CHURCH ARMY HUT, 61ft. x 21ft. x
10ft. 6in.
2 Wood OFFICERS' MESSES, 71ft. x 20ft. 9in. x
10ft. 9in.
2 Wood and 2 Corrugated Iron OFFICERS' QUAR-
TERS, 100ft. x 21ft. x 10ft. 6in.
2 Wood SERGEANTS' MESSES, 71ft. x 20ft. 9in. x
10ft. 9in.
2 Corrugated Iron KITCHENS, 56ft. x 20ft. 9in. x
10ft. 6in.
4 Wood KITCHENS, 20ft. 9in. x 20ft. 9in. x 10ft. 6in.
2 Wood DINING HALLS, 70ft. x 20ft. 9in. x 12ft. 6in.
2 Corrugated IRON DINING HALLS, 91ft. x 20ft. 9in.
x 12ft. 6in.
2 Wood N. and A. CANTEN, 125ft. x 28ft. x
12ft. 4in. with Kitchen, Office, Bedroom, Store,
W.C. and Coal Shed.
1 Corrugated Iron N. and A. CANTEN, 191ft. x
28ft. 9in. x 12ft. 4in. with Kitchen, Office, Bed-
room, Store, W.C. and Coal Shed.
1 Corrugated Iron COOKHOUSE, 60ft. 9in. x 28ft. 9in.
x 12ft. 4in.
1 Wood COOKHOUSE, 50ft. 9in. x 28ft. 9in. x
12ft. 4in.
Latrines, Ablution Sheds, Coal Places, Drying Huts,
Stores, Bath Houses, Guard Rooms, Manure Pits,
Incinerators, Horse Troughs.
4 Horse Shelters and Corn Stores, with wooden ends
and Roof, 215ft. x 20ft. x 10ft. 6in.
5 Horse Shelters and Corn Stores, with wooden ends
and Roof, 175ft. x 20ft. x 10ft. 6in.
2 Horse Shelters and Corn Stores, with Corrugated Iron
ends and Roof, 50ft. 9in. x 20ft. x 10ft. 6in.
1 Horse Shelter and Corn Store, with Corrugated Iron
ends and Roof, 55ft. x 20ft. x 10ft. 6in.
19 Corrugated Iron Harness Rooms, 90ft. x 12ft. 1in.
x 10ft. 6in.
Wood Forage Stores, 150ft. x 20ft. x 10ft.
Wood Forage Barn, 55ft. x 35ft. x 20ft.
Corrugated Iron Quartermasters' Store and Hut,
60ft. 9in. x 20ft. 9in. x 10ft. 6in.
Wooden Barrack Store, 90ft. 9in. x 20ft. x 12ft.
Wooden Barrack Office, 20ft. x 12ft. x 10ft. 6in.
3 Wooden Stores, various sizes, Coat Hooks, 69 Slow
Combustion Stoves, 3 Hose Stoves, 21 Queen Stoves,
20 Boilers, various sizes, 14 (over) Ranges, 20 Sinks,
quantity W.C. Cisterns, Baths, and Lavatory
Basins, and other effects.

The above will be on view Seven Days previous to the
Sale. Cards to View may be obtained from the Auctioneer.
Cards to View not necessary for Friday and Saturday,
May 7th and 8th.
Catalogues may be had from the Auctioneer, Mr.
A. J. BOOTH,
15, Infirmary-street, Leeds.

Figure 2.32 Auction advertisement for the sale of huts and buildings in *The Times*, 8 May 1920.

It was by this method that so many of Armstrong's *War Office Type Plan Huts* were sold and dispersed across the country, to be reused as village halls, schools, Women's Institutes, and various other community buildings. (Figure 2.33)

¹⁵⁷ Ibid.



Figure 2.33 Drinkstone Village Hall, a timber Armstrong Type Plan Hut. With thanks to Great War Huts.

Written histories document those lessons learned so that they need not be repeated, if studied carefully. Guy Williams in *History of the Corps of Royal Engineers* said in his foreword that he thought it was a shame that the First World War volumes were not written before the advent of the Second World War because he believed there were many parallels between the two conflicts and the challenges the engineers faced, that could have been made easier with a proper history to study.¹⁵⁸ 'It was a sapper war, and we entered it, through no fault of our own, both ill-prepared and under-manned, but, as these pages show, we achieved great things.'¹⁵⁹

¹⁵⁸ Institution of Royal Engineers, Vol. 6, p. iii.

¹⁵⁹ Ibid, p. iv.

Chapter Three

Huts of the Second World War (1939-1945)

Escalation to a New War

During the interwar period, Britain expanded not only its understanding of materials and construction, but also its programme for national aerial defence. The former was addressed by the establishment of the Building Research Station in 1920, and the latter by the planning for a Home Defence Air Force with new aerodromes. One opinion argued:

*The day might not be far off when aerial operations may become the principal operations of war, to which the older forms of military operations may become secondary and subordinate.*¹

These expansions were tempered by the 1919 introduction of the Ten Year Rule. It was the government instruction to limit defence budgets and enter a period of disarmament with the belief that another war would not occur within ten years, a policy which was renewed several times.² The Treaty of Versailles may have created a false sense of security in peacetime, and coupled with the need to improve Britain's economic state, the Armed services found their budgets greatly reduced. As such, it does not appear that huts as a building type were improved upon specifically during this period, at least not until well into the rearmament phase, as they were generally seen as a response to emergency and/or wartime demand, and the interwar period was mainly focused on downsizing. As noted in the previous chapter, most wartime huts were either demolished or sold on the open market in the years immediately following

¹ Francis, p. 13. A quote from General Jan Christian Smuts in 1918.

² National Archives, The Cabinet Papers, *The Ten Year Rule and Disarmament*, <http://www.nationalarchives.gov.uk/cabinetpapers/themes/10-year-rule-disarmament.htm>, [accessed 15 June 2017]

the end of First World War, many being moved and finding a new purpose as various types of community support buildings, such as village halls.

The government chose to retain some camps along with their huts, which were sometimes converted to make them more comfortable and bring them up to peacetime standards. An example of this can be seen at Catterick, where it was determined that the cost of returning the camp to its prerequisite state, as required by the Defence of the Realm Act, would cost £110,000 as opposed to just purchasing the land outright for £120,000.³ As the cost of rebuilding the camp in permanent construction would have easily soared into millions of pounds, thoroughly exceeding any post-war austerity budget, the decision was made to retain the huts but to convert them into more acceptable quarters.⁴ Schofield's report on Army camps describes how this was done:

All buildings which were to be lived in had a half-brick wall built round the existing huts and tied in, leaving a 2" air space. Stoves were replaced by central brick fireplaces, and sanitary annexes with modern fittings provided with covered approaches from each hut. Buildings which were not lived in were to be clad externally with weather boarding, fixed to battens bolted on the original steel uprights. All roofs were made good by laying new Ruberoid over the old [...] If necessary, a second half brick wall could be built round the buildings and tied to the new one, so giving (as the Committee thought) a permanent construction. If necessary, new roofs and floors and new windows could be provided.⁵

Thus, the interwar period saw huts sold, demolished or renovated, but not necessarily improved upon as a design type. The importance of this period, and its impact on the development of hutting, is that for the first time government research was conducted into materials and construction practices, providing knowledge that would later aid in the hutting programme of the Second World War.⁶ Another significant event in the development of hutting was the period of rearmament, which began in 1935 after Hitler, as Chancellor of Germany, violated Part V of the Treaty of Versailles and began rebuilding the German military. In response, Britain commenced a widespread programme of aerodrome construction, updating airfields and making heavy use of timber and steel, which meant less of these materials were available for huts when war was declared in 1939.⁷

³ Schofield, p. 7.

⁴ Ibid, p. 8.

⁵ Ibid.

⁶ Thanks to the creation of the Building Research Station discussed later in the chapter.

⁷ G. B. O. Taylor, 'The Problem of Accommodating the Army on the Outbreak of War', *Royal Engineers Journal*, (June 1940), 167-179 (p. 173).

Desmond Morton,⁸ in his lecture on the Economics of Modern Defence given in February 1939, stated that one lesson that became clear from the First World War was that the final outcome of modern wars would be decided by economic and psychological factors, for ‘hungry people are depressed people, and depressed people lose the will to win.’⁹ It seemed clear that a lack of proper shelter and the inevitable extreme discomfort and potential illness this would cause, would likewise contribute to a loss of morale. Therefore, shelter was seen as important as food in its psychological impact on a fighting force. However plain and mean, the availability of shelter that provided warmth and protection from the elements, could be argued to have had a direct bearing on the morale of troops, thus contributing to the outcome of war. Considering the enormous extent of huts required for the millions of men that made up the armed forces in the Second World War, in the face of labour and material shortages, is extraordinary. This is why the study of wartime huts, a building type for which relatively little is known, is so important. This chapter will look at the influence of the Building Research Station, the rearmament period (1935-39), the outbreak of war and problem of accommodation, the control of building materials, the general issues surrounding the design of huts, including contracts, material and labour shortages, and the impact of two major building programmes during the Second World War.

Building Research Station

Frederick Lea, in his 1971 history of the Building Research Station, wrote that prior to the First World War, building practices relied more on the tradition of trial and error, coupled with experience, than on science and technology.¹⁰

A long established art like building was not readily to be influenced by science and indeed was resistant to it. Science was long regarded by many architects as a hostile force “to be kept at arm’s length if architecture was to preserve its own soul”[...] Even as late as the 1940s, we find an architect saying wistfully: “Too much science has infringed upon what was once the straightforward craft of building.” This indeed only expressed the fear that

⁸ At the time of this article in 1939, Desmond Morton (1891-1971), was the Director of Intelligence for the Ministry of Economic Warfare. From 1929, he had worked as the Director of the Industrial Intelligence Centre, gathering information about any foreign governments potentially making ‘war-like preparations.’ See G. Bennett, *Churchill’s Man of Mystery* (Abingdon: Routledge, 2007). Churchill later brought him on as his Intelligence Advisor in May 1940 where he stayed for the duration of the war.

⁹ D. J. F. Morton, ‘Economics in Modern Defence’, *Royal Engineers Journal*, (June 1939), 167-179 (p. 167).

¹⁰ F. M. Lea, *Science and Building: A History of the Building Research Station* (London: HMSO, 1971), p. 1.

architecture might be sterilized by too much mathematical calculation or too many scientific rules.¹¹

It is probable that the shortages of traditional building materials (brick, tile, slate) during the First World War brought to light how little was known of the properties and limitations of alternative materials (steel, concrete, plywood, asbestos cement). Thus, when it was established in 1920, the Building Research Station had a simple remit: it was to improve building methods through investigating materials and practices. Staffed by young chemists, engineers and physicists, they:

[S]aw themselves as pioneers whose purpose was to provide a scientific basis for traditional methods, by explaining how things worked and why, and to develop knowledge of materials and of the physical processes that determine the behavior of buildings.¹²

Tests were run to examine the effects of wind pressure, effects of moisture on various materials, the fire resistance of concrete, the decay and preservation of natural stone, the permeability of concrete to water, and more.¹³ The organisation's first home was in East Acton, in a compound of what appears in photographs to be several Armstrong Type-Plan Huts. Here they conducted their first experiments and increased their scale of operations, until they moved to a larger facility in Garston at the end of 1925. By 1926, the Building Research Station had a new, more complex remit:

Present day civilization with its large industrial population and call for higher and higher standards of living, is making demands on the building industry far beyond those which led to the evolution of the traditional materials and methods. The new problems might be solved to some extent by the old purely empirical processes of trial and error, but such processes are too slow and costly; only by the application of modern scientific methods can satisfactory solutions be found which will meet the modern demand for rapid erection and durability, combined with economy. The necessities of post-war construction have brought the difficulties to a head, especially in relation to national housing and the need for quickly-built yet comfortable and healthy homes. The urgency and magnitude of the housing problems make it essential that all matters affecting methods of construction, supply of materials, organization of labour, and economy and despatch in execution, shall be overhauled and reconsidered.¹⁴

Thus, in the years prior to the outbreak of the Second World War, the Building Research Station established itself as the scientific research arm of modern day construction materials and practices. It is perhaps unsurprising then that it was relied upon to provide wartime advice. It did this through the production of twenty-one

¹¹ Ibid, p. 2.

¹² Ibid, p. 24.

¹³ Ibid, p. 23.

¹⁴ Ibid, p. 26.

Wartime Building Bulletins, published between 1940 and 1941. (Figure 3.1) These ranged in subject matter from *Economical Type Designs in Structural Steelwork for Single Storey Factories* to *Emergency Pipe Repairs* and *Notes on the Repair of Bomb-Damaged Houses*.¹⁵

A. PUBLICATIONS ISSUED THROUGH H.M. STATIONERY OFFICE

WARTIME BUILDING BULLETINS

No.		
1.	Economical type designs in structural steelwork for single storey factories	*
2.	The application of reinforced concrete to wartime building	*
3.	Type designs for small huts	*
4.	Supplementary type designs in structural steelwork for single storey factories	*
5.	Economical type designs in reinforced concrete for single storey factories	*
6.	Part I—Arch construction without centering	*
	Part II—Further designs for hut type buildings	*
7.	House construction	*
8.	Part IA—Walls for factory buildings	*
	Part IB—Columns for factory buildings	*
	Part II—Tubular steel trusses and purlins for factory buildings	*
9.	Conservation of cement and of clay bricks	1s.
10.	General principles of wartime building	*
11.	Precautions for concreting and bricklaying in cold weather	1s.
12.	Emergency pipe repairs	6d.
13.	The fire protection of structural steelwork	1s.
14.	Centerless arch designs	*
15.	Standard designs for single storey factories for war industries with Notes on siting and lay-out	1s.
15A.	Supplement to Bulletin No. 15	3d.
16.	Jointing mortars for brickwork	6d.
17.	Resistance of reinforced concrete structures to air attack	1s.
18.	Fire stops for timber roofs	*
19.	Economy of timber in building	3d.
20.	Sand-lime bricks	1s.
21.	Notes on the repair of bomb-damaged houses	*

*Those marked * are now out of print.*

Figure 3.1 The Building Research Station's *Wartime Building Bulletins* listed by number and title. (Appendix IV of *Report of the Building Research Board: For the Years 1940-1945*).

They were also successful in the production of working drawings for factory buildings, to the extent that 'in one period nearly 800 standard factory designs were dispatched in eight weeks.'¹⁶ Overall, the bulletins address substitute materials, alternative construction forms, fire protection and repair guidance. On the subject of hutting, *Bulletin 3: Type Designs for Small Huts*, and *Bulletin 6 (Part II): Further Designs for Hut Type Buildings* are of most relevance. However, rather than provide a list of hut designs, these bulletins only offer a study of how to reduce the use of timber and steel, while providing standards in their construction. The bulletins do offer their own experiences with a type design for small huts. One type is constructed of brick and another with a precast reinforced concrete frame, both utilizing

¹⁵ *Wartime Building Bulletins* 1 and 21, respectively.

¹⁶ Lea, p. 89.

corrugated asbestos cement sheeting for the roof.¹⁷ (Figure 3.2) It is unknown whether these designs were ever put into production.

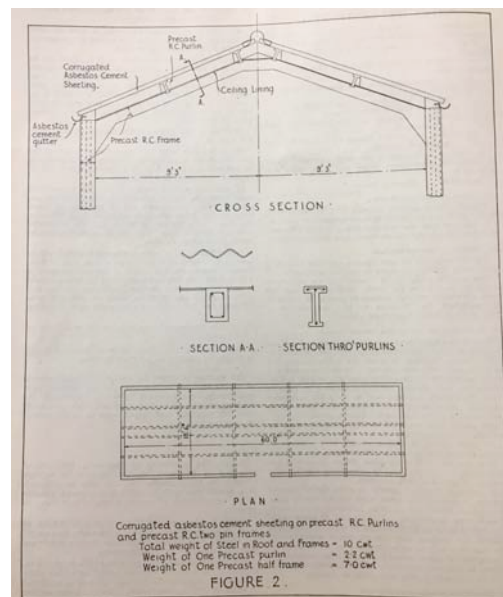


Figure 3.2 Plan for a reinforced concrete hut with corrugated asbestos cement sheeting roof, designed at the Building Research Station and published in *Wartime Building Bulletin* No. 3.

In 1948, the Building Research Board published a report that covered the wartime work over the years of 1940-1945.¹⁸ The report documented that due to wartime demand necessitating the economic use of materials, it had the unfortunate effect that hut designs tended to be somewhat flimsy. For instance, the size of timbers used in construction was reduced so drastically there was a reasonable concern over their ability to support the weight of roofing material.¹⁹ As such, the War Office, the Ministry of Supply and the Ministry of Works and Buildings, as well as many private firms, relied on the Building Research Board to conduct all necessary tests to determine if these huts would meet minimum standards as well as hold up to the force of the wind.²⁰

In general the tests consisted of the application of a number of concentrated loads in nearly horizontal direction at eaves level to represent the effect of loads equivalent to various wind velocities... With certain types of hutment having a curved roof and walls the lateral loads consisted of a series of inward loads normal to the surface of one side of the hut [...] The

¹⁷ Department of Scientific and Industrial Research, *Wartime Building Bulletin No. 6 Part II: Further Designs for Hut Type Buildings* (London: HMSO, 1940), p. 6.

¹⁸ Building Research Station, *Report of the Building Research Board for the Years 1940-1945* (London: HMSO, 1948).

¹⁹ To be discussed further in Chapter Four.

²⁰ Department of Scientific and Industrial Research, *Report of the Building Research Board: With the Report of the Director of Building Research For the Years 1940-1945* (London: HMSO, 1948), p. 61.

*loads were applied through rollers by means of a steel cable tensioned by a straining device, springs being used to measure the applied load.*²¹

There was likewise research into alternative materials to reduce the use of steel and timber. For example, at the behest of the Ministry of Works, gypsum plasterboard (drywall) was investigated as a substitute for hut glazing, walling and roofing.²² Plasterboard (introduced to the United Kingdom in 1917) was known to be pervious to moisture and thus weatherproofing experiments were conducted to determine the best methods of increasing its impermeability and thus furthering its viability as an alternative construction material.²³ In the end, it was found that the best method involved:

*A strip of self-finished bitumen roofing felt was rolled up tightly; it was then gradually unrolled along the joint while its surface coating and those of the adjacent panels were melted simultaneously with a moving blowlamp, the strip being pressed into position. Choice of suitable materials and careful execution, particularly of the site work, resulted in satisfactory hutting; poor workmanship, leading to entry of rain, could, on the other hand, prove very unsatisfactory.*²⁴

In a similar vein, plastics and slate were tested as replacements for steel in reinforcing concrete. However, both materials failed in various experiments, and were deemed insufficient for the task.²⁵

Overall, the wartime period saw the Building Research Station's Special Wartime Building Committee advise on materials, construction techniques for factories and repair alternatives for bomb damaged buildings. Their larger focus seemed to be on civilian housing and what was expected to be a post-war housing crisis. Lea says as early as 1941, the Station began work on the likely problems of post-war reconstruction.²⁶ This culminated in the creation of the Interdepartmental Committee on House Construction in 1942, chaired by Sir George Burt, to provide advice on post-war housing solutions for which the Building Research Station was integral.²⁷ However, it is likely the Station's studies, both before and during the war, into the strengths and limitations of alternative materials made a significant contribution in wartime, by expanding the range of materials and structural designs,

²¹ Ibid.

²² Ibid, p. 60.

²³ Plasterboard as a hutting material will be discussed in more detail in Chapter Five.

²⁴ *Report of the Building Research Board.*

²⁵ Ibid, p. 61.

²⁶ Lea, p. 91.

²⁷ Ibid, p. 92.

and providing necessary research for the wide variety of huts that came from this period.

Rearmament Period and Pre-War Building Programme (1935-1939)

Several events brought an end to the interwar period of disarmament and fiscal austerity, which are necessary for understanding the development of huts in what became the Second World War. The first was the termination of the Ten Year Rule in March 1932, which effectively acknowledged that there was no longer reason to believe a war was only a remote possibility. Then, in 1933, Hitler was named Chancellor of Germany, a role he used to withdraw from the League of Nations, and violate the Treaty of Versailles by once again building up the German armed forces. The following year, Hitler eradicated any rivals to his power including the office of the presidency, and assumed the title of Fuehrer, essentially a dictator. By 1935, Hitler instituted military conscription, which perhaps eliminated any remaining doubts that Germany was attempting to reenter the global scene as a military threat.²⁸ Whilst history records many of the world's leaders pursuing a policy of appeasement to avoid another world war, it is clear that at home Britain was preparing for war from as early as 1932. In terms of materials, rearmament and expansion, the construction of buildings began in July 1934, when the Government announced its plans to increase the Royal Air Force with several dozen new aerodromes.²⁹ Shortly thereafter, the Cement and Concrete Association, founded in 1935, made the promotion of both private and community air raid shelters one of its top priorities, publishing several million leaflets and distributing them around the country.³⁰ The Air Raid Precautions Act of 1937, and the mass distribution of the steel Anderson shelters from December 1938, further supported prewar building schemes, and combined with the decision to conscript and organise militiamen into new, temporary camps from April 1939 at a cost of £21 million, had an overall affect on the supply of materials once war officially broke out in September 1939.³¹

²⁸ Open University, *Hitler's Rise and Fall: Timeline*, <http://www.open.edu/openlearn/history-the-arts/history/hitlers-rise-and-fall-timeline> [accessed 6 July 2017]

²⁹ Paul Francis, *British Military Airfield Architecture* (Somerset: Patrick Stephens, 1996), p. 16.

³⁰ Edwin Trout, 'Concrete Air Raid Shelters, 1935-1941: A Study of One Industry's Influence on Public Policy', unpublished paper (2017), p. 3.

³¹ Kohan, p. 255.

Hutting Programme of the Rearmament and Expansion Period

The rearmament and expansion period once again brought hutting back into the limelight. Design, materials and ease of transport were critical points for consideration. In 1934, The Army Council published an instructional text entitled *Military Engineering: Accommodation and Installations* that provided guidelines on hutting, which included a few design plans.³² This publication is essential to understanding not only what the military policy on hutting was during this period, but also why, how and what they were building, for it is likely it provided the foundational knowledge to military engineers constructing huts in the Second World War. It is also possible that it was utilised as a reference for civilian designers looking to gain a potentially lucrative government contract. One key point addressed within the manual is that the design of any hut should always be determined based solely upon probable supplies.

*It cannot be emphasized too strongly that in war it is useless for an engineer to design any work or structure and then expect to get the requisite materials, labour and transport on indent; on the contrary he must ascertain what materials, labour and transport are available, and design accordingly.*³³

Interestingly, while the text points out the limited quantities of timber, it makes a false assumption that in the event of a war, Britain would be able to supply sufficient amounts of corrugated iron and steel sections, certainly enough 'to meet any demand likely to be made by an army.'³⁴ This clearly was not the case in the Second World War, as engineers later learned, a fact that is responsible for the range of huts later designed in alternative materials.³⁵ Of note, the text provides qualifications for what was considered an ideal standard hut for overseas use in 1934.³⁶

- i. *Be readily removable without damage.*
- ii. *Contain a minimum number of parts.*
- iii. *Be of such simple design that unskilled parties of men under their own N.C.O. can erect it.*
- iv. *Not depend on its floor for its stability.*
- v. *Be of minimum bulk and weight – i.e. no curved members and no part or package to weigh more than 2 cwt.*
- vi. *Be suitable for manufacture from materials readily obtainable in large quantities, and with a minimum of skilled labour.*
- vii. *Be capable of erection with a minimum of motion.*
- viii. *Lend itself to being rendered splinter-proof up to 3 ft. above floor level.*³⁷

³² Army Council, *Military Engineering: Accommodation and Installations, Volume VII* (London: HMSO, 1934).

³³ *Ibid.*, p. 49.

³⁴ *Ibid.*, p. 50.

³⁵ See Chapter Five.

³⁶ *Ibid.*

³⁷ *Ibid.*

‘In short, it must be simple, portable, but not easily damaged in transit, and fool-proof.’³⁸ With these qualifications in mind, the Army Council recommended the Adams Hut as an ideal standard living hut for use in overseas theatres of war.³⁹ The Adams Hut utilised galvanised iron sheets fixed to flashings at the edges by ringbolts and wingnuts, then attached to woodwork with woodscrews.⁴⁰ In form, it appears to resemble the First World War Weblee Hut and the Tarrant Light Portable Sleeping Hut. (Figure 3.3)

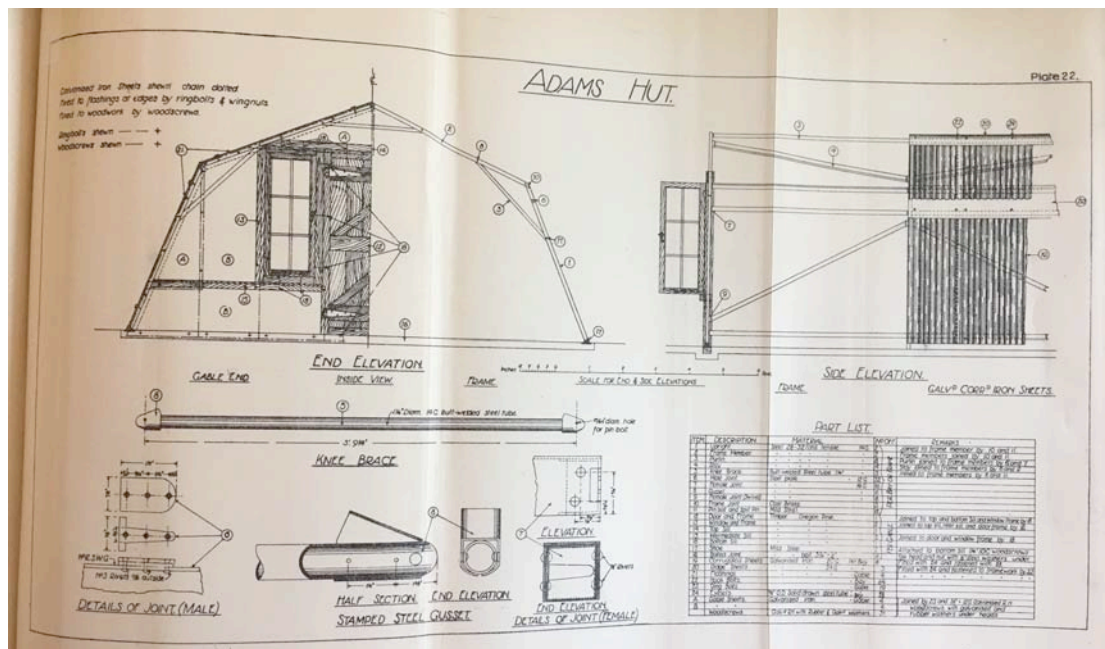


Figure 3.3 The Adams Hut. Plate 22, Army Council, *Military Engineering* (1934).

The manual also contains a chapter on hut construction, a do-it-yourself guide for engineers in distant locales working under limited conditions and with various materials of inadequate supply. It makes the recommendation that prior to deciding on a particular design, the first step must be to take into account not only the purpose of the hut, climate conditions and duration of stay, but also the availability of materials, labour and transportation.⁴¹ The point is made that due to the necessity of material economy in wartime, normal safety standards should be lowered in the extreme, ‘even if it may result in a few huts failing to resist some exceptional storm.’⁴² This practice carried into the Second World War, and was mentioned earlier in relation to the work

³⁸ Ibid, p. 51.

³⁹ Ibid.

⁴⁰ Ibid, Plate 22.

⁴¹ Ibid, p. 52.

⁴² Ibid.

of the Building Research Station during wartime when they were tasked with testing whether more economic huts would be able to withstand the force of wind. These huts were intended to be exceptionally temporary and portable buildings.

Hut spans were the next consideration. They were recommended to be limited to only a small range of sizes. This was found to save time and labour when building a huted encampment because it reduced variety and adopted a form of standardisation by assigning certain widths to particular uses.⁴³ (Table 3.1) A table is offered to organise these spans by use, which has been excerpted directly from the text and recreated below for reference:⁴⁴

Span in feet	Suitable for:
10	Lean-tos and verandahs (hospital wards in tropical climates).
12	Cooking shelters, latrines, ablution places, and stables (single row).
16	Sleeping huts, stores, small blocks of officers' quarters, etc.
20	Cookhouses, unit offices and stores, hospital wards in temperate climates, etc.
24	Stables (double row), forges, stores, hospital wards in tropical climates, etc.
28	Cookhouses, dining huts, stores, recreation rooms, double blocks of officers' quarters, large office blocks, small workshops, etc.
36	Depot store sheds, workshops, etc.

Table 3.1 Useful Spans for Various Types of Building. Army Council, *Military Engineering*, (1934).

As a guide, this table has the potential to be useful in identifying and determining possible uses of surviving huts in the field. This assumes, however, that these recommendations were strictly adhered to, which perhaps was not always the case. Nevertheless, the protocols are valuable in understanding how certain hut sizes and types were chosen for particular uses. The larger the hut span, typically the more service-oriented its purpose. After the span was decided upon, the final step was to choose a building design, which the manual provides in a series of plates with scales of accommodation. This served as a reference for which type of hut plan should be used to accommodate the different rank and file of the military, as well as the required scales of accommodation (or the amount of square feet of space to be allotted per man). (Figures 3.4 and 3.5) These standards were reduced during wartime to allow for the accommodation of additional men in each hut.

⁴³ Ibid, p. 53.

⁴⁴ Ibid.

APPENDIX I

SCHEDULE OF THE SCALE OF ACCOMMODATION ON WHICH BUILDINGS ARE DESIGNED

A. General

1. Living and general accommodation

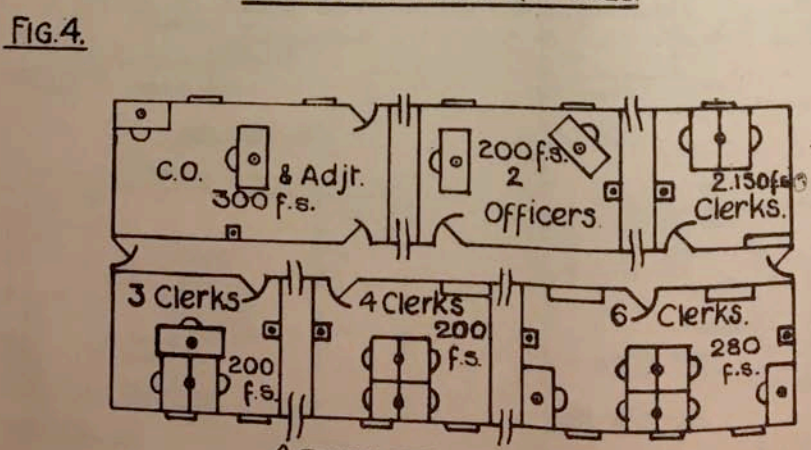
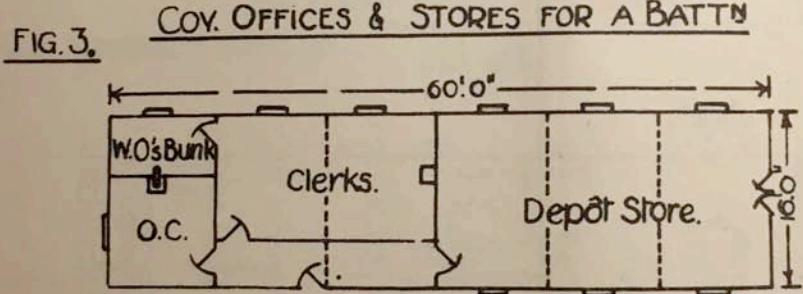
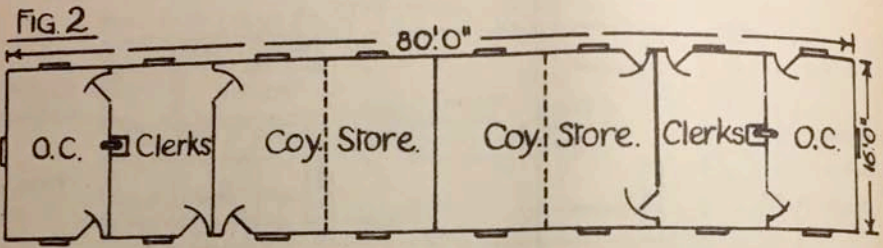
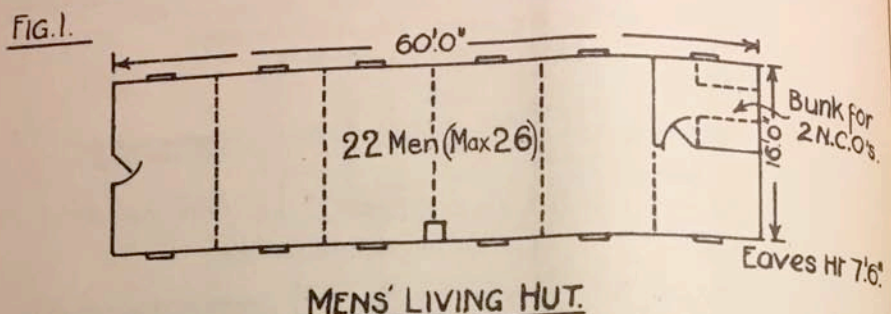
A=essential for standing camps and should be erected even if other accommodation is provided in tents.
B=provided before sleeping accommodation.

Description. (1)	Type plan. (2)	Priority of execution. (3)	Scale		Remarks. (6)
			Each officer or man. (4)	Each hut. (5)	
<i>Sleeping huts.</i>					
C.Os. or matrons	10	—	120	—	Exclusive of passages. Additional 60 f.s. for every 10 officers for servants' cleaning room. Separate bunks or cubicles if possible. If dining rooms are provided. Each man to have at least 4 ft. wall space.
Officers or nurses	10	—	60	—	
Warrant officers... ..	—	—	50	—	
N.C.Os. and men	15	—	36	—	
<i>Accessories.</i>					
Canteens	—	—	3	—	Excluding serjeants' mess members. Excluding serjeants' mess members. Requires special sanction in the theatre of war.
Institutes	—	—	9	—	

Cookhouses	14	B	—	400 f.s. and 1 to 2 f.s. for each man	Minimum 600 f.s. Includes scullery and stores.
Cooking shelters, officers ...	19	A	2	—	Minimum 100 f.s.
Cooking shelters, other ranks ...	19	A	$\frac{1}{2}$	—	Minimum 100 f.s.
Detention rooms	16	B	—	300 f.s.	For every 1,000 men.
Dining rooms	12	B	6	—	—
Drying rooms	13	A	—	400 f.s.	Up to 1,200 men.
Guard rooms	16	B	—	400 f.s.	For every 1,000 men.
Incinerators	42, 43	A	—	—	As required.
Medical inspection rooms and detention wards	60	—	—	—	To be sanctioned by competent authority. Plans to be approved by medical authority.
Messes—					
Officers	10	B	50 to 120	—	Including mess-room, ante-room, kitchen, pantry, larder, store and waiters.
Nurses					
Serjeants	11	B	40 to 60	—	Including mess-room, reading room, kitchen, liquor store, larder, store and beer cellar.
Offices—					
C.Os.	16	B	—	700 f.s.	Including clerks' room.
Company, battery, squadron, etc. ...	15	B	—	120 f.s.	—
Shops	17	—	—	200 f.s. each	Provided only when specially sanctioned.
Stores	15, 17	B	$1\frac{1}{2}$ to 2	—	Including quarter-master's office.
Wash-ups	10	B	—	1 sink for every 75 men	Near dining huts and cookhouses.

Figure 3.4 'The Schedule of the Scale of Accommodation on Which Buildings are Designed', Appendix I, *Military Engineering*, (1934).

LIVING HUT, OFFICES & STORES.



showing typical arrangement of tables and electric lights.

Figure 3.5 Plate 15 shows the layout of living huts, offices and storage huts used by N.C.O.s and men. *Military Engineering*, (1934).

Overall, the manual provides important understanding into military building schemes during the expansion period, and was presumably used as a primary reference during the Second World War, although this is difficult to gauge in practice. Plate 30 offers a plan of a 16 ft by 60 ft timber and corrugated iron hut, which bares a close resemblance to its First World War antecedent, the Armstrong Type Plan Hut. (Figures 3.6 and 3.7) Corrugated iron sheets cover the timber frame and also act as roofing material. Some differences are obvious such as the stove being moved into the centre of the hut, extra lights at each window, and the loss of four feet in width. However, these are fairly simple innovations and this design seems to have been simply a newer, improved version of Armstrong's original Type Plan hut, a tried-and-tested solution.

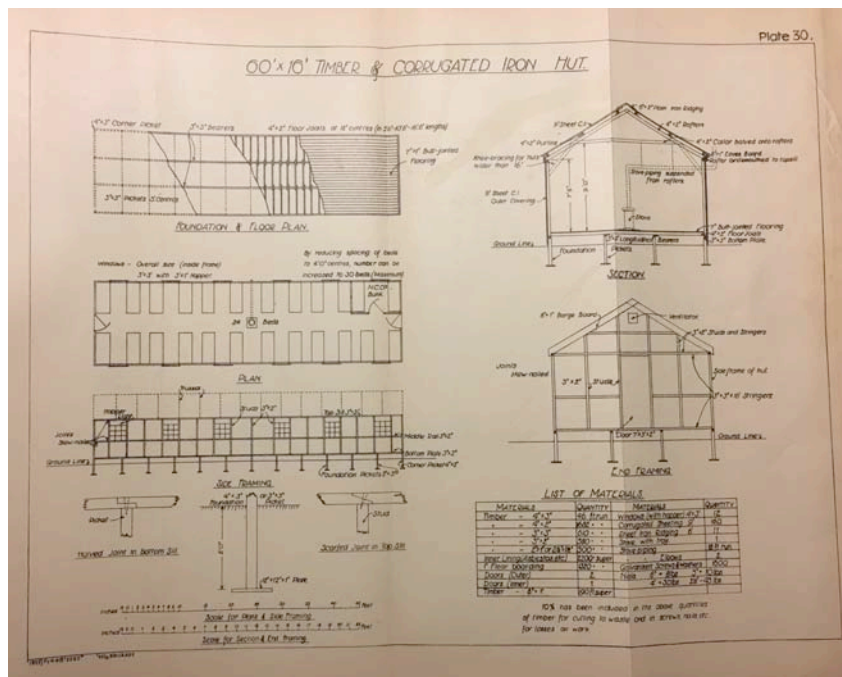


Figure 3.6 Plate 30 for a Timber and Corrugated Iron Hut that seems to be a newer version of Armstrong's Type Plan Hut. *Military Engineering*, (1934).

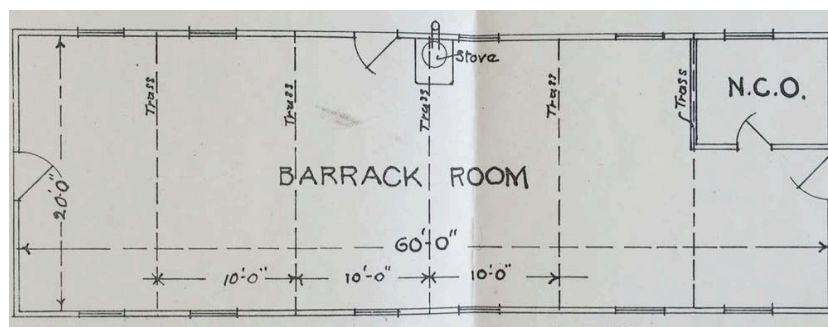


Figure 3.7 A plan of Armstrong's Type Plan Hut dated October 1914. Image courtesy of Great War Huts, the Suffolk Records Office and the archive of R. G. Hogg.

Aerodromes and Hutting

In Britain's official historical account of this period, *The History of the Second World War: Works and Buildings*, C. M. Kohan writes that for the Directorate of Works of the Air Ministry the war might be said to have begun with the period of expansion of the Royal Air Force in 1935.⁴⁵ In actuality, as early as 1934 the government had begun to expand the Royal Air Force through a series of schemes for new aerodromes and training schools.⁴⁶ Both permanent and temporary buildings were required for the myriad support buildings, workshops, storage sheds, and accommodation.

*Now the expanding Air Force called for new methods and a greater application of standardized type design, so that buildings of the same planning and design could be erected at many stations and need only be modified to meet local conditions, e.g. at the Flying Training School at Hullavington where stone-facing work was used to conform to the traditions of the Cotswold country.*⁴⁷

Paul Francis, in his book *British Military Airfield Architecture*, covers this subject in detail, so this thesis will only mention the most salient points as they relate to the broader development of hutting. Timber and steel were initially the preferred materials and used on an immense scale during the pre-war expansion period. Francis says that timber hutting was purchased in vast quantities to supplement the buildings on existing stations.⁴⁸ The huts mentioned could have possibly been the Adams Hut or the newer version of the Armstrong Type Plan Hut, discussed previously.

It is important to note that before the war, nine-tenths of Britain's timber supply was sourced from abroad.⁴⁹ These were resources that became largely unavailable as building materials shortly after war was declared. It was not until 1943, and the success of the Allies in the Battle of the Atlantic, that timber and steel could safely and more reliably be imported from America, once again allowing a resurgence of it as a building material.⁵⁰ Thus, the expansion and rearmament period, especially in relation to aerodromes, was one where the use of timber and steel in construction

⁴⁵ Kohan, p. 278.

⁴⁶ Francis, p. 16.

⁴⁷ Kohan, p. 278.

⁴⁸ Francis, p. 16.

⁴⁹ Kohan, p. 42.

⁵⁰ Mallory and Ottar, p. 181.

projects was dominant. Once war was declared, there was a shift to half-brick construction and any type of easily erected, prefabricated hutting.

Various timber and composite types were designed and produced, and because of shortage of steel and timber, the fullest possible use was made of half brick construction. By the autumn of 1940 speed was all-important and many alternative types of hut were developed – all based on the most economical use of scarce materials. Between 1939 and 1945 some 110 million square feet super of prefabricated hutting was constructed on Royal Air Force sites apart from other building in situ.⁵¹

The belief that any future war would involve aerial bombardment eventually influenced the way aerodromes were sited and new layouts had to be adopted on the ground. Rather than concentrating buildings into a central camp for convenience, buildings were dispersed over a greater area, in hopes of protecting the greater majority from a domino effect of any air attack. This meant aerodromes evolved into a collection of sites segregated into living, working, communal, training, and arsenal storage locations.⁵²

The Outbreak of War and the Problem of Accommodation

When Britain declared war on Germany on 3 September 1939, it had already begun increasing the strength of its armed forces. From a standing army in peacetime of 164,000, the government quickly worked to double that figure, with the reintroduction of conscription in April 1939.⁵³ Accommodation was understandably a priority with full use first being made of all existing buildings, before any consideration was given to the erection of new buildings.⁵⁴ This policy extended not just to military buildings but also to civilian premises, as permitted under Defence Regulation 51, which granted emergency powers of requisition of private property to the government.⁵⁵ As early as January 1939, the Office of Works requested that County Councils across Britain carry out a secret survey of potential accommodation.⁵⁶ The result became known as the Central Register of Accommodation, a list of what ultimately amounted to about 300,000 existing

⁵¹ Kohan, p. 287.

⁵² Ibid, p. 279.

⁵³ Mallory, p. 181.

⁵⁴ Kohan, p. xv.

⁵⁵ Defence Regulation 51 was instituted in April 1937 by Committee of Imperial Defence.

⁵⁶ Karey Draper, *The English Country Estate: Contributions and Consequences of Requisition in the Second World War* (University of Cambridge, unpublished master's dissertation, 2013), p. 8.

properties around the country that could be requisitioned for government use.⁵⁷ In this way, a reduction was made in the necessity for constructing new buildings, thus conserving materials. However, even existing buildings required modifications and additions to make them fit for purpose, and so temporary buildings were often erected to meet these additional needs. This was frequently seen in country house estates, where the historic and scenic landscapes were altered by the paving of roads, pouring of concrete and erection of military huts, all to provide additional accommodation beyond what the existing buildings could support. The demand for accommodation reached its peak in June 1944, when events necessitated the support of the three and a half million Allied troops stationed in Britain in the build up to D-Day.⁵⁸ The outbreak of war and the later increase in the number of troops for *Operation Overlord* were pivotal events that resulted in two distinct and massive building schemes in the later war years. Due to the various circumstances surrounding these events, the peacetime preference for heavy, permanent buildings gave way to the wartime need for quick, easy construction in materials that could be supplied economically in large amounts wherever it was required.

Whereas in the First World War, the Royal Engineers were predominantly responsible for hut design, in the Second World War, with the Royal Engineers often deployed in supporting roles abroad, the government relied more heavily on its design branches, along with civilian engineers, architects and builders. This probably contributed to the sheer number and variety of hutting designs invented during the Second World War, many of which were advertised in assorted building journals. (Figure 3.8) One reason for this was that the Second World War was more complex on the home front. Temporary huts were needed for evacuees, schools, munitions factories, war workers, civilians in bombed areas, and more, all requiring a broader variety of temporary building designs, beyond those solely needed for the military, which in itself required a massive assortment of huts suitable to various purposes.

⁵⁷ Kohan, p. xvi.

⁵⁸ Mallory, p. 181.

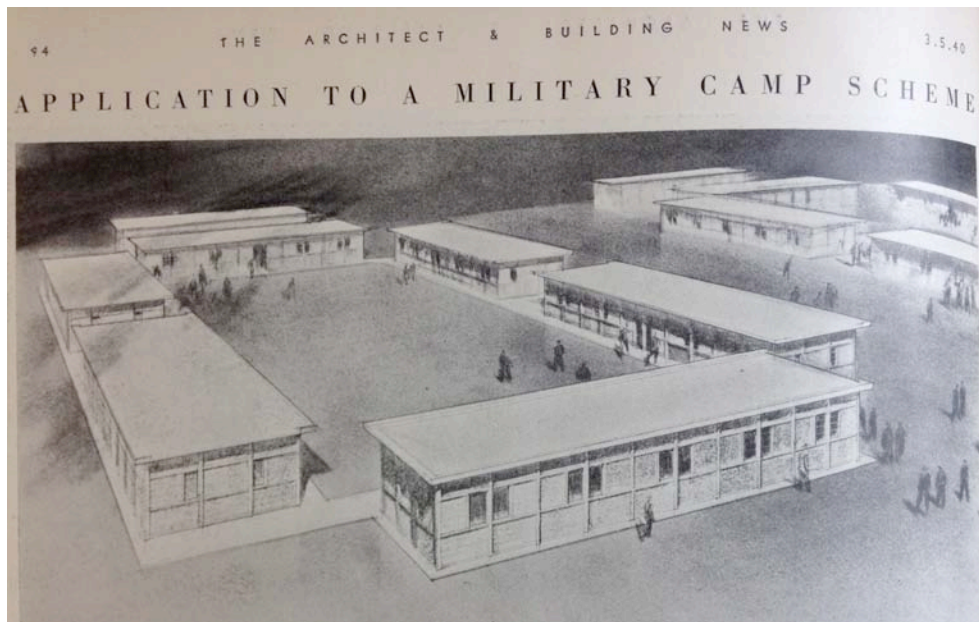


Figure 3.8 The Stancon system of concrete hutting designed by Stanley Hamp as advertised in *The Architect and Building News* (3 May 1940), p. 94.

In 1940, Major-General G. B. O. Taylor, Director of Fortifications and Works for the War Office, gave a lecture to the Architectural Association, describing the problems encountered with accommodating the army on the outbreak of war.⁵⁹ This primary source gives a rare insight into the initial building programme, very similar to the one provided by his First World War predecessor Scott-Moncrieff. The planning began in early 1939, with the Secretary of State for War promising to Parliament that ‘every man would be properly housed before the winter.’⁶⁰ As nearly all of the First World War hutted camps had either been dispensed with or repurposed, there was once again not enough existing accommodation. Taylor found himself in a similar predicament to the one Scott-Moncrieff faced two decades prior, with one key difference: war was likely but it had not yet been declared, granting some space to plan and make use of peacetime supply quantities.

With only twenty years since the end of the last war, one might too easily assume that the preparations made for the Second World War were relatively similar, bringing forward the lessons learned and perhaps reintroducing the more successful hut types. However, this was a new war with different constraints and requirements, and with the passing of time also came the advancement of knowledge about

⁵⁹ Sir George Brian Ogilvie Taylor (1887-1973) was a Royal Engineer who served as Assistant Director from 1935-1937, and then Director of Fortifications and Works for the War Office from June 1939 – June 1940.

⁶⁰ Taylor, p. 167.

materials, weapons and technology. The huts of the First World War, as discussed in the previous chapter, were predominately constructed of steel and timber, materials that for this war were soon in scarce supply.

Training and Militia Camps

On the home front, Taylor determined that the best solution was to embark on a building programme of additional accommodation at all existing depots and barracks, along with the new construction of several training camps.⁶¹

*Considerations of speed and economy led us to adopt timber as our principal material for construction and this meant a heavy demand on carpenters. To reduce the numbers required on the site, we adopted a sectional form of hut, which was fabricated in various shops and assembled on the site.*⁶²

About 3,500 of these sectional timber huts were built for the training camps and used solely for living accommodation whilst other materials were used for the construction of support buildings.⁶³ Taylor said the hut was similar to those applied earlier in the militia building scheme, however to reduce costs and conserve timber, they ‘cut out connecting corridors to ablution rooms, central heating, wardrobes and other frills, and reduced the amount of timber in windows, wooden fittings, etc.’⁶⁴ It is worth noting that the use of timber was still feasible at this point as Britain was not yet officially at war. Supplies only severely dwindled once Germany invaded Denmark and Norway.⁶⁵ Nor was steel yet being funneled for use primarily in support of munitions. So, at least initially, alternative materials were not necessary. Timber and steel were the preferred materials for huts because they were considered the best for constructing portable hutting, as they were lightweight, easily and cheaply transported, easy to work and adapt using existing tools and skills, and relatively inexpensive.⁶⁶ However, timber supplies for hutted accommodation were drained

⁶¹ Ibid.

⁶² Ibid, p. 168.

⁶³ Ibid, p. 174. These were possibly the Air Ministry Type A and B huts. See Appendix B.

⁶⁴ Ibid.

⁶⁵ Mallory, p. 183.

⁶⁶ C. M. Singer, ‘Notes on Alternative Materials and Methods of Construction for War Hutting’, *Royal Engineers Journal*, (June 1940), 180-187 (p. 180).

during the summer of 1939, and could not be replaced before war was declared in September.⁶⁷

The large amount of timber thus consumed during the summer had not been replaced by the autumn, and the outbreak of war found stocks in the United Kingdom far lower than normal for the time of year. Further, the principal sources of supply of the soft woods used for this class of work, i.e., the Baltic and North Russia, were unlikely to be able to provide any appreciable quantities. It was, therefore, early apparent that the war hutting programme would have to be carried out with the absolute minimum of timber. A common substitute for timber in the walling of huts is corrugated iron. But here again it was clear early in the war that the use of steel for this purpose could not be justified if other materials were available. Investigations were therefore put in hand to evolve a form of "hutting" which would involve the use of as little timber or steel as possible, but which would be comparable with the usual timber and corrugated iron hut in other respects, e.g., cost, speed of erection, portability, etc.⁶⁸

One result of the loss of imported timber was the need to find merchants able to convert timber in saw mills to size in Britain, a service previously provided by the Baltic suppliers. Once this capability was established among 18 different firms, Taylor said it actually provided a savings in cost from £243 for a 19 ft x 60 ft hut down to £180, and a reduction on the loss of timber in the conversion process, 6 percent down from 15 percent.⁶⁹

Mallory and Ottar argue that:

[T]he Nissen hut would have become a favourite once more had not two new factors made previous designs obsolete: the shortage of steel and timber and the increased number of uses to which hutting was put in the new war. It was the former which was to cause the main changes in design: earlier designs, which had relied on these materials, were rendered obsolete.⁷⁰

In addition, whilst the Nissen was most certainly used later in the war once more steel and timber were available, it was ultimately considered only semi-portable, being heavy with steel parts and thus more cumbersome than fully portable huts, which tended to be constructed primarily of timber. It is likely that these constraints provided further impetus for new designs in alternative materials.

Nonetheless, it would seem that Mallory and Ottar were not entirely correct in their assertion that the Nissen was not used until later in the war. There appears to have been sufficient allocation for enough steel, corrugated iron and timber to provide

⁶⁷ Ibid.

⁶⁸ Ibid.

⁶⁹ Taylor, pp. 174-175.

⁷⁰ Mallory, p. 183.

for some Nissen Huts to be built in France at the outset. Major-General Taylor recalled:

We decided that huts for France should be in steel and corrugated iron with such timber as necessary, and that huts in England should be in various substitutes for timber. In fact, for France we decided on the Nissen hut, an improved pattern to that used extensively in the last war, and we are providing accommodation (living or hospital) over there for some 250,000 men or more, before next winter.⁷¹

Defining Hutting Types for Material Allocation: Portable vs. Static

Material investigations were conducted by the Directorate of Fortifications and Works during the winter of 1939-40, and reported on by Major C. M. Singer, a Royal Engineer, in a paper for the *Royal Engineers Journal* in June 1940.⁷² The main aim of the work was to study possible alternatives to timber and steel hutting. Eventually, it was determined that, for the sake of expediency and economy, hutting should be classified into one of two categories: *portable* or *static*.⁷³ *Portable hutting* was that which would be used for 'mobile searchlight positions, and for use in the field general.'⁷⁴ It needed to be lightweight, so it could be carried by both lorry and men, and of simple enough design that the most unskilled workers could easily erect it and/or take it apart again. *Static hutting* would be utilised for the 'for the housing of troops at home in general.'⁷⁵ This was a crucial and defining distinction: huts in Britain did not necessarily have to be portable, merely quick to erect, inexpensive and constructed of easily-sourced materials. Demountability to allow for relocation was preferred, but not strictly essential, as opposed to huts in the field. The division of huts into these two distinctive classes allowed for a purposeful division in material allocation. It was realised that despite strides made with wood wool slabs, concrete, asbestos and other materials, the only truly successful portable hutting was that which was constructed with timber and steel.⁷⁶ Thus, in a bid to conserve enough resources to construct effective portable hutting, the key decision was made that static hutting would chiefly be constructed of alternative materials and any available timber and

⁷¹ Taylor, p. 174.

⁷² No additional biographical information could be found on C. M. Singer.

⁷³ Singer, p. 180.

⁷⁴ *Ibid.*

⁷⁵ *Ibid.*

⁷⁶ *Ibid.*, p. 181.

steel would be funneled into the portable hutting programme for use overseas.⁷⁷

Mallory and Ottar summed up the situation concisely with:

This effectively meant that the small amount of steel and timber available for hutting would be tied up in overseas theatres of war and that the hutted camps for the new conscript army in Britain would have to be designed to the same design criteria as similar civilian structures. A large and guaranteed market for development in this field was effectively opened and the civilian building industry, including the architectural profession, was not slow in answering this demand.⁷⁸

Therefore, in the early days of the war, the shortages of timber and steel, combined with the consequent decision to allocate any available amounts to go towards portable hutting overseas, created a pressing mandate for entirely new types of hutting at home. Many builders, architects and engineers jumped to fill this void. Before looking at the types of hutting they produced, it is first necessary to appreciate the scope of the requirements for accommodation.

Scales of Accommodation

To understand the rapid development of hutting in the Second World War, it is important to know that Britain conducted two major building schemes between 1939 and 1945. The first began in March 1939, when the British government decided to increase the size of its standing army from 164,000 to over two million personnel.⁷⁹ The second occurred from 1943 in preparation for *Operation Bolero* – the initial plan for the invasion of Europe that eventually led to D-Day in June 1944. At the outbreak of war, accommodation was required for hundreds of thousands of men.⁸⁰ To get a sense of the magnitude of demand, the Air Defence of Great Britain programme alone initially required accommodation for 100,000 men and women.⁸¹ In other areas, accommodation in existing military camps and barracks was increased by thirty percent simply by reducing the peacetime scale of accommodation from 60 sq ft per enlisted man to a wartime scale of 45 sq ft.⁸² This was the minimal standard established by health authorities in order to lessen the potential for outbreaks of disease and contagion, a risk for any group of people in close quarters. It is worth

⁷⁷ Mallory, p. 183.

⁷⁸ Ibid, p. 187.

⁷⁹ Ibid, pp. 181-182.

⁸⁰ Taylor, p. 167.

⁸¹ Ibid, p. 170.

⁸² Ibid, p. 169.

noting that these scales were revised several times throughout the war until July 1943 when accommodation was decreased to 36 sq ft per man.⁸³ The increase in available accommodation helped, as did the requisitioning of country houses and other properties, but an extensive building programme was still required. Territorial units, prisoner of war camps, air defence sites, training centres, supply depots, searchlight posts, hospitals, workshops, storage facilities, etc. all required supplies of temporary buildings in the form of hutting. Even requisitioned buildings and billets required some level of temporary building, in order for them to be able to support military use. This would most often involve the addition of kitchens, bathhouses and latrines.⁸⁴

In terms of military camps, it was determined that the traditional plan of layout and construction had to be jettisoned in order to better protect them from aerial bombardment. This followed a similar scheme of dispersal as mentioned earlier with aerodromes. Rather than a camp with buildings surrounding a central parade ground, huts were typically grouped further afield into clusters of six or seven buildings, spaced at least 50 yards apart from the next closest cluster of huts. In this way:

*[N]o bomb aimed at any collection of huts can automatically hit another collection because it is in the line of descent of the bomb. In practice it looks as if the huts had been scattered haphazard over the area from a pepper pot.*⁸⁵

Taylor pointed out that in military building design, standardisation is essential and is dictated by the wartime scales of accommodation.⁸⁶ These determine exactly how much space a man is permitted not only for sleeping, but also for eating and washing, and provide the framework for engineering how many men can be accommodated per design. As a result, a standard wartime hut designed for mass production cannot be architecturally diverse, complex or ornate. ‘The primary considerations here are simplicity, economy of material... rapidity of erection and general cheapness.’⁸⁷ In keeping with this policy, by 1940, the Ministry of Works decided on three standard hut spans: 19 ft, 24 ft, and 28 ft, with each bay within of a

⁸³ Kohan, p. 265.

⁸⁴ Taylor, p. 171.

⁸⁵ Ibid, p. 172.

⁸⁶ Ibid.

⁸⁷ Ibid, p. 173.

maximum length of 12 ft.⁸⁸ However, this changed in the following years with the influx of various designs.

Overall, it is estimated that £50 million were spent in the first year on building works.⁸⁹ This number rose significantly in the ensuing years. (Table 3.2) For all military construction, including airfields, camps, training centres, defence works, storage depots, etc. (including hut construction) the Ministry of Works estimated the following value of work done over the course of the war:

(In £ millions)	1940	1941	1942	1943	1944	1945
Military construction. Estimated value of work done in £ millions:	140	120	125	122	49	12

Table 3.2 Construction Activity in Britain: Estimated Value of Work Done. (Source: Ministry of Works as published in C. M. Kohan's *Works and Buildings* (1952), p. 426.

Control of Building Materials

At the onset of war in September 1939, the Works and Building Priority Committee asked all government departments to supply information regarding what their estimated requirements would be for timber, bricks, cement, roofing materials as well as necessary labour.⁹⁰ The responses to this query gave quotes that were excessively high, likely in a bid to ensure they each had plenty of materials to see their work done. These amounts were far beyond what could possibly be supplied and caused some alarm. As a result, the Committee decided to only commit to supplying 40% of what was supposedly needed, over three-month increments. This course was neither satisfactory to the departments nor overall as it introduced other complications, so a new move was made by the Materials Priority Sub-Committee to globally allocate materials.⁹¹ This committee oversaw material distribution until October 1940, when the Ministry of Works (replacing the old Office of Works) was

⁸⁸ Ibid, p. 176.

⁸⁹ Ibid, p. 172.

⁹⁰ Kohan, p. 41.

⁹¹ Ibid, p. 42.

established under Lord Reith. The Ministry became responsible for all building control and work, and created a new position, Priority Officer for the Ministry and Controller of Building Materials. Lord Reith appointed an engineer, Mr. Hugh Beaver to take the role.⁹²

One of the Controller's first challenges came with the decision to put an end to all private building enterprises, which took valuable materials and labour away from the war effort. A licensing system had already been instituted during the summer of 1940, which required all civilian building and engineering works to obtain a license for any work in excess of £500.⁹³ In April 1941, this was further lowered to £100.⁹⁴ This system was previously used during the First World War with general success so it was put into place once again in an effort to exert some control over materials and labour not employed by the government or local authorities. Controls were implemented on timber, steel, bricks, cement and roofing materials such as asbestos cement sheets, bituminous felt, and corrugated iron. Despite the efforts made to restrict materials and non-essential building works, materials and labour continued to face extreme levels of depletion until, in August 1941, Prime Minister Winston Churchill was compelled to comment:

I am concerned at the great amount of manpower and raw materials which are still being directed to constructional work. The works and building programme is using 2 ¾ million tons of imported materials a year (iron, steel and timber) and three-quarters of a million men [...] Please inform me what safeguards you have to ensure – (a) that new factories or building undertakings are really essential; (b) that the plans and designs for such undertakings are of the most economical character; (c) that building labour is used to the best advantage.⁹⁵

At this point, building works were costing the government roughly £22 million per month, with £730,000 of that amount being spent on the construction of Army camps.⁹⁶ The Ministry replied to Churchill's note and in regards to economy, stated that a Directorate of Construction (Economy) Design:

[R]igidly examined departments' steel and timber requirements; sometimes it checked structural design and also prepared standardised economic designs which the departments would in due course require to use.⁹⁷

⁹² Ibid, p. 50.

⁹³ Ibid, p. 63.

⁹⁴ Ibid, p. 140.

⁹⁵ Kohan, p. 101.

⁹⁶ Ibid, p. 102.

⁹⁷ Ibid, p. 103.

These comments are supported by what is known about the development of lighter hut designs and the work of the Building Research Station during this period to determine exactly how minimalist huts could be while still being able to somewhat withstand the force of wind.⁹⁸ Economy in everything was the order of the day and this was reflected in hut development. The struggle for economy continued throughout the war. Kohan goes into further depth well beyond the scope of this thesis, but suffice to say, the wartime building programme was rife with problems, curtailments and near-constant struggles to meet demand with supply whilst keeping expenditures low.⁹⁹ In relation to hutting, it is important to study how controls affected key building materials, as it was their restriction that led to the development of alternate construction materials.

One concern of the Ministry of Works with the control of building materials was that if a policy of rationing or allocation was adopted, it could create a panic and cause potentially detrimental bouts of hoarding.¹⁰⁰ Thus a system of voluntary control was utilised, with the Minister ensuring that 'the quantities of materials produced should be just sufficient for the labour-strength of the industry, and then to ration the labour by means of the allocation system.'¹⁰¹

Control of Timber

As mentioned earlier, timber was sourced and converted nearly entirely from outside of Britain before the war, so it was clear from the start that methods of control would have to be applied. From September 1939, it was almost completely restricted from use in the construction of houses.¹⁰² Eighteen British firms were identified as having the proper equipment and space to be able to convert timber into ready sizes, saving the government more than £200,000 over what had been paid by importing converted timber.¹⁰³ At about the same time, a committee within the Ministry of Supply was established under Sir Malcolm McAlpine, of the civil engineering firm, to

⁹⁸ Department of Scientific and Industrial Research, *Report of the Building Research Board: With the Report of the Director of Building Research For the Years 1940-1945* (London: HMSO, 1948), p. 61.

⁹⁹ See Kohan, *Chapter IV: Problems of Control*, pp. 82-118.

¹⁰⁰ Kohan, p. 161.

¹⁰¹ *Ibid.*

¹⁰² *Ibid.*, p. 42.

¹⁰³ Taylor, p. 175.

find alternatives to timber in hut construction, and provide recommendations for what types of hut should be used in camp construction.¹⁰⁴ Their ‘timid and conservative’ response was to fall back upon the traditional materials of brick, concrete blocks, tiles and slate — which Kohan understandably found disappointing — rather than using the opportunity to explore newer technology and designs.¹⁰⁵ The initial recommendation at the outset of the war was thus to use brick in place of timber for constructing hutting. Other alternatives only came later (see below).

Control of Steel

Much like timber, the control of steel and iron became a consideration early in the war. From 1940, governmental departments calculated a total of 1.6 million tons of steel would be required for the year’s building works.¹⁰⁶ This included supplies necessary in both government and private building and engineering, and railway work required for the construction of factories.¹⁰⁷ However, the Works and Building Priority Committee would only commit to providing one million tons, advocating the necessity for conservation and economies in the reduction of steel. To support the need for economy, it was at this time when the Building Research Station began the first of its studies into economical type designs in structural steelwork, also known as *Wartime Building Bulletin, No. 1*, published in 1940. Despite economies, it soon became evident that even with the substitution of alternative materials, only so much steel could be saved. Any further cuts to the steel supply would have the adverse effect of slowing the building programme or possibly bringing it to a complete halt.¹⁰⁸ Steel provision was critical. Thus, by the summer of 1940, the Works and Building Priority Committee instituted a new policy whereby any building involving steel required a license.¹⁰⁹ The guidelines suggested that licenses would not be issued to any project that was not in support of the war effort. In this way, as mentioned earlier with licenses for building works over £500, the government was able to exact more control and economies over all supplies of steel.

¹⁰⁴ Sir Malcolm McAlpine (1877-1967) was the part of the family civil engineering firm Sir Robert McAlpine Ltd. See Kohan, p. 42.

¹⁰⁵ Ibid, p. 44.

¹⁰⁶ Ibid, p. 45.

¹⁰⁷ Ibid, p. 46.

¹⁰⁸ Ibid, p. 47.

¹⁰⁹ Ibid.

Control of Bricks

Bricks were considered an indispensable and relatively plentiful building material, especially utilised in rebuilding efforts and the construction of air raid shelters. They were also employed as a substitute for timber. In huts, this can be seen in the Nissen Hut, which originally was designed to have timber ends but due to the timber restrictions in the Second World War, there were often replaced with brick ones.¹¹⁰ Initially, the availability of bricks was assumed to be plentiful as housing construction had come to a virtual halt with the advent of war, leaving a surplus of material. However, wartime demand was so high that within the first year of war stocks were quickly diminished, making it clear that a better scheme of control was needed to ensure enough supply.

To this end, the Ministry of Works appointed a Director of Bricks and established a Committee on the Brick Industry to research the issue and liaise with groups such as the National Federation of Clay Industries to identify and work to solve all problems.¹¹¹ One issue was that nearly 400 brickmaking firms had closed down in 1941 because of the reduced overall demand from the housing industry.¹¹² Serious setbacks were being encountered by the brick producers still in operation thanks to the effect of the war on transportation (economies on fuel) and on labour. In order to prevent the brick industry from completely collapsing, the government worked to coordinate output to meet demand, whilst only employing those firms who were able to manufacture and deliver bricks 'with a minimum demand on national resources.'¹¹³ By recommendation of the Committee and several brick industry representatives, the Ministry of Works created the National Building Brick Council, which oversaw the issuing of licenses to brickworks and coordination of production, transportation and prices.¹¹⁴ These important measures helped to secure the brick industry and material production throughout the rest of the war.

¹¹⁰ Mornement, p. 116.

¹¹¹ Kohan, p. 52.

¹¹² Ibid, p. 163.

¹¹³ Ibid, p. 164.

¹¹⁴ Ibid, p. 167.

Control of Cement

Supplies of cement were relatively dependent on weather conditions, with production being somewhat higher in summer than at other times of year.¹¹⁵ Surplus stock could be stored, but not indefinitely or it would deteriorate. Wartime demand was such that cement stores were rapidly depleted in the first year, causing concern. This called for the implementation of a priority system to determine how much cement would go where, in order of necessity. At the top of the list was anything involving emergency defence works. This was followed by any small amounts for essential maintenance work endorsed by the Ministry of Supply.¹¹⁶ These were later pushed aside in favor of priority going towards airfield construction, munitions factories and air raid shelters.¹¹⁷ In this way, cement was regulated and available with good supplies generally being maintained throughout the war.

Control of Roofing Materials

Roofing materials were generally understood to include bituminous felt, corrugated metal sheeting, corrugated asbestos cement sheeting, reinforced concrete slabs, wood wool slabs, and breeze slabs covered with felt. All were used in hutting and equally felt the effects of wartime demand that eventually required government intervention and control. This control fell under Defence Regulation 55 in 1942, by which all roofing materials including plasterboard were regulated, often requiring a specific license to use them.¹¹⁸ An interesting case was seen during the war with the slate industry in Wales, which illustrates how both extremes of wartime demand are reason for government intervention and control. With the restrictions on building at the onset of war, slates were not in demand, and the industry fell into decline. As Kohan states, ‘the first effect of the outbreak of war on the slate industry was to threaten it with disaster.’¹¹⁹ In just the first month of war, unemployment in Wales rose from 6.6 percent to 18.9 percent, with 4,600 quarrymen losing their jobs.¹²⁰ The danger of this was not only the loss of skilled workers and damage to a key industry,

¹¹⁵ Ibid, p. 170.

¹¹⁶ Ibid, p. 49.

¹¹⁷ Ibid, p. 50.

¹¹⁸ Kohan, p. 178.

¹¹⁹ Ibid, p. 57.

¹²⁰ Ibid, p. 58.

but also the loss of a staple roofing material that could have been provided in abundant supply. It was precipitous to think it might not be needed, as was later discovered:

The bombing of British cities and towns by the enemy from the autumn of 1940 onwards soon revealed the folly of allowing a skilled industry of this kind to disintegrate with the decline of the normal market. The existing stocks of slates were soon exhausted and steps had to be taken by the Government through the Ministry of Works to encourage the output of roofing slates and to economise their use.¹²¹

Alternative Materials and Methods of Construction

While it might seem that the control of timber, steel, bricks, cement and roofing materials is a separate subject from hutting, it was in fact integral to its development. The shortage and subsequent regulation of such predominately-used building materials drove innovation by directly leading to the government appealing to the building industry to propose schemes for portable hutting using alternative materials that could likewise be swiftly assembled. Experiments ensued into a range of alternative materials and methods of construction. Sir William Halcrow, President of the Institution of Civil Engineers, said in 1948:

[T]he war gave rise to many novel engineering problems and to the exercise of considerable ingenuity in their solution. Whilst these arose from military necessity, the results are by no means peculiar to military engineering, but are often of wider application to civil engineering practice.¹²²

Builders and architects from around the country responded with a multitude of designs utilising materials such as concrete, asbestos, plywood, wood wool, plasterboard and sawdust. The most successful designs were those that incorporated readily-available materials and could be erected in minimal time by unskilled labourers. While not all went on to be widely used in the field, the sheer number of designs and strides made with material development in the areas of architecture and engineering during this period could be said to be one of the great triumphs of the Second World War. The temporary wartime hut went from having less than two dozen variations in the First World War to having nearly three times that number in

¹²¹ Ibid. Excerpt from Ministry of Works Report, *The Welsh Slate Industry* (London: HMSO, 1947).

¹²² Institution of Civil Engineers, *The Civil Engineer in War: A Symposium of Papers on War-Time Engineering Problems* (London: Institution of Civil Engineers, 1948), p. 1.

the Second, many drawing on less traditional building materials and prefabricated methods.

Standardisation

A key concept in hut design was standardisation. Standardisation meant that buildings could potentially be built more quickly from a set kit of parts. The same tools could be used. Parts could be interchangeable. Unskilled labourers could, with the minimum of training, repeat the same formula again and again in erecting the huts. Standardisation did not necessarily mean prefabrication.

An important concept in this development is the idea of *generic* versus *bespoke* hut design. One of the benefits of timber standardised in sections and details meant that buildings could be quickly adapted and used for an almost infinite variety of layouts and spans. Standard sections could be cut to size on site to suit any requirement. It did not need to be prefabricated. Drawings could be adapted and redesigned to make a building customized for purpose. Timber lent itself to bespoke design using standardised components, which allowed buildings to more closely fit their purposes. The disadvantage of this system was that designing huts for each occasion meant that there had to be staff devoted to producing the drawings, cutting timber on site inevitably led to waste, and the adaptations, while simple, still required basic carpentry skills.

With the loss of timber resources and shortages of skilled labour, controls placed on materials led to searches for *generic* forms of construction. There were benefits to a 'one-size-fits-all' kit form of construction. One was the speed of production. It enabled them to be mass-produced with a more streamlined process of packaging, transport, and quick erection on site. Many included the added feature and flexibility of being able to increase length or choose a larger span. These kit systems were deliberately designed to be erected by staff with no building experience, with the minimum of tools. They could also be designed to be demountable, and so could be taken down and used elsewhere. Bespoke-designed huts were still used for those buildings of more specific purpose, such as hospitals and bakeries, but this thesis is concerned with the generic ones.

Alternatives to Timber and Steel

Timber and steel were the two most essential materials requiring alternatives relatively close in tensile strength. They were used in nearly all types of construction and were the preferred materials for hutting, mostly due to cost, portability and the speed in which buildings of these materials could be erected. The question of alternatives was brought into consideration first by the McAlpine Committee, mentioned earlier, which only concluded that bricks, concrete blocks, tiles and slates should be used.¹²³ The recommendation was that bricks should be used as an alternative to timber in sleeping huts. Where steel was required, especially in roofing and framing, reinforced concrete, timber and asbestos cement sheeting could be substituted.¹²⁴ The obvious issue is that concrete was heavy and permanent by nature, not temporary, and cost more than timber. It was a pressing dilemma requiring extensive research, much of which was conducted by the Building Research Station.

By June 1940, Taylor mentioned that a suitable substitute for timber had yet to be found, however, testing was being conducted on combinations of cement and sawdust, cement and wood wool, and cement and wood chippings:

*The difficulty is to get tensile strength without reinforcement, or to get a reinforcement which will stand up to the chemical action, as in some of these substitutes, the wood chippings or what-not, must have a prior chemical treatment. Cement and sawdust looks the most promising. It will saw, and hold a screw or nail and can undoubtedly be used as a substitute for wood framing or studding. What we want really is a timber substitute which will act as a joist or purlin – we may have it, but we are not quite certain yet. Cement and wood wool looks promising as a substitute boarding, but again we haven't anywhere near reached finality yet in this respect.*¹²⁵

Around this same time, Major Singer argued that four-inch diameter asbestos cement piping, spaced three feet apart, could be used as purlins over a span of ten feet.¹²⁶ 'A complete truss built up of asbestos cement piping [...] has also been evolved for a span of 19 feet.'¹²⁷ However, he added that this material had been known to fail suddenly under loads (essentially it was brittle) and often failed below

¹²³ Kohan, p. 44.

¹²⁴ Singer, p. 183.

¹²⁵ Taylor, p. 176.

¹²⁶ Singer, p. 183.

¹²⁷ Ibid.

the ‘normal’ failure point. He concluded that it should only be utilised for rafters or purlins and not for major structural members.¹²⁸

The alternative material for the raised timber flooring which had hitherto been largely ubiquitous for ground floors was most often concrete.¹²⁹ Today, the concrete floors or bases of wartime huts may be all that remains on the ground as a trace of their locations. As concrete ground floors have become the norm in modern housing, it is easy to forget that this was not typically the case in the 1920s and 1930s. At this time a traditional way of building a ground floor was to build a brick wall around the edge of the building and suspend from it a timber floor, leaving a large ventilation space underneath. This guaranteed a damp-proof floor. Laying concrete directly on the ground was easy but the damp could percolate upwards if it was laid directly on the ground. Concrete was fine as a finish for garages and workshops. Where linoleum was to be put on top of concrete, some damp coursing was necessary. This was done by applying a waterproof bituminous covering between two 3-inch thick layers of concrete, then laying the linoleum on top.¹³⁰ Timber walls were replaced most often with brick and sometimes pre-cast concrete blocks. With brick, Singer said a 4-½ inch wall was cast aside in favour of a standard wall depth of 8 inches, with two skins of brick on edge.¹³¹ He said this was considered the best measurement in terms of cost, stability and insulation.¹³² Singer is likely referring to a method of bricklaying known as ‘rat-trap bond.’ It had been invented in the nineteenth century as a cheap way of building workers’ cottages but had never been popular. Pre-cast concrete blocks (which would have been an obvious solution today) were rare in the 1940s and had not yet replaced brick as the materials of choice for internal leafs of cavity walls (themselves a relatively recent innovation). The small supply and relatively few sizes available made them generally unsuitable. Reinforced concrete columns were found to be one alternative to timber framing either cast in situ or prefabricated. If prefabricated, their weight and the fact they had to be manufactured to size was an obvious problem. In-situ casting generally wasted a lot of timber in formwork so brick columns were a more common alternative.

¹²⁸ Ibid.

¹²⁹ Concrete as a flooring material had been in practice since the turn of the 19th century. See David Yeomans, *Construction Since 1900: Materials* (London: Batsford, 1997).

¹³⁰ Singer, p. 181.

¹³¹ Ibid, p. 182.

¹³² Ibid.

Singer noted that the only hut design that almost completely eliminated the need for steel or timber was one with a parabolic arch springing directly from the ground, 'building up of pre-cast sections of a cement sawdust composition, which are readily assembled into 19-foot span living huts.'¹³³ Tarran Industries invented a hut of this description manufactured from green hardwoods, cement and sawdust that made little use of steel and timber and could be erected in less than a day.¹³⁴ (Figure 3.9) It will be discussed further in Chapter Four.

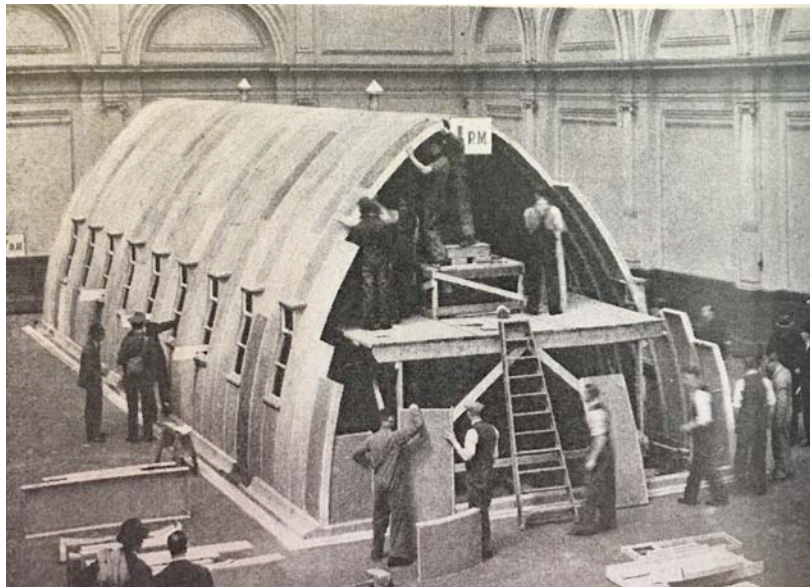


Figure 3.9 The Tarran Hut. *The Builder* (10 May 1940)

From 1940, in an attempt to reduce costs and achieve some level of standardisation, the Ministry of Works adopted hut spans of only three different sizes: 19 ft, 24 ft, and 28 ft, with minimal variance in doors and windows.¹³⁵ Within these scales, flexibility of material was allowed, and presumably acted as guidelines for civilian designers.

In terms of walling, construction materials expanded to include hollow clay blocks, breeze blocks, composition blocks made up of cement, sawdust or wood wool, and even rendering on hessian.¹³⁶ If available, a layer of plaster could be applied to

¹³³ Ibid, p. 184.

¹³⁴ 'A New Type of Hut', *The Builder*, (10 May 1940), p. 568.

¹³⁵ Taylor, p. 176.

¹³⁶ Singer, p. 186.

the surface. The decision on how to construct and what to use was often contingent on the environment and location of the hut:

Any type of walling must, of course, be considered in relation to the hut in which it is proposed to use it and the local conditions of the site. A rendered hollow clay block, for instance, may give a perfectly satisfactory wall for an office or store hut in a sheltered situation, but may be far from satisfactorily weatherproof for a living hut on an exposed site.¹³⁷

Another issue for consideration was how to fix the components together. Traditionally, nails were preferred, and if a hut was intended to be static (not portable or demountable), they would still suffice. Screws were another option. They were better than nails but took some time to put into place, and were no easier to remove. They were intended to more permanently fix parts into place. In order to be truly portable, however, another fixing solution was necessary. Many designs chose to use bolts, which were strong, easy to install and still enabled a hut to be taken apart and put back together again, sometimes with wing nuts to ease construction.

Cladding Alternatives

A final aspect of wartime hut construction was the issue of covering materials. More economically constructed buildings, such as the timber huts, were often flimsy and could not support the heavy weight of coverings like corrugated sheet metal, concrete slabs, etc. However, these materials could also add overall strength to the structure as well as weatherproofing. So there was a balance to be found in pairing sheet materials with the framework. Corrugated asbestos cement sheets, reinforced concrete slabs covered with felt, breeze slabs covered with felt, wood wool slabs covered with felt, resin bonded plywood, and wood framed panels were all commonly used roofing materials.¹³⁸ Exterior coverings employed a variety of alternative materials in place of timber and steel: Wood framed panels filled with wood wool covered with asbestos cement, chemically treated sawdust concrete panels, plywood, corrugated asbestos sheets, felted plasterboard, pre-stressed concrete planks, pressed concrete blocks, bricks or other type of blocks depending on local availability.

¹³⁷ Ibid.

¹³⁸ 'Prefabricated Huts', *Architects' Journal*, (13 August 1942), 107-110.

Labour Shortages and Contracts

The subject of labour shortages and contracts tend to go hand-in-hand. In July 1939, in the midst of the militia camp construction programme, the building and engineering labour force numbered nearly 1.4 million men. By the end of the war, that force had been depleted down to 600,000 as men were pulled away to the Services leaving less skilled workers behind.¹³⁹ A White Paper on Housing estimates the impact was even more severe at just 337,000 men still in the building trades by 1945.¹⁴⁰ The life of a wartime builder was demanding. As Kohan noted:

[I]t was complained that the story of the building trade worker and his participation in the war was kept almost as great a secret as the movements of the Fleet. The building industry, after all, had gone into action much earlier than any other industrial organization.¹⁴¹

The supply, demand and costs of labour were a constant source of discussion between the War Office, National Joint Council and Minister of Labour during the wartime period.¹⁴² An overriding concern was preventing extortionate contractor rates billed to the government for wartime building. In the earliest stages of the war, contractors:

[W]ent to all lengths to attract men by the incentive of high earnings, made up of high hourly rates, daily subsistence rates, and exceptional overtime. Advertisements were common guaranteeing an 80-, 90- or even 100-hour working week. Carpenters and other skilled workmen were receiving wages of £7 to £8 for a week of 70 to 80 hours.¹⁴³

Measures were taken at various points, including a Control of Employment Bill, which forbid employers from advertising for workers and instead required them to draw labour from a central employment exchange, one where labourers were expected to register and keep informed whenever they were unemployed in a building project. In this way, it was hoped that a control could be kept on labour supply, sourcing of the most needed, skilled workers could be immediate, and perhaps most importantly, prevent the poaching of labour to the highest bidder.¹⁴⁴ Eventually, in the interests of protecting the government financially, the Minister of Labour agreed to limit worker's output to a 60-hour week.¹⁴⁵

¹³⁹ Kohan, p. 399.

¹⁴⁰ White Paper on Housing, Cmd. 6609, (March 1945). See also, R.B. White, *Prefabrication: A History of its Development in Great Britain* (London: HMSO, 1965), p. 121.

¹⁴¹ Kohan, p. 400.

¹⁴² *Ibid.*, p. 39.

¹⁴³ *Ibid.*, p. 38.

¹⁴⁴ *Ibid.*, p. 35.

¹⁴⁵ *Ibid.*, p. 39.

Cost Plus Fee Contracts

Several contract schemes were applied during the war, of which the three most commonly used in the construction of huts will be discussed. The first was *cost plus fee*, which was used during the building of the hutted militia camps during the summer of 1939. Kohan describes the conditions when this form of contract is necessary:

*[W]here the character or scope of the work is undetermined at the time of the contract, where time is not available for the preparation of particulars, and also where the builder might be unwilling to give fixed prices for work having regard to fluctuations in cost of materials, wages, output of labour and such other circumstances as make a fixed price contract difficult to negotiate.*¹⁴⁶

This is supported by Taylor's account, which stands as a primary source detailing how the contracts surrounding the construction of the militia camps were negotiated:

*Time was short, sites unknown, details and plans of buildings not yet prepared. What happened was that some of the leading firms of contractors were asked to undertake the work. They all expressed willingness to do so. In order to introduce some element of competition, they were invited to tender for the fee. The full scope of the work was undecided, and an approximate estimate was worked out by the War Office for each camp, and an upper and lower limit was also fixed for the purposes of earning a fee [...] In many cases contractors tendered a fixed lump sum to cover the whole range of the job.*¹⁴⁷

Whilst expedient, the detractor to this form of contract is that it can be exorbitant in cost. 'There is a direct financial incentive to extravagance; the inefficient contractor will make a larger profit than the efficient one.'¹⁴⁸ As a result, the War Department established several oversight controls to ensure each contractor was held fiscally responsible. The first control was to only hire 'large and well-established firms of contractors of reputation, such that it was hoped that they could not afford to have their names associated with bad or extravagant work.'¹⁴⁹ The second was to employ a team of surveyors to supervise the work at each camp. The final control was to make it known that government auditors would conduct a final review of accounts.¹⁵⁰ In this way, it was hoped that the government would be able to hold contractor's accountable from over-spending. Ultimately, Taylor considered this

¹⁴⁶ Ibid, p. 469.

¹⁴⁷ Taylor, p. 177.

¹⁴⁸ Kohan, p. 469.

¹⁴⁹ Taylor, p. 177.

¹⁵⁰ Ibid.

contracting scheme for the militia camps a success, but he acknowledged that it had the drawback of not providing any incentive to the builders to carry out the work economically.¹⁵¹

Fixed Price/Lump Sum Contracts

The next contract scheme was known as the *fixed price or lump sum contract*. Under this contract, a fixed price is decided for a project based on available drawings, which the builder works from and carries out to plan. However, this type of contract was vulnerable to fluctuations in the cost of materials and labour, which during wartime could vacillate significantly, causing an increase or even a decrease in overall project cost. This led to the addition of a 'rise and fall' clause, providing protection to both the contractor and the government in the event of an increase or decrease in costs.¹⁵² In 1940, Taylor believed this form of contract would be the most widely used, as it allowed the government to work:

[O]n a schedule of quantities for the whole of a camp, instead of on a detailed bill for each individual building in the camp [...] We do not wish to delay the start of work by the time required to prepare these detailed bills, a laborious process in view of the number of alternative materials and methods of construction permissible. The schedules cover all the necessary operations of work, with the various alternatives, and the quantities, although naturally approximate, are got sufficiently close to ensure that we get close pricing and tendering by contractors genuinely desirous of getting the job.¹⁵³

Target Cost Form Contracts

The third type of contract employed in wartime building was one Taylor referred to as *target cost form*. Under this scheme, which was used by the War Department to pay for forty searchlight battery camps projected to cost £45,000 each, the contractor received a fixed percentage fee (4 percent) on top of the estimated target cost, plus an additional 25 percent of any savings potentially achieved off the overall cost.¹⁵⁴ The benefit is that it put a profit cap on how much a contractor could

¹⁵¹ Ibid, p. 178.

¹⁵² Kohan, p. 469.

¹⁵³ Taylor, p. 179.

¹⁵⁴ Ibid, p. 178.

feasible make. The main criticism of this contract was that it took too much time to research projected costs and come to an agreement.

Labourers as 'Unknown Soldiers'

Over the course of the war, contracted building work was challenged by the loss of a labour force that was steadily depleted as men left to join the military, suffered illness and injury, or simply quit. Despite this depletion and the consequent difficult odds encountered through two massive programmes of building, Kohan highlights the incredible feats accomplished during the Second World War:

What was far from inevitable what indeed was unpredictable and unlikely, and therefore all the more a paradox, is that despite every retarding human factor – increasing years, diminishing skill, absenteeism through sickness or slackness, weariness and occasional weakening morale – so great a volume of building should have been carried out by a shrinking labour force.¹⁵⁵

Churchill said in 1940 that the Second World War was a war of the unknown warriors:

The whole of warring nations are engaged, not only soldiers, but the entire population, men, women and children. The fronts are everywhere [...] The workmen are soldiers with different weapons but the same courage.¹⁵⁶

The development of huts built during this period was continuously subject to the mercurial fluctuations of labour and contracts, just as much as it was to the availability of materials. The mass scale of building works required constant problem solving on every front. As Taylor concluded his experiences with the building programme on the outbreak of war, he added:

Architecture, as such, plays little part in it. Our difficulties have been and are not those of design and such, but to adjust our plans to the availability of materials and labour.¹⁵⁷

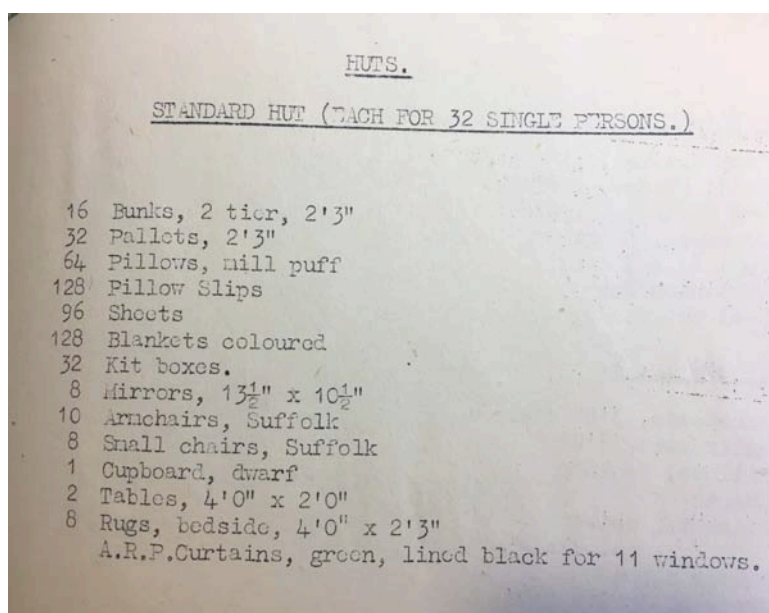
¹⁵⁵ Kohan, p. 399.

¹⁵⁶ Winston Churchill, *War Speeches I* (London: Cassell, 1951), p. 235. See also Angus Calder, *The People's War: Britain 1939-45* (London: Jonathan Cape, 1969), p. 17.

¹⁵⁷ Taylor, p. 179.

Fittings and Furniture for Huts

Based upon original copies of several Ministry of Works fittings and furniture catalogues covering the years 1942-1944, it is possible to gain a view into what kinds of pieces may have been used in hutted camps and hospitals.¹⁵⁸ In one example for a temporary hostel, standard huts, which were originally designed to accommodate sixteen people, were doubled in capacity by the addition of bunk beds. To this end sixteen bunk beds, with two-tiers, measuring 2 ft 3 in. wide were supplied, along with thirty-two pallets of the same size. Sixty-four pillows of mill puff and 128 pillowcases were included along with ninety-six bed sheets and 128 coloured blankets. This seems like a generous allocation, providing four blankets and two pillows per person, but as these were hostels they were likely for civilian rather than military use. The full inventory is listed in Figure 3.10:



HUTS.

STANDARD HUT (EACH FOR 32 SINGLE PERSONS.)

16	Bunks, 2 tier, 2'3"
32	Pallets, 2'3"
64	Pillows, mill puff
128	Pillow Slips
96	Sheets
128	Blankets coloured
32	Kit boxes.
8	Mirrors, 13 $\frac{1}{2}$ " x 10 $\frac{1}{2}$ "
10	Armchairs, Suffolk
8	Small chairs, Suffolk
1	Cupboard, dwarf
2	Tables, 4'0" x 2'0"
8	Rugs, bedside, 4'0" x 2'3"
	A.R.P. Curtains, green, lined black for 11 windows.

Figure 3.10 Hut inventory as listed in Ministry of Works and Buildings, *Temporary Hostels: Schedule of Furniture, Equipment and Layouts*. (Airfield Research Group)

This particular hut was arranged into five interior bays with the insertion of partitioning. The two outer bays were designated on each end for sleeping leaving the centre bay for living space. (Figure 3.11)

¹⁵⁸ Uncatalogued. Held at the Airfield Research Group Archive. Postcards and photographs could also be a source for further research.

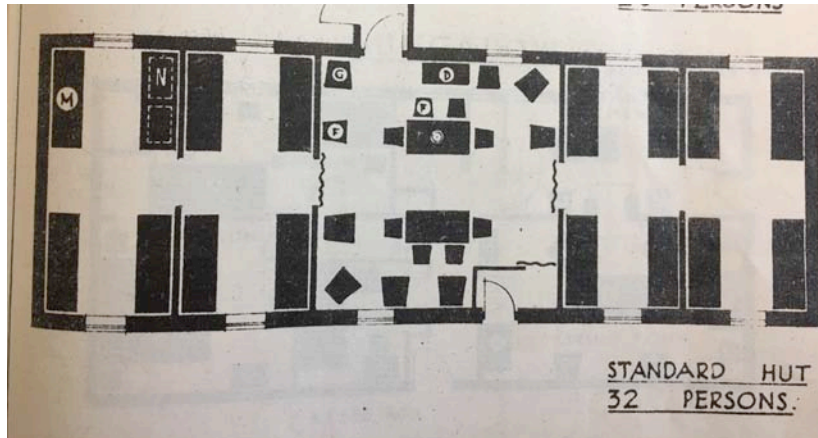


Figure 3.11 The arrangement of space within a temporary hostel hut. *Temporary Hostels Schedule of Furniture, Equipment and Layouts*. Undated. (Airfield Research Group)

The letters in Figure 3.11 indicate the type of furniture assigned to the space. In the sleeping bays, M is a bunk bed, and N is a chest. In the living space, F is a standard chair, G is an armchair and D is a cupboard. (Figure 3.12)

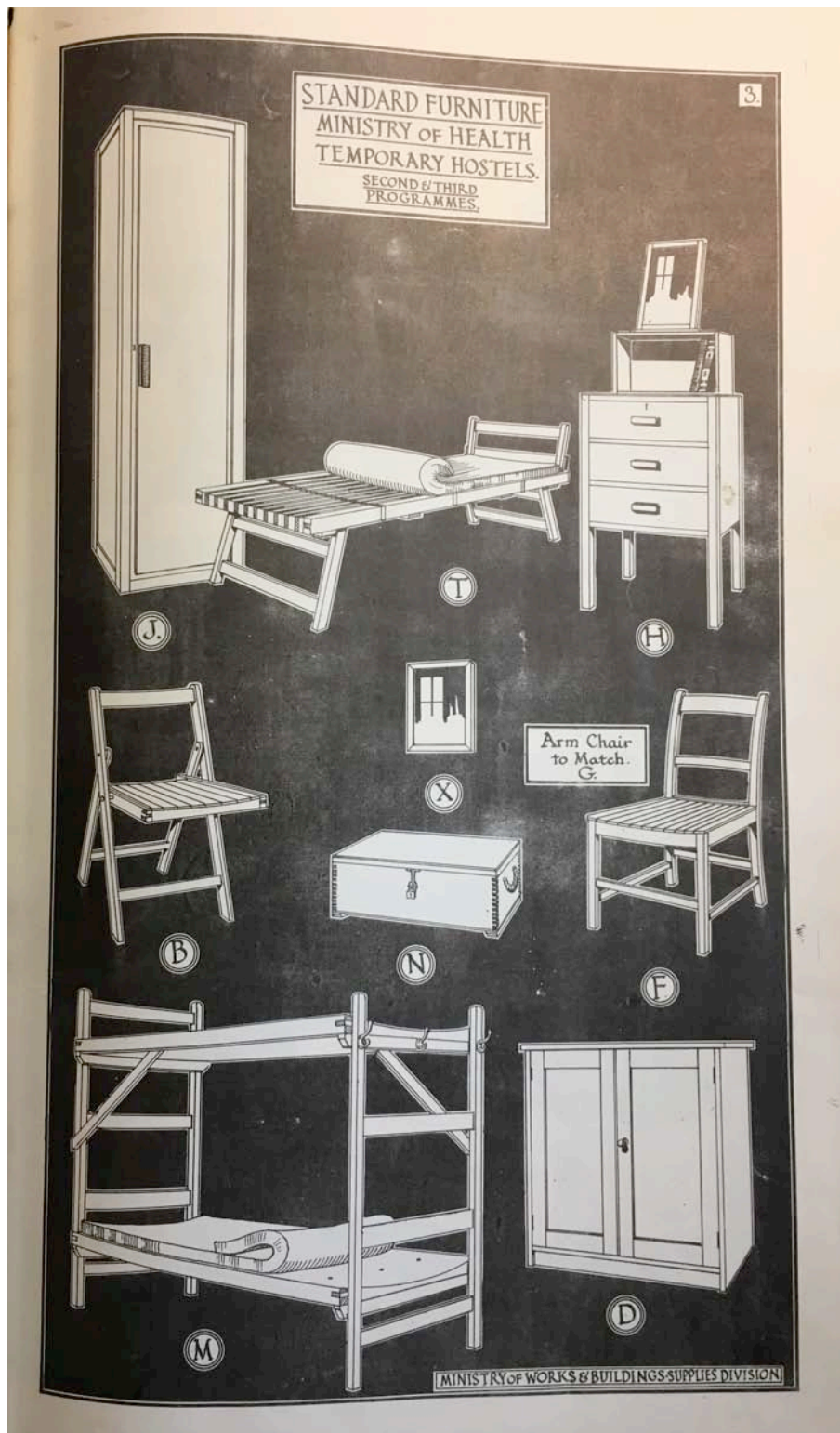


Figure 3.12 Standard furniture issued for Ministry of Health Temporary Hostels. *Temporary Hostels Schedule of Furniture, Equipment and Layouts*. Undated. (Airfield Research Group)

In hospitals, one standard ward hut to accommodate forty beds was assigned with a schedule of equipment. This list consisted of the typical furniture and supplies

one would expect of a medical unit, but also included other unexpected and miscellaneous items such as forty pairs of pyjama suits, a bread bin, a canister of tea and sugar, six table clothes, three pots of mustard, six butter dishes, three fireguards, a rake, and eighty feather pillows. (Figures 3.13 and 3.14)

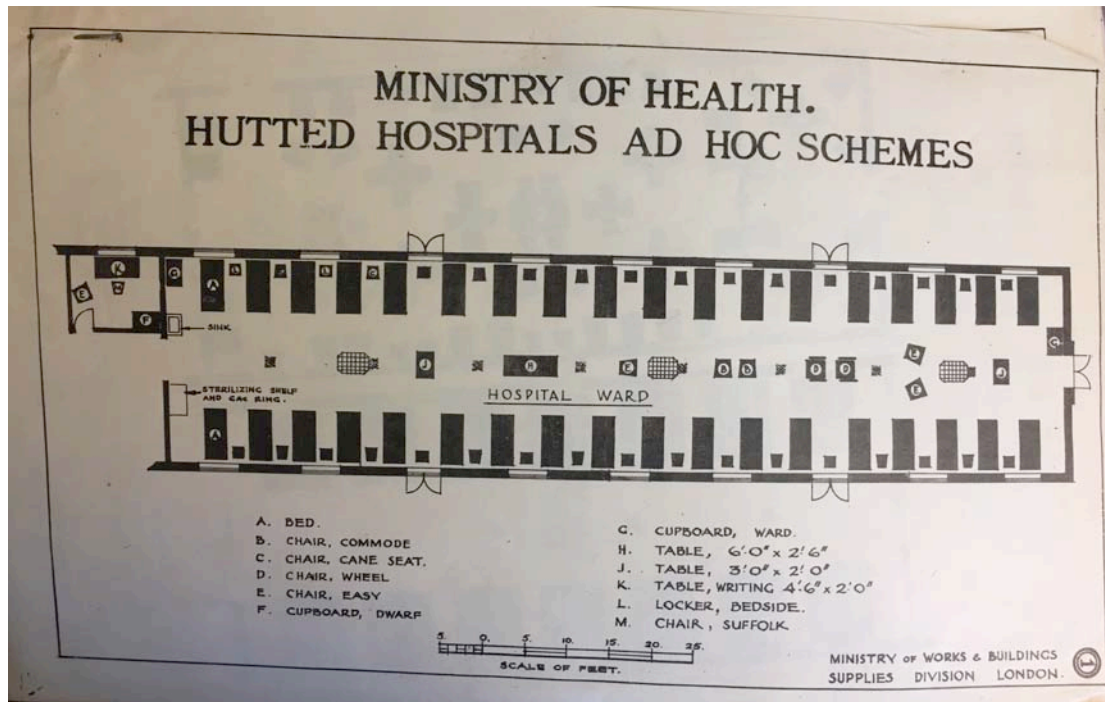


Figure 3.13 The layout of a forty-bed hospital hut. *Schedule of Furniture & Equipment as Supplied to Ministry of Health Hutting Hospitals Ad Hoc Schemes, December 1941.* (Airfield Research Group)



Figure 3.14 Standard hospital furniture as specified in the *Schedule of Furniture & Equipment as Supplied to Ministry of Health Huttred Hospitals Ad Hoc Schemes*, December 1941. (Airfield Research Group)

The Second Programme of Building and Operation Bolero

Having considered the challenges facing the initial building programme at the outbreak of war, the scales of accommodation, material shortages, alternate materials and methods of construction, labour concerns and contracts, furniture and fittings, etc., it is important to look at the development of design and the general work of the building programme, especially as it reached its pinnacle with *Operation Bolero*. This section relies and references periodically C. M. Kohan's official history of the subject because much of the information supplied therein is a result of his free access to official documents and primary sources made available to him directly after the end of hostilities, which he then recorded and published in 1952. Due to his temporal proximity to the events as well as his contact with the primary sources, living and material, his work could perhaps be considered nearly a primary source in its own right. For the purpose of this chapter, it is a useful reference with an overwhelming degree of detail into the political and historical aspects of the many governmental departments and their building works during the Second World War. Only a small portion is dedicated to the subject of hutting, and what is recorded is more general in nature. It does, however, provide necessary background into the development of camps and the building programme.

When the first major building scheme began in the spring and summer of 1939, the War Office focused first on the construction of hutted militia camps. The later phase commenced in 1942/43 with the implementation of *Operation Bolero*, the massive movement and accommodation of American troops from the United States to the United Kingdom in preparation for the Normandy invasion.

With insight gathered from earlier in this chapter, it is perhaps understandable that given the economic and material constraints already felt in the building industry, in addition wartime austerity and a dwindling labour force, the prospect of any further demands might have seemed out of the question. Thus, when word reached the Ministry of Works of a possible, secret influx of over a million American troops into England all of whom would require accommodation, a letter was sent to War

Department Chief Engineer, General C. J. S. King, which encapsulates the preliminary negative reception to such a task.

*I am alarmed by a report that you are contemplating accommodation for one million American troops in this country in the next six months, partly in billets or requisitioned houses and partly in camps. Even if only a small part is to go into hutted camps, of however rough a description, the demand for labour and materials would be enormous, and I know no means of meeting it from civilian labour. Can you let me know what truth there is in the story and what immediate action is necessary?*¹⁵⁹

Eventually, a total of 1,446,000 Americans did come, with 904,600 in place by 9 April 1943.¹⁶⁰ Accommodation, hospitals, storage depots and workshops for the Americans would need to be constructed at the estimated cost of nearly £50 million.¹⁶¹ During the planning stages it was decided that *Bolero* would necessarily need to be supported at three key points if it was to be at all feasible to house so many new troops in Britain. The first was that the *Bolero* programme of accommodation would be entirely under the control of the British government, to prevent the two countries from competing for the same supplies.¹⁶² The second required the Americans to contribute in the areas of both labour and materials, especially steel, which was in such short supply.¹⁶³ And finally, whilst the British Treasury would fund the building programme, the U.S. would be required to reimburse Britain for the expenditures on their behalf after the war ended.¹⁶⁴ Under these agreed upon conditions, building commenced with the Americans supplying most materials and about 25,000 soldiers to help in the construction work.¹⁶⁵

American vs. British Standards

There were numerous challenges along the way, which was perhaps to be expected when combining the military forces of two separate and very different nations. One of the first challenges faced was the difference between the British and American scales of accommodation. The Americans assumed their scales would be

¹⁵⁹ Letter from Director-General of MoW to Major-General King at the War Office, dated 24 April 1942. See Kohan, p. 262.

¹⁶⁰ Kohan, p. 263.

¹⁶¹ *Ibid.*, p. 267.

¹⁶² *Ibid.* Kohan says this was the most important of all three decisions made in this building programme.

¹⁶³ *Ibid.*

¹⁶⁴ *Ibid.*

¹⁶⁵ *Ibid.*, p. 277.

adhered to, which were far more spacious for the average soldier and were not keen with the British scale, which by that point several years into war, had been necessarily reduced to just 36 sq ft per person:

American approved scales were in excess of the British, and neither army could agree to better treatment for the American than for the British soldier, a complete new set of accommodation standards for the United States forces in the United Kingdom had to be worked out...Quartering, works, and hygiene were all affected.¹⁶⁶

Eventually the Americans acquiesced to the British and the same scales were adopted.

Another challenge in the *Bolero* building programme was in the differences between American and British standard building materials and construction methods, including the disparity in electrical and plumbing norms:

When the American troops arrived and began working on the Bolero programme, it was at once apparent that there were considerable variations between British and American standards of construction. The British were used to work with brick, tile, plasterboard, and corrugated iron, the Americans with wood. Before they could make good use of British materials they had to accept the delay and annoyance of being put through training schools specially set up for them. Again, in the United Kingdom voltages differed from those in the United States, and for the use of mixed British and American equipment additional transformers and circuits had to be found. Plumbing standards, too, were different, and early arrivals from American had to be supplied with British tools to which they were unaccustomed.¹⁶⁷

With regards to the building of new American camps, they were generally constructed with huts for accommodation, although some tents were used, with a scale of accommodation ultimately resting at 72 square feet per officer and 36 square feet per enlisted man.¹⁶⁸ The camps were organized into standardised scales of size to accommodate anywhere from 250 to 1,500 men.¹⁶⁹ However, not all American soldiers were placed in hutted camps. Over 100,000 were billeted in existing buildings and houses. Over 200,000 were accommodated in tents.¹⁷⁰ Kohan records that by 1 June 1944, the total accommodation was distributed in the following table:¹⁷¹

¹⁶⁶ Ibid, p. 264.

¹⁶⁷ Ibid, p. 265.

¹⁶⁸ Ibid, p. 269.

¹⁶⁹ Ibid, p. 268.

¹⁷⁰ Ibid.

¹⁷¹ Ibid.

Construction Type	Number of Americans accommodated
Existing camps	650,034
Tented expansions on austerity scale	59,687
Hutted camps	162,004
Winter tented camps	30,470
Summer tented camps	192,564
Billets	111,590
Total:	1,206,349

Table 3.3 American accommodation in Britain as of 1 June 1944. Extracted from Kohan, *Works and Buildings*, (London: HMSO, 1952) p. 269.

Hutted Hospitals

In relation to the construction of American hospital camps, these fell under the auspices of the Ministry of Works and provided in two types. The first was a station hospital of 834 beds at a cost of £187,000 and the other a general hospital that could accommodate 1,084 beds at a cost of £250,000.¹⁷²

Lilford Hall, U.S. 303rd Bomb Group Hospital

An example of an American station hospital was located in the park of Lilford Hall, Northamptonshire.¹⁷³ The Ministry of Works requisitioned the country house and its parkland in 1942 for the use of the U.S. Army's 303rd Bomb Group medical unit. The original design was for a 750-bed occupancy site, but this number doubled after D-Day expanding to include 1500 beds. This was accomplished by erecting 15-bed tents and attaching them to each of the Nissen Hut wards.¹⁷⁴ The station hospital was constructed predominantly of Nissen Huts, all connected by concrete walkways. Each hut was situated on top of a concrete foundation. While wards made up the majority of huts, there were support huts for dining, theatre, workshops,

¹⁷² Ibid.

¹⁷³ This example taken from my master's dissertation, Karey Draper, *The English Country Estate: Contributions and Consequences of Requisition in the Second World War* (University of Cambridge, unpublished master's dissertation, 2013), pp. 83-95.

¹⁷⁴ Memories of American nurse Frances Nunn, 'The 303rd Station Hospital', 303rd Bomb Group, <http://www.303rdbg.com/sp-hospital.html>, [accessed 26 February 2013]

administration and reception offices. The male staff members were billeted in huts to the southeast of the Hall in the deer park. The female nurses were billeted in the Hall. An additional hut was situated to the rear of the hall for the nurses to use for bathing. (Figure 3.15)



Figure 3.15 Lilford Park as a U.S. Army Station Hospital, 1944. (303rd Bomb Group)

The effect of these semi-circular, austere huts set amongst the trees in the pleasure ground of Lilford Hall was recorded by one young medic, Private Harry Dudley, in January 1944: (Figure 3.16)

From the first minute I arrived here I felt at home [...] This morning we got a look at our quarters. I'm sure that I am dreaming. We are on an estate with an enormous manor (castle to me). The grounds are beautiful with enormous trees, beautiful pheasants wandering about and attractively arranged buildings [...] The nurses live in the castle and the officer's club is there [...] The buildings are scattered around over the grounds mostly under trees or near them. The Army has done wonders to keep it looking neat and not too much unlike it before they came. Our billets as well as all of the buildings are the corrugated tin curved roof ones and are quite comfortable. They are heated by coal stoves and have electric lights. Just outside our back door is the group of three buildings – the latrine, washroom, and shower room. Concrete walks connect most of the buildings and they are quite strict about walking on the grass.¹⁷⁵

¹⁷⁵ Letter from Private Harry O. Dudley to Katherine Carpenter, dated 28 January 1944, collection of the 303rd Bomb Group, <http://www.303rdbg.com>, [accessed 26 February 2013]



Figure 3.16 Nissen huts in Lilford Park. (303rd Bomb Group)

Dudley elaborated further about the types of hutted communal rooms at Lilford Station hospital. One hut was designated for recreational purposes with reading material supplied by the Red Cross, a radio, writing tables and a bar that served beer. Another hut was used as a movie theatre with films being shown three times a week. This map provides some insight into the arrangement and use of huts at Lilford. (Figure 3.17)

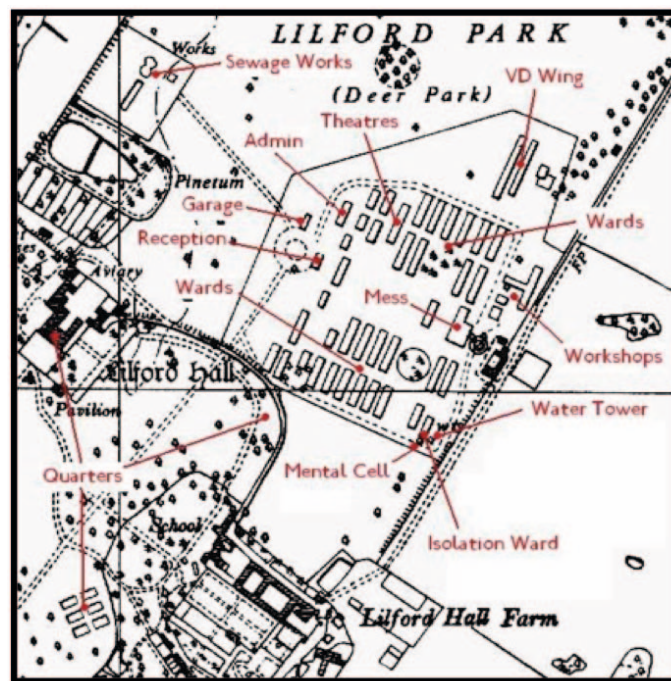


Figure 3.17 Layout of 303rd Station Hospital, 1942-1945 with labels assigning hut names and purpose. (Image courtesy of P. Bellamy and the Airfield Research Group)

Kohan said that though these American hospitals were hutted, they were essentially semi-permanent structures.

*The standard adopted was lavish and, as compared with British hospitals, the staff accommodation was on a generous scale. Covered ways with smooth paving without steps connected the surgical wards with the operating block, and the theatre appointments were of the costliest and most modern types.*¹⁷⁶

Retrospect

Overall, the *Bolero* building programme was considered a success. Despite the material and labour shortages suffered at various points, it was completed mostly on schedule and just under budget of the originally estimated cost of £50 million.¹⁷⁷

As part of a 1948 symposium by the Institution of Civil Engineers entitled *The Civil Engineer in War*, a paper was given on the design of wartime buildings, claiming the war was not a time of outstanding development in design or methods of construction, but:

*[A] period when the romance of building was lacking and when, for the science of building, there was substituted the organization necessary to produce drawings in their daily thousands.*¹⁷⁸

The authors go further to provide a glimpse into what it was like to work inside a government design office during the high operational tempo time of war:

In Design Branches, possibly more than in any other of the professional branches of the Air Ministry, it was necessary, in methods of organization to produce drawings, and in the forms of construction employed, to anticipate the outbreak of war and the requirements during the war period, in the years which immediately preceded it. It was then visualized that it would be necessary to utilize forms of temporary construction to meet the greatly increased demands for accommodation which would necessarily be required at short notice. Whilst designs had been prepared for the many permanent buildings erected during the expansion period 1934-39, they were not in types of construction, or in scales, economical, either in speed of construction or in the use of materials, for the vast demands anticipated. It was therefore necessary, during that period, to so organize the various Designs sections of the Air Ministry to allow for the rapid production of designs and drawings and also to produce details of various forms of temporary construction.

¹⁷⁶ Kohan, p. 270.

¹⁷⁷ Ibid, p. 276.

¹⁷⁸ Anderson, W. and G. Biggs, 'Design and Layout of Buildings for Airfields in War', *The Civil Engineer in War: A Symposium of Papers on Wartime Engineering Problems*, 1 (January 1948), 86-104, (p. 86).

Each new station or service was scheduled in respect of types and numbers of buildings to be provided. Copies were circulated to the various sections comprising lay-out, working drawings, structural engineering, survey, water, sewage, petrol, heating and ventilating, mechanical and electrical, and issues. By that method, together with the subsequent distribution of preliminary drawings, all sections were coordinated and work proceeded concurrently in all branches.¹⁷⁹

Presumably the military camps, hospital sites and prisoner of war camps were designed in this way, as were some of the Ministry hut types.¹⁸⁰ However, the government's design branches were not the only groups working to design wartime huts in non-traditional, alternative materials. Their civilian engineer and architect counterparts aided them in this task. The following chapters will examine the products of this rare period of rapid development and innovation, which provided such a fertile test ground for the development of huts, the use of alternative materials, and prefabrication as a building system.

¹⁷⁹ Ibid, pp. 86-87.

¹⁸⁰ For more on prisoner of war camps, see Roger JC Thomas, *Prisoner of War Camps (1939-1948)* (Swindon: English Heritage, 2003).

Chapter Four

Timber Huts of the Second World War

Throughout history timber has played a dominant role in building construction and it is still a primary material today. Even where buildings are apparently built of brick or stone, the construction is reliant on timber frameworks for roofs, floors and internal partitions. Despite the introduction of iron in the late eighteenth and early nineteenth centuries, along with steel and concrete in the late nineteenth century, all of which enabled broader spans, timber remained a major part of every building in Britain throughout the twentieth century.¹ Timber was chiefly chosen because of its versatility and its low cost. Its only major drawback in time of War was that it had to be imported from abroad. Importation was not a twentieth century phenomenon: Britain had been reliant on foreign timber for centuries.² Historically, this has had an impact in a number of areas, not least of which was in determining a method of stress grading and understanding its structural properties, a task made more difficult and more important because of the large number of species imported from numerous countries.³ David Yeomans, in his book *Construction Since 1900: Materials*, explains the complexity of timber as a building material during wartime.

Much of the development of timber construction in this century may be attributed to the two world wars, both to design efforts during the wars and to the post-war shortages, partly because ways had to be found to economize on the timber used and partly because timber was seen as an alternative to other materials which were also in short supply. There is a paradox: timber becomes scarce in time of war because war consumes timber, but while in Britain most timber has to be imported, it is still seen as a substitute for other materials and developed as such. This is partly because it offers a light-weight building material for temporary

¹ Norman Davey, *A History of Building Materials* (London: Phoenix House, 1961), p. 32.

² Christopher Powell, *The British Building Industry Since 1800: An Economic History* (London: E & FN SPON, 1980), pp. 43-44, 94.

³ David Yeomans, *Construction Since 1900: Materials* (London: Batsford, 1997), p. 129.

*prefabricated construction but also because there may be shortages of other building materials or building skills.*⁴

This chapter studies timber as a building material in wartime and how the lack of timber affected hutting designs.⁵ As will be discussed, it was sometimes the case that timber frames were reduced so drastically in size that the design had to be tested to ensure it could still stand up to the force of wind. Wartime austerity meant compromising on sturdiness. Although many other alternative types of hutting incorporated some small amount of timber into their design, this chapter focuses on those huts that were constructed predominantly of timber and which provided the most documentary evidence for discussion, such as the Blister Hut, the Ministry of Supply Timber Hut, the Transportable Timber Hut Types A and B, and the X, Y, and Z huts. All available information found for those not discussed in this chapter (the All Timber Guard hut and the Army Type Portable Hut) can be referred to in Appendix B. (Table 4.1)

<i>Timber Huts of the Second World War</i>
1. Air Ministry Type A Hut
2. Air Ministry Type B Hut
3. All Timber Guard Hut
4. The Army Type Portable Hut
5. The Blister Hut
6. The Ministry of Supply Timber Hut (aka Magnet Timber Hut)
7. Transportable Timber Hut Type A
8. Transportable Timber Hut Type B
9. X, Y, and Z Huts

Table 4.1 Timber huts used in the Second World War

⁴ Ibid.

⁵ As mentioned in the previous chapter, timber supplies were largely depleted prior to the outbreak of war with the construction of militia camps, which seem to have employed a design similar to the Armstrong Hut as well as Nissen Huts. Thus restrictions in timber affected timber hut designs once war was declared. See Schofield, p. 14.

Challenges of Timber Shortage

As discussed in Chapter Three, timber supplies fell into decline following the summer of 1939 when supplies were depleted from the vast construction of military camps.⁶ These supplies could not be properly restocked from North American and Baltic sources before war was declared in September. Thus, the initial strategy was to significantly reduce the amount and weight of timber used in building. As a result, the timber huts constructed from late 1939 and 1940 became progressively thinner and flimsier. Several questions arose: one was how to make timbers as small as possible whilst still being strong enough to support their coverings. Another was what to use in place of timber as a flooring material. A third was how to best affix the various parts in a way to support portability. In answer to the first question, experiments with reduced scantlings and an assorted range of coverings were tried. In terms of the second, concrete was typically chosen as the flooring replacement in single-storey construction, which cut down considerably on the amount of timber required in the overall construction. To answer the third, bolts replaced screws and nails when demountability and portability were required. Glues, cements, and synthetic resins were likewise part of the experimentation process.

As mentioned earlier, one notable benefit of timber was with its flexibility with design. It could be bespoke, constructed on site and adapted for purpose. As this chapter will illustrate, of all the hut materials, timber huts were the least generic in form. The tendency in timber was to experiment with scantling sizes and construction details, hut layouts often being drawn to suit the use required.

First Hut Types

Prior to the declaration of war, high-quality timber hutting was constructed in airfields and camps on a large-scale during the rearmament and expansion period that occurred between 1935-39. The Air Ministry predominantly relied on two standard timber type sectional designs Type A and Type B (hereafter referred to as 'Air

⁶ C. M. Singer, 'Notes on Alternative Materials and Methods of Construction for War Hutting', *Royal Engineers Journal*, (June 1940), 180-187 (p. 180).

Ministry Type A' and 'Air Ministry Type B'). They were meant to be adaptable and extendable to meet a variety of purposes, making use of sectional units that bolted together to either increase or decrease the length. Both Air Ministry Type A and Air Ministry Type B were constructed in a similar fashion with timber frames, timber roof trusses and even timber floorboards. 'The timber-framed panel walls were covered externally with .75-inch rebated weatherboarding, internal walls were lined with plasterboard, and standard metal windows were used.'⁷ They came in four spans 10 ft, 18 ft, 20 ft and 28 ft.⁸ Paul Francis says that the smallest span was typically reserved for garages and WC blocks, while hutting with spans of 18 ft and 20 ft were most often employed as barracks and other domestic buildings.⁹ The main difference between the two hut types was that Air Ministry Type A employed Canadian cedar for its weatherboarding, which repelled rodents and perhaps contributed to its longer life expectancy of ten to fifteen years, as opposed to Air Ministry Type B, which was clad in standard timber weatherboarding and only had a lifespan of five years.¹⁰ Another difference was that Air Ministry Type A had a roof of corrugated asbestos sheeting, whilst Air Ministry Type B had a timber and felted roof.¹¹ In Francis's surveys of airfields, he found these huts were used for a variety of purposes and that several could in fact be bolted together to create a large complex.¹² Thus, the arrangement and orientation of these huts was quite flexible and multi-purpose: an ideal quality for military hutting.

In the 1956 Air Ministry publication, *The Royal AirForce Builds for War*, it states that Air Ministry Type B was the preferred hut choice at the very start of the war, likely due to its being, 'a timber framed weather boarded structure of excellent quality with an almost indefinite life subject to proper and constant maintenance and preservation.'¹³ Nonetheless, the loss of Baltic timber in the earliest months of the war made it necessary to develop new designs that required less timber to manufacture.¹⁴

⁷ Francis, p. 206.

⁸ Ibid.

⁹ Ibid.

¹⁰ Ibid.

¹¹ Ibid.

¹² Ibid.

¹³ Air Ministry, *The Royal AirForce Builds for War: A History of Design and Construction in the RAF 1939-1945 (WORKS)* (London: HMSO, 1956), p. 137.

¹⁴ Taylor, pp. 173-174.

Some quantities of imported timber stock were filled with homegrown timber as a substitute and, while not ideal, probably managed to help to some measure.¹⁵

Coverings: Sheet Materials

As mentioned previously, the control on timber led to questions about how to make timbers as small as possible while still being strong enough to withstand the weight of roofing and cladding materials. A standard modern timber framed house will use 2 by 6 or 2 by 8 inch studs for the walls.¹⁶ In comparison, a 1942 Air Ministry plan for a hut of home grown timber specifies a minimum scantling size of 1.5 by 3 inches for studs, tie-beam and braces, and slightly larger 2 by 4 inch timbers for the purlins, because they were necessary to support the galvanized corrugated iron roof. The flimsiness of the Air Ministry hut is immediately apparent. (Figure 4.1) The hut itself was likewise covered in galvanized corrugated iron sheeting, 'or other approved [material].'¹⁷

¹⁵ Such as with the Tarran Hut, which used English-grown green hardwoods. See 'A New Type of Hut', *The Builder* (10 May 1940), p. 568. See also Figure 4.1, which details a plan for a hut made of home-grown timber.

¹⁶ Francis D.K. Ching and Cassandra Adams, *Building Construction Illustrated*, 3rd edn (New York: John Wiley & Sons, 2001), p. 5.44.

¹⁷ See Air Ministry Plan No. 638/42. (Airfield Research Group)

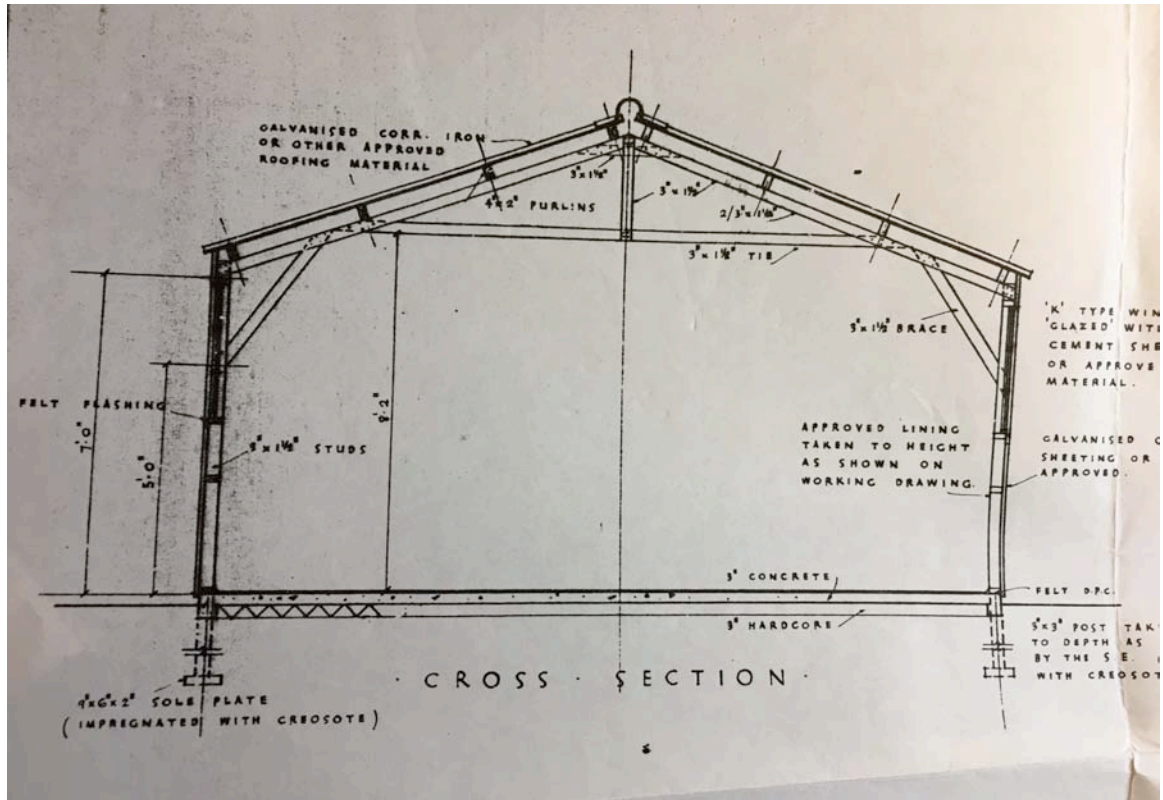


Figure 4.1 Air Ministry Plan No. 638/42, *Typical Details of Construction (Home-Grown Timber)*. (Airfield Research Group)

Corrugated sheet metal was a good covering material when it was available. It was adaptable, easily transported and weatherproof, and required only the attaching of sheets to a timber frame to cover a surface. It could be used for roofing and external cladding. The interior could be lined or left unlined. It was not without its disadvantages, of course. In the rain, the noise of raindrops falling on the roof was deafening and it had virtually no insulative value at all, the metal (usually steel) being an excellent conductor. So in winter it was freezing cold and in summer baking hot.¹⁸

Corrugated metal sheets became a restricted material under the Iron and Steel Control in 1940, and efforts were made to economise by substituting with reinforced concrete slabs, timber and asbestos cement sheeting in its place.¹⁹ For timber huts, corrugated asbestos cement sheets and felt-covered boarding were common.

¹⁸ Interview conducted with Captain Stanley Perry in August 2017, who was the adjutant officer of Weekley German PoW Camp at Boughton House, Northamptonshire from 1946-1948 and in charge of overseeing hut construction. He recounted his memories of living in a Nissen huts.

¹⁹ Kohan, p. 47.

The Huts

X, Y, Z Huts

One solution was the prefabricated X, Y, and Z huts designed and produced by Gerrard & Sons of Swinton, Manchester. They still utilised timber but on a lesser scale and therefore were not as sturdy as the Air Ministry Huts. They were manufactured for the Air Ministry from September 1939 until 1942. (Figure 4.2)

It was supplied only in standard lengths and was available in 18 ft spans, unlike sectional hutting which was purchased in several different spans and any length. The hutting was used to supplement existing accommodation at aerodromes already completed where stocks of sectional hutting were exhausted.²⁰

According to Air Ministry drawing plan number 14543/39, the X Hut measured 18 ft wide by 50 ft long, the Y Hut 18 ft by 70 ft, and the Z Hut 18 ft by 50 ft. The Z Hut provided an extra foot of height at 8 ft versus the X and Y Huts which were 7 ft high. (Figure 4.3) During their sixteen months of manufacture, over five thousand were produced for the Air Ministry. (Table 4.2). Note that comparable figures for hut erection within the other government branches could not be located. It is unknown whether any of these huts survive.

	1939	1940	1941	1942	Total
X Hut	615	2,978	38	9	3640
Y Hut	153	721	45	1	920
Z Hut	184	512	5	6	707

Table 4.2 Number of timber X, Y, and Z Huts built per year for the Royal Air Force. Calculations based on data in *The Royal Air Force Builds for War* (1997) p. 140, originally published as *Air Publication 3236, The Second World War 1939-1945 Royal Air Force: WORKS* (1956).

²⁰ Francis, p. 207.



Figure 4.2 A Gerrard & Sons Y Hut at RAF Chivenor, since demolished. (Photo by Paul Francis, Airfield Research Group)

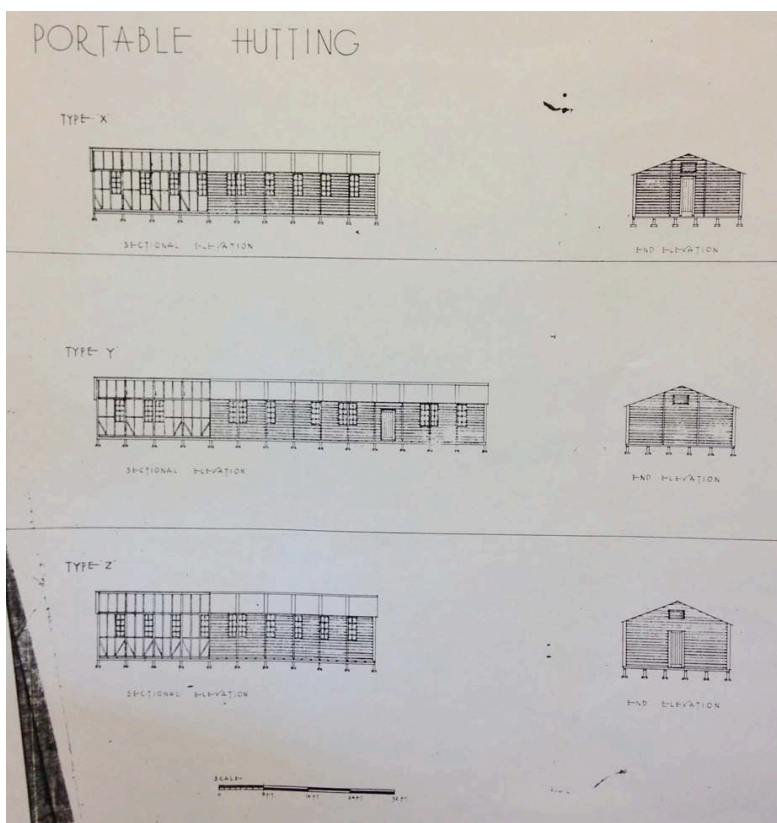


Figure 4.3 The Gerrard & Sons X, Y and Z Huts. Air Ministry drawing number 14543/39. (Airfield Research Group)

The Ministry of Supply Timber Hut

The Ministry of Supply Timber Hut, sometimes referred to as the Magnet Timber Hut, was designed to be an improved replacement for the X, Y, and Z Huts.²¹ While there is not a great deal of documentary or photographic sources for this hut, it would seem to have been a sturdier, but unlined timber hut used for accommodation. It was manufactured by Magnet Limited, a joinery company that had been practicing mass production techniques on windows and doors since the 1920s, and is still in production today. This newer timber hut was put into production at the same time X, Y, and Z Huts were taken out of production, in January 1941.²² Unlike the X, Y, and Z Huts, which came in several spans, Magnet Huts came in just one span of 16 ft and measured 54 ft long. They still made use of timber in their framework and walls of weather boarding, but were left unlined, given concrete flooring and covered with a felt roof. The Magnet Hut seems to not have been overly successful as the Air Ministry only kept it in production for six months.²³ Francis believes this was likely due to the large amount of timber it required at a time when shortages were becoming more extreme.²⁴ The total number of huts supplied and erected over that six-month period was 1,015.²⁵ (Figure 4.4) It is unknown whether any survive.

Three versions were available: barrack block for one NCO and 16 airmen with a single No. 3 slow-combustion stove; quarters for eight sergeants or eight airmen in five bedrooms with a central corridor, each room having a Queen stove; quarters for four officers with a servants' dormitory and a corridor running along a side wall, each room having a Queen stove.²⁶

²¹ The Airfield Research Group Archive has two drawings for this hut. Drawing numbers 16056/40 and 16227/40.

²² Air Ministry, p. 138.

²³ Ibid.

²⁴ Francis, p. 207.

²⁵ Air Ministry, p. 140.

²⁶ Ibid.

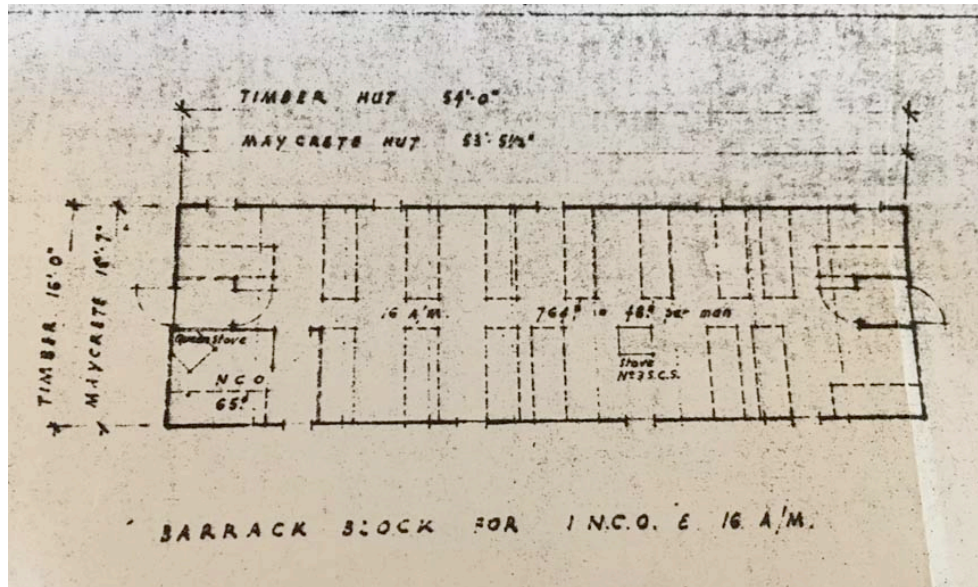


Figure 4.4 A plan to show arrangement of barrack accommodation using either a Ministry of Supply Timber Hut (Magnet Hut) or a Maycrete Hut. The MoS Timber Hut was slightly larger but both could accommodate 16 airmen with 1 non-commissioned officer. Drawing number 16227/40. (Airfield Research Group)

The Blister Hut

While the Air Ministry, X, Y, & Z and Magnet Huts are quite difficult to tell apart without close examination, the Blister Hut is instantly recognisable, although so rare there are no known surviving timber examples. It was introduced for military use in 1941 by the firm of Norman & Dawbarn in association with William C. Inman. The contract for its construction within the United Kingdom fell to C. Miskin & Sons.²⁷ However, its patent was applied for two years earlier in November 1939, with Inman and Dawbarn listed as the inventors. The genius of the Blister Hut is that it was intended to not only provide accommodation for men and aircraft, but its design allowed it to blend into the surrounding earth making it fairly invisible from the air in the event of an aerial attack. (Figure 4.5)

[T]he object of the invention being to provide an easily erected structure which will efficiently house preferably a single machine and in addition provide accommodation for attendant personnel and furthermore, be of such a character that it is practically invisible from the air and when adequately camouflaged, indistinguishable from its surroundings.²⁸

²⁷ Graham Dawbarn, 'Blister: A System of Construction for the Rapid Erection of Halls, Factories, Hangars, Etc.', *Journal of the Royal Institute of British Architects*, (April 1941), 108-110 (p. 108).

²⁸ Patent number GB538429, 'Improvements in Hangars or like Shelters, more particularly for Aircraft.' (28 November 1939).

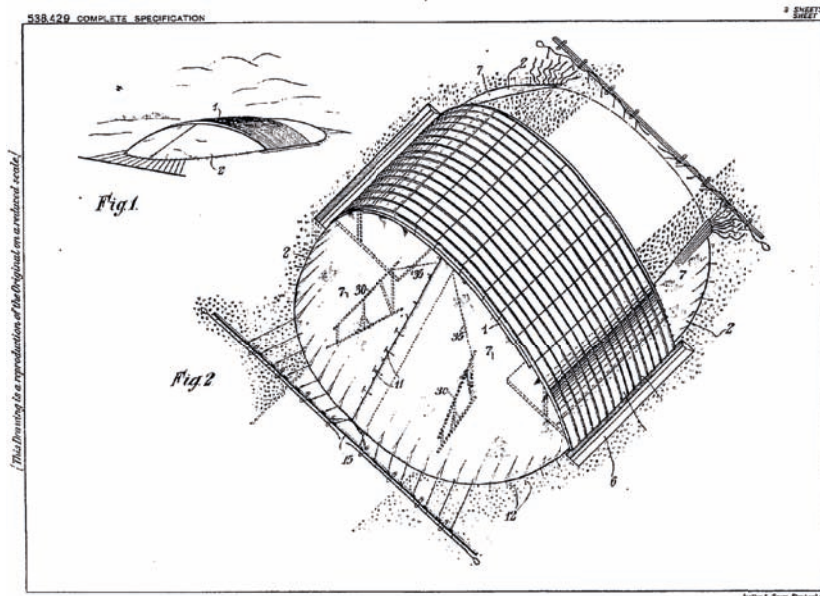


Figure 4.5 A drawing for the Blister Hut as submitted with patent GB538,429 in November 1939.

The Blister Hut was formed of ‘sectional arched ribs springing from ground bearers and restrained each side by vertical posts which are also supported on the bearers.’²⁹ There were three types. The first and smallest had a span of 45 ft and was constructed of timber. The other two were larger and required construction with welded steel units. ‘Wooden platforms are laid over the bearers down either side of the building and the bearers themselves lie on transverse runners. Wood purlins between ribs carry curved steel sheeting of “Continental” pattern.’³⁰ The timber version measured 25 ft long and 14 ft 3 in. at its highest point. Its uses varied from hangar hut to workshop to accommodation.

Transportable Timber Huts

The Transportable Timber Huts, designed by H. Dalton Clifford and Alan Best, are evidence of the greater influx of timber from 1943 when they were introduced to the military. They came in two types: Transportable Timber Hut A and

²⁹ ‘Blisters’, p. 108.

³⁰ *Ibid.*

Transportable Timber Hut B. Both measured 14 ft 6 in. wide x 36 ft long and had collapsible timber truss frames. They both had characteristic sloping walls. However, this is where similarities ended. Transportable Timber Hut Type A was 'covered with sheet material such as corrugated asbestos or iron, wall-board or plywood, and Type B with canvas or other flexible material.'³¹ Type A could be erected in thirty-five hours and Type B in just ten hours. The huts were prefabricated and then the entire assemblage was organised into bundles, and flat packed for transport on a lorry. One lorry could transport four Type A Huts at a time.³² The hut was advertised for use in camps, for storage or as worker's buildings.³³ (Figure 4.6)

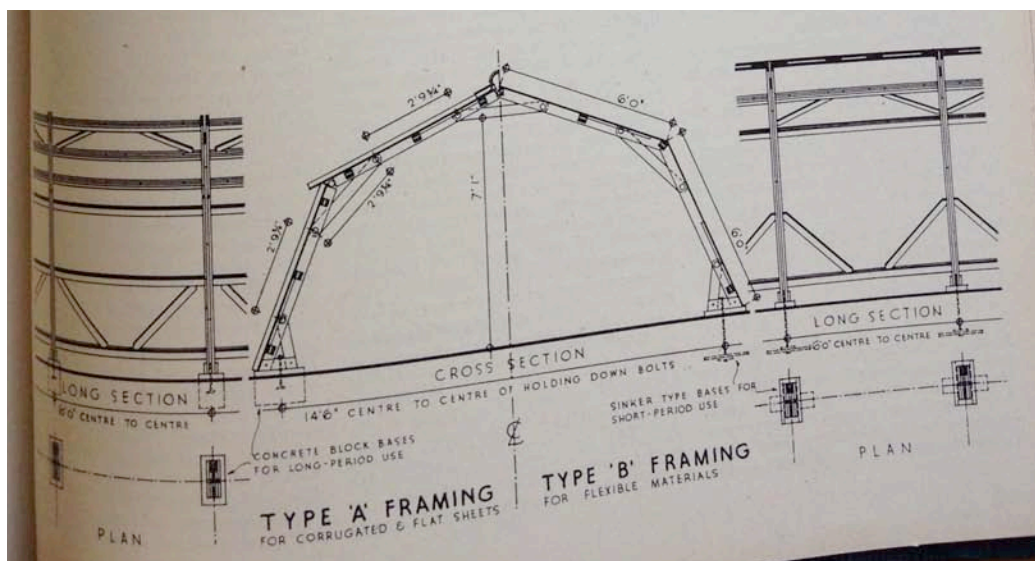


Figure 4.6 The Transportable Timber Huts, *Architects' Journal*, 29 April 1943.

Limitations on Adoption

The brevity of this chapter stands as evidence of the limited number of timber designs in the Second World War. There was simply very little imported timber supply available from the start of the war until roughly 1943 when control of the Atlantic began to lean in the Allies favour. To give a quantitative form of reference, in 1939, timber hutting accounted for 911,880 sq ft of accommodation and was the only form of hutting being supplied and erected.³⁴ By 1942, that number had dropped to

³¹ 'Transportable Timber Hut', *Architects' Journal*, (29 April 1943), p. 286.

³² *Ibid.*

³³ *Ibid.*

³⁴ Air Ministry, p. 140.

just under 20,000 sq ft whilst alternative material huts soared into the millions.³⁵ Small amounts of timber were still used as framing in various designs as part of a combination with other predominant materials, such as the Ministry of Supply's Maycrete Hut. It was sometimes referred to as the MoS Timber and Maycrete Hut because of its timber roof trusses, even though it was constructed primarily of sawdust concrete panels with reinforced concrete posts. The Ministry of Supply Living Hut and the Laing Hut also consisted of light timber frames, although they each mainly made use of plasterboard or weatherboard panels for the walls. Others, such as the Tarran, made some use of locally homegrown green hardwoods. As the war progressed, and supplies of timber waned, the stage was set for the advent of huts constructed from concrete, asbestos, plywood and other alternative materials. These huts and more are all discussed in the next chapter.

³⁵ Ibid.

Chapter Five

Huts of Composite Materials: Plasterboard, Wood Wool, Plywood

The decline in availability of timber and steel led to several new developments in hut design by both the government and civilian sectors. This was fairly revolutionary if one considers that the building industry up to this point in time had tended to stay committed to traditional materials and methods. It was only due to scarcity of materials, wartime restrictions and complete necessity that forced the industry to change, to be open to experimenting and adopting new materials and construction techniques.

These alternative materials were not necessarily new; some were existing ones employed in fresh ways. In these explorations, as mentioned previously, designers were aided by the work of the Building Research Station, which spent the earliest years of the war testing the worthiness of different materials and structures. Out of these evolving conditions came new hut designs that innovatively employed these more readily available, alternative materials. One development, which will be addressed in the next chapter, was made by employing concrete and asbestos products into hut design. This occurred fairly early in the war, with the first concrete designs being advertised in December 1939.¹ Whilst fairly inexpensive and available in large quantities, asbestos sheets were fragile and concrete was not necessarily given to portability. Timber and steel were still the most ideal materials for hutting and finding comparative tensile materials to match them was an ongoing pursuit. Thus, concurrent

¹ 'Concrete Hutments', *The Architect and Building News*, 160.3705 (22 December 1939), pp. 266-268.

with concrete and asbestos innovation, designers turned to exploring a range of alternative materials for hutting. The need for quickly erectable and inexpensive huts to provide for a range of uses drove development at speeds only possible in wartime.

Plastics, gypsum plasterboard, wallboard, wood wool, plywood, felt, plaster-faced blocks, sawdust, clay and terracotta were all considered viable alternative materials to timber and steel. Out of these considerations, the most successful and repeatedly used were plasterboard, wood wool slabs and plywood. Thus, this chapter will examine those designs that most successfully employed these composite materials, such as the Plywood Hut (also known as the All-Ply Hostel), the Ministry of Supply and Ministry of Works Plasterboard Huts (which included variations such as the Hall, Laing and the Living Huts), and the Seco Hut. A full list of composite material huts researched for this chapter are provided below. (Table 5.1) The Half-Brick Hut will not be discussed further in this chapter is recorded in Appendix B.

<i>Huts Constructed of Composite Materials</i>
1. Half-Brick Hut
2. MoS Laing Hut
3. MoS Living Hut
4. MoS Plasterboard Hut
5. MoW Hall Hut
6. Plywood Hut (All-Ply Hostel)
7. The Seco Hut

Table 5.1 Composite Material Huts

Composite Materials

Plasterboard

Plasterboard, sometimes referred to as gypsum plasterboard, gypsum wallboard, or drywall (due to its low moisture content), is a building board fabricated from Plaster-of-Paris, (a product created from grinding gypsum rock into a fine powder, which when mixed with water eventually sets into a hard material), and pressing it between two sheets of paper.²

Anhydrous gypsum or Plaster-of-Paris is not a new material. Gypsum had been used in the Middle East as a mortar since the beginning of civilization. It seems to have been first introduced in England as a plaster during the thirteenth century by Henry III after he noticed its application on a visit to France.³ Today, rather than a new untried material, plasterboard has become so ubiquitous that it is generally considered to be a common unit in building construction, especially for interior walling. Modern construction manuals define gypsum plasterboard as a sheet material for covering walls:⁴

It consists of a gypsum core surfaced and edged to satisfy specific performance, location, application and appearance requirements. It has good fire resistance and dimensional stability. In addition, its relatively large sheet size makes it an economical material to install.⁵

Construction practices continue to be the same from the wartime period with plasterboard remaining easy to cut:

Either by sawing or for straight lines by scoring both surfaces and snapping over a straight edge, in the same way as flat glass. Plasterboard is “hung” on walls or ceilings by a plasterer. On brickwork it is held with dabs of adhesive or on timber studs secured with plasterboard nails or screws.⁶

² Henry Adams, *Cassell's Building Construction* (London: Cassell and Co., 1905), p. 162.

³ Norman Davey, *A History of Building Materials* (London: Phoenix House, 1961), p. 94.

⁴ Francis D.K. Ching and Cassandra Adams, *Building Construction Illustrated*, 3rd edn (New York: John Wiley & Sons, 2001), p. 10.09.

⁵ *Ibid.*

⁶ James H. Maclean and John S. Scott, *The Penguin Dictionary of Building*, 4th edn (London: Penguin Group, 1993), p. 218.

The only downside to the material is that, if left untreated, it is vulnerable to water, so it needs to be weatherproofed if there is the possibility of it being exposed to the elements.

First Appearance

The first use of gypsum to make plasterboard is difficult to trace. It seems to have been employed by builders in the United States from the end of the nineteenth century. Three Americans patented a specification for 'plaster board' in 1904, but it is likely to have been in use even earlier than this date in the United States.⁷ In Britain, it is not mentioned in *Cassell's Building Construction* manual of 1905, however, in the 1911 edition of the *Encyclopaedia Britannica*, there is a description of a plaster slab that is somewhat close and is perhaps an antecedent to plasterboard:

*For partitions and ceilings, plaster slabs are now in very general use when work has to be finished quickly. For ceilings they require simply to be nailed to the joists, the joints being made with plaster, and the whole finished with a thick setting coat. In some cases, with fire-proof floors, for instance, the slabs are hung up with wire hangers so as to allow a space of several inches between the soffit of the concrete floor and the ceiling. For partitions the slabs frequently have the edges tongued and grooved to form a better connexion; often too, they are holed through vertically, so that, when grouted in with semi-fluid plaster, the whole partition is bound together, as it were, with plaster dowels. Where very great strength is required the work may be reinforced by small iron rods through the slabs. This forms a very strong and rigid partition which is at the same time fire-resisting and of light weight, and when finished measures only from two to four inches thick.*⁸

Whether this passage really is describing plasterboard or the use of thicker plaster panels is unclear. The only parts missing from this description would be the paper that encases the gypsum plaster, a development that took several more years to reach Britain. The true start of plasterboard in Britain probably begins with the British Plaster Board Company, which acquired an American plasterboard plant in 1917 and set up operations in Seacombe, Cheshire.⁹ The same year, they applied for a patent, 'An Improved Composite Board or Slab chiefly intended for Building Purposes, and Apparatus for Making the same.'¹⁰ (Figure 5.1) It is described as providing:

⁷ 'Improved Plaster Board,' by Harry Elmer Sharp, George Ulrich and James Loughlin, of Hartford, Connecticut. Patent number GB190408690A, (15 April 1904).

⁸ *The Encyclopaedia Britannica*, 11th edn, 29 vols (New York: The Encyclopaedia Britannica Company, 1910-1911), xxi (1911), p. 786.

⁹ For more on the history of the British Plaster Board Company, see John Routley, *A Saga of British Industry: The Story of the British Plaster Board Group* (London: British Plaster Board, Ltd., 1959).

¹⁰ Patent number GB116550, (16 June 1917).

[A] durable material or board for use in making walls, roofs floors and ceilings which shall be sound-proof, heat and col-proof, fire-proof and damp-proof... the improved board or slab is composed of a layer of plaster or the like interposed between two layers of paper, or cardboard, felt, cloth or similar material as a substitute for paper. The board (hereinafter referred to as the plaster board) may be of any suitable thickness usually about half an inch and of any size or shape, a convenient shape being rectangular generally a square having sides about thirty-two inches in length. When the plaster between the paper has properly set it adheres strongly to or unites firmly with the paper forming the exterior surfaces of the plaster board the whole being rigid and strong and very suitable for use in making permanent or temporary buildings or structures of various kinds.¹¹

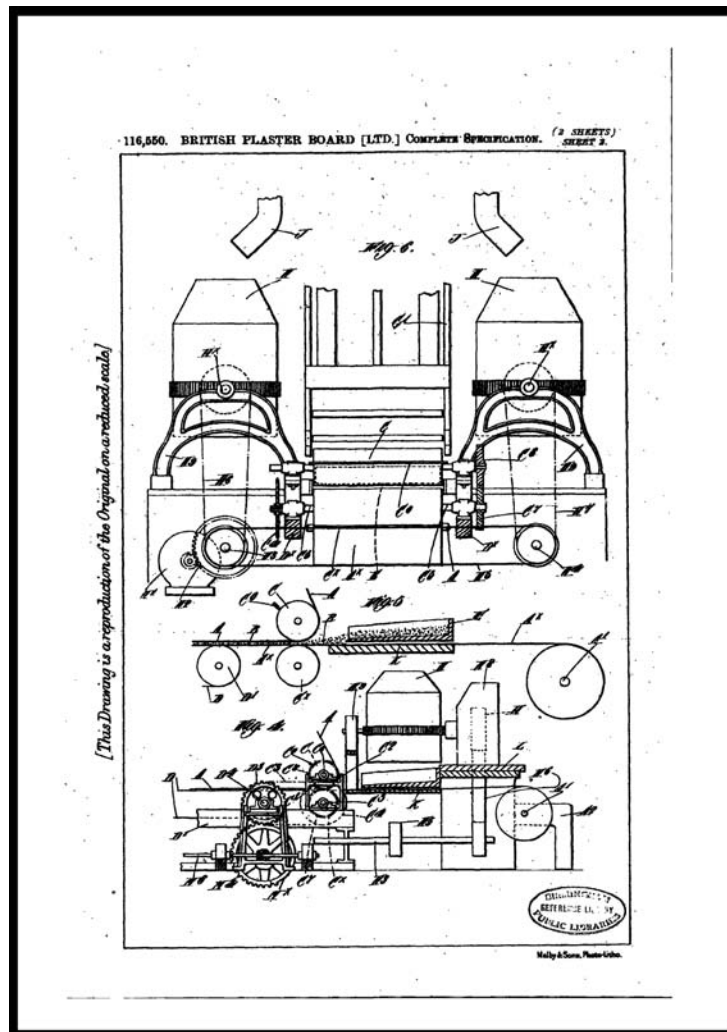


Figure 5.1 The British Plaster Board Company's drawing for a machine that manufactures plasterboard. Patent number GB116550, dated 16 June 1917.

In 1940, the British Plaster Board Company filed for another patent, one that would have a direct effect on hut construction. Until this time, it was only possible to use plasterboard for interior work as it was not waterproof and would decay into a

¹¹ Ibid.

chalky mess if exposed to damp. This new patent aimed to solve this problem by applying bituminous roofing felt to the outside of the plasterboard, rendering it waterproof and suitable for exteriors:¹²

Plaster-board as at present manufactured, comprises a layer of plaster between two layers of stout paper, cardboard or the like, this composite material usually being made in a continuous manner by spreading plaster on to a paper web fed from a roll or spool, the layer of plaster being placed on the upper surface of this web, and after the plaster has been spread another paper web is applied to the spread plaster, this web also being fed from a roll or spool thus providing a continuous process to produce a length of the composite material which is transversely cut into pieces or sections of the required size or length... The chief object of the invention is to enable plaster-boards to be used externally in the construction of certain classes of buildings, such as huts... On the exterior surface of one of the said paper layers a bituminous substance or material... is applied. Preferably the bituminous substance or layer is in the form of bituminous felt or bitumen ply felt such as the well-known roofing felt.¹³

This was accomplished by processing the bituminous felt through a heated system of rollers, which softened the material, before applying it directly onto the surface of the plasterboards, laid upon a table. Once it cooled and hardened, the plasterboard was considered waterproof.¹⁴ For obvious reasons this was an important development and whilst waterproofing was not always necessary, the ability to use plasterboard as an exterior material provided a new material source that could be acquired rather cheaply and employed quickly in hut construction.

Wood wool

Wood wool slabs are defined as ‘a panel product made of long thin strands of wood that are mixed with cement and compressed in a mould to bind them together [...] giving fire resistance as well as heat and sound insulation.’¹⁵ Wood wool, known in the United States as excelsior, is a product of the nineteenth century originating from Germany and seems to have been used in Britain from the interwar period.¹⁶ In the wartime period, wood wool slabs were used as an alternative material for both roofing and wall cladding. Marian Bowley said that as a material, wood wool could be applied between concrete blocks or slabs and the building boards that act as lining

¹² British Patent number GB535749 filed by the British Plaster Board Company and Leslie Francis Allsop on 2 January 1940.

¹³ Ibid.

¹⁴ Ibid.

¹⁵ Maclean, p. 512.

¹⁶ Erik Johansson, ‘Woodwool Slabs: Manufacture, Properties and Use’, *Building Issues*, 6, No. 3 (1994), 4-26 (p. 5).

to provide extra insulation.¹⁷ It was relatively inexpensive and a useful method for lining provision in both hutting and post-war housing.

Production of wood wool panels is a fairly straightforward process. It typically consists of mixing wood shavings with water and Portland cement, although in the past other binders have been used such as magnesite and gypsum:¹⁸

*The mixture of woodwool, binder and water is put into moulds which are filled with the required amount of mixture by weight. The moulds are then stacked on top of each other and put under pressure so that the mixture in each mould is compressed. After the slabs have hardened, usually in 24 hours, they are demoulded and the edges trimmed with a saw. They cure for two to three weeks before they are delivered.*¹⁹

The end product is considered to be durable, fire-resistant, water-resistant, pest-resistant and impervious to rot.²⁰ Slabs could be flat-packed and were easy to transport. These would likely have been seen as attractive qualities to designers of wartime construction.

Plywood

Plywood is an interesting alternative material to timber. It is defined as:

*[A] product in which several plies or pieces of veneer are glued to each other or to a lumber core. The grain of any one ply is usually at right angles to the adjacent layer or layers. The use of the term broadening, and “plywood” may be considered to include products referred to as blockboards, laminboards, stripboards. Boards formed of more than three layers of veneer are usually designated “multi-ply”.*²¹

As a material process, plywood is in no way a new resource and can be traced back millennia. Perhaps in direct contrast to modern views of plywood as a common, cheap material, it was once used in constructing fine pieces. There are surviving examples of ancient Egyptian furniture and sarcophagi that not only employ what one might consider modern principles of plywood technology, but also displays its durability through time:

¹⁷ Marian Bowley, *Innovations in Building Materials* (London: Gerald Duckworth, 1960), p. 355.

¹⁸ Johansson, p. 5.

¹⁹ *Ibid.*, p. 6.

²⁰ *Ibid.*

²¹ Andrew Wood and Thomas Linn, *Plywoods: Their Development, Manufacture and Application* (London: W. & A.K. Johnston, Ltd, 1942), p. 443.

[Inside] a royal tomb from the Third Dynasty, is a sarcophagus the sides of which consist of six layers of wood securely glued together [...] How the wood was sawn or cut, how the glue has managed to hold the face veneers to the solid core for some thirty-five centuries, must ever remain a wonder to the modern woodworker.²²

Even Chippendale is mentioned using plywood in Frederick Robinson's *English Furniture*:

*His frets were no mere pierced planks, but consisted of several thicknesses glued together in different ways of the grain, until the result was ornament capable of withstanding climatic changes and the effect of time to an extraordinary extent.*²³

The widespread use of plywood, however, depended on the development of machinery capable of cheaply mass-producing standard flat sheets. Plywood only really developed into a commercial material in the twentieth century in part due to the invention of a rotary-cutter that could produce reliable, large-size veneers in a wide range of standard sizes.²⁴ This also allowed the production of large multi-ply boards. The technology was perfected during the First World War, when plywood was used as a prime material in aircraft design:²⁵

*It is generally agreed that the Great War of 1914-1918 was, in the main, responsible for the very rapid advance made by aeronautical engineers from 1914 onwards. Aircraft factories required considerable quantities of thin plywood, and the development of the plywood industry kept pace with that of the aeroplane. Chemists throughout Europe and in America set about the task of evolving a waterproof glue, and it is questionable if plywood could have been the sound product it is to-day but for the intense research work crammed into these early days of the war.*²⁶

Interestingly, plywood continued to be used in aircraft manufacture in the Second World War.²⁷ Andrew Wood and Thomas Linn discuss this subject thoroughly in their book, *Plywoods* (1942). The key point they make in regards to plywood versus timber is that normal timber has several weaknesses (namely structural vulnerabilities to splitting and humidity, and inability to resist shear) that are overcome by converting it into plywood, which makes the wood infinitely stronger and more durable.²⁸ The efficiency of plywood was in turn strongly

²² Ibid, p. 1.

²³ Ibid. See also, Frederick Robinson, *English Furniture* (London: Methuen and Co., 1905).

²⁴ Wood and Linn, p. 48.

²⁵ Wood and Linn, p. 5.

²⁶ Ibid, p. 6.

²⁷ One example was the De Havilland Mosquito bomber aircraft, which was constructed of plywood and first flown in 1941. See <https://www.raf.mod.uk/history/TheMosquito.cfm> [accessed 7 September 2017]

²⁸ Wood and Linn, p. 28.

dependent on the development of glues that did not degrade and could successfully resist the loads put on them, which in the case of bent plywood structures could be considerable. It is a versatile material that proved useful as shuttering for concrete, flooring, ceilings, partitions, and when resin-bonded, could be used externally. Writing in the midst of the Second World War, the authors add, 'in the field of pre-fabricated temporary or permanent structures exterior plywood is invaluable and offers many advantages over competitive materials.'²⁹

For this chapter, it is important to note that while, as a category, these were huts that made use of composite materials, this does not mean that timber, asbestos cement, concrete, and/or brick were completely absent from their designs. The contrary is true. They quite often incorporated a combination of materials. They have been included here, instead of in one of the other chapters, because they were designs that predominantly made use of an alternative building material in savings of another more traditional material. Several of these types will be discussed below.

The Huts

The Plywood Hut

An All-Ply Hostel was first advertised in *The Builder* in February 1942. It was a sizeable hut constructed nearly entirely of plywood with the exception of its light timber frame. It was touted as a revolutionary development, adopting the American technology of applying resin bonding (in the form of urea formaldehyde) to the plywood in order to achieve a weatherproof board.³⁰ The resin-bonded plywood was cemented to a light timber framework, and lined internally with ordinary plywood panels. Screws and steel straps were used to anchor the joints as well as in securing the external walls to the concrete foundation.³¹ The large panels were prefabricated so could be stacked together and brought directly to the site ready to be used. As a

²⁹ Ibid, p. 423.

³⁰ 'An All-Ply Hostel for the Ministry of Works and Planning: The Use of Resin Bonding', *The Builder*, 162.5168 (20 February 1942), 169-171 (p. 169).

³¹ Ibid.

timber alternative, test results were positive, indicating that just $\frac{1}{4}$ in. of resin-bonded plywood could support the same weight as 1.25 in. solid timber.³² (Figure 5.2)

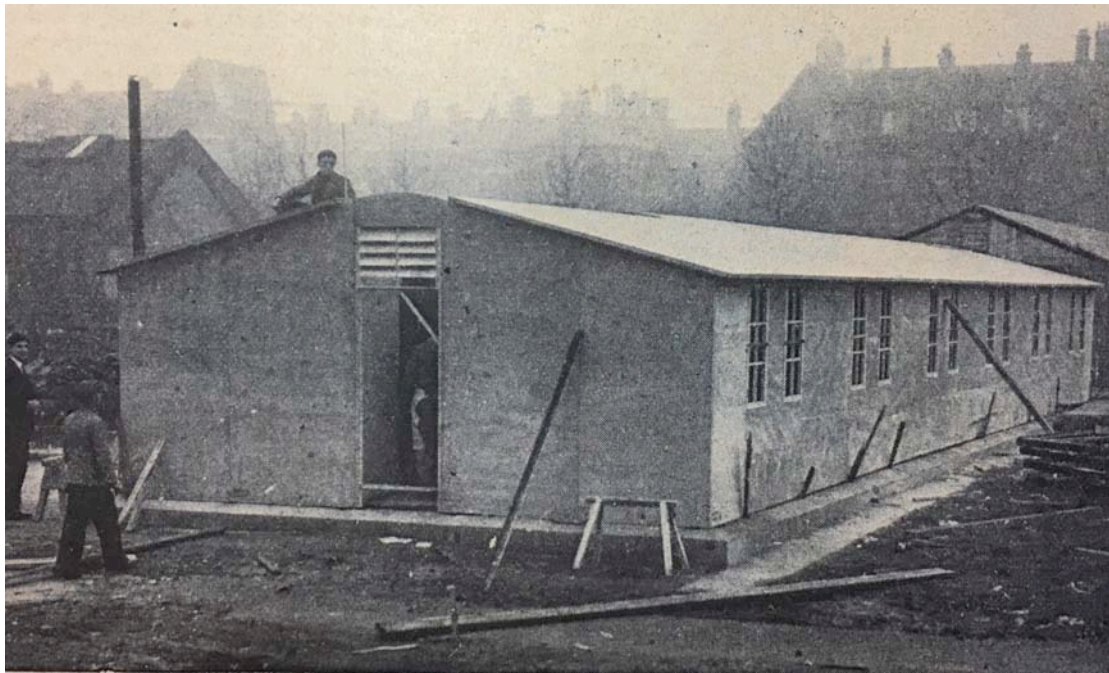


Figure 5.2 The Plywood Hut designed as a hostel for the Ministry of Works. *The Builder* (20 February 1942)

The All-Ply Hostel plan of the Plywood Hut measured 18 ft 6 in. wide by 72 ft in length. Like all plywood huts, it was specifically designed to fit the exact module of a plywood sheet, avoiding any cutting on site wherever possible. It was thus divided internally into a series of cubicles, twelve per side, with plywood partitions to accommodate for up to twenty-four agricultural or munitions workers.³³ Both the walls and the roof were constructed ‘in standard sections 6 ft wide, of 1 $\frac{1}{2}$ in. square timber framing divided into a lattice by $\frac{3}{8}$ in. thick slats faced both sides with $\frac{1}{4}$ in. plywood, bring the over-all thickness of the walls up to 2 in.’³⁴ (Figure 5.3) *The Architects’ Journal* published an article in August 1942 commenting that the Plywood Hut is of a cubicle type and ‘seems to be rather luxurious for wartime conditions.’³⁵ (Figure 5.4) These were designed specifically for accommodation. It is unknown how long they were in production, how many were ultimately erected, or if any survive.

³² Ibid.

³³ Ibid.

³⁴ Ibid.

³⁵ ‘Prefabricated Huts’, *The Architects’ Journal*, 96 (13 August 1942), 107-110 (p. 108).

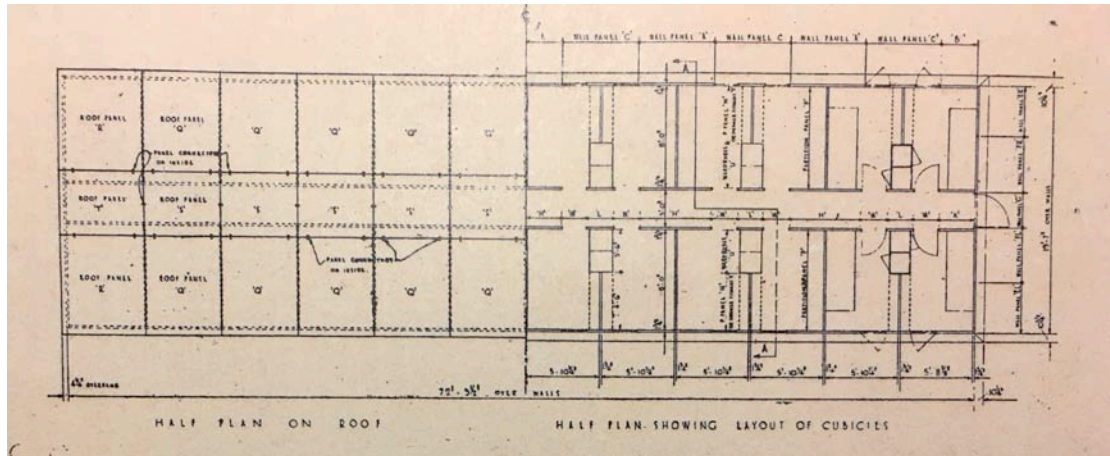


Figure 5.3 The half plan showing the plan of the roof with its 6 ft sections (left), and the layout of the worker's cubicles (right). *The Builder* (20 February 1942)

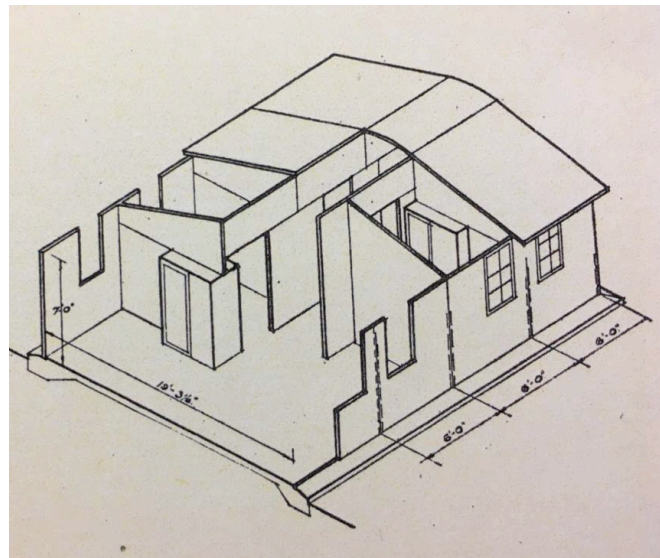


Figure 5.4 The Plywood Hut as advertised in *The Architects' Journal*, 13 August 1942. Notice the window openings which were precut into the plywood panels at the factory, ready for window units to be installed.

The Ministry of Supply and Ministry of Works Plasterboard Huts

From 1940, the Ministry of Supply and the Ministry of Works explored a range of hutting options utilising plasterboard as the main covering material over a timber frame. The Ministry of Supply had three types in production at various points. The Laing Hut, the Living Hut and the Plasterboard Hut.

The Ministry of Supply Laing Hut was in use from January 1941 to April 1942.³⁶ The Air Ministry took possession of 12,540 Laing Huts during this period.³⁷ They measured 18 ft by 60 ft and employed felted plasterboard panels for walling and corrugated asbestos sheets for roofing. (Figure 5.5) A Revised Laing Hut was produced from May 1942 to June 1943, which was the same size but was covered with corrugated steel, lined hardboard or plyfelt.³⁸ Plyfelt is a mysterious term used by the Air Ministry, perhaps a shortened term for bituminous-felted plywood panels.

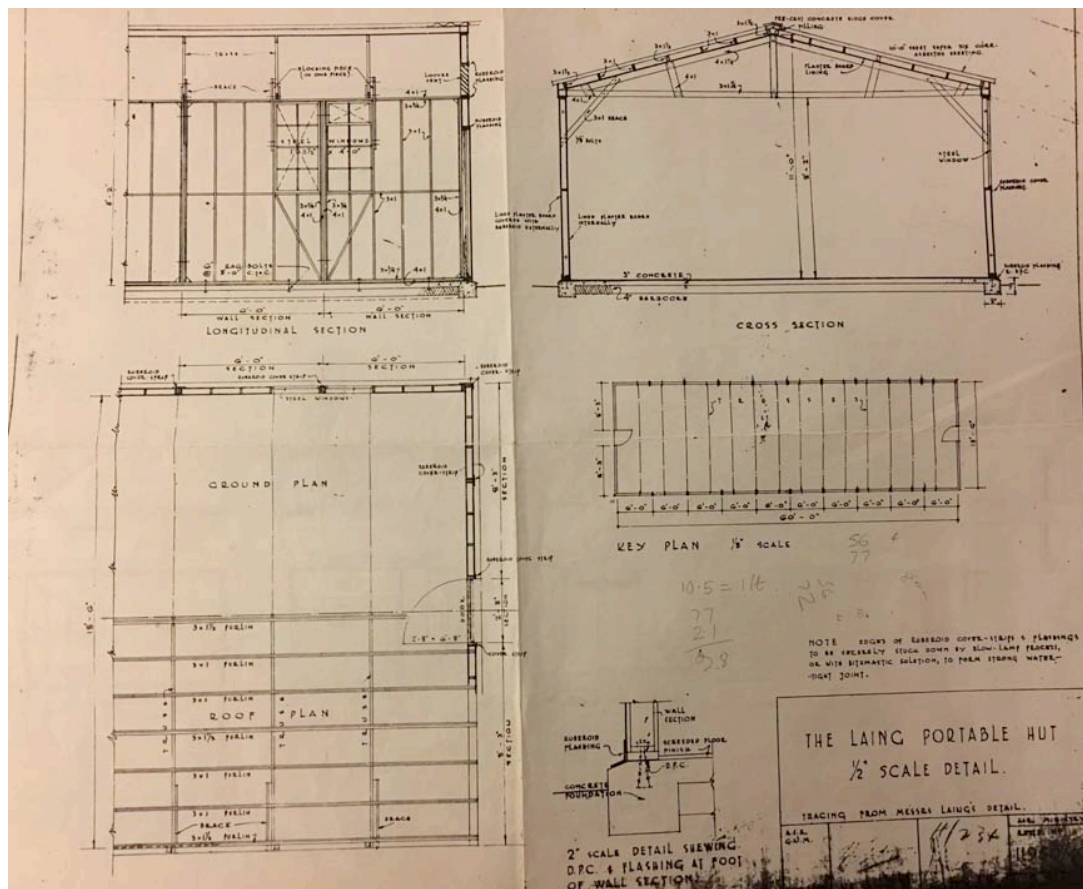


Figure 5.5 The Ministry of Supply Laing Hut. Air Ministry drawing number 11950/40. (Airfield Research Group)

The Ministry of Supply Living Hut was also designed in 1940 and somewhat confusingly was known by several different names including Thorber, Thorbex and Thorn. It spanned 17 ft 3 in. and was 60 ft in length.³⁹ It had a distinctive timber framed design with cant-sided walls, covered externally with felted plasterboard. (Figure 5.6) The Air Ministry history says these huts were in production from January

³⁶ Air Ministry, *The Royal AirForce Builds For War (Works)* (London: Stationary Office, 1956), p. 139.

³⁷ *Ibid.*, p. 140.

³⁸ *Ibid.*

³⁹ Francis, p. 208.

1941 until July 1941 with 500 being erected over that six-month period.⁴⁰ Paul Francis surveyed several surviving Living Huts at WAAF site No. 6 at Castle Camps for his book on airfield architecture. He described their construction as involving:

[A] simple system of two knee braces (small and large) and a collar-beam instead of a roof truss, which ensured that the roof and wall panels were both sturdy and remained at the correct angle. The gable ends were made of five sections of light timber studwork framing which were bolted together, the centre section containing a door. Side elevation walls and roof all shared a common frame section except where windows were required. They were all clad on both sides with plasterboard, the external face being felted. Typically, each 60 ft long hut was constructed from 80 frame sections, each 3 ft wide, making a total of 90 sections when gable end walls were included.⁴¹

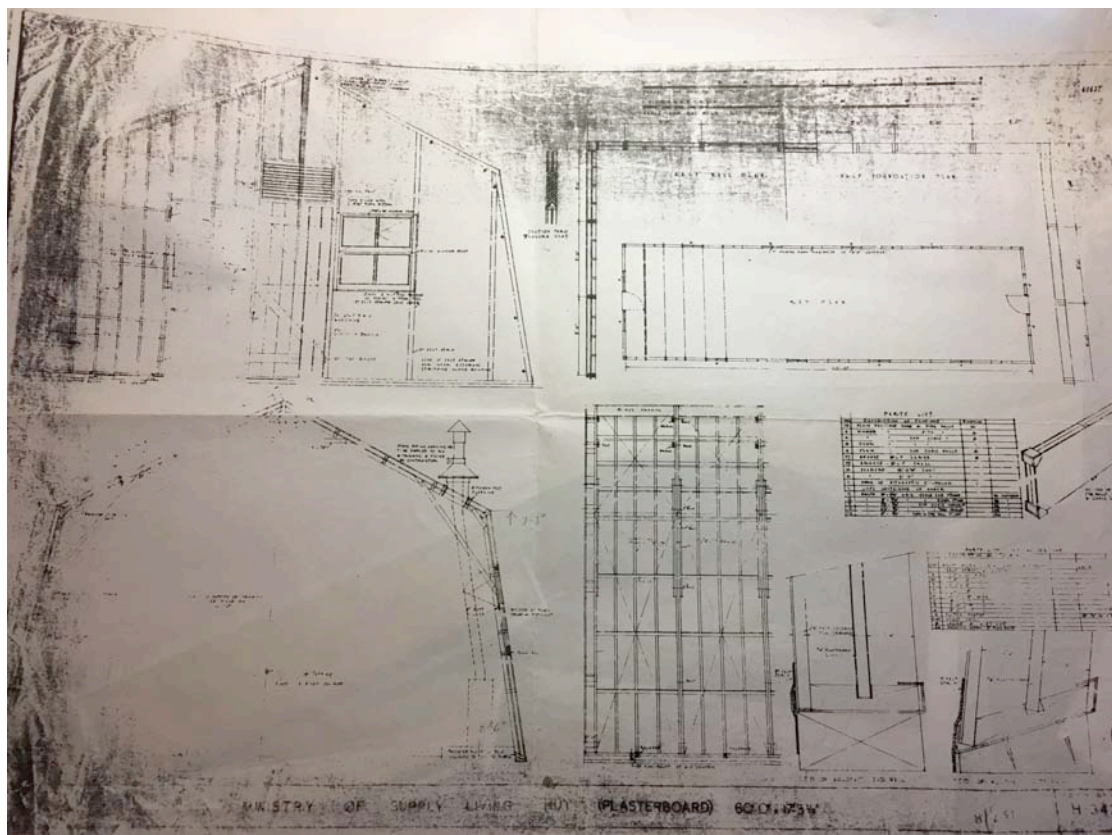


Figure 5.6 A plan for a Ministry of Supply Living Hut, drawing number H342/40 and Air Ministry 16057/40. (Airfield Research Group)

The Air Ministry specifies that the Ministry of Supply manufactured another plasterboard hut, which they called the MoS Plasterboard Hut. It measured 18 ft by 60 ft and was in production from October to December 1941, with 355 huts erected.⁴² It

⁴⁰ Air Ministry, p. 138, 140.

⁴¹ Francis, p. 208.

⁴² Air Ministry, pp. 139-140.

was of similar design to the other plasterboard huts with light timber framing, felted plasterboard covering on the exterior with plain plasterboard on the interior walls, and concrete floors.⁴³

The Ministry of Works Hall Hut

In 1942, Ministry of Works adopted their own plasterboard and timber hut, which they named the Hall Hut. It was a timber-framed hut of traditional style but the exterior walls and roof were covered with felted plasterboard panels. Plain plasterboard panels lined the interior. It measured 18 ft 6 in. in width and could be extended in increments of 6 ft 6 in. lengths.⁴⁴ It was constructed without purlins, using the felted plasterboard roofing panels to span the distance between trusses.⁴⁵ The Air Ministry used the Ministry of Works Hall Hut from July 1942 until February 1943, erecting 810 over this period.⁴⁶ (Figure 5.7)

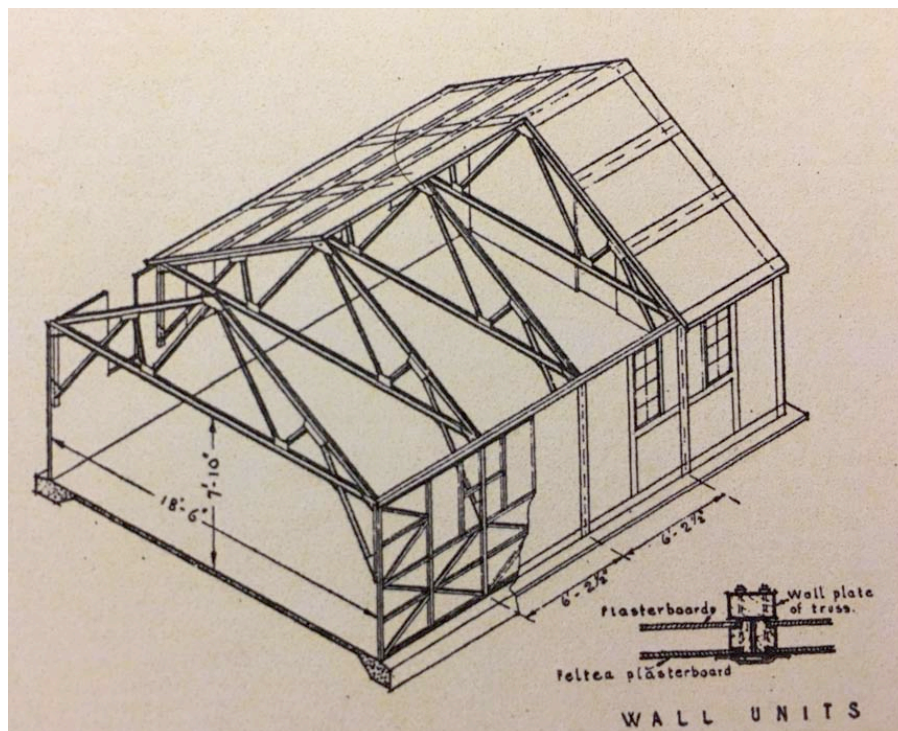


Figure 5.7 The Ministry of Works Hall Hut. *Architects' Journal* (13 August 1942)

⁴³ Ibid, p. 139.

⁴⁴ Ibid, p. 138.

⁴⁵ 'Prefabricated Huts', p. 108.

⁴⁶ Air Ministry, pp. 139-140.

The Seco Hut

The Seco Hut was designed in 1942 by Universal-Selection Structures Limited. The company advertised its hut as being versatile with unlimited options for floorplans and one that could later be re-erected as a domestic dwelling in the post-war period.⁴⁷ In a 1942 memo to contractors, the managing director Bernard Brunton said:

The “SECO” System combines the use of a number of standardized Units or Panels for walls and roof, and Component portions of carefully calculated pre-determined dimensions. These can be assembled with almost unlimited flexibility into buildings of one floor planning, either of Clear Span, utilising the “SECO” ‘Aero’ Beam and Columns, or of Cellular Construction, where the Units also form the internal partitions, and act as roof supports [...] The System represents true pre-fabrication in building construction within the limits imposed by the restrictions on the types and quantities of materials available at the present time. It has been scientifically designed from the point of view of thermal and acoustic insulation, lightness for transportation, and speed of erection. “SECO” buildings combine hygienic living conditions and pleasing appearance.⁴⁸

Interestingly, Brunton also makes the point that because these units can be reused for post-war housing, he asks the contractors involved in their site construction to given the building units and components more care than they might normally give to other emergency hutments.⁴⁹ To this end, Uni-Seco Structures offered the services of their associate company, Selection Construction Co. Ltd., who could supply a trained, skilled staff of professional Seco Hut builders to erect the buildings on site, or provide supervision.⁵⁰ This correspondence is a rare, surviving document held in the archive at the Airfield Research Group that provides particular insight to the operations of a wartime hutting company. (Figure 5.8)

The schedule of units and components for a Seco Hut measuring 19 ft 7 in. by 59 ft 7 in. included the wall units, window and roof panels, columns beams, roof spars, tie bards, keel plates, baseboards, corner posts, door frames, blackout surround frames with curtain rods, bolts, screws, and three gallons of “SECOMASTIC,” to be applied to all exterior joints, which presumably provided a waterproof barrier.⁵¹ (Figure 5.9)

⁴⁷ Memo from Bernard Brunton, Managing Director of Uni-Seco Structures to Contractors dated September 1942. (Airfield Research Group Archive).

⁴⁸ Ibid.

⁴⁹ Ibid.

⁵⁰ Ibid.

⁵¹ *Mark II “Seco” Unit System of Construction*, September 1942. (Airfield Research Group Archive)

UNI-SECO STRUCTURES LIMITED.

THE "SECO" SYSTEM OF UNIT CONSTRUCTION.

DIRECTORS
C. WIGHAM RICHARDSON,
CHAIRMAN.
BERNARD BRUNTON,
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TECHNICAL CONSULTANT
R. G. BOOTH, A.R.I.B.A., A.A., D.P.
CONTRACTS MANAGER,
A. B. K. CHEEK.

BB/JVB

September, 1942.

TO CONTRACTORS ERECTING "SECO" BUILDINGS

Dear Sirs,

We have pleasure in attaching hereto a brief Specification describing the correct procedure which should be adopted for the erection of Clear Span Buildings in the "SECO" System of Unit Construction.

The "SECO" System combines the use of a number of standardised Units or Panels for walls and roof, and Component portions of carefully calculated pre-determined dimensions. These can be assembled with almost unlimited flexibility into buildings of one floor planning, either of Clear Span, utilising the "SECO" 'Aero' Beam and Columns, or of Cellular Construction, where the Units also form the internal partitions, and act as roof supports. It will be appreciated, therefore, that, strictly speaking, there is no such thing as a "standard" building in the accepted sense as applied to emergency hutting.

The System represents true pre-fabrication in building construction within the limits imposed by the restrictions on the types and quantities of materials available at the present time. It has been scientifically designed from the point of view of thermal and acoustic insulation, lightness for transportation, and speed of erection. "SECO" buildings combine hygienic living conditions and pleasing appearance.

It will be many years after the War is concluded before housing re-construction can meet the demands, and the recovery of "SECO" Units for re-erection as domestic dwellings will be of paramount importance in meeting some of this need.

We would ask you, therefore, to regard "SECO" Building Units and Components as being worthy of just that extra attention in their handling and in their erection on Sites than is normally given to emergency "Hutments".

We take this opportunity of mentioning that our Associate Company, Selection Construction Co. Ltd., of the above address, has trained a skilled staff of Erectors, and will be pleased to arrange, if required, for the supply of Demonstrators or Supervisors, and to give any assistance which Contractors may require on such questions as cutting away and making good for services, fixing radiators and internal fittings, or applying external "SECOMASTIC" Jointing.

Yours faithfully,

For and on behalf of
UNI-SECO STRUCTURES LIMITED,

Bernard Brunton
Managing Director.

Figure 5.8 A general memo dated September 1942 from Bernard Brunton, Managing Director of Uni-Seco Structures to contractors involved with building Seco Huts on site. This seems to be a standard letter probably included with the specification papers for hut construction. (Airfield Research Group)

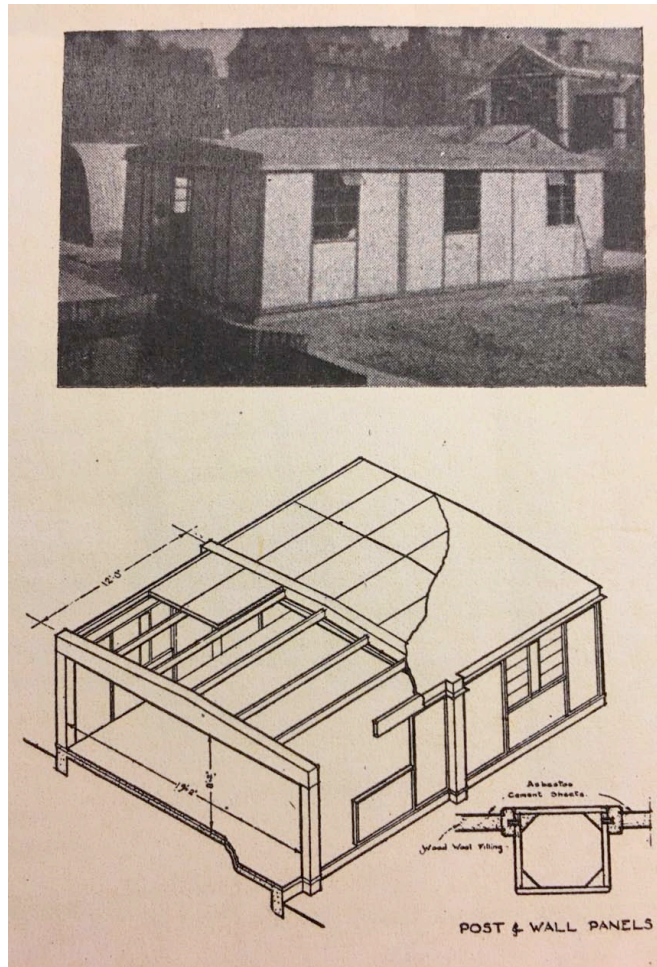


Figure 5.9 A plan for the Seco Hut as published in *The Architects' Journal* (13 August 1942).

The company provided a note with all specifications regarding the handling and stacking of the hut units. They recommended all parts should be stacked and stored with care as 'the exact requirements for complete buildings are despatched, and obviously a broken or missing part will hold up progress of erection.'⁵² The concern was particular due to the fragility of the asbestos sheet faces, which could easily be damaged in transit.⁵³

Uni-Seco not only constructed and supplied their Seco hut, but they also licensed out the manufacturing of their patented unit system to other construction companies. The most successful was probably En-Tout-Cas in Syston near Leicester, which employed both women and Italian prisoners of war to manufacture the parts.⁵⁴

⁵² Ibid.

⁵³ The Airfield Research Group Archive holds a number of Seco Hut construction manuals and plans in various models.

⁵⁴ Francis, p. 215.

(Figure 5.10) En-Tout-Cas is an interesting case study due to the discovery of a transcript describing the wartime period by its owner, Ronald Brown.⁵⁵ The transcripts are undated but after much study, they could reasonably be assumed to date to the 1960s.⁵⁶ The company began in 1909 as a tennis court construction firm under Ronald's father, Claude Brown. The name translates somewhat roughly to mean *in any condition*, which was a nod to the firm's unique surfacing methods for tennis courts that allowed them to be used in any weather.⁵⁷



Figure 5.9 The En-Tout-Cas Factory at Thurmaston, near Leicester. (Photo from *Seco: In War and Peace*, a brochure held by Airfield Research Group)

Within two decades they had established offices in North America, Europe and London, and had the official endorsement of King George V.⁵⁸ The transcripts describe how this expertise made them a reasonable choice for constructing aerodromes, runways and buildings during the expansion period of the 1930s.⁵⁹ When war came, the government contracted heavily with En-Tout-Cas to provide a range of building services. Brown describes his decision to expand into Seco hutting:

An interesting development occurred in about 1942 which we followed up and later developed into an important and profitable section of the business. I refer to the "Uni-Seco" system of building. The basic principle involved was the construction of walling and roofing slabs comprising two sheets of asbestos fixed in a wooden frame and the cavity between the two

⁵⁵ A copy of this transcript was given to Paul Francis (Airfield Research Group) in the 1980s by the founder's grandson, Colin Brown, and kindly lent to me for use in this research.

⁵⁶ The Leicester Record Office corroborates this date under file DE5860/585 entitled, 'Notes on the History of En-Tout-Cas', compiled by Ronald H.S. Brown c.1960s.

⁵⁷ Bruce Tarran, *George Hillyard: The Man Who Moved Wimbledon* (Leicester: Troubador, 2013), p. 121.

⁵⁸ *Ibid.*

⁵⁹ Airfield Research Group, Ronald Brown transcript, CHTB 2, p. 6.

sheets was filled with concrete using a wood wall [wool] as the aggregate⁶⁰. This system was protected by a patent held by the company which was engaged in its development promoting its use for every kind of hutting required. The Chairman of the Uni-Seco Company was a man called Bernard Brunton, a very capable and I should say an extremely clever chap [...] He made arrangements for our company to commence on the construction of wall and roof slabs. The principals for roof support and load carrying stancions were made up of plywood formed into box girders. A commencement of construction was made in the large corrugated iron workshop adjacent to the old railway siding at Thurmaston Works. For the first six months methods had to be evolved to deal with the actual mixing of wood wall concrete in ordinary concrete mixers, and conveyance of the mixed material to the construction table was made by means of steel two-wheeled hand propelled donkey barrows [...] The financial arrangements were based on a cost plus system with a percentage of, I think, 7.5% allowed for the company [...] The huts could speedily be erected by even small builders and contractors, and meant that all kinds of buildings could be provided for aerodromes at high speed. Thermal insulation was excellent; rather better in fact than a 9-inch brick wall. All kinds of buildings were erected such as Royal Air Force mess buildings, sleeping quarters, recreation rooms, armouries, etc. The demand developed enormously and very soon Admiralty, War Department, and other Governmental Departments were being provided with this kind of speedily erected accommodation [...] Some two years after production was started we discovered that we had become the largest of all production units connected with the manufacture of slabs for roofs and walls.⁶¹

A major issue faced by En-Tout-Cas was in procuring sufficient amounts of workers in order to meet output and demand. Brown said that local women were hired and found to be quite proficient in manufacturing the prefabricated parts, but unfortunately, many eventually acquired a type of dermatitis believed to be caused from either direct contact with wet cement or from the wood preservative used in the timber.⁶² Doctors were consulted and it was decided that because women had more delicate skin than men, they were more susceptible to irritation. It was recommended that the company should fire all women with blond or red hair, and only keep darker haired workers, as they would likely have less sensitivity to the materials.⁶³ Brown said that other than the angered reactions of the women who were let go, the solution worked for a short while until it was necessary to again increase production. (Figure 5.11)

⁶⁰ He tends to refer to wood wool as wood wall.

⁶¹ Brown, CHTB 3, pp. 4-6.

⁶² Ibid.

⁶³ Ibid, Tape 4, p. 1.



Figure 5.10 Women war workers at the En-Tout-Cas Factory manufacturing the Seco Hut panels. (Photo courtesy of Paul Francis, Airfield Research Group)

At this point, more labour was required and the company was offered Italian prisoners of war. The Italians were delivered each day by lorry from a camp near Melton Mowbray.⁶⁴ Brown said the vast majority were hard workers, and they made those who could speak English and had a real interest in the work, into sub-foremen.⁶⁵ (Figure 5.12) Of note, is one particular story stemming from this use of prisoner labour:

After some time we did notice that production towards the end of the working day fell off quite sharply. Basically, these were good workers, and at first we did not understand why this decline towards the end of the day occurred. We then found out that these men were weak from shortage of food which they required to enable them to stand the heavy work for eight hours each day. The provision of food for these men was not our responsibility as they were fed by the Military Authorities in charge of the prison camp. I therefore decided that each man should be given one large meat sandwich (spam) and a cup of coffee at mid-day. This had an astonishing effect as the afternoon session immediately picked up and production became as good in the afternoon as in the morning, and all went very well indeed for about three months until one day I received a visit from the Officer in charge of the camp. He set about me properly and told me that I had broken the regulations and that it was illegal to feed prisoners of war. I explained why this had been done and the excellent results which had arisen as a result of the issue of this food. I pointed out that we were trying our utmost to give the best possible production in the interest of the country's war effort. This explanation was not accepted...He said that they had rations strictly in accordance with the rules of the Geneva Convention, so far as they concerned prisoners of war. He would listen to no argument, and in consequence, the issue of this food had to be stopped at once. The result was immediately apparent. Production from the Italians fell away and we were back where we started. Indeed, it became worse than before because their moral was affected as well as their physical state.⁶⁶

⁶⁴ Ibid, p. 2.

⁶⁵ Ibid.

⁶⁶ Ibid.



Figure 5.11 Italian prisoners of war and women war workers at the En-Tout-Cas Factory. (Photo courtesy of Paul Francis, Airfield Research Group)

Ultimately, the prefabricated parts, walls and roof slabs constructed at the En-Tout-Cas factory were shipped to locations across England and used to construct Seco Huts. A hut typically measured 19 ft by 24 ft but the length could be greatly extended to whatever was required. It was constructed of plywood columns and roof beams supporting a roof of wood wool slabs covered with felt.⁶⁷ The walls were likewise constructed with wood wool slabs sandwiched between two sheets of asbestos cement.⁶⁸ The huts were used for a range of purposes: canteens, hospitals, offices, and accommodation. (Figures 5.13, 5.14, 5.15) The Seco Hut is perhaps most famous for making successfully making the transition to the post-war housing market (to be discussed in Chapter Eight).

⁶⁷ Air Ministry, p. 139.

⁶⁸ 'Prefabricated Huts', p. 108.



Figure 5.12 Seco Huts being constructed at Uni-Seco Training Centre in London. (Photo from *Seco: In War and Peace*, a brochure held by Airfield Research Group)



Figure 5.13 The Seco Hut as a hospital. (Photo from *Seco: In War and Peace*, a brochure held by Airfield Research Group)



Figure 5.14 The Seco Hut as a N.A.A.F.I. canteen. (Photo from *Seco: In War and Peace*, a brochure held by Airfield Research Group)

Limitations on Adoption

The wartime period, material restrictions and the necessity for hutting provided the perfect opportunity for designers and builders to experiment with composite materials, such as plasterboard, wood wool and plywood. Plasterboard huts were highly successful from January 1941 until the end of 1943, producing 15.3 million sq ft of accommodation space during the war.⁶⁹ The Seco Hut, which did not begin construction until late summer 1942, continued to be produced up through the end of the war providing more than 6 million sq ft of accommodation space over this period.⁷⁰ Huts of composite building materials also laid the groundwork for studies in post-war housing options, of which the Seco Hut was especially successful.⁷¹ These huts were fairly lightweight, inexpensive, and prefabricated. However, they were not necessarily portable. They were meant to be a low-cost, readily available, quick and simple to erect, solution to the hutting problem. The Air Ministry figures give proof

⁶⁹ Air Ministry, p. 140.

⁷⁰ Ibid.

⁷¹ See *Chapter Eight*.

that composite materials were successfully employed in hutting. It also gives rise to the idea that wartime necessity pushed material innovation and design in ways that would not have happened otherwise, or at the least, may have taken several more decades to realise. As far as it relates to the war, composite materials covered a crucial gap between the restrictions of timber and steel in 1939 straight through to 1943 when the availability of steel and timber began to increase in England with the entry of the Americans into the war and more Allied control of the Atlantic. It is over the last years of the war that one can see a rise in designs incorporating corrugated iron. However, first it is necessary to study other two other alternatives to traditional building materials: concrete and asbestos.

Chapter Six

Concrete and Asbestos Huts in the Second World War

The development of huts constructed of concrete and/or asbestos directly correlated to the rising restrictions placed on timber and steel from 1939, and resulted in the largest alternative building material collection of huts designed during the Second World War. Two dozen new hut designs were invented between 1939 and 1945. Some incorporated both concrete and asbestos while others were predominantly concrete. Several of these found continued success in the post-war years when they were converted into designs for civilian housing. This chapter will highlight a selection of huts that made predominant use of concrete and asbestos in their construction using plans, photographs, and articles in journals of the period, with attention being paid to designers, construction methods, manufacturers and uses. (Table 6.1) A more comprehensive listing of each of the Second World War huts can be found in Appendix B.

<i>Concrete and/or Asbestos Huts of the Second World War</i>
1. The Asbestos Arch Hut
2. The BCF Clear Span Hut
3. The BCF Light Hut
4. The C'tesiphon Hut
5. The Cubbitt System
6. The Curved Asbestos Hut
7. The Fidler System
8. The Handcraft Hut

9. The Hessolite Hut
10. The MoS Maycrete Hut (aka MoS Timber and Maycrete)
11. The MoW Maycrete Hut
12. The MoW Standard Hut
13. The Mopin Hut
14. The Nashcrete Hut
15. The Nofrango Hut
16. The Orlit Hut
17. The Patrick Portable Hut
18. The Plycrete Hut
19. The Precast Paving Slab Hut
20. The Quetta Hut
21. The Stancon System
22. The Standard Army Hut (aka Precast Unit Construction Hut)
23. The Tarran Hut System
24. Turner's Everite Hut

Table 6.1 Huts constructed of concrete and/or asbestos during the Second World War.

Concrete

Concrete technology as it stood in the beginning of the Second World War could be divided into:

- Portland Cement
- Concrete blocks
- Steel reinforced concrete
- Fibre-reinforced cementitious sheet materials,
of which the most successful was Asbestos Cement Sheet.

It is worth looking at each of these in turn before we explore their applications in hut design.

Portland Cement

While concrete as a building material has ancient origins, modern concrete developed in the nineteenth century.¹ Roman mass concrete had relied on the development of reliable hydraulic lime mortar, which formed the binder that allowed aggregate of various sizes to be bonded together in a rigid and long-lasting material.² It was usually faced with a surface material such as brick or stone because otherwise it broke down in wind, rain and frost. Used purely as mass concrete, it had virtually no strength in tension. The ability to make comparable reliable hydraulic mortars in the Middle Ages was largely lost, and it was only with the invention of Ordinary Portland cement in the 1820s that mass concrete again became a viable option.³

The nineteenth century saw a full exploration of the possibilities of uses for Portland cement. It was first intended as a render (hence the name - it looked like Portland Stone), but it was soon realised that its ability to dry underwater made it an invaluable mortar and an ideal lining material for drains, as well as a natural solution for the construction of harbor walls.⁴ By the 1940s, Portland cement was a typical ingredient of all brick mortars and was widely available. It was being manufactured in large quantities in the United Kingdom from raw materials, which did not need to be imported. Its disadvantages were those generally associated with masonry: the material was heavy, it was prone to damage from damp, it needed a skilled work force to apply and it was difficult to handle on site. Nevertheless, Portland cement mixed with a gravel aggregate formed a simple mass concrete, which was ideal for forming ground slabs. The longevity of these can be seen in the fact that they are often the only remaining evidence for the existence of huts on a site long after the huts themselves have disappeared.

¹ Bowley, *Innovations*, p. 54.

² Davey, p. 103.

³ *Ibid*, p. 106.

⁴ Bowley, *Innovations*, p. 86.

Concrete Blocks

Concrete blocks have so displaced bricks in modern construction that it is easy to forget that their use was comparatively rare at the outbreak of the Second World War.⁵ Construction manuals from the 1930s had begun to show the cavity wall construction that dominated post-war mass housing, but both leaves of the cavity still shown as being constructed from brick.⁶ It is only long after the war that concrete blocks completely replaced bricks for use in the internal leaf. This change was undoubtedly helped by the greater use of concrete blocks in the Second World War.

Concrete blocks themselves were not new: a Mr. Hold of Leeds and Sellars of Birkenhead had patented a device for moulding concrete blocks in 1875.⁷ This led to consideration of concrete blocks as a walling material, a practice that did not immediately find widespread success, but was explored as an alternative material in the decades leading up to the Second World War:

The basic concrete block was discussed extensively by Searle (1913). Their advantage was that the blocks could be made on site with relatively inexpensive equipment and alternative materials could be used for the aggregates. Block-making machines were readily available and simple to operate, and, as the price of cement fell, so blocks became a more attractive alternative to bricks where they were not exposed, that is, for the inner face of the wall, or for the outer face if the wall was to be rendered [...] Although breeze blocks were regarded as a cheap substitute, they were structurally quite adequate for house construction and thermally better.⁸

There were two types of concrete blocks. One was lightweight and the other dense. It was the lightweight block that was often referred to as breeze block, likely due to the air trapped within the concrete. Breeze blocks were unique in that they could be used with nails, allowing them to be covered with another fascia, if preferred.⁹ David Yeoman, in his book *Construction Since 1900: Materials*, says that breeze blocks were in use from an early date as partition walling but they were:

[N]ot always accepted for load-bearing walls. The aggregate for these was a waste product of the gas industry but breeze had never been particularly satisfactory because it was quite likely to contain some unburnt material and it was far from chemically inert. The substitute

⁵ Ibid, p. 231.

⁶ Department of Scientific and Industrial Research, *Principles of Modern Building*, 3rd edn, 2 vols (London: HMSO, 1959), I, p. 250.

⁷ Yeomans, p.42.

⁸ Ibid, p. 43.

⁹ Ibid, p. 45.

*increasingly used was clinker obtained from power stations, although the term “breeze block” had by then passed into the language and continued to be used for clinker blocks.*¹⁰

As a wartime building material, concrete was promoted heavily by The Cement and Concrete Association, a trade organisation that had pledged their resources to the government at the start of the war.¹¹ Concrete blocks were touted as substitutes for not only bricks but also sandbags.¹² The blocks were a useful alternative to bricks and timber for walling. They:

*[W]ere light to handle and faster in laying than brickwork, they may be cut to shape easily on site, and chased out to take pipework and electrical conduits as well as providing good thermal insulation.*¹³

Yeomans said concrete blocks were not without disadvantages, citing their high rate of shrinkage and requirement for careful handling and storage due to their ability to absorb water.¹⁴

Like brick, concrete blocks offered reasonable protection from shrapnel, a factor undoubtedly important when sites were subject to air raids, and indeed they would also block bullets from light firearms. Overall, as a wartime building material, they proved useful, but even though they were quicker to lay than bricks, they still required skilled labour and were heavy and bulky to transport.¹⁵

Steel Reinforced Concrete

The introduction of steel reinforcement in concrete in the nineteenth century opened up a world of possibilities previously unachievable. Concrete and steel were the two great new materials of this period. Steel was ideal for frame construction, quick to erect, easy to transport, allowing increased spans, but requiring fire-proofing and some form of skin to provide weather resistance. Reinforced concrete could be formed into both wall and frame and was fireproof. When steel was in short supply concrete used comparatively little so was a viable alternative. This left the issue of transportability and this depended on how it was cast.

¹⁰ Ibid.

¹¹ Edwin Trout, *Concrete Air Raid Shelters, 1935-1941: A Study of One Industry's Influence on Public Policy* (unpublished paper, 2017), p. 1.

¹² Ibid, p. 23.

¹³ Yeomans, p. 44.

¹⁴ Ibid.

¹⁵ Marian Bowley, *The British Building Industry: Four Studies in Response and Resistance to Change* (Cambridge: Cambridge University Press, 1966), p. 186.

Casting

There were two options for casting reinforced concrete: units could be *precast* or they could be *cast-in-situ*. Precast construction occurred in a factory or workshop setting, typically using re-usable metal moulds. Whilst portable and saving on formwork, the parts were quite heavy.¹⁶ Lifting equipment was required to move the units both at the factory and on the building site. The weight could also be a factor if the building collapsed in an air raid, risking crushing the occupants.

Casting in-situ got over the problems of transportation but required skilled labour to erect the formwork and shuttering. This method was sometimes used for walling as well as reinforced concrete piers that could support a roof.¹⁷ In situ construction was not ideal unless the problem of shuttering could be overcome: if made out of timber, more timber would be required in the formwork and shuttering than in a timber building, a disadvantage when timber was in short supply. Much of the innovation was thus in precast units, designed to be as light as possible and slotted or bolted together on site. This offered a considerable challenge to designers. The alternative was to use in situ concrete but with particularly clever solutions to the shuttering problem.

Sheet Materials

Thin shells of cement could be constructed with steel reinforcement and indeed this was the patent that Monier had originally proposed for making concrete flower pots.¹⁸ A similar method was and still is used for the construction of concrete boats, where single layers of mesh are covered in thin layers of cement, kept damp until the whole shell is complete. It is more difficult to make thin boards of cement suitable as an alternative to plywood or corrugated steel as a roofing and walling material. Steel in such thin layers adds strength but it also adds weight and if it rusts

¹⁶ Singer, p. 185.

¹⁷ Ibid.

¹⁸ Bowley, *British Building Industry*, p. 17.

leads to failure. As steel was in any event in short supply in wartime, alternatives were sought. In theory, all sorts of fibres could be used and many were tried, but the most popular solution was asbestos, which was already tried and tested, mass-produced and readily available.¹⁹

Asbestos

Asbestos, stemming from the Greek word meaning unquenchable or indestructible, was a mineral applied heavily in construction materials during the Second World War. It was an attractive option because it could be added to certain materials to increase its tensile properties, making it nearly as strong as steel, whilst also improving a material's resistance to heat. As early as 1884, asbestos fibers were being applied to construction boards. Asbestos cement products followed shortly thereafter when 'the modern asbestos cement board was invented by Ludwig Hatschek and patented in 1900.'²⁰ This was done by combining 90% Portland cement and 10% asbestos fibers with water, before processing it through a cardboard machine.²¹ The result was a material that could be used in both roofing and wall panels. It was also relatively lightweight and fire-retardant.

Today asbestos carries so many negative connotations that it is difficult for us to believe it was seriously proposed as a building material. Asbestosis had been identified as a cause of death and the first legislation appeared in 1932 but the severity of the risk was far from being well understood and it seems to have had little effect on its use in the Second World War. Indeed, asbestos continued in general use in construction well into the 1970s.²²

¹⁹ W.E. Sinclair, *Asbestos: Its Origin, Production and Utilization* (London: Mining Publications, 1959), p. 279.

²⁰ Ibid. See also Nigel Isaacs, 'How Britain made the New Zealand House', *Studies in the History of Construction: Proceedings of the Second Conference of the Construction History Society* (March 2015), 323-332 (p. 326).

²¹ *History of Eternit*, < <http://www.asbestosfocus.co.uk/eternitahistory.htm> > [accessed 23 July 2017]

²² See <https://www.asbestos.com/mesothelioma/uk/>

Types of Concrete Huts

In December 1939, the Cement and Concrete Association erected five early types of single-storey concrete hutments, by various designers, at Coombe Hill Golf Course, in order to showcase the range of applicable uses for the military whilst also conserving scant materials:

They show that serviceable buildings for camps, garages, etc., military or civil, can be erected without wasting precious materials such as timber and steel. Moreover, by using substitute materials which can be produced within the country not only will work be given to slack industries, but tonnage and foreign currency will be conserved.²³

The Mopin Hut

One type was the Mopin Hut, designed by the French architect E. Mopin, based in Leeds. The walls of his hut design were constructed of:

[P]recast concrete columns at 12-ft. centres, between which are hollow, vertical units keyed and grouted together [...] The foundations, which consist of precast concrete stools set on in situ concrete. The floor is formed of thin concrete slabs (6 ft. by 18 in. approx.) supported on precast beams 6 ft. apart [...] The roof [...] consists of similar hollow or trough-shaped units which thrust against a precast gutter beam. Steel ties connect the columns across the width of the hut [...] Two types of external wall finish, resembling large pebble dash, have been used, and the roof is covered with bituminous sheet.²⁴

The advantages to this system were that it used a minimal amount of steel, did not require an external finish and included insulation.²⁵ (Figures 6.1 and 6.2)

²³ 'Concrete Hutments', p. 267.

²⁴ Ibid.

²⁵ 'Hutting in Concrete', *The Builder*, 158.5057 (5 January 1940), 5-8 (p.5).

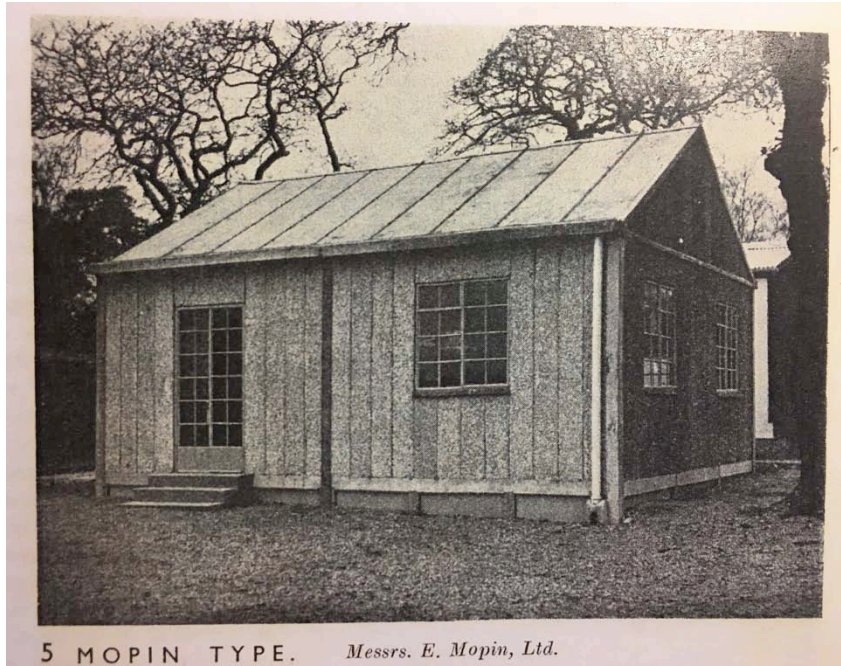


Figure 6.1 The Mopin Hut by E. Mopin, Ltd. in Leeds, as erected by the Cement and Concrete Association in 1939. *The Architect & Building News*, (22 December 1939).

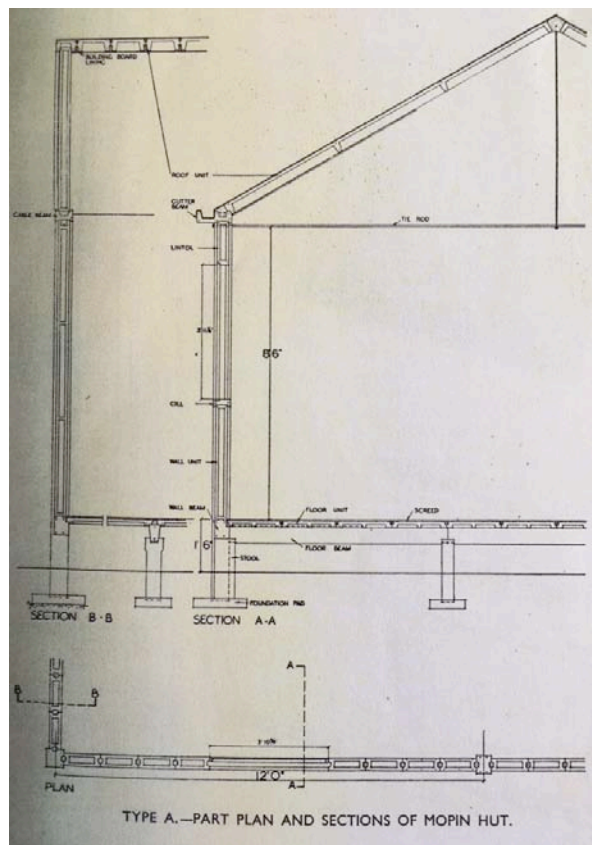


Figure 6.2 Plan and sections of the Mopin Hut, as advertised in *The Builder*, (5 January 1940).

The Plycrete Hut

The second type was the Plycrete Hut, designed by the London-based civil engineers Cowdell and Stewart. (Figures 6.3 and 6.4) *The Builder* described it succinctly:

Low-pitch roofing has been applied to the hut [...] The basis of the system is the use of a very light hollow-concrete block, formed by wrapping a good quality Kraft paper (brown wrapping paper) which as previously been covered with 5/16 in. – 7/16 in. of cement mortar round a removable core. These blocks are laid between vertical precast wall units and rendered both inside and outside. For the floor the blocks can, if desired, be given additional strength by being reinforced with a further covering of cement.²⁶

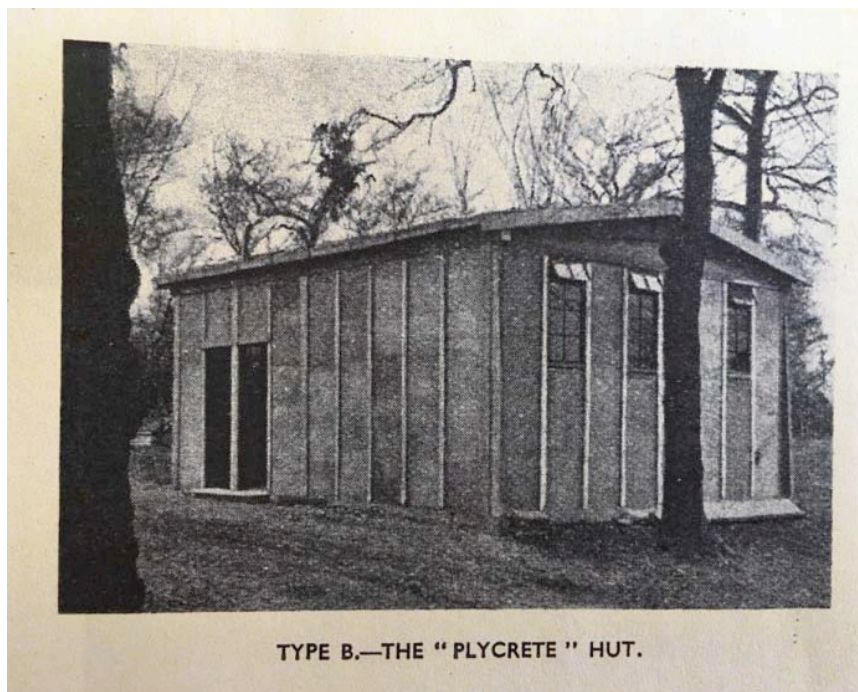


Figure 6.3 The Plycrete Hut by Cowdell and Stewart. *The Builder* (5 January 1940)

²⁶ Ibid, p. 7.

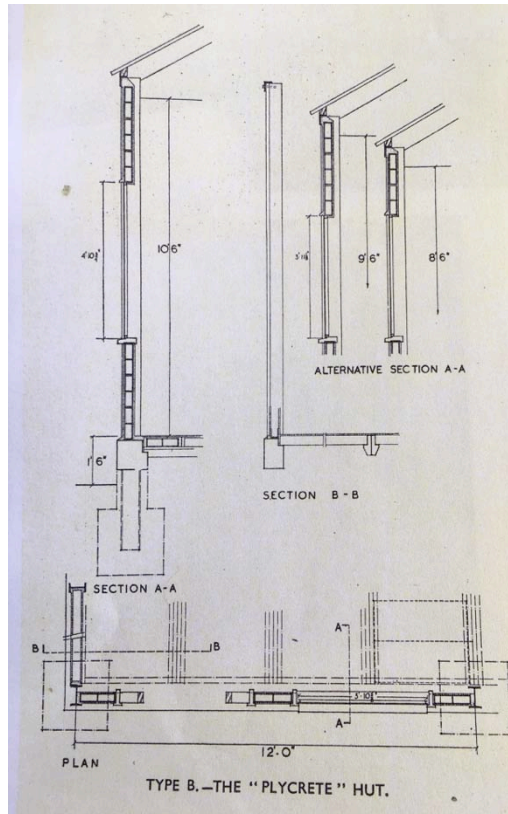


Figure 6.4 Plan and sections. *The Builder* (5 January 1940)

The Precast Paving Slab Hut

The third type of concrete hut to be displayed was generally referred to as the Precast Paving Slab Hut, designed by the British Concrete Federation, based in Ealing. It made use of standard paving slabs, which were widely available, applying them as infill to a basic hutted framework. (Figure 6.5)

The surface may be rendered weatherproof by the insertion of pre-moulded bitumen strips between adjacent slabs. A cavity wall is provided by an inner leaf of light-weight concrete blocks in order to minimize any possibility of condensation and enable a fibre-board lining to be fixed should this be thought desirable.²⁷

²⁷ Ibid, p. 8.

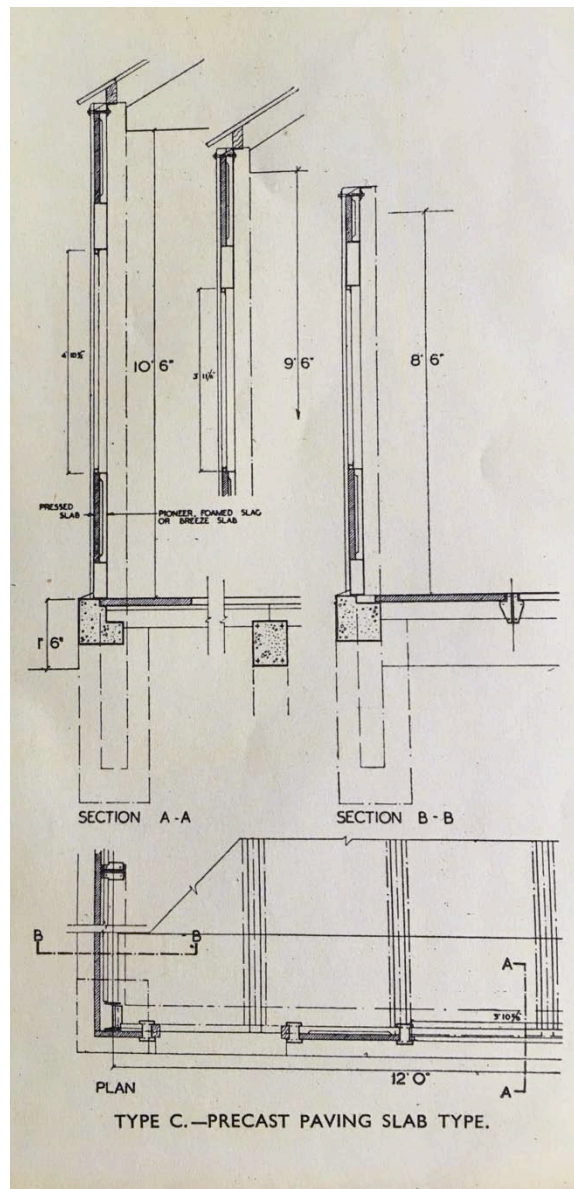


Figure 6.5 The Precast Paving Slab plan by British Concrete Federation. *The Builder* (5 January 1940)

The Nofrango Hut

Also showcased was the Nofrango Hut by a company of the same name based in Dublin. It was unique in that it involved rendering fabric with cement mortar after hanging and affixing it to a steel frame. (Figures 6.6 and 6.7) It is quite likely the result of a cooperative effort between Nofrango and James H. de Warrenne Waller, to be discussed later in the chapter.

For these walls a very light 24-gauge steel framework of channel form with continuous holing (to allow easy adjustment to any particular spacing of windows and doors) is fixed between the stanchions, fabric is hung on both sides and wired to this framework. Standard steel

windows are bolted to the framework and the fabric cut away and folded back at intervals. Both inside and outside fabrics are then rendered, forming a cavity wall. The floor beams are cast in light metal formwork, fabric is stretched across them with a certain amount of reinforcement and the surface rendered in cement mortar. Apart from the rendering, the weight of material to be transport is a minimum.²⁸

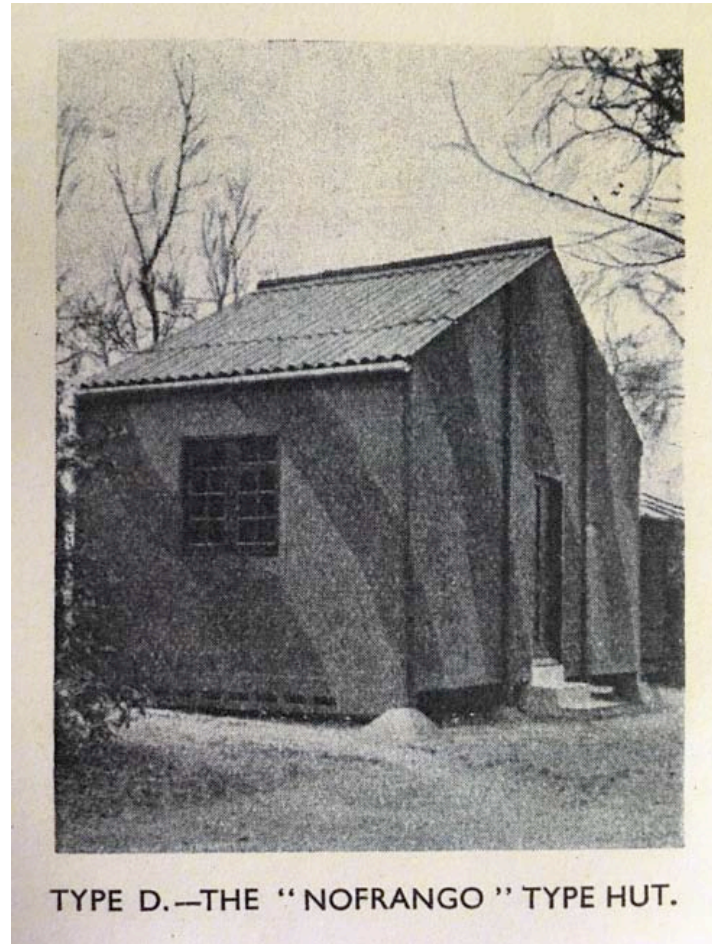


Figure 6.6 The Nofrango Hut, made of rendered fabric and steel. *The Builder* (5 January 1940)

²⁸ Ibid.

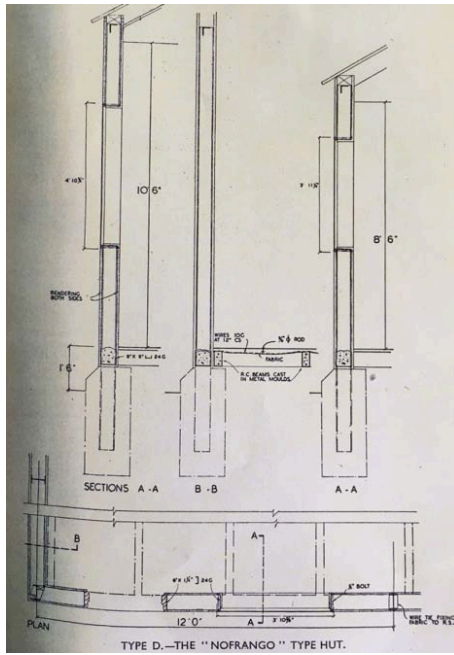


Figure 6.7 The Nofrango Hut plan. *The Builder* (5 January 1940)

The Hessolite Hut

The final hut erected was the Hessolite Hut. It was similar in fabrication to the Nofrango in that it likewise was covered in a rendering of cement, applied by a cement-gun.²⁹ It was quite likely also designed by de Warrenne Waller. (Figure 6.8)

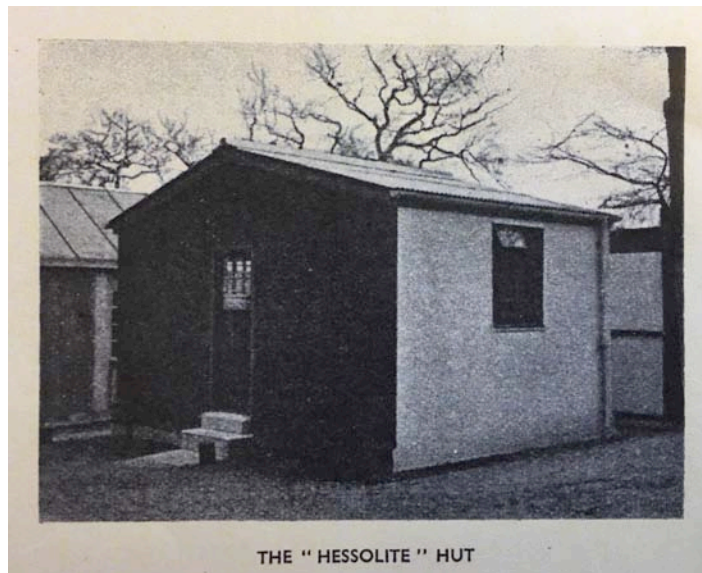


Figure 6.8 The Hessolite Hut, erected in December 1939 at Coombe Hill golf course to showcase accomplishments in concrete hut construction. *The Builder* (5 January 1940)

²⁹ Ibid.

These huts were the earliest wartime examples that applied concrete in place of timber and steel. Their introduction was just the start of a flood of innovation. In March of 1940, the civilian engineer firm Twisteeel Reinforcement, Ltd in Surrey, published their design that applied precast concrete trusses to hut construction. It was said to already have government support, and could be utilised across all types of buildings from huts to factory buildings.³⁰ ‘Each converse frame consists of two vertical posts, two rafters, and one ridge piece. A repetition of these units is sufficient for the construction of the framework of any continuous length of hut.’³¹ The roof was made up of ‘Thermacoust’ slabs and covered in bituminous sheeting. The benefits of this design were advertised as being comparable in to cost to timber, relatively lightweight, the precast units could be made locally, it did not require skilled labour, and it was somewhat fire resistant.³² (Figure 6.9)

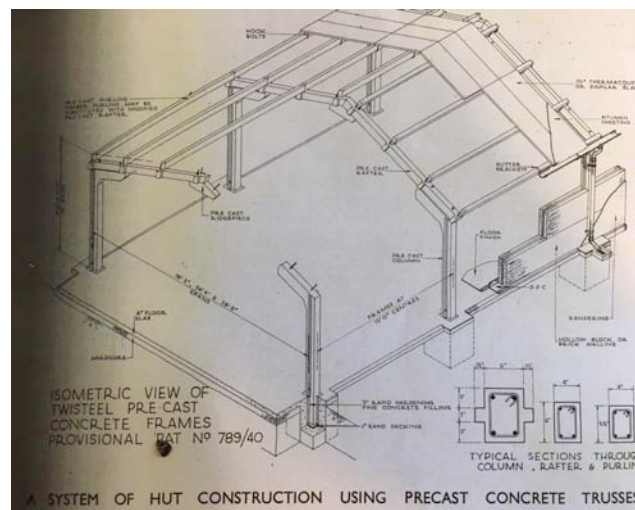


Figure 6.9 A hut design using precast concrete trusses in place of timber by engineering firm Twisteeel Reinforcement, Ltd of New Malden Surrey. *The Builder* (29 March 1940)

Concrete and Fabric Huts: James H. de Warrenne Waller

The Quetta Hut

First advertised as a Circular Hut in a July 1941 issue of *The Builder*, the Quetta Hut, with its uniquely conical shape, was designed by the Australian-born

³⁰ ‘A System of Hut Construction Using Precast Concrete Trusses’, *The Builder*, 158.5069 (29 March 1940), p. 393.

³¹ *Ibid.*

³² *Ibid.*

James Hardress de Warrenne Waller. Prior to the war, Waller worked with developing reinforced concrete roofing slabs, an invention which was granted a patent in 1921.³³ He was also a known innovator in the realm of applying liquid concrete to a flexible, vegetable fiber skin, such as hessian fabric, for the purpose of creating a new type of construction material. It was this technology, patented in 1934 in collaboration with Nofrango, Ltd., which Waller applied to his circular hut.³⁴ Paul Francis asserts that the hut was actually developed in 1936 as a result of the Quetta earthquake (in modern day Pakistan), providing evidence to its name.³⁵ It was often erected to provide airfield defence accommodation.

The hut was manufactured by applying multiple coats of a mixture of sand and cement onto jute fabric. With a roof span of up to 53 ft, and an internal span of 50 ft, the hut was set up on a duodecagonal plan and required 7.5 tons of Portland cement and 40 lbs of jute fabric in its construction.³⁶ The constructional method was somewhat complex. The floors consisted of suspended concrete poured around a wooden post marking the central point of the hut. Precast concrete wall posts were then set into the concrete base, topped with concrete lintels, which provided an anchor for the roof. Construction continued as follows:

From post to post a 6 in. by 6 in. trench is then dug in the ground. On either side of the trench rough boards are placed on edge and clamped to the wall posts to provide formwork for a dwarf wall, which is poured in situ concrete... The earth inside the circle thus enclosed by the dwarf wall is dug to a depth of 6 in., screeded off and blinded with a ½ in. coat of sand level with the top of the dwarf wall. A sheet of jute fabric is then placed over the whole area and is secured by means of a small fillet to the outer plank of the formwork to the dwarf wall. Working off the plans, the jute is then flushed with a 3 to 1 cement grout, the fabric being lifted occasionally to ensure that the grout flows through to the sand underneath. Next a series of holes about 3 ft. apart each way are formed in the subsoil by a crowbar driven to stiff resistance. These holes are filled with a liquid grout and the floor is then ready to receive a layer of 3 to 1 concrete, which is finished with a wood float pivoting at the centre of the hut.

The walls may be built now [...] or at the same time as the roof. Two rows of nails projecting half an inch and at 6 in. centres are inserted during casting on the top of the lintel and on the inside face of the concrete posts. These nails serve to anchor the top of the jute fabric, which is wound round outside and inside the concrete wall posts to form a cavity wall. The external skin of canvas requires no fixing, either to the posts or at the foot of the wall, since when the canvas shrinks it contracts.³⁷

³³ Patent number US359363, (1 February 1921).

³⁴ Patent number US597838. (17 April 1934).

³⁵ Francis, p. 217.

³⁶ 'A Circular Hut: A New Constructional Method', *The Builder*, 161.5138 (25 July 1941), 79-80 (p. 79).

³⁷ *Ibid.*

The roof was constructed using tubular scaffolding and rods to provide a framework for the jute fabric, which was stretched over the top and attached to rings at the top and around the base. It is then rendered with two coats of the cement and sand mixture until it is 1.5 to 2 in. thick.³⁸ It was thought the roof could also be used on bases of brick or other materials, and was not constrained to just concrete. (Figures 6.10 and 6.11) This design was further promoted as flexible enough to be used as a house. (Figure 6.12)



Figure 6.10 The Quetta Hut. *The Builder* (25 July 1941)

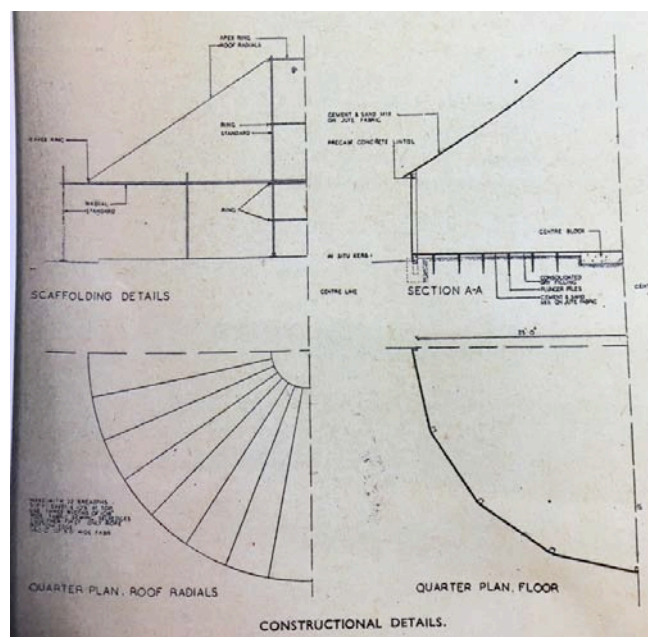


Figure 6.11 Plan details of the Quetta Hut.

³⁸ Ibid, p. 80.

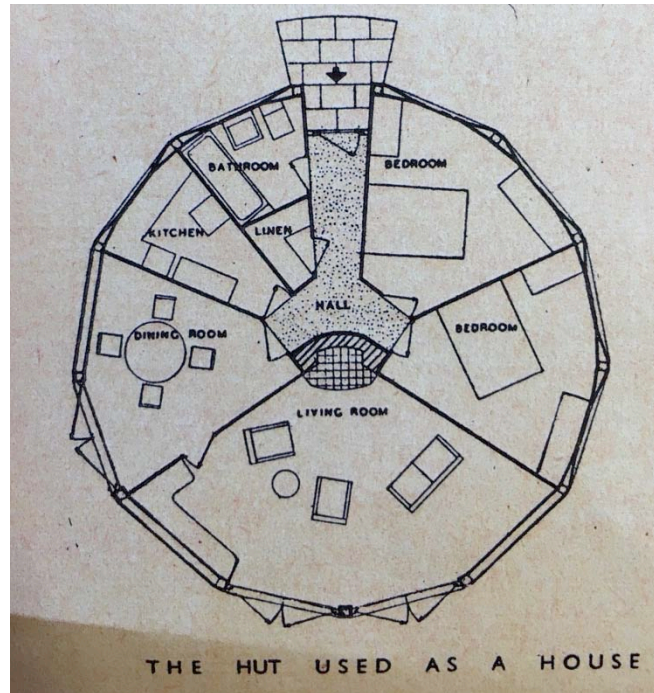


Figure 6.12 Proposed house layout within a Quetta hut.

There are a few surviving examples of this easily recognisable hut but they seem to be mostly much smaller in scale.³⁹ The round plan limited its usefulness.

The Patrick Portable Hut

The Patrick Portable Hut was the next innovation in hut design by Waller, which also made use of a cement and sand render. A demonstration of this hut was provided in Westminster in late-spring 1941, with the claims that it was ‘a complete break-away from convention both in construction and design.’⁴⁰ The hut was constructed entirely of 2 ft wide reinforced concrete sections, which were created by applying cement to a woven sack, effectively using it as a mould:⁴¹

The system is designed to obtain the maximum advantage from the use of reinforced concrete by forming the covering or infilling structure in the framework [...] A flexible mould is used, consisting of a sheet of loosely woven sacking. This sheet is supported on a pair of side frames, and is cut in such a form that when stretched on the frames, it takes up the variable channel shape desired. The concrete is smeared over the sacking and one or more coats of rendering are applied. All main stresses are taken up by the steel reinforcement and the concrete, while the fibre mould is an effective shield against cracking or shattering.⁴²

³⁹ See surviving examples at Monxton, Hampshire: <http://www.geograph.org.uk/photo/790964>

⁴⁰ ‘A Portable Concrete Hut’, *The Builder*, 160.5131 (6 June 1941), p. 553.

⁴¹ *Ibid.*

⁴² ‘The Patrick Portable Building’, *The Architect and Building News*, 166.3784 (27 April 1941), p. 184.

The roof was made of a material called Flexiform, a fireproof and waterproof material, ‘over which is laid a layer of fibre-toughened concrete.’⁴³ Presumably, these fibres were asbestos:

*In fixing the roofing, the “Flexiform” material, which is supplied in rolls ready for fixture, is tacked to the rafters in strips running in one piece from ridge to eaves. Semi-liquid cement and sand are then brush on or placed as a rendering coat [...] with ¼ in. of concrete between each layer of fabric.*⁴⁴

Waller’s design was part of a collaborative effort with P. Bowen-Colthurst, who helped with the construction details, and John Sheffield Construction, of Scunthorpe, who provided the materials. A 36 ft prefabricated hut was estimated to cost £166, plus transport. (Figures 6.13 and 6.14) This easily recognisable hut does not seem to have survived well and I have yet to find any surviving examples.

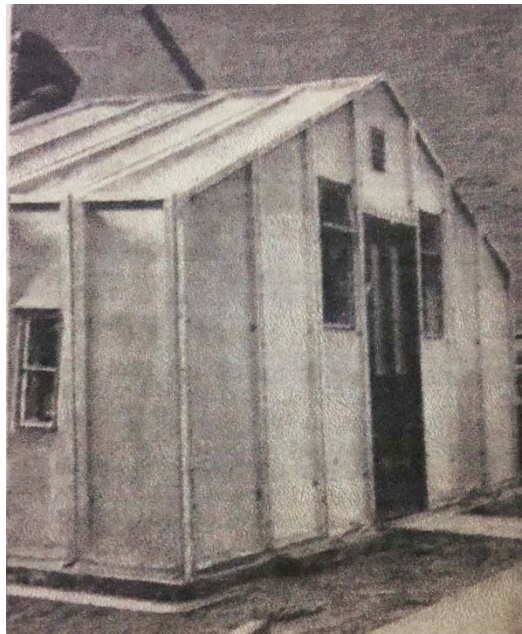


Figure 6.13 The Patrick Portable Hut by J. H. de W. Waller. *The Builder* (6 June 1941)

⁴³ ‘A Portable Concrete Hut’, *ibid.*

⁴⁴ *Ibid.*

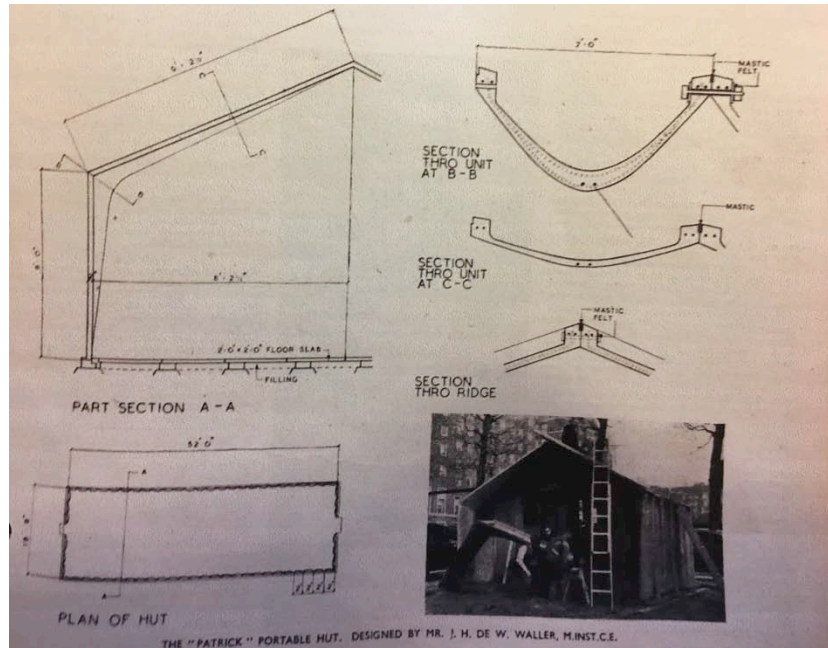


Figure 6.14 Plan for the Patrick Portable Hut.

The C'tesiphon Hut

Waller's final contribution to huts constructed with cement rendered fabric was the C'tesiphon Hut. Invented in 1941, its aim was to provide a new method of construction that would be quick to erect, low-cost and not require controlled materials. It was able to achieve this by being the first design to apply an all-compressive thin concrete shell in a moulded arch form.⁴⁵ The arch was formed of corrugations, the result of taking stretched hessian fabric and applying up to three layers of concrete.⁴⁶ (Figure 6.15) Mallory and Ottar described the details of the C'tesiphon:

During the feverish construction of the American camps, in preparation for the offensive, Waller had been given the go-ahead to construct hutting using the method of cement grout on fabric, which completely avoided the use of steel reinforcement. A temporary set of steel or wooden arches was erected over which fabric was stretched. When rendering was applied the fabric would sag between each arch, thus providing corrugation of the shell and further stability. The cement rendering would be applied until it reached a final thickness of 50 mm, after which the temporary arches were removed. Spans of 4.9, 8.5 and 11.0 m were built. One hut, 4.9 m wide and 11.0 m long, was completed by 16 men in 12 hours[...] This development opened up a whole new field of structural approach.⁴⁷

⁴⁵ Mallory, p. 197.

⁴⁶ Paul Francis, *Appendix 26: Hut and Shed Types*. Notes provided through email correspondence based upon his book, *British Military Airfield Architecture*.

⁴⁷ Mallory, pp. 197-199.



Figure 6.15 A C'tesiphon Hut, Everleigh, Wiltshire before demolition. Photo by Paul Francis (Airfield Research Group).

Waller applied for a patent for his invention in 1941 in the United Kingdom, and in 1947 in the United States.⁴⁸ The design was made in collaboration once again with Bowen-Colhurst & Partners of Colchester. (Figure 6.16) It is unknown if any still survive.

⁴⁸ 'Method of Molding In Situ Concrete Arched Structures', Patent number US2616149, (4 November 1952).

Nov. 4, 1952

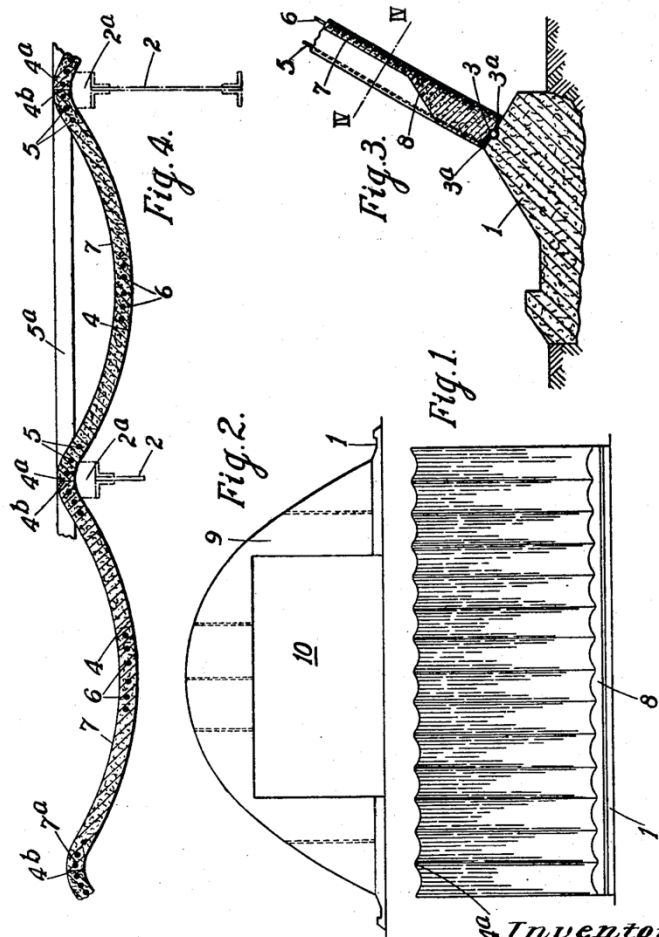
J. H. DE W. WALLER

2,616,149

METHOD OF MOLDING IN SITU CONCRETE ARCHED STRUCTURES

Filed Dec. 11, 1947

2 SHEETS—SHEET 1



Inventor
J. H. De W. Waller
By *Glascock Downing & Co. Attys*

Figure 6.16 Patent drawings for J. H. de W. Waller's C'tesiphon Hut. (Espacenet)

The Tarran Hut System

R. G. Tarran of Tarran Industries, based in Hull, first introduced the Tarran System in early 1940. It was described in one journal article as the solution to the immediate necessity for a new type of portable hut that, whilst using the concrete, could still be dismantled and re-erected elsewhere, without relying on Baltic or Canadian timber.⁴⁹ Tarran did this by making use of English-grown green hardwoods to form a parabolic framework filled with prefabricated concrete panels, consisting of cement, sand and sawdust. This mixture was chemically treated and given the proprietary name of Lignocrete. The hut could be lined with plasterboard for insulation, and only required wood screws to attach it together. One hut measured 19 ft wide by 62 ft long and could be erected in nine hours with semi-skilled labour. *The Builder* published an article in May 1940 after watching a demonstration of a Tarran Hut being erected. (Figure 6.17)

The structural element consists of a parabolic arch rib comprising a series of curved sections placed end to end. Each section consists of two light timber ribs having a concrete panel cast between and attached to them. Nails are driven through the wood ribs before casting in order to provide a key, and wire ties are stretched across the mould and welded to opposite nails. Wire ties are also laid as required transversely, the complete welded mat forming a tie through the panel to the ribs. The elliptical arch rib is divided into a number of segments placed end to end with butt joints, and adjacent ribs are screwed together through the timber. The window frames are of concrete, a window unit being erected in place of a standard unit [...] The outside of the structure is covered with roofing felt or other waterproof material...The insides of the timber ribs form the base for attaching a wallboard or plaster lining, if this is needed, thus effecting a hollow construction and increasing the insulation properties.⁵⁰

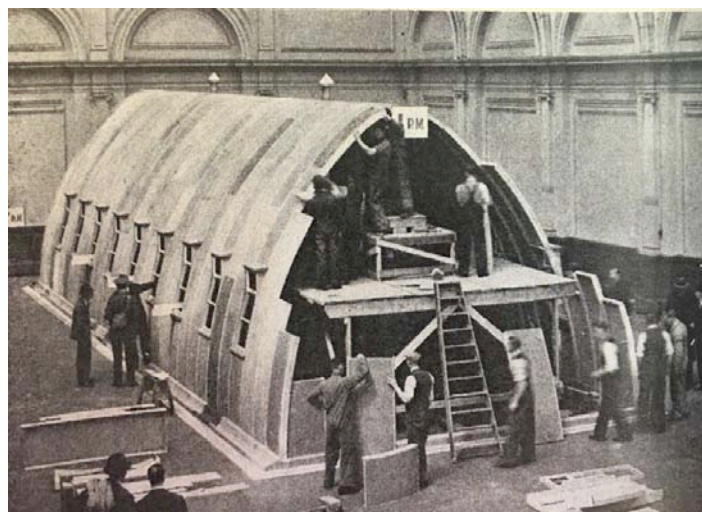


Figure 6.17 The Tarran Hut during construction. *The Builder* (10 May 1940)

⁴⁹ 'A New Type of Hut', *The Builder*, 158.5075 (10 May 1940), p. 568.

⁵⁰ *Ibid.*

Tarran applied for a patent on this design in March 1940, in which he described the hut as, ‘a structure which can be readily dismantled and rendered portable.’⁵¹ (Figure 6.18) The drawings that accompanied the application show how the same Lignocrete slabs could be applied to form a concrete exterior to a Nissen-style hut.

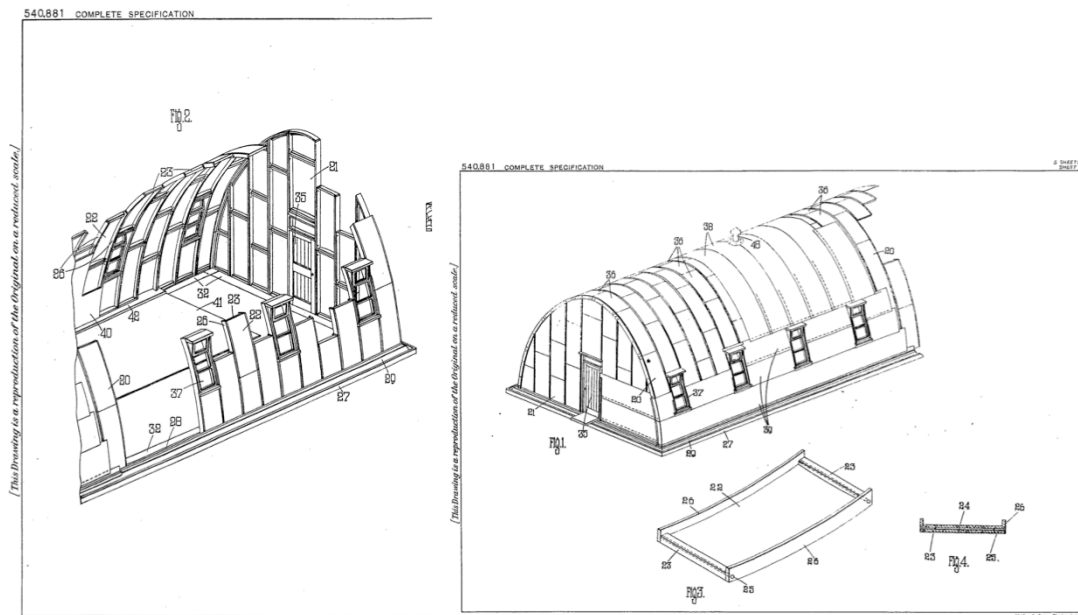


Figure 6.18 The Tarran Hut patent drawings. Patent number GB540881. (Espacenet)

By 1942, what began with one hut had been further developed into a system of hutting, known as the Tarran System. There was still the parabolic Tarran hut, but the infill was no longer limited to Lignocrete. It could also take the form of plywood or matchboard and, by that point, was offered in two sizes: 16 ft by 38 ft and the original 19 ft by 62 ft, both of which could be shortened or lengthened in two feet increments to suit whatever purpose necessary.⁵² Another hut offered was a straight-sided Tarran hut. (Figure 6.19) The standard size of this hut was 17 ft by 38 ft. It was constructed on the same principle as the original hut with Lignocrete panels on a timber frame.

⁵¹ *Improvements in or relating to Buildings or Structures*, Patent number GB540881.

⁵² 'Prefabrication: The Tarran System', *The Architects' Journal*, 95 (21 May 1942), 356-359 (p. 356).

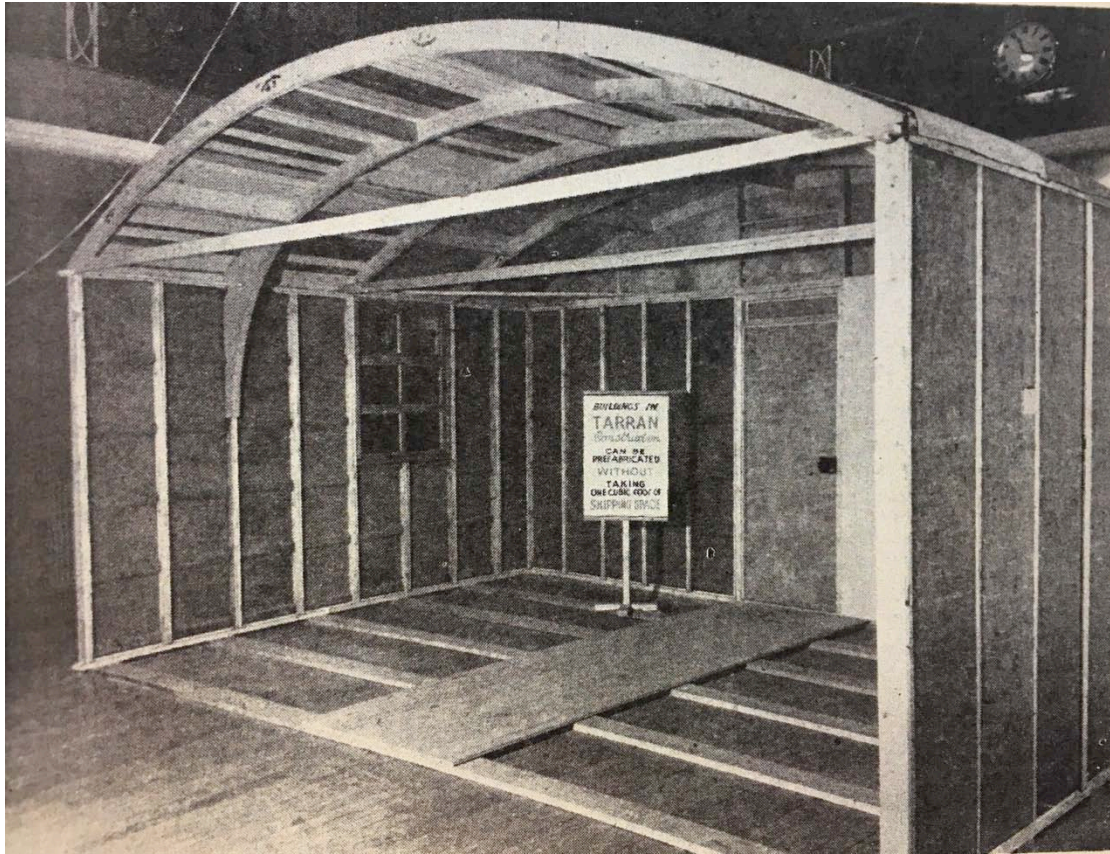


Figure 6.19 The Tarran Straight-Sided Hut. *The Architects' Journal* (21 May 1942)

Of note, by 1942, it is clear the designers were already considering how these huts might be converted into post-war private dwellings:

Such huts may be used after the war as holiday camps, youth hostels or bungalows, etc., far away from their present site. They are much more of a temporary character than the B.C.F. hut or other systems in reinforced concrete. By rendering the external face of the walls or by adding a boarding on the outside the huts can be given the appearance of a permanent building [...] To sum it up, it can be said that the Tarran System solves the problem of the portable hut with great economy in labour and materials. Its disadvantage in war time is the use of timber although the amount of timber required is comparatively small. Most of the labour is used in the factory; the weight to be transported to the site is small, only a minimum of labour is wanted on the site and a great number of huts can be quickly erected and used immediately after completion.⁵³

No surviving examples of wartime Tarran huts could be found during this research, however, there are several Tarran post-war prefabricated houses which will be discussed further in Chapter Eight.

⁵³ Ibid, p. 359.

The B.C.F. Hut

The British Concrete Federation developed two types of prefabricated concrete huts for the Ministry of Works that were widely used from 1942. One was the B.C.F. Clear Span Hut and the other was the B.C.F. Light Hut. The Clear Span consisted of a reinforced concrete frame with walls of pressed concrete and 2 in. breeze blocks creating a cavity inside.⁵⁴ The roof was flat and covered in concrete slabs covered in felt. It was used for living accommodation such as barracks and hostels, as well as emergency accommodation for schools and factory workers.⁵⁵ (Figure 6.20) The B.C.F. Light was likewise constructed with a reinforced concrete frame and walls of pressed concrete blocks, but its roof was pitched and sometimes covered with corrugated asbestos cement sheets.

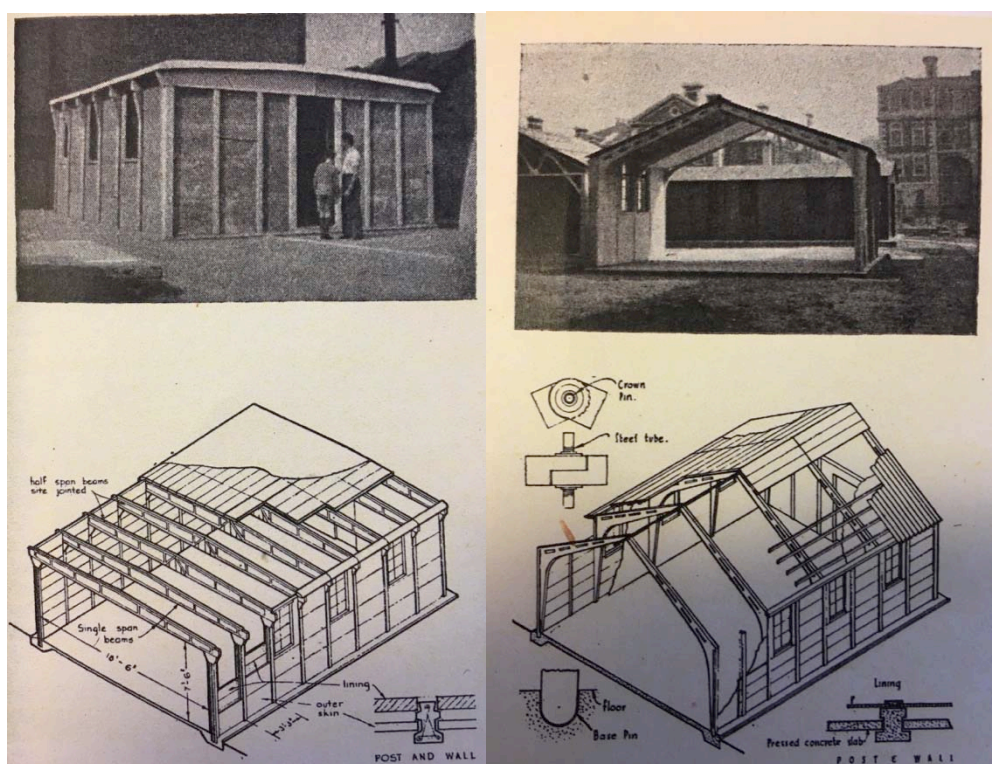


Figure 6.20 The B.C.F. Clear Span Hut (left) and the B.C.F. Light Hut (right). *The Architects' Journal* (13 August 1942)

The Architects' Journal noted in 1942 that the difficulty with both of these designs is that they were difficult to transport. Whilst prefabricated, they were more solid and permanent in nature, not given to portability.

⁵⁴ 'Prefabricated Huts', *The Architects' Journal*, 96 (3 September 1942), 107-110 (p. 109).

⁵⁵ 'Clear-Span Hostels of Prefabricated Type', *The Builder*, 162.5171 (13 March 1942), p. 236.

*In spite of the fact that the system has been evolved primarily to meet emergency building requirements, the structures are permanent in every respect and should not be considered parallel with lightweight, purely temporary systems, intended to last only a few years.*⁵⁶

This was a feature that served it well in the postwar years when the British Concrete Federation was able to convert and market their huts for civilian housing. (Figure 6.21)



Figure 6.21 A surviving BCF Clear Span Hut. Photo by Paul Francis, (Airfield Research Group).

The Ministry of Works Standard Hut

In late-1942, Ministry of Works developed a hut to a standardised plan with the aim that it would be flexible enough to allow for the use of a wide range of locally available materials, rather than being limited to just one type. It was also intended to be a less expensive alternative to the B.C.F. huts on the market.⁵⁷ Typically, the MoW Standard Hut utilised wood panels constructed in 4.5 in. brick, clay blocks, concrete blocks, plasterboard and rendered wood wool slabs.⁵⁸ It came in two sizes: 18 ft 6 in. by 60 ft and 24 ft by 120 ft. The roof could be made up of corrugated asbestos cement

⁵⁶ 'The B.C.F. Constructional System', *The Architect and Building News*, 169 (6 March 1942), p. 177.

⁵⁷ Francis, p. 219.

⁵⁸ 'The M.O.W.P. Standard Hut', *Journal of the Royal Institute of British Architects*, 49.11 (September 1942), 193-194 (p. 193).

sheeting, felted plasterboard or reinforced fibrous plaster or wood-wool covered with roofing felt.⁵⁹ The frame consisted of four reinforced concrete sections that were bolted together to create a gabled arch. (Figures 6.22 and 6.23). The RIBA reported:

*The Standard Hut uses all these available materials in a single design with many alternative infillings; each product is to be used where it is suitable, and the average result should be that huts are stronger, lighter and quicker to build [...] Since the framework is standard, the foundation slab can be poured without waiting for a decision on the materials for the walls and roof. This standard foundation can also be used for steel Nissen huts or plasterboard huts, since these have nearly enough the same bay spacing [...] The design was developed the Ministry of Works and Planning Directorate of Works, in consultation with client departments and representatives of the various industries whose products are to be used in the construction of the huts.*⁶⁰



Figure 6.22 Ministry of Works Standard Huts, 18 ft 6 in. span. Photo by Paul Francis, Airfield Research Group.

⁵⁹ Ibid.

⁶⁰ Ibid.

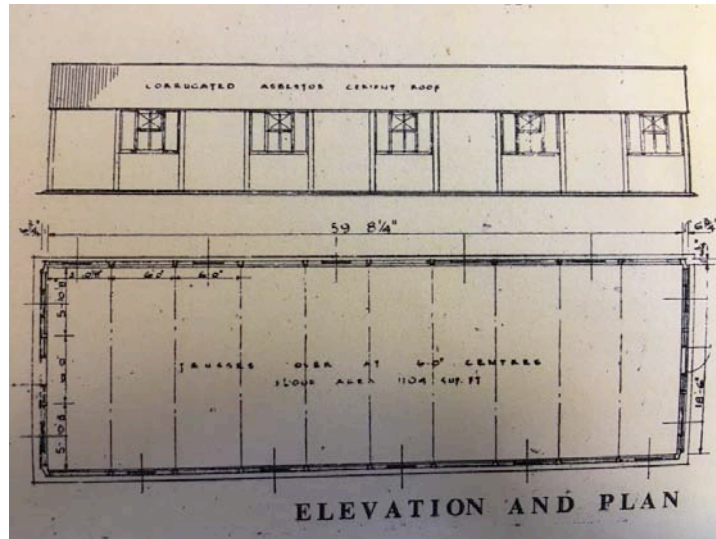


Figure 6.23 Elevation and Plan of a Ministry of Works Standard Hut, 18 ft 6 in. span. *The Architects' Journal* (3 September 1942)

To provide some idea towards numbers, according to *The Builder*, by 1944 at least 12,000 Ministry of Works Standard Huts of the 18 ft 6 in. span had been put into commission, with a further 1,000 of the 24 ft span also in use.⁶¹ (Figure 6.24) The Ministry of Works Standard Hut was so successful it was employed, not just by the Ministry of Works as living huts for soldiers, but in a range of occupations across all government departments. These included offices, support services for schools, hospitals, and worker's housing.⁶² They were even used to provide accommodation for the Allied troops stationed in Britain. By the end of the war, the standard types of infilling adopted were:

*[P]refabricated wood-framed panels covered externally with hardboard, mineralized sidingboard or felted plasterboard; hollow clay blocks; Seco units; wood cement units. In addition clay bricks, concrete bricks and concrete blocks have been used, and in some cases cavity walls have been formed with bricks and/or blocks.*⁶³

The challenge this poses to the historian or surveyor is that one cannot assume to make a positive identification based solely upon building material, as there was a fluidity based upon local availability. Inspection of the design is the imperative first step, followed by analysis of the building materials.

⁶¹ 'The M.O.W. Standard Hut', *The Builder*, 166.5280 (14 April 1944), p. 308.

⁶² *Ibid.*

⁶³ *Ibid.*

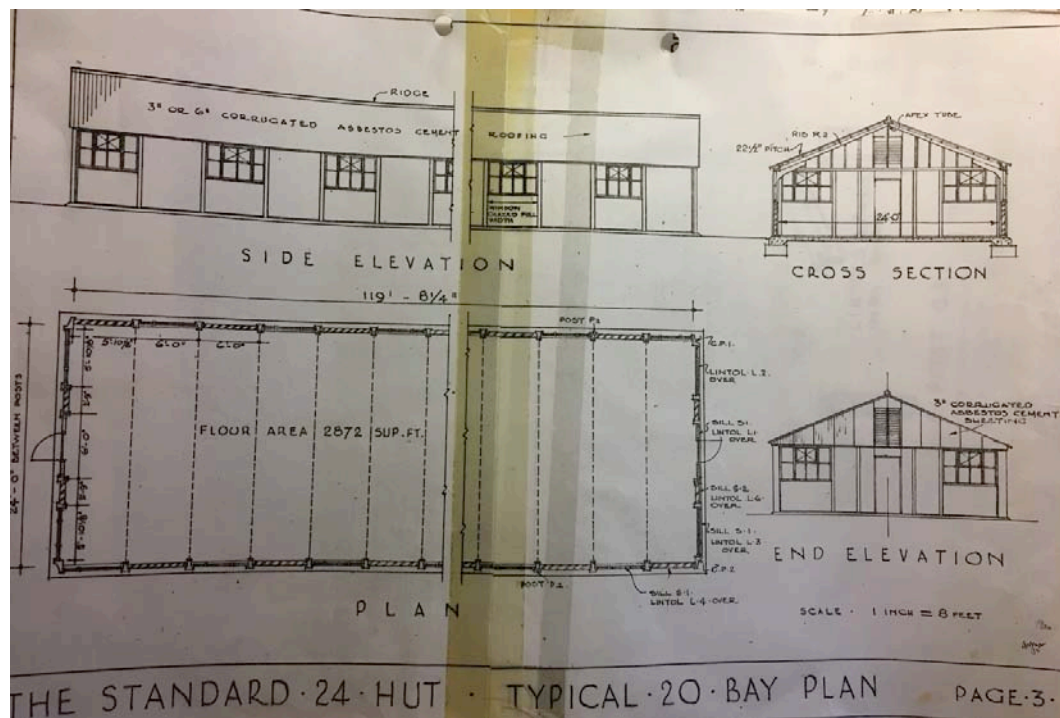


Figure 6.24 A plan for a 24 ft Ministry of Works Standard Hut. (Airfield Research Group)

The Handcraft Hut

The Handcraft Hut was a product of the Universal Asbestos Manufacturing Company based in Watford, Hertfordshire, and was constructed predominantly of asbestos. (Figure 6.25) During the war, they produced a range of asbestos materials including building sheets for siding and roofs, tiles, slates, decking and even extractor ventilators. The hut seems to have come into production from May 1942, and used predominantly for barrack accommodation.⁶⁴

⁶⁴ Francis, p. 214.

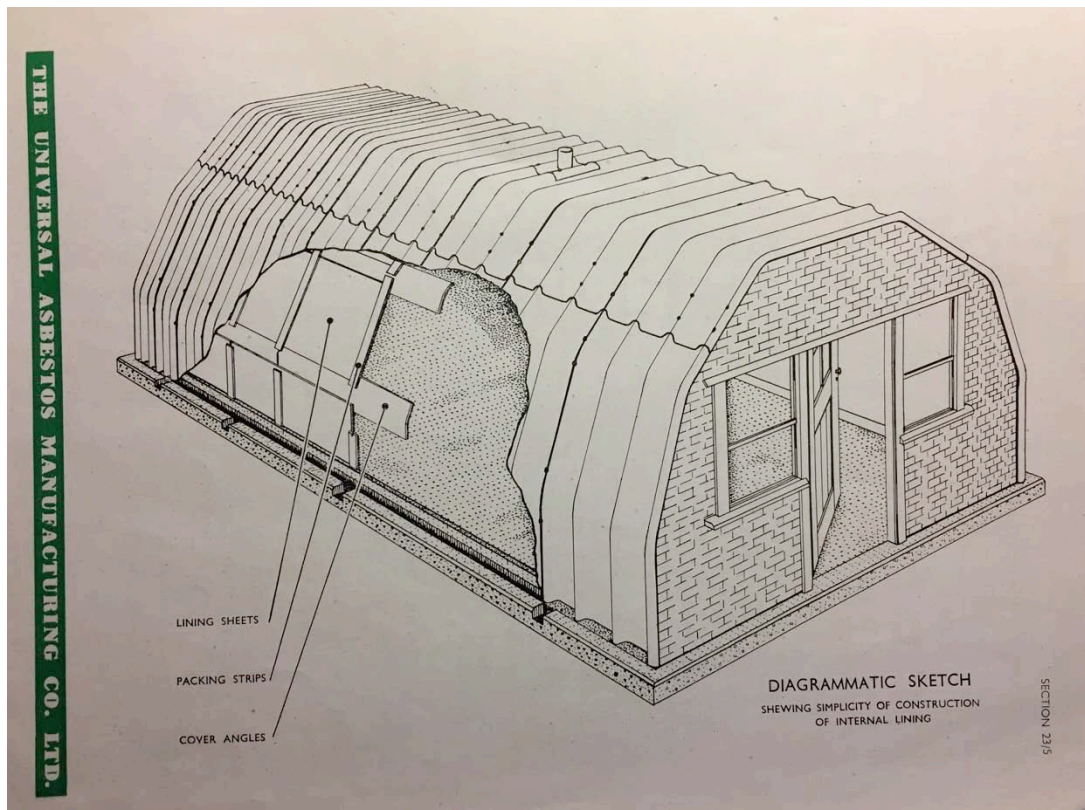


Figure 6.25 The Handcraft Hut. (Airfield Research Group)

The Handcraft Hut was advertised as an 18 ft span temporary construction with a length of 36 ft, which could be adjusted upon requirements.⁶⁵ It consisted of three 'Handcraft' reinforced asbestos-cement double cranked units, measuring 4 ft wide by 12 ft long. The exterior has a distinctive shape, similar to the Nissen, but with seven sides. (Figure 6.26) The interior walls were lined with asbestos-cement sheets. (Figure 6.27) The exterior end walls could be constructed from a variety of materials such as brick, breeze blocks, hollow blocks, and asbestos cement.⁶⁶ Along with the hut, the manufacturer also sold necessary parts and accessories, including window units of a box type frame, made of asbestos-cement, shelving and ventilators.⁶⁷

⁶⁵ Universal Handcraft Asbestos Manufacturing Company, 'Handcraft 18'0" Huts', sales leaflet no. 23, (Airfield Research Group).

⁶⁶ Ibid.

⁶⁷ Ibid.

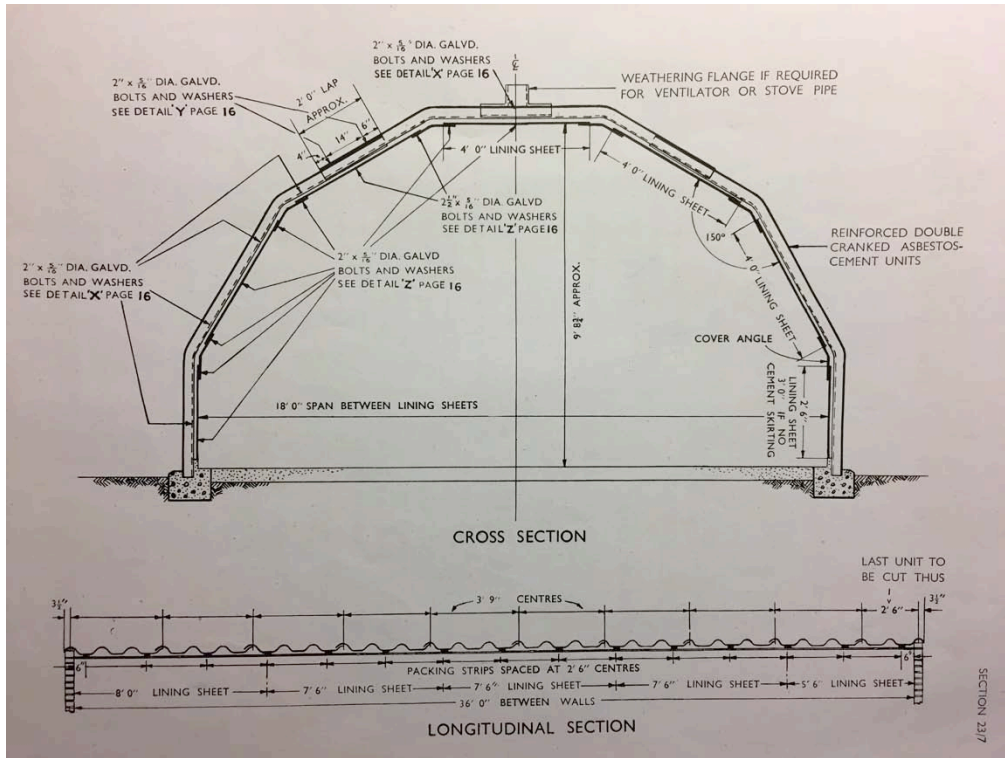


Figure 6.26 Section of a Handcraft Hut. (Airfield Research Group)

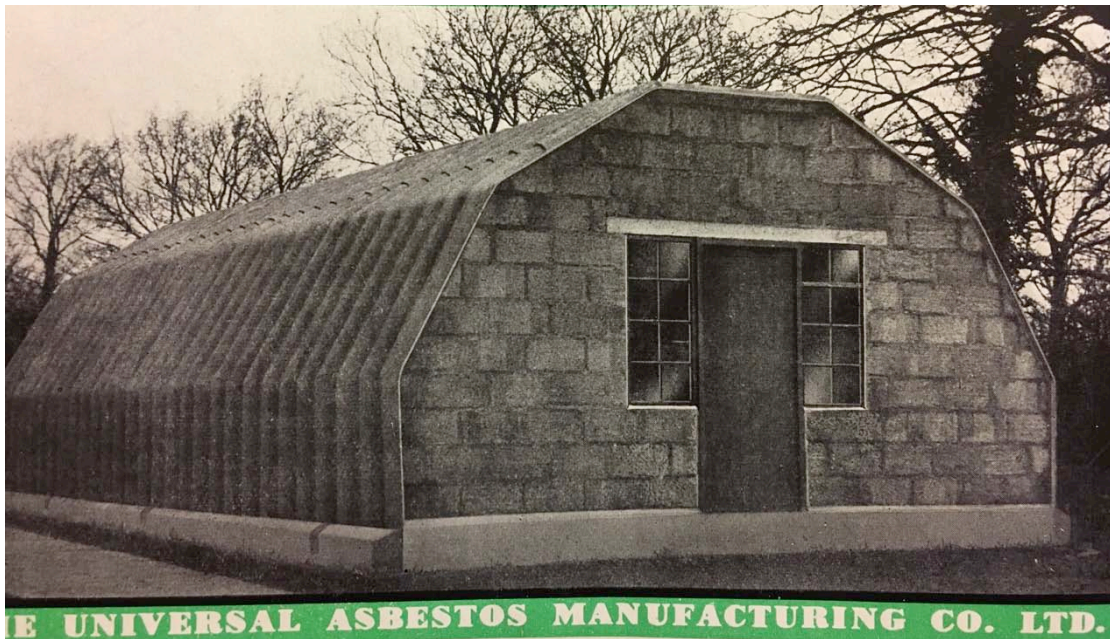


Figure 6.27 The Handcraft Hut. (Airfield Research Group)

Surviving examples of the Handcraft can be found in England and Scotland. Some seem to have been converted into private dwellings after the war ended.⁶⁸

⁶⁸ See this example at Portmaculter, Scotland: <http://her.highland.gov.uk/FullImage.aspx?imageid=57934&uid=MHG51107>

Limitations on Adoption

Huts designed of concrete made up the largest material group during the Second World War. Concrete was in relatively high supply and could be applied in numerous ways, from framework to roofing. The obvious detractor of this material was that just by its very nature it obviated a hut's capability to be portable. Combined with asbestos, the material was fairly weather resistant and fire retardant, both important characteristics in wartime. This chapter discussed a majority of the types of concrete and asbestos huts designed during the war. The remainder are listed in Appendix B with as much relevant information as could be discovered. There were various other notable contributions, including the Maycrete and Nashcrete Huts, both of which were constructed of reinforced concrete supported by sawdust cement panels. The Ministry of Supply and the Ministry of Works each had their own Maycrete Hut design. Somewhat confusingly, there were two other types of asbestos huts with similar names: the Curved Asbestos Hut and the Asbestos Arch Hut. They were relatively inexpensive to erect. The Curved Asbestos Hut was similar to the Nissen Hut, but made use of prefabricated plasterboard or brick for the ends, and cost around £140 to transport and erect.⁶⁹ All of these and more are included in the appendix.

Whilst the First World War had made use of concrete in the Air Ministry Concrete Hut, the Second World War saw the greatest leaps of innovation with prefabricated concrete construction. This had enormous effects on the development of post-war housing. Several of these designs were converted into civilian housing, and in other cases, the manufacturers simply applied the same technology to a new family home design. However, in the absence of timber and steel, concrete and asbestos were not the only materials to be employed in hut building during the Second World War. Corrugated iron was also utilised as will be reviewed in the next chapter.

⁶⁹ Wartime construction sheet of hut types, materials and costs. (Airfield Research Group).

Chapter Seven

Corrugated Iron (Steel) Huts of the Second World War

A Brief History of Corrugated Iron

As discussed in Chapter One, corrugated iron was invented in 1829 by Henry Robinson Palmer to provide a new type of roofing material for a shed in the London Docks. The product was manufactured by passing iron sheets through fluted rollers, creating a wavy pattern that structurally was stronger in the opposite direction of the corrugations.¹ Versatile and lightweight, corrugated iron quickly became an indispensable building material that successfully expanded across the global market in the nineteenth century.² Originally, wrought iron was the most common metal used to produce the sheets, however with the improvement and cost reductions in mild steel manufacture in the latter half of the nineteenth century, wrought iron was phased out in favor of hot-dip galvanised mild steel.³ The galvanising process required dipping the steel into molten zinc, which when applied, providing protection against corrosion. Therefore, it is important to note that the term ‘corrugated iron’ is a colloquialism and that the actual material employed from the 1890s was almost universally galvanised mild steel.

By 1905, *Cassell's Building Construction* manual records galvanised corrugated iron as a roofing material being ‘useful for temporary buildings and for

¹ Mornement and Holloway, pp. 11-12.

² For more on the history of corrugated iron in the nineteenth century, see Gilbert Herbert's *Pioneers of Prefabrication* (1978), or Mornement and Holloway's *Corrugated Iron* (2007).

³ These improvements were due to the Bessemer process and the Siemens-Martin process, which provided inexpensive methods for mass-producing steel. For more see Robert Gordon, *American Iron 1607-1900* (London: Johns Hopkins University Press, 1996) and W. K. V. Gale, *The British Iron and Steel Industry* (Newton Abbot: David and Charles, 1967).

covering sheds cheaply. May be laid at any angle. Weight about 350 lb per square (16 B.W.G.). Decays rapidly in town air, unless painted every three years.’⁴ Around the same time, William Cooper Limited, a London retailer based on Old Kent Road, published a catalogue including a range of prefabricated timber and iron buildings, with the claim:

*Our Wood and Iron Buildings have been in use sufficiently long to put them to the test in every possible way, and from the continually increasing demand for them it may fairly be said that they justify a claim superior to any class of structure, for similar use, that existed prior to their introduction.*⁵ (Figure 7.1)

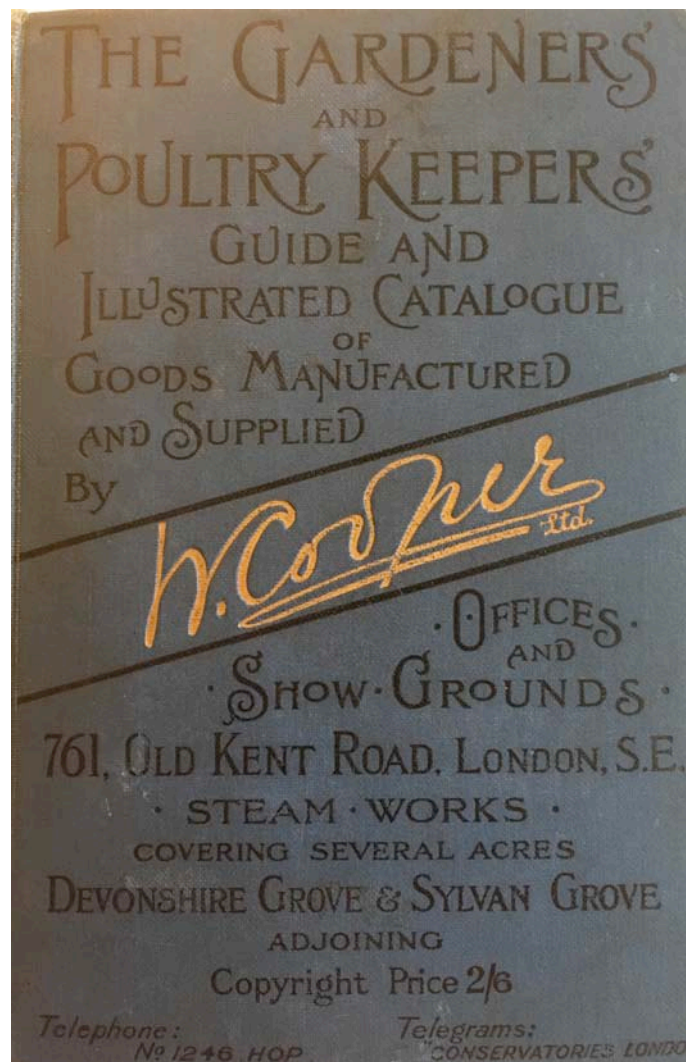


Figure 7.1 William Cooper Ltd. illustrated catalogue (1901)

William Cooper offered iron buildings to serve for anything from bike sheds and cottages to churches and merchant's shops. (Figure 7.2) They were manufactured

⁴ Henry Adams, *Cassell's Building Construction: Comprising Notes on Materials, Processes, Principles, and Practice Including About 2,300 Engravings and Twenty-Four Coloured Plates Drawn to Scale* (London: Cassell and Co., Ltd., 1905), p. 260.

⁵ William Cooper Ltd., *The Gardeners' and Poultry Keepers' Guide and Illustrated Catalogue of Goods Manufactured and Supplied* (London: William Cooper, 1901), p. 5.

in sections, portable and ready for delivery or export. They could be delivered by rail, lorry, or depart by ship from the London Wharf.

*Each part is numbered and lettered to correspond with a diagram which accompanies the Buildings, so that reference is made easy, and the putting together of the sections is a matter of common intelligence, no technical skill being required.*⁶

These were the original flat-packed kit buildings.

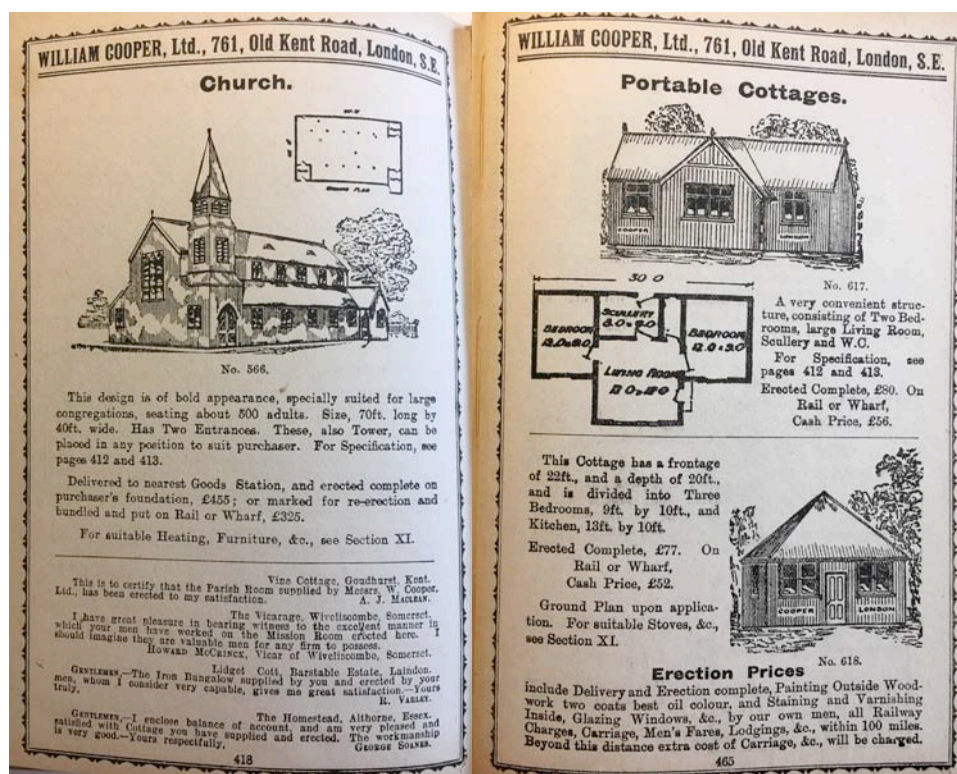


Figure 7.2 Advertisements for a corrugated iron church and a portable cottage in the William Cooper catalogue (1901).

The buildings required a foundation of either brick or stone positioned under the supports of the structure, to be in place before construction began. The framework was done in timber; the lining was made up of matchboards, and the flooring in seasoned deal wood planks. The exterior was covered in:

*[G]alvanised corrugated iron sheets of standard Birmingham gauge only are used, truly and evenly corrugated, thickly coated with pure Silesian spelter, true and even in temper, and free from flaws and cracks. They are fixed on a principle that admits of their being easily released without damage to the structure. At the apex of the roof plain galvanised iron capping is provided.*⁷ (Figure 7.3)

⁶ Ibid, p. 415.

⁷ Ibid, p. 413.

These were buildings of the late Victorian, early Edwardian period and thus, it should perhaps be expected that they came complete with gables and pinnacles ‘studied from the most approved Gothic designs.’⁸



Figure 7.3 A corrugated iron house as advertised in the William Cooper catalogue.

Cooper advertised its export trade to the Colonies, South Africa and India, claiming their portable iron buildings were suitable for all climates. ‘For tropical climates our buildings are constructed with a double roof, each end being covered with perforated zinc in order to admit a through current of air. This not only assists to cool the interior, but may be made to act as a through ventilator.’⁹ This was important technology as in hot climates the inside of a corrugated iron building can often feel several degrees warmer than the outside. Applying zinc to the perforations would have provided further protection against corrosion.

Cooper also sold individual galvanised corrugated iron sheets in standard widths of 2 ft 3 in. in lengths ranging from 3 ft to 10 ft. (Figure 7.4) Corrugated iron buildings were touted as providing a structure that was:

*[N]eat in appearance [...] On the grounds of cleanliness they have no equal. The risk from fire is minimised, and from an economical point of view they are cheaper, commensurately, than any other form of temporary structure. With ordinary attention to the exterior they will last a lifetime. All that is necessary for their preservations is to see they are painted, say, every three or four years.*¹⁰

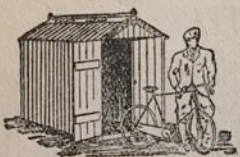
⁸ Ibid.

⁹ Ibid, p. 415.

¹⁰ Ibid, p. 414.

WILLIAM COOPER, Ltd., 761, Old Kent Road, London, S.E.

Bicycle or Tricycle House.



No. 641.

Span-Roof.

Wooden Framework, covered with galvanised corrugated iron, 7ft. long, 4ft. wide, 5ft. high in centre. Fitted with wood floor and double doors in front, with good lock.

Cash Price, £3 10s.

Lean-to House.


7ft. long, 4ft. wide, 5ft. high at back, 4ft. in front. Complete with floor. Cash Price, £2 15s.; if with wood back, 10s. extra. Corrugated Iron Back, 15s. extra.

Corrugated Galvanised Iron Sheets.

Large Quantities of every Size kept in Stock, from 3ft. to 10ft. long, by 2ft. 3in. wide. Curved Sheets to order.

		Cash Prices.	
		26 Gauge.	24 Gauge.
		s. d.	s. d.
3ft. long	0 11	.. 1 2
4ft. "	1 3	.. 1 7
5ft. "	1 7	.. 1 11
6ft. "	1 10	.. 2 3
7ft. "	2 2	.. 2 7
8ft. "	2 5	.. 3 0
9ft. "	2 10	.. 3 7
10ft. "	3 4	.. 4 1

All prime Sheets not wasters.



No. 642.

Galvanised Ridging.

In 6ft. Lengths. Cash Prices:

26 Gauge at 1s. 6d. each. 24 Gauge at 1s. 11d. each.

Galvanised Cone Head Nails and Washers.

		Cash Prices.	
		s. d.	
Nails	2 3	per gross.
Nails	0 3	per dozen.
Washers	1 3	per gross.

450

Figure 7.4 Galvanised corrugated iron sheets for sale as a building material in the William Cooper catalogue (1901).

William Cooper was not the only retailer of corrugated buildings during this period. There were other large building suppliers who issued catalogues with similar offerings and varied designs, such as Rose Lane Works in Norwich, John Lysaght, Ltd in Bristol, Isaac Dixon & Co., Hill & Smith, Speirs & Co. of Glasgow, Frederick Braby & Co of Glasgow, and Boulton & Paul of Norwich.¹¹ (Figure 7.5) Boulton & Paul will be mentioned again below for they were still in operation by the Second World War and manufactured a hut of some success.

¹¹ Mornement, pp. 41-53.



Figure 7.5 John Lysaght, Ltd., ironworks factory, Bristol. Built in 1876, demolished 1976. © Barton Hill History Group

From these catalogues and advertisements, one can see that corrugated iron was a staple of portable, prefabricated buildings from the very beginning of the twentieth century. It provided a lightweight, mass-produced sheet material that could be easily stacked, transported and secured to timber framing providing a hardy covering for both walls and roofs. They proved to be useful not just to colonists but also across Britain where iron buildings were being sold and erected as a cheaper alternative to local materials.¹² During the Derwent Valley Dam project that began in 1900, Messrs. Catto, Mather and Co. built 94 temporary workers huts in corrugated iron to house a population of 900 in Birchinlee, Derbyshire.¹³ These buildings included everything a temporary community would require, such as a hospital, stores, canteen, school, police station, and more.¹⁴ Mornement and Holloway's book on the subject, *Corrugated Iron*, gives several examples of iron cottages built during this period in England and Scotland. They said:

By the outbreak of the First World War, it was a feature of rural and agricultural landscapes throughout the world. It had also played a major role in the religious revivals, influenced the practice of farming, provided shelter – temporary and permanent – to millions and was just about to make its marks on the face of modern warfare. By 1914 corrugated iron had become a truly global construction material.¹⁵

¹² Ibid, p. 51.

¹³ Ibid, p. 43.

¹⁴ Ibid.

¹⁵ Ibid, p. 51.

It is perhaps unsurprising then that these developments and characteristics were capitalised on in making corrugated iron the primary cladding and roofing material in Armstrong's Type Plan Hut (1914) and the Nissen Hut (1916) during the First World War. Corrugated iron sheets proved to be a versatile mainstay in portable, prefabricated buildings, which is why it was just as important a building material in the Second World War.

Corrugated Iron in the Second World War

Kohan said that the first shortage of steel began to make itself felt during the early months of 1940.¹⁶

*The estimated demand of the Government building programme for the calendar year 1940 was for 1,600,000 tons of finished steel, a total which excluded steel requirements for air raid precautions. Against that demand the Production and Materials Priority Sub-Committee had given the Works and Building Priority Committee a global allocation of one million tons.*¹⁷

This Committee had the mandate for supplying materials in order of priority, first for all government departments, then private and civil engineering, followed by railway work associated with Royal Ordnance Factories, and finally for maintenance, repair and civil building.¹⁸ Kohan said that overall there was a required three-eighths cut in the amount steel allocated during that first year of the war.

*In regard to all departments it was clear that any further reduction in the estimates could only be made by retarding the completion of the building programme. In some instances (for example, Air Ministry) the programme had already been delayed through tardy deliveries of steel.*¹⁹

By late 1940, it was decided that although the Works and Buildings Priority Committee had been somewhat successful, they 'lacked the authority to lay down a firm policy,' so the Minister of Works was ultimately made responsible for the control of building materials.²⁰ It was even stated that some shortages of building materials were not necessarily real, but rather illusive and did not actually exist.²¹

Although this provision gave the Minister of Works wide powers, it became the consistent policy of his department to avoid control of building materials by any system of rationing or allocation which was likely to create an artificial scarcity through overbidding and subsequent hoarding. The Ministry's aim was always to ensure that the quantities of materials produced should be just sufficient for the labour-strength of the industry, and then to ration the labour by means of the allocation system. Steel and timber were exceptions because they

¹⁶ Kohan, p. 45.

¹⁷ Ibid.

¹⁸ Ibid, p. 46.

¹⁹ Ibid, p. 47.

²⁰ Ibid, p. 161.

²¹ Ibid.

*were used not solely by the building industry but by nearly all industries. These materials could only be acquired and used for building by the authorization of the respective Controllers, although small quantities of certain products could be acquired without authorization from stock-holding merchants.*²²

What is important to glean from these details is that whilst controlled, steel was still available in limited quantities. The priority of resource allocation was given to those government works deemed most important. These were compiled on a list called the W.B.A.

*With regard to steel and timber, the contractor was to be notified by the department concerned that the job he was doing had been placed on list W.B.A. and that the symbol "Q" was to be used in addition to the contract number when ordering steel or making inquiries from the Iron and Steel Control.*²³

In this way, steel could be obtained for building high-priority huts. Thus, one can see that despite the control on materials and the application of alternative materials, steel huts were still being constructed. At first on a lesser scale in keeping with early concerns over shortages, and increasing in number through the later years of the war.²⁴ This was in large part due to the Americans entering the war and providing much needed materials as well as the winning of the Battle in the Atlantic in May 1943, allowing more imports to England without threat of sinking by a German U-boat.²⁵ This chapter will now cover some of the most successful corrugated iron and steel huts used during this period.

²² Ibid.

²³ Ibid, p. 87.

²⁴ Air Ministry, *Royal Airforce Builds for War* (London: HMSO, 1956), p. 140.

²⁵ Mallory and Ottar, p. 197.

The Huts

<i>Huts Constructed of Corrugated Iron/Steel</i>
1. Air Ministry Revised Laing Hut
2. The Iris Hut
3. The Jane Hut
4. The Nissen Hut
5. Marston Sheds
6. MoS Padmos Hut
7. The Quonset Hut
8. The Romney Hut/ Semi-Romney Hut
9. The Steel Construction Hut
10. The War Office Abbey Hut
11. The War Office Tufton Hut

Table 7.1 Huts constructed of corrugated iron or steel during the Second World War.

The Nissen Hut

The original Nissen Hut design was studied in Chapter Two, but will be revisited here in terms of how it came to be put back into construction for a new war, and how it was improved upon in the intervening years. After the First World War, Peter Nissen hired a solicitor who pursued and won royalty payments for his hut design. He was subsequently made several lump sum payments from the British and American governments.²⁶ He went on to run a building company called Nissen Buildings, Ltd., which took on various projects, among them a scheme for a domestic two-storey Nissen Hut house in 1925. It was marketed as the Nissen-Petren house and had a corrugated asbestos steel roof attached to a semi-circular steel frame.²⁷ (Figure 7.6)

²⁶ McCosh, p. 112.

²⁷ Ibid, p. 122.



Figure 7.6 The Nissen-Petren House c1925 in Goldcroft, Yeovil. Photo by Bob Osborn, Yeovil History.

Nissen died in 1930, however his company continued to thrive from its factory location at Rye House, Hoddesdon, under its managing director W. H. Folkes. Fred McCosh, in his book *Nissen of the Huts*, describes one newspaper reporter's experience upon visiting the factory in the 1930s:

To watch the Nissen buildings made and see how easily they can be assembled is to appreciate the simplicity of solving the housing problem where primitive conditions preclude restrictions associated with building bye-laws [...] Today, the shops at Rye House turn out all kinds of constructional steelwork; steel frame buildings from 16 feet to 50 feet span. The hut is, more or less, a sideline, which, however, has proved adaptable for use in the remote parts of Europe, Africa and Asia. For example, the work of damming the river Nile, meant providing quarters for native labour and the Nissen hut proved a clean and cool building, which could be kept far more sanitary than mud dwellings used by the local natives [...] There have been calls for these huts from the Sudan, South Africa and Kenya. An oil company in Iraq purchased hundreds and the home market is not yet satisfied. Nissen huts are at present being erected in Labour Training Camps.²⁸

From this article it would seem that during the inter-war period, the Nissen Hut was in mass-production and being successfully sold and shipped around the world. When war was declared in September 1939, Nissen Buildings waived its royalty fees and began production of Bow Huts and Hospital Huts.²⁹ The Second

²⁸ Ibid, p. 133. (Extract from a reporter at *The Hertfordshire Mercury*).

²⁹ Ibid, p. 143.

World War version of the Nissen Hut differed slightly due to material controls, and were built with concrete floors and brick or concrete block ends, when portability was not a necessity.³⁰ Some also included dormer windows. (Figure 7.7) When the corrugated steel sheets for roofing fell into short supply other alternatives were experimented with such as corrugated asbestos cement sheets and plasterboard, ‘but the asbestos [...] failed to stand up to rough handling and the plasterboard was apt to leak.’³¹ Paul Francis said that Nissen Huts were purchased in bulk during the war and supplied to aerodromes by the Air Ministry:³²

They were used as an alternative to brick construction and soon became one of the standard forms of temporary buildings for all types of accommodation. Like all Nissen huts, the 16 ft span hut was semicircular in section and could be built to any length in multiples of 6 ft bays (normally six). The frame consisted of steel T-ribs in three sections spaced at 6 ft centres; corrugated steel sheets laid horizontally providing an internal lining and were held in place by the T shape of the rib and by straining wires. The external covering was 26-gauge corrugated iron sheeting; these were attached to timber purlins fixed to the ribs. End walls, each containing two windows and a door frame, were normally supplied with the hut and consisted of timber-framed sections, clad with timber boarding and felt. Alternatively, half-brick walls could be built.³³

The Nissen Hut of the Second World War also came in spans of 24 ft and 30 ft. Francis said these larger huts were more often used as communal buildings such as cinemas or dance halls.³⁴ This table provides some insight into the numbers of Nissen huts erected during the war years. (Table 7.1) The figures were calculated based on information supplied in *The Royal Airforce Builds for War* (1956).

<i>Nissen Hut</i>	<i>1941</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>	<i>Totals</i>
16 ft x 36 ft	25,551	39,181	6,465	1,028	72,226
24 ft x 36 ft	1,860	10,466	8,231	601	21,158
30 ft x 36 ft	57	4,840	4,723	0	9,620
				TOTAL:	103,004

Table 7.2 Nissen huts built and erected for the Air Ministry during the Second World War.

³⁰ Ibid.

³¹ Ibid.

³² Francis, p. 211.

³³ Ibid.

³⁴ Ibid p. 213.



Figure 7.7 A Nissen hut with dormer windows located at RAF Alconbury. Photo by Paul Francis (Airfield Research Group)

The calculations for the 24 ft and 30 ft span Nissen huts in Table 7.1 were based on the assumption they were 36 ft in length. However, these could have been custom-built to any length in multiples of six ft. sections. Francis said that this was usually 36 ft, and the Air Ministry data only provides one length for the 16 ft hut, which was 36 ft, so this is the number used in the calculations. This provides for a total of 103,004 Nissen huts built during the wartime period for the Air Ministry. These Nissen huts are the ones most often still found in woods near old aerodrome sites or recycled as farm storage sheds.

The Romney, Semi-Romney and the Iris Huts

The Directorate of Fortifications and Works at Romney House in London, decided it was necessary to design huts along the same principle as the Nissen, but that were larger and rather than accommodation, would be used for storage or communal purposes.³⁵ The first was the Romney Hut. It was semi-circular, like the Nissen, with a span of 35 ft and a typical length of 96 ft, built in sections of 8 ft

³⁵ Ibid. Francis said they were 'primarily for storage but could be easily adapted for use as workshops, canteens and cinemas.'

widths.³⁶ This was a hut that made generous use of steel as a building material. The main ribs consisted of 2.5 in. tubular steel sections that curved to a radius of 17 ft 6 in. and then secured into a concrete foundation.³⁷ Steel was also used for the purlins and the covering was 24 gauge corrugated steel sheeting. Deadlights were inserted into some of the roof sheeting providing natural light. Massive sliding doors extending to provide an opening of 10 ft 8 in. wide and 13 ft high could be inserted to either end of the hut.³⁸ (Figure 7.8)



Figure 7.8 A Romney Hut with natural deadlights visible in the corrugated steel sheets. (Airfield Research Group)

The Semi-Romney was designed as a more portable version of the Romney:

[R]equiring less shipping and less erection time and labour than the more permanent Romney Hut. It is composed of part of the Romney steel frame, but covered with canvas instead of corrugated iron, and can be erected by unskilled labour on earth foundations. A Semi-Romney can be converted to a Romney, if required, by the addition of steel end-frames and the replacement of the canvas by corrugated-iron sheeting.³⁹

It was likewise semi-circular and measured 35 ft wide by 96 ft long. (Figure 7.9)

³⁶ Romney Hut Instruction Manual. (Airfield Research Group)

³⁷ Ibid.

³⁸ Ibid.

³⁹ Semi-Romney Hut Instruction Manual. (Airfield Research Group)

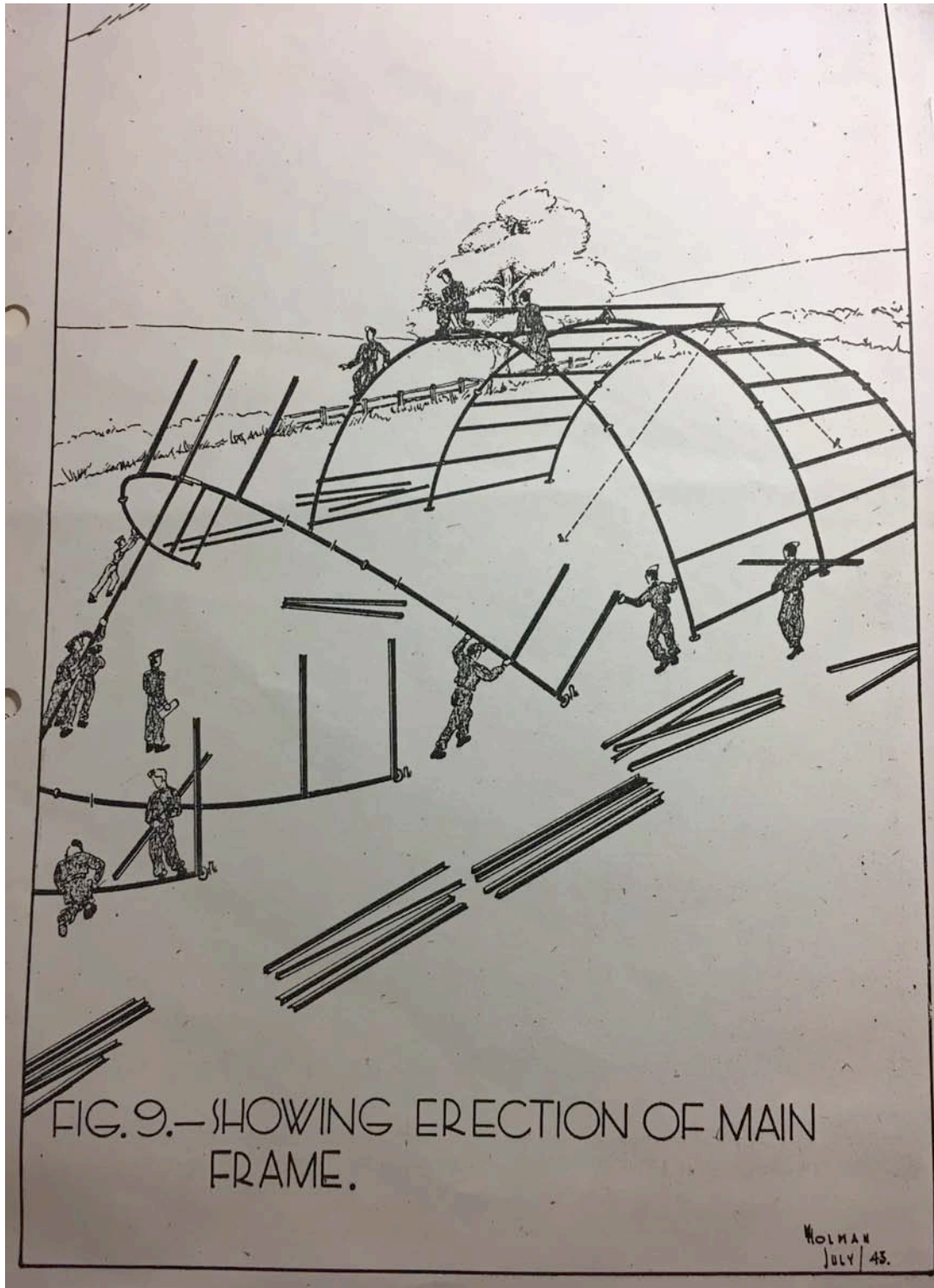


Figure 7.9 Drawing dated July 1943 included in the Semi-Romney Hut Instruction Manual showing how to erect the main frame. The manual indicates that erecting the ribs would take ten men 2 hours and 10 minutes to complete, to affix the purlins six men 1 hour 50 minutes, and ten men 2 hours to affix the canvas cover. (Airfield Research Group)

The Iris Hut was in production by at least 1942, but more likely by 1941, although very little is known about it. Francis said it was similar to the Romney:

[E]xcept that the frame consisted of tubular ribs, 2 inches in diameter, and tubular purlins. The small-diameter tubing made the structure too flimsy and its manufacture was soon discontinued and replaced by the Romney Hut.⁴⁰

The Air Ministry records an ‘Iris Romney’ hut of 35 ft by 96 ft, which was erected from 1941 to 1944, with a total of 1,242 of this type erected over the war period.⁴¹ It is possible this is just a cumulative figure of all Iris and Romney’s erected, with the earliest huts likely being the Iris design, however it is impossible to know for sure how many of each type were erected based solely upon the Air Ministry data. (Figure 7.10)



Figure 7.10 Workers erect two Iris Huts for storage and workshop requirements at a military camp in 1942. *The Architects' Journal*, (19 November 1942)

⁴⁰ Francis, p. 213.

⁴¹ Air Ministry, p. 140.

The Quonset Hut

The Quonset Hut was an American invention, but is worth mentioning because it was constructed in Britain during the Second World War and as such, some survivals may still be seen around the countryside. Julie Decker and Chris Chiei's book *Quonset Hut: Metal Living for a Modern Age*, asserts that the Quonset Hut was the American answer to developing their own type of prefabricated hutting during the war. In early 1941, 'the Allies were reaching financial crisis on all fronts. England declared that by June they would no longer be able to purchase supplies and arms provided by the U.S.'⁴² This led to Roosevelt's famous Lend Lease Act which would allow America to continue to supply Britain's needs without violating the Neutrality Act of 1939. In return, Britain passed ownership of several forward bases for the U.S. to use in Scotland and Northern Ireland.

Since material resources and local labor were all but drained from the British Empire, the U.S. military had no other choice than to supply prefabricated building systems shipped from the U.S. to house their troops. Quonset Point was selected as the assembly point for all supplies and materials required for the construction of these bases.⁴³

Contracting companies George A. Fuller, and Merritt-Chapman and Scott were tasked with inventing a new type of prefabricated hut specifically for accommodating troops serving abroad. 'These buildings would need to be portable, erected and knocked down quickly and easily, adaptable to any climate and geography, and provide soldiers with the most protection and comfort possible.'⁴⁴ Not only this, but they had barely two months to do it. The Navy wanted the first shipment of huts ready by June 1, 1941.⁴⁵ Otto Brandenberger was the architect in charge of the design team. Their only remit from the Navy was that 'the new huts had to be arch shaped, for strength and deflection of shell fragments, and able to be quickly and simply assembled.'⁴⁶ As such, they began with the British Nissen hut and quickly got rid of everything but its semi-circular form. 'Fuller claimed, "The British had been on the right track but too many gadgets slowed down erection; and with no insulation between inner and outer metal shells the Nissen huts were hot in the summer and cold

⁴² Julie Decker and Chris Chiei, *Quonset Hut: Metal Living for a Modern Age* (New York: Princeton Architectural Press, 2005), p. 2.

⁴³ Ibid.

⁴⁴ Ibid, p. 3.

⁴⁵ Ibid.

⁴⁶ Ibid, p. 6.

in the winter.”⁴⁷ The final design was for a 16 ft by 36 ft ‘Nissen type hut for Temporary Aviation Facilities.’ Although the end product still looks very much like a Nissen, the main visual clue is that the Nissen has vertical corrugated cladding, whereas the Quonset’s corrugations ran horizontal to the hut. (Figure 7.11) It was redesigned several months later by Stran-Steel in order to better accommodate furniture, making more floor space available. (Figure 7.12)



Figure 7.11 A large Quonset hut. (Airfield Research Group)

⁴⁷ Ibid.

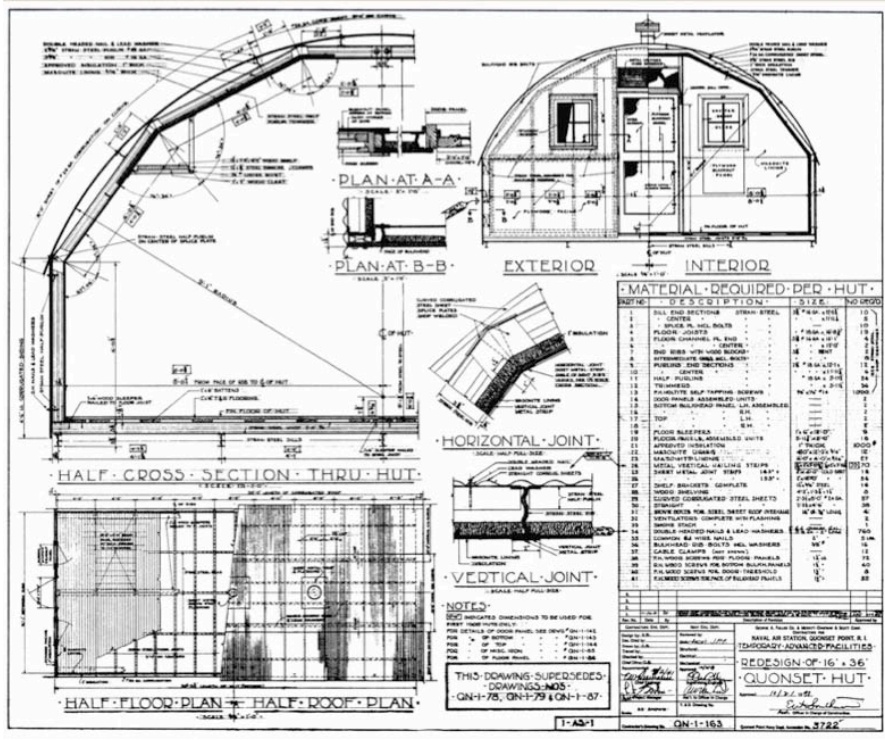


Figure 7.11 The Redesign Plan of the Quonset Hut (1941).

The Jane Hut

The Jane Hut is believed to have been designed and manufactured by Boulton & Paul of Norwich, a building firm mentioned earlier with origins in the nineteenth century. It was originally designed using plasterboard cladding but this was later replaced by corrugated iron. Francis surveyed a Jane Hut at Panshanger and recorded:

It was made of lightweight timber-framed panels, covered on the outside with straight sheets of corrugated iron laid vertically, and on the inside with felt reinforced with chicken wire. Each 3 ft wide wall panel contained a timber half-window. The internal partitioning of rooms was usually achieved with 9-inch clay blocks [...] felt was nailed to common rafters while straight corrugated iron was fixed to the purlins on the outside [...] The internal span was 18 ft; bay width was 3 ft; internal height was 8 ft.⁴⁸

⁴⁸ Francis, p. 210.

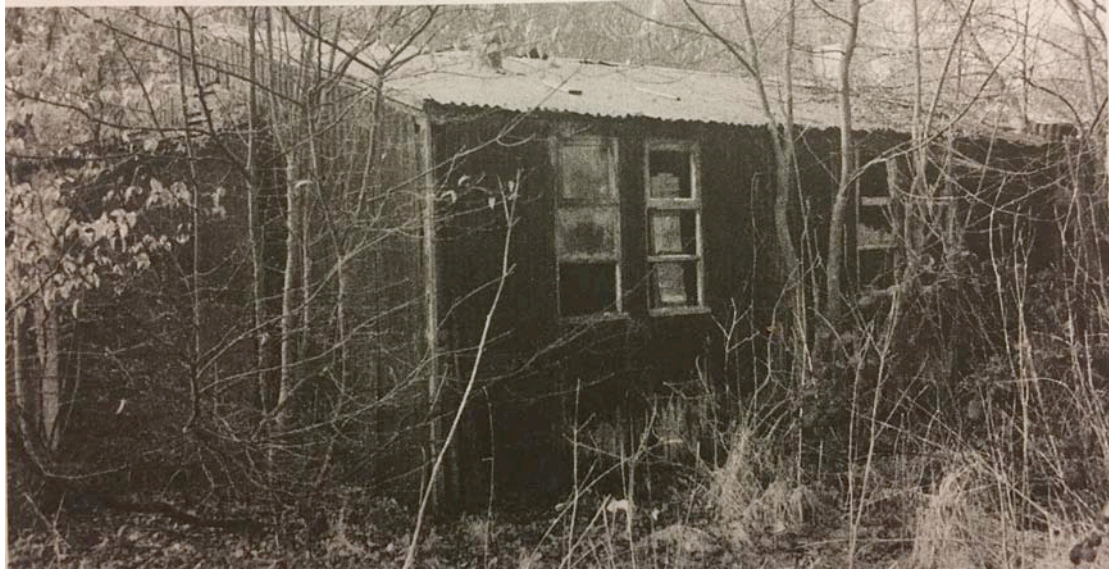


Figure 7.12 The Jane Hut, Panshanger. Photo by Paul Francis.

Limitations on Adoption

Corrugated sheet metal huts, the first type introduced by Peter Nissen in the First World War, were just as successfully employed in the Second World War. They were lightweight, prefabricated for quick erection on site, and often demountable. The only factor that held them back from more widespread manufacture was the shortages on available steel and timber, the two core materials of a corrugated iron hut. Despite these restrictions, Nissen Huts, Quonset Huts, Jane Huts, Iris and Romney Huts, were still mass-produced and erected across Britain serving as accommodation, storage depots, workshops, cinemas, dance halls, and more. Their use of corrugated iron and versatility made them a recognizable staple of the warfare period. The unique semi-circular profile shared by several of these designs often still lead them to being confused with one another.

Chapter Eight

The Effects of Wartime Hutting on Post-War Britain

The lessons learnt from wartime hutting would have a significant part to play in the post-war reconstruction. This forms the subject of this chapter. The intention here is not to attempt to provide a comprehensive survey of post-war housing. There have been plenty of previous studies on this subject: see R. B. White's *Prefabrication: A History of its Development in Great Britain* (1965), Marian Bowley's *The British Building Industry* (1966), John Short's *The Post-War Experience: Housing in Britain* (1982), Brenda Vale's *Prefabs: A History of the UK Temporary Housing Programme* (1995), and more recently, Nicholas Bullock's *Building the Post-War World: Modern Architecture and Reconstruction in Britain* (2002), and Greg Stevenson's *Palaces for the People: Prefabs in Post-War Britain* (2003). For a more technical analysis, the Building Research Establishment published *Non-Traditional Houses: Identifying non-traditional houses in the UK 1918-1975* (2004).

A prolonged treatment of this subject is beyond the scope of this thesis. This chapter aims to provide a general summary of the circumstances and broader issues during and immediately following the war, highlighting how the previous hut designs influenced civilian housing. It is important to note that while research and design into wartime hutting was underway, there was probably in the background a motivating consideration that these temporary military buildings could also prove useful (and even lucrative) in the private sector, as a much-needed housing solution.

Hutting was initially the more imperative concern, but the balance slowly shifted during the war period, with the looming housing crisis slowly taking precedence. The first and most surprising thing to note is how early consideration of post-war reconstruction began.

Forward thinking: Wartime Considerations to Post-War Housing

The Burt Committee

Sir Frederick Lea, Director of the Building Research Station from 1946-1965, said in his account of the Station's history, that the single most important contribution it made during the war years was its work with the Interdepartmental Committee on House Construction, making preparations for the post-war housing construction programme.¹ The Committee was established in 1942 under the leadership of Sir George Burt, who was also chairman of the Building Research Board.² They knew that if they were to avoid the pitfalls of the housing crisis that followed the First World War, they would have to think beyond traditional building materials and instead make use of alternative, lesser-used resources. In this way, it could be said that the wartime hutting programme provided the side benefit of a post-war housing testing ground, a place for evaluating both material performance and expediencies in building construction methods. Additionally in its favour:

The government had at its disposal BRS advice, supported by criteria for assessment of alternative methods and materials, derived from the 1930s and enshrined in Principles of Modern Building. This became the "bible" of the committee set up under Sir George Burt to approve or discard new systems for the post-war house building programme.³

It was the first volume of *The Principles of Modern Building* that so aided the committee as it was initially published in 1938, with a second edition being issued the following year.⁴ It addressed the construction of walls, partitions and chimneys. (The second volume, which dealt with floors and roofs, was not published until

¹ F. M. Lea, *Science and Building: A History of the Building Research Station* (London: HMSO, 1971), p. 92.

² Ibid.

³ George Atkinson, 'Thoughts During the Building Research Establishment's 75th Anniversary', *Construction History*, 12 (1996), 101-107 (p. 103).

⁴ Robert Fitzmaurice, *The Principles of Building, Volume 1: Walls, Partitions and Chimneys* (London: HMSO, 1938).

1961). Lea said that the establishment of the Burt Committee provided a singular opportunity to bring into focus this wealth of new knowledge accumulated since the Building Research Station began operating and set new standards in the construction of housing.⁵ The Second World War forced the building industry to break from past tradition and try new methods. The development of wartime hutting provided the perfect opportunity for testing and assessing alternative materials and prefabricated technology.

The Housing Crisis

It is necessary to examine a few of the circumstances surrounding why the post-war housing crisis occurred. The situation was undoubtedly complex and made worse by various contributing factors, such as the widespread destruction of civilian homes during German bombing raids. Another causative aspect can perhaps be further understood most simply through a study of numbers.

As discussed in Chapter Three, house construction was brought to a virtual halt during the war in order to conserve building materials for the war effort. Only a small number of houses, under the strictest of circumstances, were given permission by the Government for construction. Table 8.1 provides a numerical value to the drop in England and Wales's housing industry during the war, as well as showing the slight increase experienced at the end of the war. The data for this table is taken from the *Statistical Digest of the War*, allowing me to calculate the deficits in new house construction during the war period.⁶

⁵ Lea, p. 92.

⁶ Kohan, pp. 428-429.

<i>Years</i>	<i>Number of Houses Built</i> ⁷	<i>Deficit in New House Construction (as a result of wartime restrictions)</i> ⁸
1935-38 (average)	334,405	n/a
1938-39	332,360	2,045
1939-40	195,962	138,447
1940-41	42,498	291,907
1941-42	9,841	324,564
1942-43	9,577	324,828
1943-44	5,768	328,637
1944-45	5,613	328,792
1945 (Apr.-Dec.)	10,384	324,021
		<i>Total deficit of housing accrued during the wartime period:</i> 2,061,196

Table 8.1 Number of houses built in England and Wales from 1935-1945 with the resulting deficit in housing, (calculated by the author).

These numbers illustrate a national housing market that generally saw the annual construction of more than 330,000 new houses in the immediate years prior to the outbreak of war. From 1939 there is a steady drop, until by 1944 the country faced its lowest figure with only 5,613 new houses given permission for construction. If compared to pre-war figures, taking into account the cumulative loss of new housing during the war years, one can calculate that by 1945, Britain was at a deficit of more than two million houses. This is the loss of what was generally required in peacetime and does not include provision for the large numbers of houses damaged or destroyed by German bombing, which was estimated in March 1945 to be roughly three million houses.⁹

However, the post-war housing crisis was not entirely a product of war. It was also the result of a prevailing and widespread low standard of living, especially amongst the poorest of the population prior to 1939.¹⁰ There had been long-standing

⁷ The figures from this column are excerpted from Kohan, pp. 428-429.

⁸ Author calculated.

⁹ Greg Stevenson, *Palaces for the People: Prefabs in Post-War Britain* (London: B.T. Batsford, 2003), p. 25.

¹⁰ *Ibid.*, p. 22.

social housing problems such as slums (sub-standard mass housing first built in the nineteenth century to provide accommodation for factory workers and their families, built in haste to house huge influxes of poor from the countryside. They were rudimentary when first put up, but without inside toilets or running water, and after nearly a century of poor maintenance, were squalid and unhealthy environments requiring demolition. Aneurin Bevan, Minister of Health, said in 1946 that four to five million new houses were required in Britain before anyone could say that the British people were decently housed.¹¹ The Association of Building Technicians published a book in 1946 entitled *Homes for the People*, which advocated higher housing standards and new construction, and explains why the post-war housing crisis was not just the result of war. Indeed, it could nearly be said that this was a case of a pre-war housing crisis that was compounded by the war.

At the beginning of the war, five million houses out of a total of about twelve million were over 60 years old; two million were more than 100 years old. Some are many-storied, large-roomed, designed for one family with many servants and now hard to clean, draughty, and unsuitable for conversion into decent flats. Others have always been mean and minimum, built in the grim conditions of the early nineteenth century. In some of our towns there are still many streets of the notorious "back-to-backs," houses with only one outside wall. In 1939, 200,000 houses were "unfit for habitation." But besides these there was a large proportion that were damp, verminous, inefficient in a hundred ways, though not officially condemned [...] In this age of mass production, which has developed superb labour-saving appliances, hundreds of thousands of families are doing their household work under 19th century conditions. The cost in drudgery, wasted effort, and loss of health is impossible to assess. Nor is it only in towns that standards are low. Nearly one-third of the parishes in England and Wales had no piped water supply in 1939. Nearly one-half had no proper system of sewerage. The Scott Committee on Land Utilisation said in its Report issued in 1942: "Housing conditions usually associated with slums are both common and widespread in country towns, in villages and among scattered dwellings" [...] Since about 1800 Britain has undergone a period of enormous expansion that has changed it from an agricultural country of nine million inhabitants to a highly industrialised one of 45 million inhabitants. During this period the planning of towns and districts has been, on the whole, haphazard. It is this uncontrolled growth, more than any other one cause, that has made the slums a national scandal.¹²

Thus, the post-war housing crisis that followed the Second World War could be said to be the cumulative effect of years spent without a sufficient building programme, failing to meet the needs of a growing population nor replacing deteriorating housing, further exacerbated by wartime bombing and construction restrictions, imposed to enable the winning of a war. The housing crisis, worsened by material and labour restrictions, seems to be an issue recognised by the

¹¹ The Association of Building Technicians, *Homes for the People* (London: Paul Elek, 1946), p. 9.

¹² *Ibid.*, pp. 15-16.

government as a necessary consequence of war, but an area with the highest priority of addressing once hostilities ceased, to provide homes for the returning soldiers. This is evidenced with the establishment in 1942 of the Burt Committee and the Codes of Practice Committee for Civil Engineering, Public Works, Building and Constructional Work, as well as the changing focus of the Building Research Station to post-war housing solutions.¹³

Prototype Development and Demonstrations of 1944

The Burt Committee's first report, *House Construction: Post War Building Studies No. 1*, was published in 1944.¹⁴ It provided details into alternative materials and construction methods, whilst giving recommendations to those with the most promise.¹⁵ Lea said that the report formed:

*[A] landmark in the history of house construction and the standards it recommended provided the basis for subsequent developments. Further, it is the concept of functions set out in this report and in the earlier Principles of Modern Building that has since so much influenced the approach to architectural design of all kinds of buildings.*¹⁶

The findings of the first report was further supported and disseminated by the Ministry of Health and Ministry of Works in their publication *Housing Manual 1944*, which provided housing guidance to local authorities on everything from site planning and space standards to alternative building materials and kitchen equipment.¹⁷ Another possible key contribution to design was the Dudley Report, issued by the Ministry of Health Central Housing Advisory Committee and published in July 1944. It pulled together the opinions of builders, architects and housewives on 'the most desirable type of house needed.'¹⁸ The committee's recommendations for this report on post-war housing culminated in a lengthy list of specific requests including a minimum of three bedrooms, two living rooms (one for

¹³ Lea, p. 91.

¹⁴ Ministry of Works, *House Construction: Post-War Building Studies, No. 1, The Report of the Committee on House Construction* (London: HMSO, 1944).

¹⁵ Ministry of Health and Ministry of Works, *Housing Manual 1944* (London: HMSO, 1944), p. 8.

¹⁶ Lea, p. 92.

¹⁷ Ibid.

¹⁸ Stanley Gale, *Modern Housing Estates* (London: B.T. Batsford, 1949), p. 177.

study and the other for meals), tiled bathrooms, and all at a cost of less than £700 so that the rent would equate to about 13s. per week.¹⁹

About the same time these reports were published, a sample of temporary houses were built in Northolt, organised by the Ministry of Works, in order to showcase designs, test construction methods and provide estimates of building costs.²⁰ A short account published about this event described why it was seen as significant at the time and the perceived importance of finding alternative methods of construction:

It has been estimated that four million new houses will be needed in a period of between ten and twelve years immediately following the end of the European war. While these houses are being produced, other heavy burdens will fall upon the building industry. Several million houses and other buildings damaged by enemy action will have received only temporary repair; these buildings must be made permanently sound at the earliest moment if worse damage is not to ensue. A six-year accumulation of deferred maintenance will also have started a process of deterioration which cannot be allowed to go unchecked. In addition, many new buildings other than houses will be required: schools [...] factories [...] farm buildings [...] If these results are to be achieved, it is essential that the maximum output and efficiency in building should be secured by all possible means [...] It is clear that, even under the most favourable circumstances, industry will not be able to meet the unprecedented demand without making use of all alternative methods of construction.²¹

Rather than promoting a certain brand or make of prefabricated house, the demonstration used prototype examples to demonstrate and compare how many man-hours could be saved in erection, cost and labour. The first group of examples fell under the category of Steel-Framed Houses. One was named the ‘Northolt’ Concrete-Clad House, and it demonstrated a savings of 900 man-hours versus a normal 2,050 man-hours for a comparable building size constructed of traditional materials.²² It was overall assessed to be ‘economical in labour and materials’ whilst still maintaining ‘a high standard of efficiency and permanence.’²³ (Figure 8.1)

¹⁹ Ibid.

²⁰ Ministry of Works, *Demonstration Houses: A Short Account of the Demonstration Houses and Flats Erected at Northolt by the Ministry of Works* (London: HMSO, 1944), p. 7.

²¹ Ibid, p. 8.

²² Ibid, p. 13.

²³ Ibid.



Figure 8.1 The Concrete Clad House erected in less than two weeks at Northolt. *Demonstration Houses* (1944)

The second example was a prefabricated, steel-framed brick clad house that demonstrated to have no savings in man-hours, but did succeed in showcasing the value of a steel frame within a traditional construction material.²⁴ (Figure 8.2)



Figure 8.2 The steel-framed brick clad house at Northolt. *Demonstration Houses*, (1944)

The third type was a variation of two steel-clad houses developed by the British Iron and Steel Federation, and its architect Frederick Gibberd, which demonstrated how frames, structural components and interior fittings could all be prefabricated.²⁵

The next category was Poured Concrete Houses. Using techniques from the Burt Committee's first report, they demonstrated houses built of concrete poured in

²⁴ Ibid, p. 16.

²⁵ Ibid, p. 17.

situ.²⁶ One used no-fines concrete that only consisted of cement and coarse aggregate.²⁷ A foamed slag concrete house and an expanded clay concrete house were also constructed as part of these demonstrations to further highlight the usefulness of alternative materials.²⁸

The final category was comprised of just one traditionally-designed house constructed of brick. Its purpose was to act ‘as a control or yardstick to serve as a comparison with the poured concrete houses and with the steel-frame brick-clad house.’²⁹ This demonstration of prototypes was significant in that it displayed new methods and forms of construction, a willingness to look beyond traditional practices, and it did all of this with what could only be described as possibly a hopeful eye to the future, because it took place in the midst of war. It was probably also a move on the government’s part to convince the public that despite its departure from traditional house construction, there were many benefits and modern conveniences that made these new prototypes attractive, post-war housing solutions.

Perhaps the most important prototype of this period was one developed in May 1944 by the Ministry of Works. It was an experimental steel and plywood model called the Portal Bungalow, named for Lord Portal, then Minister of Works. Much like the demonstration houses at Northolt, this prefabricated bungalow was put on display at the Tate Gallery with the intent of garnering advice for improvements whilst showcasing its potential to the public.³⁰ (Figure 8.3) The Association of Building Technicians, in their book *Homes for the People* (1946), gave the 620 sq ft emergency bungalow a mixed review: (Figure 8.4)

*There are plenty of cupboards, the kitchen equipment is good, and the bedrooms are excellently planned to give everything needed without wasting space, but the relation of the rooms is very defective. There is no direct path from bedrooms to bathroom or W.C. and the living room is a mere passage.*³¹

²⁶ Ibid, p. 19.

²⁷ Ibid, p. 21.

²⁸ Ibid, pp. 22-23.

²⁹ Ibid, p. 23.

³⁰ Vale, p. 1.

³¹ The Association of Building Technicians, p. 37.



Figure 8.3 The Portal Prefab on display at the Tate Gallery in 1944. (Image courtesy of The Prefab Museum)

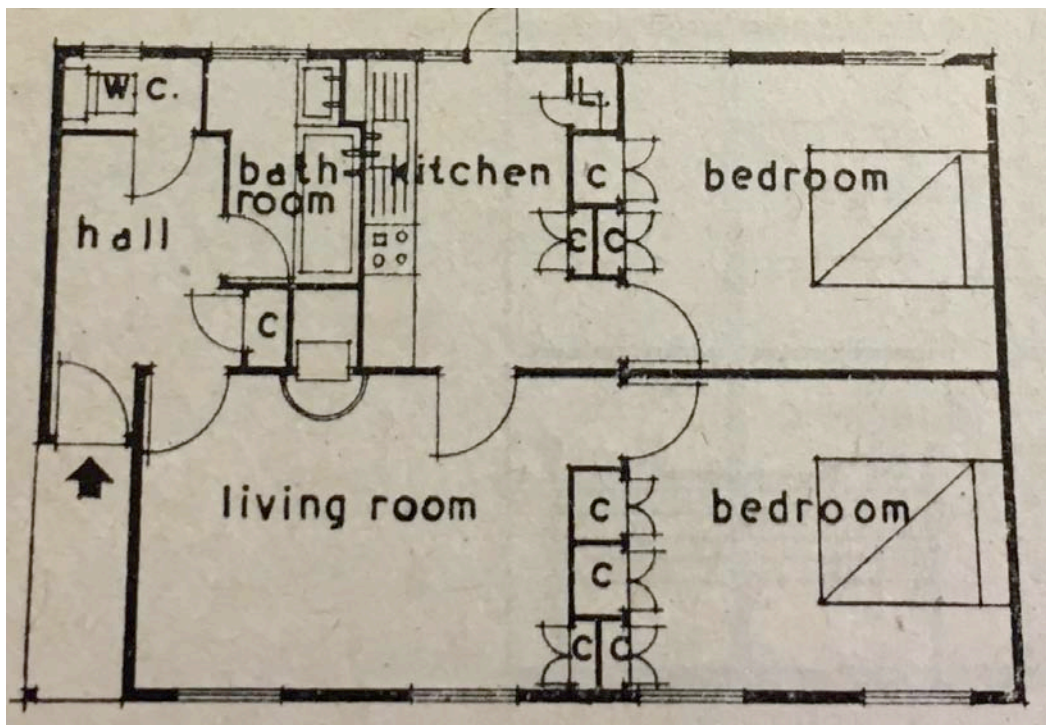


Figure 8.4 The Portal Bungalow Plan, *Homes for the People* (1946).

One can perhaps see from the images above a comparable likeness of this house to a wartime hut design. Ultimately, the Portal bungalow prototype was never actually manufactured but it did become the basis from which several other prefabricated houses, such as Uni-Seco and Tarran, organised their floorplans.³² One feature from the Portal that proved successful was the Ministry of Works-designed kitchen and bathroom, which was manufactured as a prefabricated unit with a shared wall.

³² Vale says the Arcon, the Uni-Seco and the Tarran used some form of the Portal bungalow in their plan or design. (pp. 1-2)

(Figures 8.5 and 8.6) While none of these mass-produced non-standard houses would prove successful, this prototype fitted kitchen foresaw future developments.

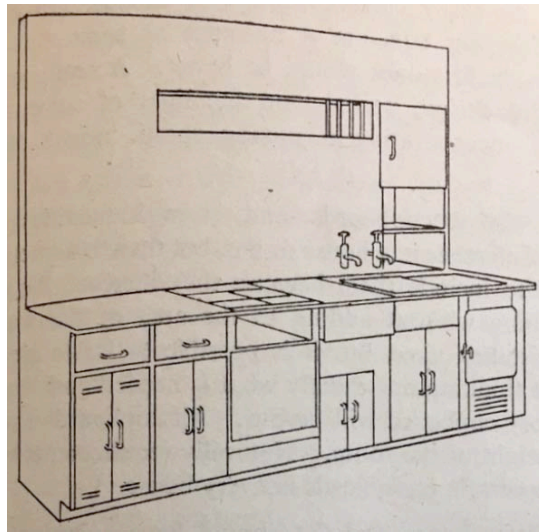


Figure 8.5 The Ministry of Works prefabricated kitchen originally used in the Portal Bungalow. *Homes for the People* (1946)

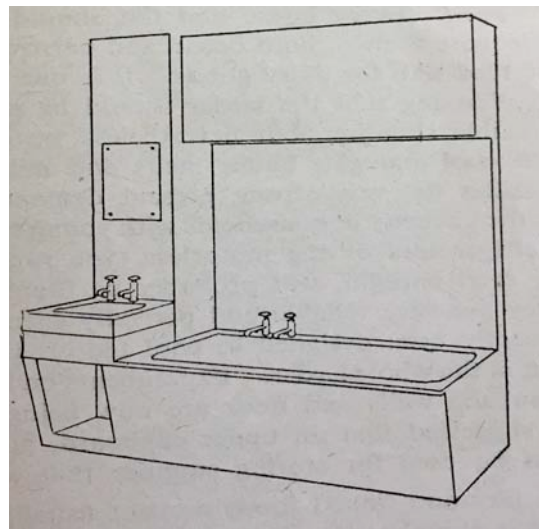


Figure 8.6 The Ministry of Works prefabricated bathroom. *Homes for the People* (1946)

The Timber Industry and Post-War Housing

It should perhaps be considered how post-war housing developments and planning in the wartime period affected the timber building industry. After the severity of wartime restrictions on timber building, it can be reasonably presumed that the industry was looking forward to the end of the war when timber supplies

would be reinstated to pre-war levels and they could once again reestablish their preeminence as the construction material of choice. In 1945, the Timber Development Association displayed this optimism by holding a Timber House Competition, with the winning design coming from architect John Tingay.³³ (Figure 8.7)

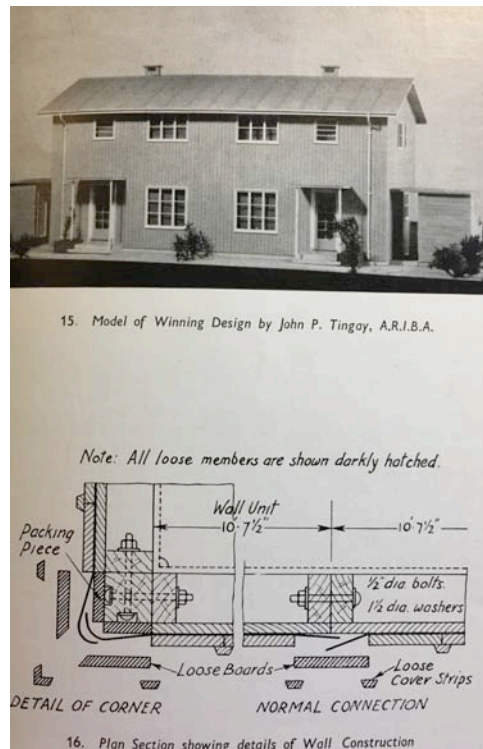


Figure 8.7 A model of the T.D.A. House, a timber post-war prototype, designed by architect John P. Tingay. *Prefabricated Timber Houses* (1947)

Named the T.D.A. House, it was comprised externally of vertical cedar boards, with walls prefabricated in 10 ft wide sections, and internally with plasterboard or plywood.³⁴ However, the optimism and belief in a reviving timber industry that ultimately fuelled this competition never actually came to fruition. Amidst preparations for the post-war period and the flurry of alternative material use and designs by the Ministries of Health and Works, the Timber Development Association released a booklet, *Prefabricated Timber Houses*, in 1944 with a further revision in 1947. It is likely this publication was intended as a way to remain relevant and promote the benefits of timber in a restricted timber market. Phillip Reece, Director of Constructional Research for the Association, said that the original purpose of the publication in 1944 was:

³³ Timber Development Association, *Prefabricated Timber Houses* (London: Timber Development Association, 1947), p. 22.

³⁴ Ibid.

[I]n anticipation of a post-war building programme in which timber housing, on its merits, would play a substantial part. Owing to the shortage of timber this expectation did not materialize, and although timber is the prefabrication material par excellence, such prefabrication as has been achieved in housing has for the most part been confined to building components or to construction in other materials.³⁵

He went on to compliment the experimental work of the Ministries of Health and Works but stated somewhat forbiddingly that until timber was widely available, the full benefits of timber-framed prefabrication would never be realised.³⁶ The booklet includes a range of prefabricated timber house designs, most of which were not practically feasible for construction during the immediate post-war period. It notes that the Americans shipped thousands of Homosote prefabricated timber houses to Britain towards the end of the war, but that they were not generally well liked.³⁷ Sweden also sent a supply of timber houses. While this publication expresses the opinion that the timber industry generally believed that timber supplies would increase quickly after the war, it is clear that there was disappointment when the timber stock was much slower to return to normal availability. Without a ready supply of homegrown timber, it was always going to be an expensive option. Thus, the booklet concludes in the 1947-revised edition:

[F]or the time being, and apparently for many months to come, there is unfortunately little prospect that timber houses, either prefabricated or site-built, can be built in any considerable numbers. Meanwhile, it is hoped that this small book will be of [...] more practical use in the future when timber will be again available to take its place on its merits as a house-building material.³⁸

It is evident from this source that whilst timber post-war housing prototypes were developed and published as designs, timber was still a restricted material even through 1947, further supporting why the post-war building programme needed to rely heavily on alternative materials.

Alternative Materials: Temporary Huts to Temporary Houses

After the War it became clear that most houses would be built using traditional methods with the addition of a limited number of new materials as linings

³⁵ Ibid, p. 5.

³⁶ Ibid.

³⁷ Ibid, p. 20.

³⁸ Ibid, p. 39.

and finishes. There was however a need for temporary accommodation while all these new houses were being constructed. While the most obvious solution was simply to repurpose military huts, there was a concern that these houses might remind people too much of wartime.

From the first it was recognised that housing after the war had to differ from the housing conditions that prevailed during the war. Those returning from abroad, or those who had been working long shifts in factories...did not necessarily want to return to a world that reminded them of war time. If any houses made on factory production lines were to look like temporary barracks and hostels then it was unlikely that they would be acceptable to the majority.³⁹

Thus the Nissen Hut had proven to be a successful, cost efficient temporary accommodation solution through two wars, but it was not selected as part the government's designs for the post-war temporary housing programme. Its distinctive appearance was too reminiscent of military life. Out of sheer necessity, some Nissen Huts were repurposed from bases for temporary civilian housing, but they were not ideal, with the shape not conducive to furniture placement against the walls, and the interior especially loud when rain pelted the roof.⁴⁰

The necessity for non-traditional alternative materials coupled with the remit to garner public support may also explain why the government put emphasis on these designs being only *temporary* houses that would provide a short-term solution until permanent housing could be built:

During a series of BBC discussions on housing which took place in March 1944, after Churchill's announcement of the emergency steel bungalow, the following exchange took place: Mrs White: "Will all the temporary houses be like huts?" Chairman Slade: "I don't know Mrs. White, does bungalow sound better?" The suggestion here is that the image of the factory produced, prefabricated or demountable accommodation was linked in the layperson's mind to what they already knew of the product. Since the proposed Portal bungalow under discussion bore more resemblance to hutting of this type than some of the later successful permanent prefabricated houses [...] the "temporary" label remained to reassure the public that the Portal bungalow was not the only possible model for the house of the factory but merely an interim solution that happened to use similar technology.⁴¹

Vale also argues that the use of the word 'temporary' in relation to these prefabricated houses was a way of providing assurance to the traditional building

³⁹ Brenda Vale, *Prefabs: A History of the UK Temporary Housing Programme* (London: E & FN Spon, 1995), p. 100.

⁴⁰ Interview with Capt. Stanley Perry, Adjutant Officer to a German PoW Camp at Boughton House, 21 August 2017. Perry was in charge of procuring and erecting more than 100 huts for the camp to replace tented accommodation in 1946. He gave his recollections of what it was like to live in a Nissen hut.

⁴¹ Vale, p. 107.

industry and trade unions that this was only a short-term emergency measure and that their jobs would be secure in the long-term with the permanent housing programme that would follow.⁴²

The Temporary Housing Programme

Between 1945-1949, the Housing (Temporary Accommodation) Act of 1944 authorised the government to spend £200 million towards the first stage of the post-war building programme of temporary housing, an amount that resulted in 158,748 new prefabricated houses.⁴³ The plan, known as the Temporary Housing Programme, was put under the auspices of the Ministry of Works and the Ministry of Supply. They ultimately chose a selection of prefabricated designs, some of which were proposed by companies who also supplied wartime huts, such as Uni-Seco, Tarran and Orlit.⁴⁴ (Table 8.2)

<i>Authority Responsible for Production:</i>	<i>Type</i>	<i>Number of Houses Constructed:</i>
The Ministry of Works	Arcon	41,000
	Uni-Seco	29,000
	Tarran	19,015
	U.S.A.	8,450
	Phoenix	2,428
	Spooner	2,000
	Universal	2,000
	Orlit	255
	Miller	100
The Ministry of Supply	Aluminium	54,500
	Total:	158,748

Table 8.2 The number of prefabricated houses initially authorized for construction in 1945. (Kohan, 1952)

⁴² Ibid, p. 108.

⁴³ This figure was provided by Kohan in 1952, (p. 428), however, Brenda Vale estimates a slightly lower figure of 156,623 and R.B. White estimated 156,667. It's unclear which figure is correct. White's figure was taken from White Paper Cmd. 7304 in 1948, and Kohan's quote is for houses constructed through 1949. See Vale, p. vii. R.B. White, *Prefabrication*, p. 139. White also says the Act provided spending only £150 million towards the programme. White Paper Cmd. 6609 (March 1945) proves that Kohan was indeed correct, that Section 5 of the Act provided an additional £50 million, bringing the budget to £200 million.

⁴⁴ This table is provided from information extracted from Kohan (p.428). Missing from Kohan's house list is the Isle of Lewis design, also manufactured in the early post-war period, however only 50 houses were built likely due to its exceptionally high cost of £2000/each.

These initial prefabricated designs were intended to be a temporary solution to meet the emergency state of housing required in Britain immediately following the war. Their specified lifespan certainly supports this as most were only assured for a short duration of ten to fifteen years, although many lasted much longer. From the figures provided in the above table, it is evident that the most popular designs were the Aluminium, Arcon, Uni-Seco and Tarran. This is reflective of the fact that these four designs were the earliest frontrunners to be approved by the Ministries of Health and Works.⁴⁵ Two of these, Uni-Seco and Tarran, (as well as the lesser produced Orlit), were also suppliers of wartime hutting and seem to have successfully made the transition, meeting the needs of both wartime and post-war civilian housing.⁴⁶ As Vale surmised:

The chief area of experiment with prefabrication techniques in Britain began with the war-time programme of hutments. The use of prefabrication in these structures formed a precedent for the later Temporary Housing Programme and firms such as Tarran and Seco, later associated with the temporary bungalows, were involved in the design of huts from the start.⁴⁷

The study of these early post-war prefabricated houses has already been covered in detail by various authors including Brenda Vale, Nicholas Bullock, Greg Stevenson, R. B. White, and thus will not be discussed further here. However, it is worthwhile and relevant to this study to further examine the few designs that were developed into civilian housing from wartime hutting.

The Houses

The Uni-Seco House

During the war, Universal-Selection Engineering Company, or Uni-Seco Structures, Ltd. as they came to be known, developed a system of construction for hutting that consisted of prefabricated timber panels filled with wood wool and encased on both sides with asbestos cement sheeting, slotted into a frame and erected as a wall unit onto keel plates. These panels were used for both walling and roofing, made waterproof by covering in bituminous felt. For post-war housing, they

⁴⁵ 'The Four Official Temporary Houses', *Architects' Journal*, (20 November 1944), p. 392.

⁴⁶ The Seco Hut is discussed in Chapter Five and the Tarran Hut in Chapter Six. Further details can be found in Appendix B.

⁴⁷ Vale, p. 70.

merely applied their system of panels to a bungalow plan. There were several types, of which Mark III, Mark IV and Mark V seemed to be the most common. The following images were taken from a wartime brochure *Seco...In War and Peace*.⁴⁸ (Figures 8.8-8.12)



Figure 8.8 Wartime catalogue cover issued by Uni-Seco Limited to illustrate its wartime hutting and post-war housing solutions. (Airfield Research Group)



Figure 8.9 A Seco panel is inserted into the frame. (Airfield Research Group)

⁴⁸ Held in the Airfield Research Group Archive.



Figure 8.10 Laying the roofing panels. (Airfield Research Group)

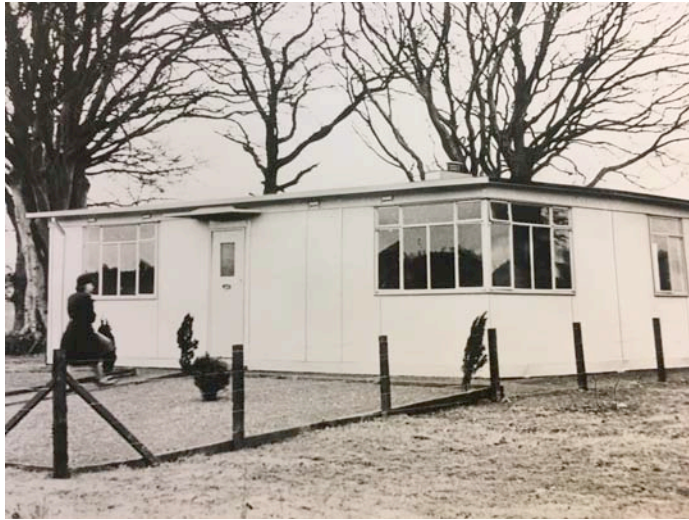


Figure 8.11 The constructed Mark III Seco House. Note the distinguishing feature of full corner windows. (Airfield Research Group)

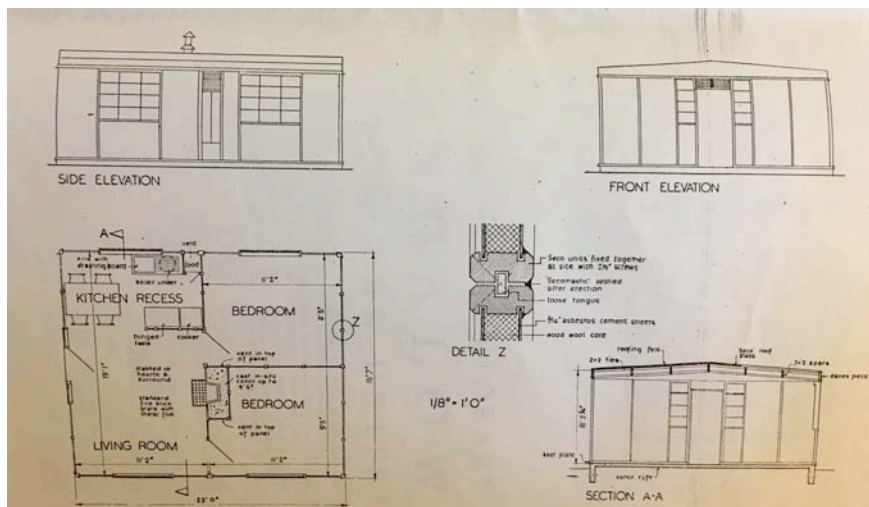


Figure 8.12 A plan for a Mark III Seco House. *The Architects' Journal* (26 October 1944)

The Uni-Seco House had a distinctive box-like shape and a nearly flat roof with an extremely shallow pitch, just like the military hut version. (Figure 8.13) They often had corner windows and like the huts, were designed to be demountable. Its internal plan was improved at various points but the external appearance generally remained the same.⁴⁹ Vale estimates one Uni-Seco House cost around £1100 to construct, with a total government expenditure from 1945-1948 of £32,798,000.⁵⁰

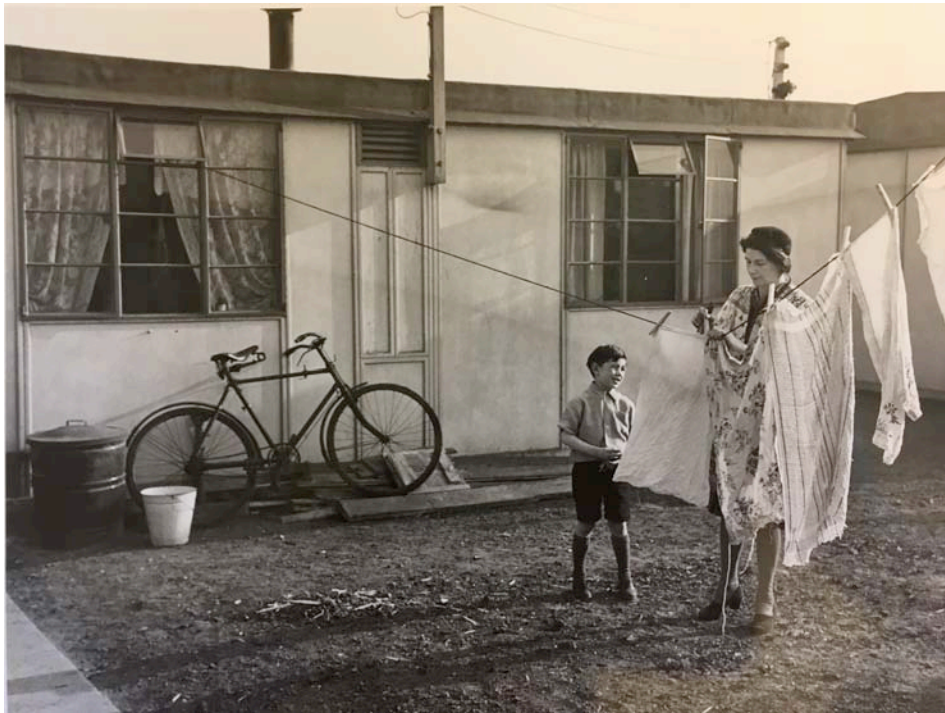


Figure 8.13 A mother and child outside of their Uni-Seco house c. 1947. (Airfield Research Group)

Survivals of these temporary buildings still existed well into the 1990s with some of the original owners still inhabiting the same prefabricated house they had moved into just after the war ended. The *Telegraph Magazine* ran an article during this period that visited surviving prefabs erected in the post-war period and interviewed the owners.⁵¹ One man, George Bale in Bristol, said he originally moved into his Uni-Seco house in September 1946 and that each house took three days to finish.⁵² Nearly fifty years later, the Bristol City Council renovated his house with new heating, insulation and a coat of paint.⁵³ The Excalibur Estate in Catford,

⁴⁹ For more information, see White, p. 148.

⁵⁰ Vale, p. 148.

⁵¹ Lesley Gillilan, 'Built not to Last', *Telegraph Magazine* (undated but likely 1993-95), pp. 26-31.

⁵² *Ibid.*, p. 28.

⁵³ *Ibid.*

south-east London was noted in 2013 as the largest surviving estate of wartime prefabs still standing in Britain, with 187 houses (mostly Uni-Secos), although they have since been mostly demolished.⁵⁴ One resident said it often felt like living in a holiday camp all year round.⁵⁵ When John Grindrod did his research for *Concretopia* (2013), he found that one notable feature of the Excalibur Estate was the lack of anything above head height other than telephone poles or trees, throughout the entire neighbourhood.⁵⁶ He provided this commentary on the surviving state of the Uni-Seco Houses at Excalibur:

Though factory produced, there was something strangely organic about these houses. Whereas the surrounding Victorian brick buildings had the look of giant fossils – long dead beasts that had become immovable features of the landscape – the prefabs had none of that sense of rock-solid permanence. Instead, they were slowly sagging, stricken by rickety joints and crumbling skeletons, worn out by the constant, losing battle to halt the decay evident in their mottled skin.⁵⁷

The Tarran House

The Tarran House was developed in 1943 by Hull-based Tarran Industries, the same company who designed the parabolic Tarran Hut during the War.⁵⁸ Between 1944 and 1956, they developed several different prefabricated models such as the Dorran, Myton and Newland, but the one selected for the initial post-war housing programme was the Tarran House.⁵⁹ It was constructed of prefabricated ‘Lignocrete’ panels that consisted of Portland cement mixed with chemically treated sawdust.⁶⁰ The Lignocrete panels formed the walling while asbestos cement sheets were used as the roofing material. Plasterboard was used to line the interior walls. Several variations were experimented with including a two-storey model that Tarran showcased in London in 1943. However, ultimately the company adopted a two bedroom plan-form that was nearly identical to the one used by Uni-Seco, both based upon the Portal Bungalow.⁶¹ It is likely this was necessary to conform to the requirements of the Temporary Housing Programme, which tended to adhere to a

⁵⁴ John Grindrod, *Concretopia: A Journey Around the Rebuilding of Post-War Britain* (Brecon: Old Street, 2013), p. 21.

⁵⁵ *Ibid.*, p. 31.

⁵⁶ *Ibid.*, p. 25.

⁵⁷ *Ibid.*

⁵⁸ See Chapter Six.

⁵⁹ Harry Harrison, Stephen Mullin, Barry Reeves and Alan Stevens, *Non-Traditional Houses: Identifying Non-Traditional Houses in the UK 1918-75* (Watford: BRE, 2004), p. 448.

⁶⁰ Vale, p. 12.

⁶¹ Vale, p. 13.

standard layout of two bedrooms, a living room, bathroom and kitchen combination unit, and often included both a garden and a shed.⁶² The Tarran prefabricated house had a traditionally pitched roof, could be constructed in less than a day, but was also the heaviest of the most popular prefabs, weighing 14 tons as opposed to 8 tons, which was the more common weight of the other houses.⁶³ It cost roughly £1100 per house to construct.⁶⁴ (Figure 8.14)



Figure 8.14 A Tarran House c. 1990. (Photo by Paul Francis, Airfield Research Group)

The Orlit House

The Orlit House, designed by architect E. Katona for Orlit Limited, was offered in two models and constructed into the 1950s. One type was a bungalow and the other was a two-storey house that could also be terraced to make multiple units.⁶⁵ It was constructed of reinforced concrete columns and beams with the

⁶² Stevenson, p. 60.

⁶³ Ibid, p. 88.

⁶⁴ Ibid, p. 100.

⁶⁵ Harrison, p. 400.

interior walls and ceilings lined with plasterboard.⁶⁶ The roof came in two styles. It could be constructed of timber with a medium pitch and tiles, or it could be flat with 4 ft by 1 ft 4 in. by 2 in. thick precast concrete slabs covered with bituminous felt, similar to the Uni-Seco.⁶⁷ (Figures 8.15-8.19) The benefit of this design was that it was constructed nearly entirely of pre-cast concrete, and whilst small cranes and steel jigs were necessary to move the heavy parts, it was said that the overall erection process was quick and could be done with unskilled labour.⁶⁸ The Orlit House cost £1200 to construct.⁶⁹

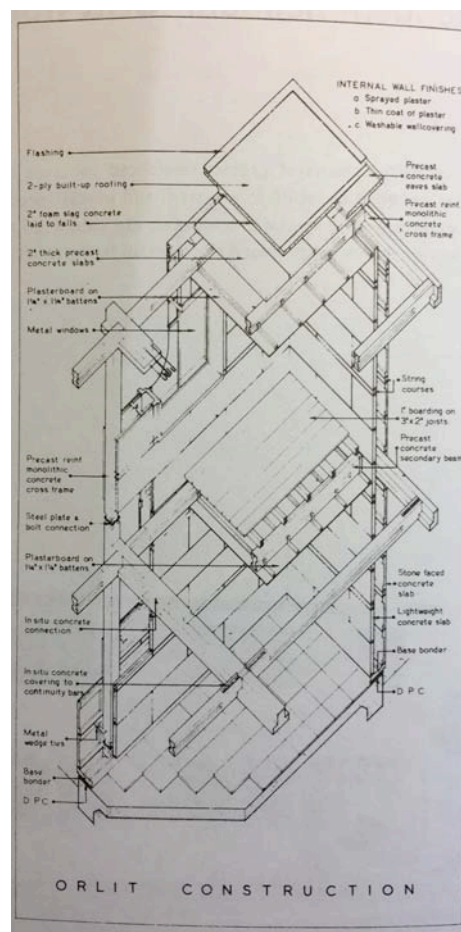


Figure 8.15 Orlit construction details. (Building Research Establishment)

⁶⁶ Ibid.

⁶⁷ Ibid.

⁶⁸ Francis Digby Firth, 'The House: Non-Traditional Methods of House Construction', (*Unknown publication held as a photocopy by Airfield Research Group*), 855-873 (p. 868).

⁶⁹ Stevenson, p. 100.

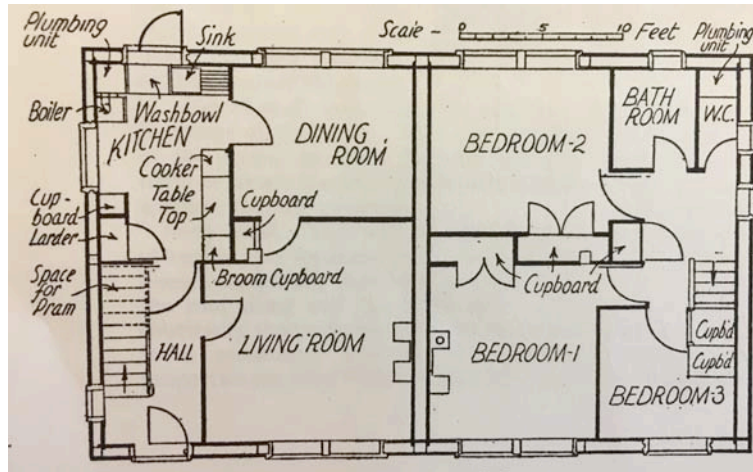


Figure 8.16 Plan for an Orlit house divided into two residences. (Image from 'The House: Non-Traditional Methods of House Construction' by Francis Digby Firth, Airfield Research Group)



Figure 8.17 The pitched roof Orhit House c. 1990. (Photo by Paul Francis, Airfield Research Group)



Figure 8.18 The flat-roofed Orlit House c. 1990. (Photo by Paul Francis, Airfield Research Group)

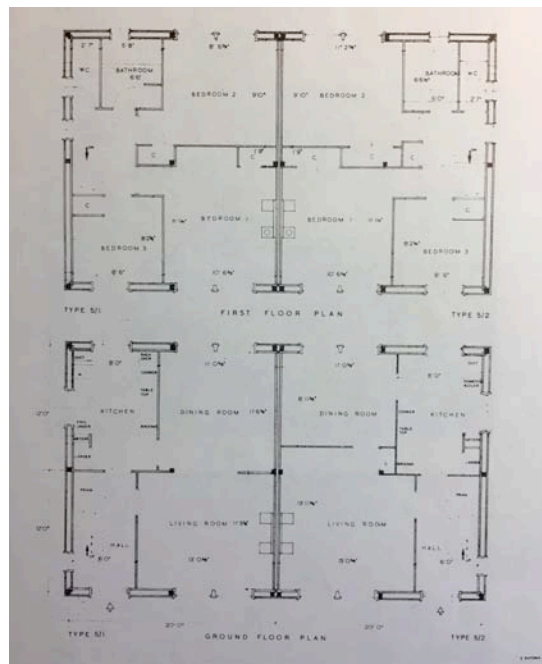


Figure 8.19 The Orlit House Plan (two-storey). (BRE)

Post-War Housing

Prefabricated housing estates were set up around the country with the largest number typically going to the places that had received the greatest amount of bomb damage, such as London, Coventry, Liverpool, Birmingham, Bristol, Plymouth,

Portsmouth, Hull, Norwich and Manchester.⁷⁰ (Figure 8.20) The government established a set of requirements for the allocation of the housing, giving priority to families with more than one child. Despite concerns that the public might be reticent to accept prefabricated, non-traditional houses as the government's solution to the post-war housing crisis, they were fairly well received. Many people who moved into these houses had come from living in cramped conditions without electricity or even indoor plumbing. The difference in their improved quality of life was likely quite overwhelming:

Moving into a home with electric lighting and sockets, a plumbed-in internal bathroom and toilet, hot water on tap, a wash boiler, cooker and refrigerator was an exciting event for the original occupants of Britain's post-war prefabs. To have moved from rented 'rooms' where people often had to share a toilet, bathing and cooking facilities with other families, to having all the latest mod cons for oneself was a memorable occasion.⁷¹

As Neil Kinnock, former Labour Party Leader and prefab housing resident, remarked:

It had a fitted fridge, a kitchen table that folded into the wall, and a bathroom. Friends and family came visiting to view the wonders. It seemed like living in a spaceship.⁷²

Although the first prefabricated houses of the post-war period seemed to have much to recommend them at the time, they also had some detracting elements that prevented them from ever being fully ideal accommodation. Not everyone appreciated their appearance or temporary, lightweight design. They were also often susceptible to damp and could be very cold. John Grindrod noted during his visit to the Excalibur Estate in 2013:

'I'm sure the Selection Engineering Company would be proud – and perhaps also shocked – to know that a whole estate of them is still standing, nearly 70 years after their construction. Despite their initial popularity, it soon became apparent that these miracle boxes, and many others like them, weren't perfect: there were leaky roofs; their thin walls and single glazing let the warmth out and the cold in; and the concrete, or sometimes wooden, bases allowed the damp to rise [...] These days a damp cardboard smell permeates many of the remaining buildings. And while their frailty and small scale makes it easy to feel a connection with them, the same qualities can also prompt resentment – even without the many tragic cases of asbestosis and bronchitis that have been attributed to them.'⁷³

⁷⁰ Ibid, p. 55.

⁷¹ Stevenson, p. 103.

⁷² Ibid.

⁷³ Grindrod, p. 29.

Vale makes the interesting point that the temporary prefabricated house was the first product that benefited from the strides made in wartime organisation and technological development in housing.⁷⁴ Much like wartime hutting, they were not meant to last beyond ten to fifteen years, yet they proved to survive remarkably well. Although temporary, the quality of construction was such that even with using alternative materials and constructing during a period of strict austerity, they managed to succeed in designing and building houses that surpassed their original remit. However, their failure, as detailed by Colin Davies, was in large part economic, none of the types securing sufficient numbers to allow economies of scale.⁷⁵ They were also quite flimsy, cheap and lacking durability, thus while a good solution for short-term accommodation, much like hutting, they were never going to be popular as long-term housing.

By the mid-1960s, when the post-war temporary, prefabricated houses were supposed to be dismantled and disposed of, having served their purpose, 71% were still standing.⁷⁶ Not only did they continue to provide much needed housing solutions to some towns, but often the people who resided in them were happy and wanted to remain. The Guardian published an article about surviving prefab estates in 1992:

*Notwithstanding condensation and poor insulation, the occupants loved them. And even now, with what may be a remnant of wartime spirit, existing tenants are prepared to defend them. In Catford, John Taylor and his fellow residents were so concerned for the future of their North Downham estate that they applied to Lewisham council to run it themselves as a tenants' co-op. Now, their Excalibur Co-operative collects rents and oversees maintenance. Almost every city authority has a prefab story to tell. Birmingham used to have 4,000 of them. And when they announced in 1978 a five-year plan to phase them out, hundreds of residents lodged petitions. "One minute they were cold, damp houses," said Maureen McDermott of Birmingham Housing Authority. "The next they were all saying, 'keep your hands off my little palace.'"*⁷⁷

One could say that there was a clear flow of innovation and technology development that began with wartime hutting and led to the first temporary post-war bungalow designs, which in turn led to the more permanent prefabricated houses

⁷⁴ Vale, p. 24.

⁷⁵ The reasons for the complete failure of prefabricated houses are set out in Colin Davies, *The Prefabricated Home* (London: Reaktion, 2005).

⁷⁶ Grindrod, p. 30.

⁷⁷ Lesley Gillilan, 'Absolutely Prefabulous', *The Guardian Weekend* (5 December 1992), p. 37.

that followed in the 1950s.⁷⁸ Each group could be said to be the prototypes for the ones that came next. Of course, the most obvious influence of WWII huts was on the continuing construction of military huts in the Cold War. Wayne Cocroft, Roger J.C. Thomas and P.S. Barnwell have written on the more permanent surviving buildings from this period but a survey of temporary military buildings from the Cold War has yet to be written.⁷⁹ Likewise, the development of wartime hutting provided a basis for temporary building types in use today at refugee camps and by the military stationed in inhospitable environments. This however lies beyond the scope of this thesis.

The pressures of wartime requirements created an environment where technology, methods and materials made leaps and bounds in improvements and applications, in ways that would not normally be seen in peacetime. The overall result was a military better accommodated in training and in the field, a country's people better housed with an improved quality of living, and a building industry with more knowledge of methods and materials than before.



Figure 8.20 A prefabricated housing estate in Great Yarmouth c. 1947. (Photo held by Paul Francis, Airfield Research Group)

⁷⁸ This study only addresses the first prefab houses that directly stemmed from hutting. For more on the problems of post-war non-traditional houses see R.B. White's *Prefabrication* (1965), Davies, *Op. cit.* and Building Research Establishment's *Non-Traditional Houses* (2004).

⁷⁹ Wayne Cocroft, Roger J.C. Thomas, and P.S. Barnwell, *Cold War: Building for Nuclear Confrontation 1946-1989* (Swindon: English Heritage, 2003).

Conclusion

The famous Nissen brand is too often used to describe any kind of temporary military hut during the twentieth century, much like the Hoover name has come to describe all vacuum cleaners. As this thesis has shown, there were in actuality a great many other huts used during the First and Second World Wars, of which the Nissen was just one and far from being the most important.¹

This thesis provides the first comprehensive list of hut designs for the First and Second World Wars. The full lists and descriptions of each hut are given in the appendices. These lists, 20 types for the First World War and 52 from the Second World War, show the huge range and scope of the huts used and is the major contribution of this thesis. Of course this list cannot hope to be exhaustive. Firstly, the concentration here is on generic types. Some huts were designed as one-offs and there is no possible way to catalogue these. This thesis has focused instead on those designs or industrially-produced types, which were meant to be produced en-masse as generic solutions to the problem: the sort of hut which might justifiably be given a name (such as a 'Tarran', a 'Seco', etc.). This thesis enables future historians to be able to identify these types. Secondly, while every attempt has been made to make as comprehensive a list as possible of the huts used in the two World Wars, and hopefully all the most common types have been captured, the sources are limited and it is quite possible that some hut designs have been missed, either because the sources were not apparent or because, although the idea was put forward, it resulted in very few examples or never went beyond the drawing board and has thus been invisible to the historical record. What this thesis will do is allow such huts to be added to the existing list if and when they are discovered. In other words it provides, what is hopefully a firm basis, for future research.

¹ As described in the Introduction with reference to John Martin Robinson's book *Requisitioned* (2014), which referred to a group of architect George Cole's Standard Army Huts, constructed of reinforced concrete, as 'ugly wartime Nissens.'

Whilst huts could be bespoke, built or altered on site to an exclusive design, the generic form of construction provided added benefits in wartime, such as mass-production in a factory, kit-like packaging, transportability, and quick erection on site by unskilled labour with the minimum of tools. Thus, this thesis challenged the Nissen misconception by providing a broad survey of the many other generic and temporary military buildings erected during the First and Second World Wars. Furthermore, this thesis illustrates the leaps made in material and construction innovation as a direct result of wartime necessity and details how these advances were successfully applied to post-war housing.

The first chapter set out the background for the use of prefabricated military and civilian buildings. It traced their development from the earliest Roman and Norman examples to the development of modern military huts in the late Georgian period, when the need for temporary timber barracks arose during the Napoleonic Wars. The Industrial Revolution, the invention of corrugated iron, and the development of prefabricated houses for use in distant colonies, all contributed to the creation of the temporary, military hut as a building type, with the first probably being the Gloucester Hut used in the Crimean War. This chapter showed that there were similar themes from all of these periods showing that wartime hutting is not necessarily a modern invention.

Chapter Two is the first of the main chapters which set out to describe the huts themselves. It discussed the engineers of First World War hutting, many of whom made important contributions but have perhaps been overshadowed and forgotten in history by Nissen and how they were able to draw upon the advances made in technology and materials in the nineteenth century to devise at least twenty new types of temporary wartime buildings, many of which have been rediscovered through this research. This thesis showed that rather than one Armstrong Hut design, there were actually several. Major Armstrong's first design, the Type Plan Hut, made probably the most significant and immediate contribution to the war effort by providing military accommodation across Britain for Kitchener's New Army. Armstrong then designed several other temporary huts all of which seemed to be referred to as Armstrong Huts, but were in fact, as this thesis has shown, quite different. Other

designs were developed by private inventors such as Aylwin, military engineers such as Brocklehurst, Liddell and Nissen, as well as large civilian building firms such as Tarrant. Scott-Moncrieff and Baker Brown's papers on the subject of hutting during the war were key to understanding the various problems encountered such as material and labour shortages. Scales of accommodation were also reduced from 60 sq ft to 40 sq ft per person to allow more soldiers to sleep in each hut. This research has found that the problem of hutting in the First World War was two-fold. It necessitated more static, temporary hutting on the home front and more portable hutting on the front lines of France, both of which needed to be easily and quickly erected with a minimum amount of unskilled labour. This was a theme that was repeated in the Second World War. This chapter also provided evidence that the Nissen Hut, widely thought to only have been erected abroad during the First World War, was probably also erected in England.

Chapter Three focused on the development of hutting in the Second World War with a brief discussion of the work of the Building Research Station in the interwar period, and how it influenced non-traditional materials in hut design. Due to the broader employment of hutting, for both civilian and military use, huts were required on a much larger scale than that of the First World War. This helped to promote the standardisation and prefabrication of generic hutting that could be built quickly from a set kit of parts. This war also differed in that it employed the work of more civilian architects and less military engineers. Severe material shortages and controls likewise pushed hut designs to new heights by applying both old and new materials in fresh ways. The idea of portable versus static helped the government in allocating materials, assigning timber and steel to portable hutting for use overseas and leaving static hutting in Britain to be constructed of alternative materials. Scales of accommodation were reduced even further from the First World War, down to 36 sq ft per soldier. In this research, over fifty huts were identified and considered, some of which have never before been studied. The lessons learnt from using alternative materials and construction methods in wartime hutting during this period had the additional effect of providing a firm basis for temporary post-war housing designs.

It is not possible to provide summaries of all the Second World War huts within the word limits set to a PhD thesis. A brief summary of all of them is provided

in the appendices. Instead of attempting to provide a list, this thesis groups the huts broadly according to material and the key examples of huts in each group are then discussed in detail. Chapter Four was the first of these material chapters. It studied the small number of huts constructed predominately from timber, and how the sizes of the timbers changed as controls became more strict, leading to flimsy hut designs. This had the additional effect of necessitating a suitable cladding that was light enough to be supported by the reduced timber sizes. This chapter specifically looked at the X, Y and Z Huts, the Ministry of Supply Timber Hut, the Blister Hut, and the Transportable Timber Huts.

Chapter Five studied the use of composite materials in hutting during the Second World War. They were developed as building materials in an effort to conserve and reduce in the use of traditional building materials like timber and steel. The history of the plasterboard, wood wool, and plywood were highlighted followed by a survey of several composite huts designs such as the Ministry of Supply Living Hut, the Ministry of Supply and Ministry of Works Plasterboard Hut, the Ministry of Works Hall Hut, the Seco Hut and the Plywood Hut, several of which have never been properly identified or studied.

Chapter Six focused on the use of concrete and asbestos in hutting as another alternative to traditional building materials. Nearly two dozen huts were identified that made use of concrete and/or asbestos in their design, the largest of any of the Second World War hutting material types. It looked at the Mopin Hut, the Plycrete Hut, the Precast Paving Slab Hut, the Nofrango Hut, the Hessolite Hut, the Quetta Hut, the Patrick Portable Hut, the C'tesiphon Hut, the Tarran Hut, the B.C.F. Huts, the Ministry of Works Standard Hut, and the Handcraft Hut.

Chapter Seven studied corrugated iron, probably the most iconic of wartime building materials, from its advent in 1829 to its application for portable buildings. Eleven huts constructed with corrugated iron as a cladding were identified during the Second World War period. The chapter focused specifically on the Nissen Hut, the Romney Hut, the Semi-Romney Hut, the Iris Hut, the Quonset Hut, and the Jane Hut.

Chapter Eight sought to demonstrate how the knowledge gained from the development of hutting was transferred into post-war housing designs in the years

immediately following the end of the war. This chapter also looked at the wartime involvement of the Building Research Station and the Burt Committee. Finally, it identified three hut manufacturers (Tarran, Orlit, and Uni-Seco) who succeeded in shifting their wartime building programmes into post-war housing using similar, if not the same, design principles to their huts.

Contribution to Existing Scholarship

This research adds to the current pool of knowledge, filling the gaps in Mallory and Ottar's *Architecture of Aggression* (1973), expanding upon Francis's *British Military Airfield Architecture* (1996), and forging links between Gilbert's *Pioneers of Prefabrication* (1978), Mornement and Holloway's *Corrugated Iron* (2007), Douet's *British Barracks* (1998) and White's *Prefabrication* (1965). This work stands to provide a general guide to the development of military hutting as a building type.

This research also contributes to scholarship in a more practical way by providing important documentary details, which can help in correctly identifying huts in the field. This was made evident through the following recent example: Near Bury St. Edmunds in Suffolk is an organisation called Great War Huts that seeks to buy and restore surviving huts for their First World War museum. They recently procured a hut from the Girton Women's Institute near Cambridge with an interesting history, a fact that also serves to demonstrate the often-longstanding fate of these buildings once considered to be purely temporary. Until recently, it was believed that the hut came from a First World War hospital in Cherry Hinton established to care for soldiers with venereal disease during the war. The hospital was located in a field, southeast of Cambridge, between the modern streets of Cowper Road and A1134. During the Ministry of Munitions sales in the 1920s, the Women's Institute of Girton purchased the hut, and moved it by horse and cart from Cherry Hinton to its final location on the High Street in Girton.² The government included the benches, chairs and tables in the sale of the hut. It served as the Women's Institute up until 2017 when it was

² Angela Blackburn, 'Focus on Girton Women's Institute', *Girton Parish News*, (2009) <http://www.girton-cambs.org.uk/focus/wi.html> [accessed 16 May 2017]

purchased by the owners of Great War Huts. The only disruption occurred during the Second World War when it was requisitioned and occupied by the Home Guard.

Upon beginning the process of dismantling the hut for transport to the museum site, one of the owners, Taff Gillingham, shared images on a social media site of the corrugated metal sheets that covered the exterior walls and the roof. Based upon my research for this thesis, it appeared to me to be a rare survival of one of Armstrong's original Type Plan Huts for the War Office, constructed just prior to the corrugated metal shortage when most of Armstrong's huts shifted to timber. I made this comment but Gillingham did not initially agree, saying that the hut was not built in sections and that the timber frame was much heavier than others they had seen. It was also slightly wider than the standard 20 feet. I responded, referencing Scott-Moncrieff's 1924 article, that Armstrong's first designs were not constructed in sections. Sectional construction only became important later in the war. Thus, the earliest huts were built of a wooden framework with corrugated iron roofs and external sides, identical to what we were seeing with Girton's WI hut. Gillingham did some further research and came back to confirm I was indeed correct in my assertion. Until my comment, it had been believed that the hut was constructed as part of the hospital buildings. However, my observations pushed Gillingham to research further and discover that prior to the hospital, there had been an army camp on the site and that the hut had served as part of the barracks, constructed in October 1914 during the earliest phases of establishing Kitchener's First Army. The camp for 1,000 men was built in just six weeks by local contractor William Sindall.³ It initially accommodated the 11th Service Battalion, Suffolk Regiment, until it was repurposed as the hospital. (Figures C.1, C.2)

³ 'Cherry Hinton WWI Hospital', <http://www.capturingcambridge.org/queen-ediths/cherry-hinton-road/cherry-hinton-wwi-hospital/> [accessed 16 May 2017]



Figure C.1 Interior view of the Armstrong Type Plan Hut prior to dismantling for its move to the Great War Huts site. Originally built in October 1914, it was repurposed as the Girton Women's Institute Hut c. 1920. (Taff Gillingham and Great War Huts)



Figure C.2 Dismantling of the Girton Women's Institute Hut shows the original corrugated metal sheets set to the timber frame. (Taff Gillingham and Great War Huts)

This discovery comes as a direct result of this thesis, highlighting the current gap in knowledge and the importance of this research, whilst making it evident this is work that should be published and made available to aid other historians working in this area.

Geoffrey Scott wrote on the eve of the First World War that the art of architecture studied not structure in itself, but the effect of structure on the human spirit.⁴ Never was this more truly applied than in that Great War, when men found shelter out of the mud and elements in something more substantial than a canvas tent. The most humble and plain of building types cannot be underestimated for its effect on the human spirit, especially in the midst of an armed conflict. Like Herbert said of prefabrication, the history of the hut could very well be seen as a record of successful response in the face of recurrent crises. A temporary building often only designed to last three to five years, can still be found standing in some cases a hundred years later, on airfields, nestled in overgrown wooded areas, and dotted randomly around the British landscape. Some still serve as school buildings, community centres, storage sheds and even village halls. Sir Henry Wotton said that ‘The end is to build well.’⁵ This thesis has hopefully shown that British builders and engineers adhered to this principle, sometimes with only second-rate materials at hand and often without proper tools or sufficient manpower, expanding the realm of knowledge into new building methods with both traditional and non-traditional materials, whilst simultaneously providing that all-important human necessity: shelter.

Further Work

Although this thesis has identified many previously unknown hut types, it is only the start. Further study is, of course, required to explore the lesser-known huts identified in this thesis in more detail. At present, there seems to only be in-depth studies made of the Nissen Hut and the Quonset Hut. It would be useful if other widely produced huts could receive equal, singular attention. In addition, a comprehensive field survey of surviving huts in Britain (and possibly British huts still in France) would be invaluable to filling the remaining gaps in knowledge. A study of

⁴ Geoffrey Scott, *The Architecture of Humanism* (London: Constable & Co., 1914).

⁵ Henry Wotton, *Elements of Architecture* (London: 1624).

some of the inventors of this period would likewise be useful, especially the most prolific such as B. H. O. Armstrong in the First World War and James H. de W. Waller in the Second World War. There is likely also more research that could be done delving into the catalogues at the National Archives. Finally, social historians could explore the stories of the people who lived in huts both during wartime and as repurposed accommodation in the post-war periods. This research will hopefully provide a spring-form for such work.

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Appendix A

First World War Huts

1. The Adrian Hut	A2
2. The Air Ministry Concrete Hut	A7
3. The Armstrong Type Plan Hut	A8
4. The Armstrong Hospital Hut	A11
5. The Armstrong Hut No. 4	A12
6. The Armstrong Timber and Canvas Hut	A14
7. The Armstrong Timber and Canvas Tent	A15
8. The Aylwin Hut	A16
9. The Cavanna Hut	A18
10. The Forest Hut	A19
11. The Liddell Hut	A20
12. The Nissen Bow Hut	A22
13. The Nissen Hospital Hut	A24
14. The R.G.B. Standard Light Portable Building	A26
15. The Somerville Hut	A27
16. The Swiss Liddle Hut	A29
17. The Tarrant Dechets Portable Hut	A30
18. The Tarrant Light Portable Sleeping Hut	A32
19. The Tarrant Portable Mark II	A34
20. The Weblee Hut	A36

The Adrian Hut

Designer: Augustin Adrian

Alternative Name: Adrian Living Hut

Period Built: First World War

Location: France

Patent: GB102955, (1 March 1915).



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IDENTIFICATION

Distinctive exterior appearance with roof overhanging angled walls and louvered windows. Constructed of timber planks/boards, held together by bolts passing through bolt holes which may be previously formed in the boards.

USES

YMCA canteens, soldiers huts.

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A. ADRIAN.
REMOVABLE HUT.
APPLICATION FILED DEC. 5, 1916.

1,262,156.

Patented Apr. 9, 1918.
3 SHEETS—SHEET 1.

Fig. 1.

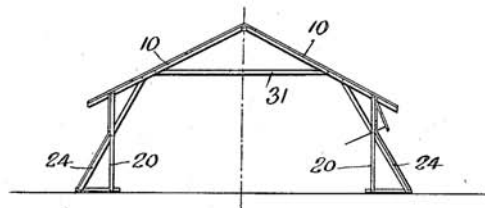


Fig. 2.

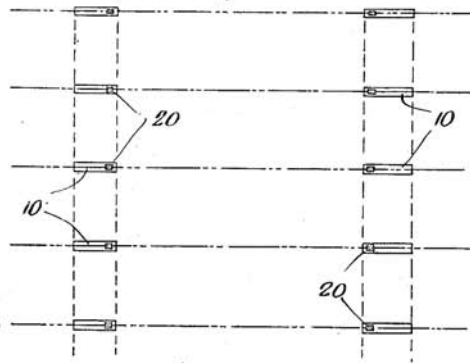


Fig. 4.

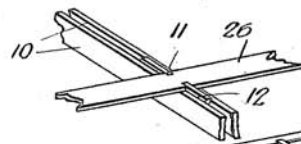
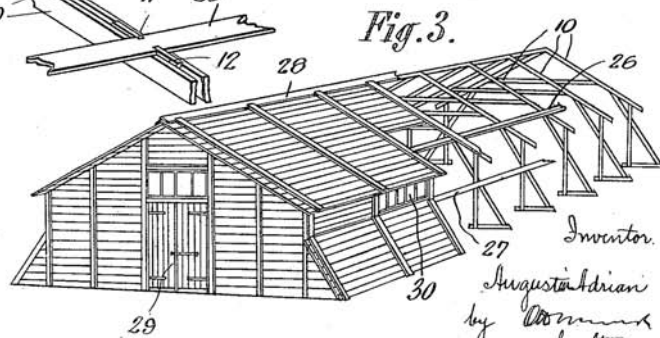


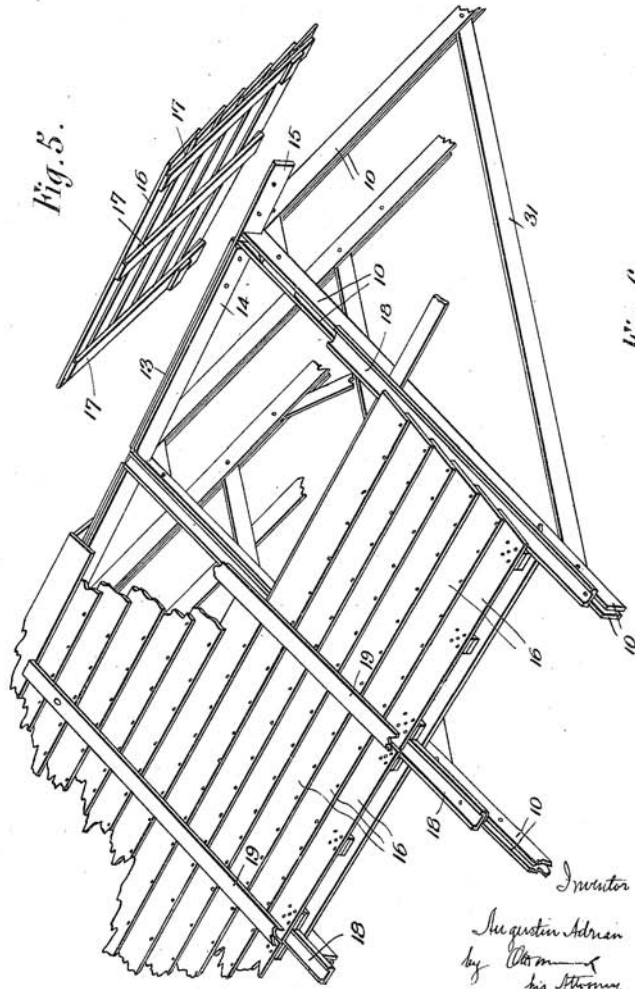
Fig. 3.



A. ADRIAN.
REMOVABLE HUT.
APPLICATION FILED DEC. 5, 1916.

1,262,156.

Patented Apr. 9, 1918.
3 SHEETS—SHEET 2.



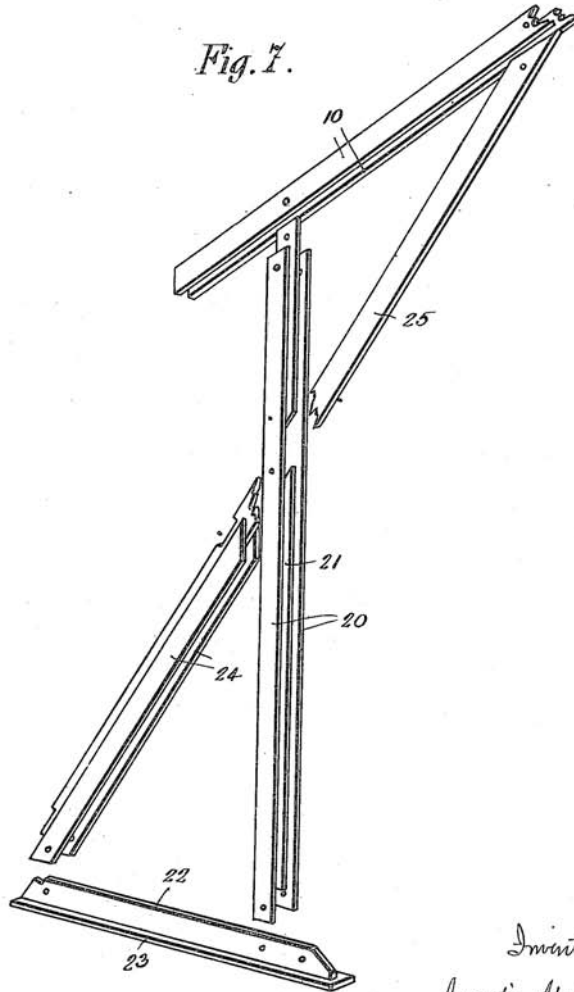
Inventor
Augustin Adrian
by *[Signature]*
his Attorney

A. ADRIAN.
REMOVABLE HUT.
APPLICATION FILED DEC. 5, 1916.

1,262,156.

Patented Apr. 9, 1918.
3 SHEETS—SHEET 3.

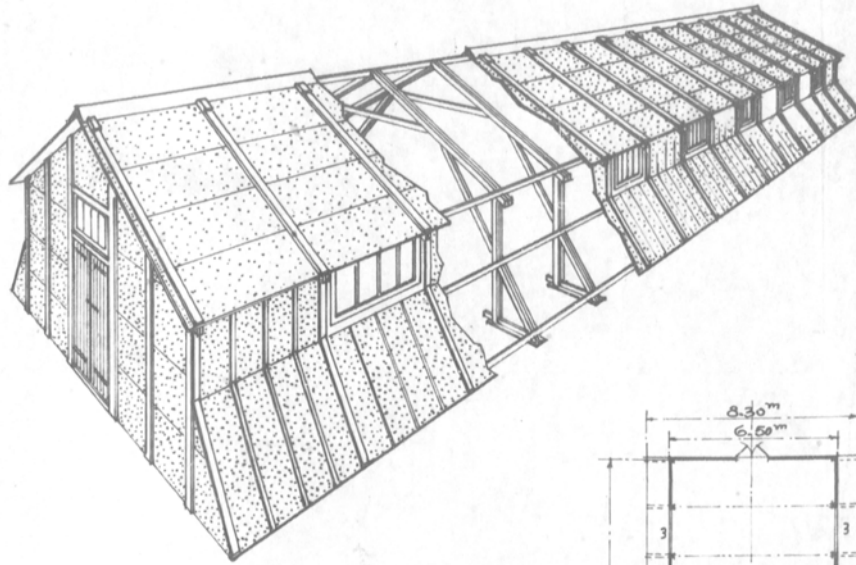
Fig. 7.



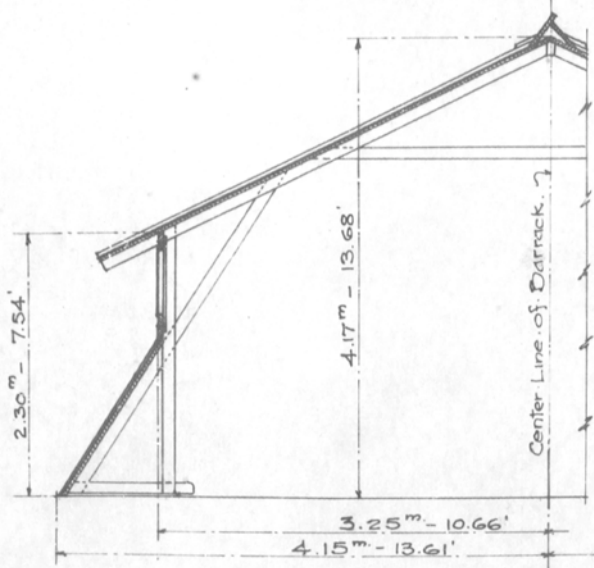
Inventor
Augustin Adrian
by *[Signature]*
his Attorney

ADRIAN BARRACK

1



PERSPECTIVE - VIEW.
PORTION OF ROOF & SIDES UNCOVERED.
SHOWING TRAMING & TRUSS CONSTRUCTION.



HALF TRANSVERSE SECTION.



PLAN.

FILE NO. 2-1-1.

SERIES OF NOVEMBER '18.

The Air Ministry Concrete Hut

Designer: Air Ministry Designs Branch

Alternative Name: Universal Concrete Hut

Period Built: First World War and Second World War

Location: Britain

Patent: Unknown



Photo courtesy of Paul Francis, Airfield Research Group

IDENTIFICATION

‘A tall centre section with a shallow-pitched roof, and two lower outer sections, each with a single-pitched roof. Vertical sides contained clerestory windows. The walls were constructed of 3-inch wide concrete slabwork fitted or cast in situ between square-section reinforced concrete posts. The whole external wall was then coated in a wash of ironite and cement. The roof was timber framed and carried wire mesh and Andrite felt, or slates. Inside, it was divided longitudinally into halves with entrances located in the end walls. Heating was provided by three stoves each side.’ (P. Francis, 1996) Could sleep up to 86 men. Francis has a photograph of this hut at Duxford. Drawing no. 481/18.

USES

Accommodation

REFERENCES

P. Francis, *British Military Airfield Architecture*, (Somerset: Patrick Stephens, 2006), p. 215.

The Armstrong Type Plan Hut

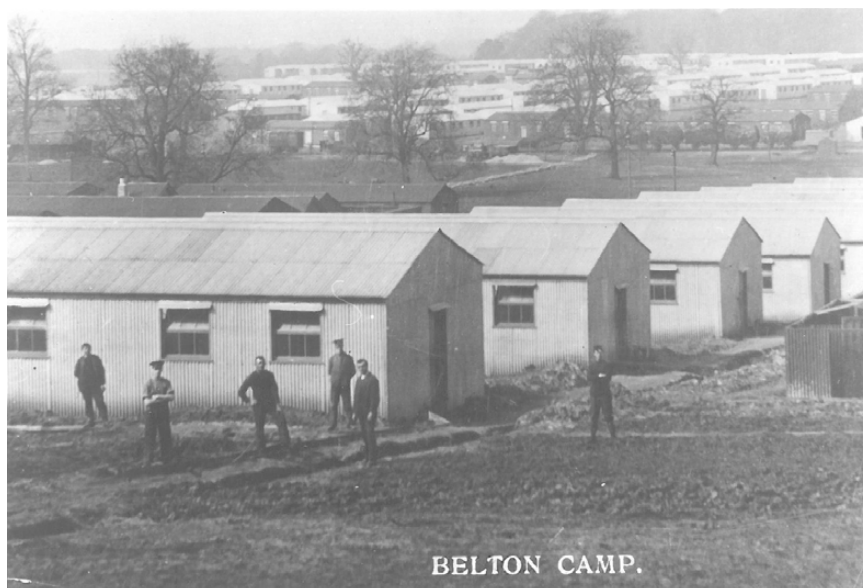
Designer: Major Bertie Harold Olivier Armstrong, Royal Engineers

Alternative Names: The Armstrong Hut, War Office Type Plan BD85A/14

Period Built: First World War. From August 1914.

Location: England and possibly France, but may have been too heavy to transport.

Patent: None found



IDENTIFICATION

The original type plan hut was constructed entirely of corrugated sheet metal over a timber frame with an asbestos lining or matchboard and 3 ply. (Schofield, in *Army Camps*, says asbestos sheeting was tried at first but found too brittle so matchboard and 3 ply used instead). Measurement: Originally supplied in two widths, 20 ft. and 30 ft. and length of 60 ft. Rare survivals are indicative of an early building date, likely between August and November 1914, when corrugated metal was still available. From 1915, they were typically constructed entirely of timber. Each was heated by a stove on wall in the middle of the hut. Front and rear entry points, with narrow double doors, although this may have been substituted with single doors later, depending on availability. May have originally had brick foundations, then moved to creosoted wooden piles (Schofield, 2006). Later redesigned into two sizes: 60 ft. x 15 ft. and 28 ft. x 10 ft. and manufactured in 10 foot sections. (Baker Brown p. 423-425)

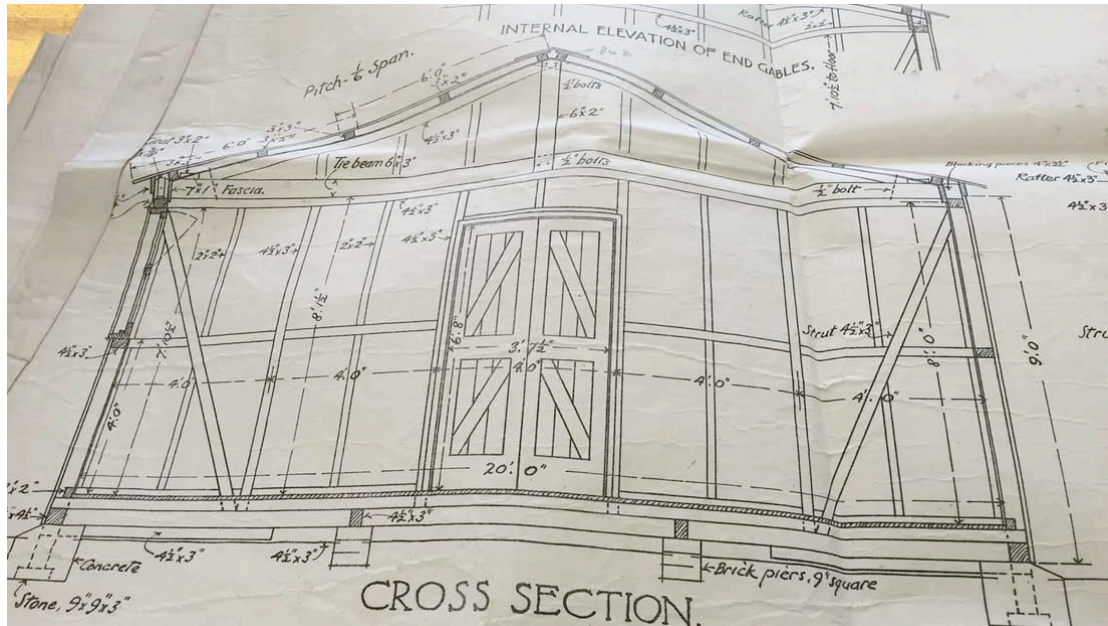
USES

Designed to provide for 17 different uses within one battalion of infantry, although most commonly used for accommodation.

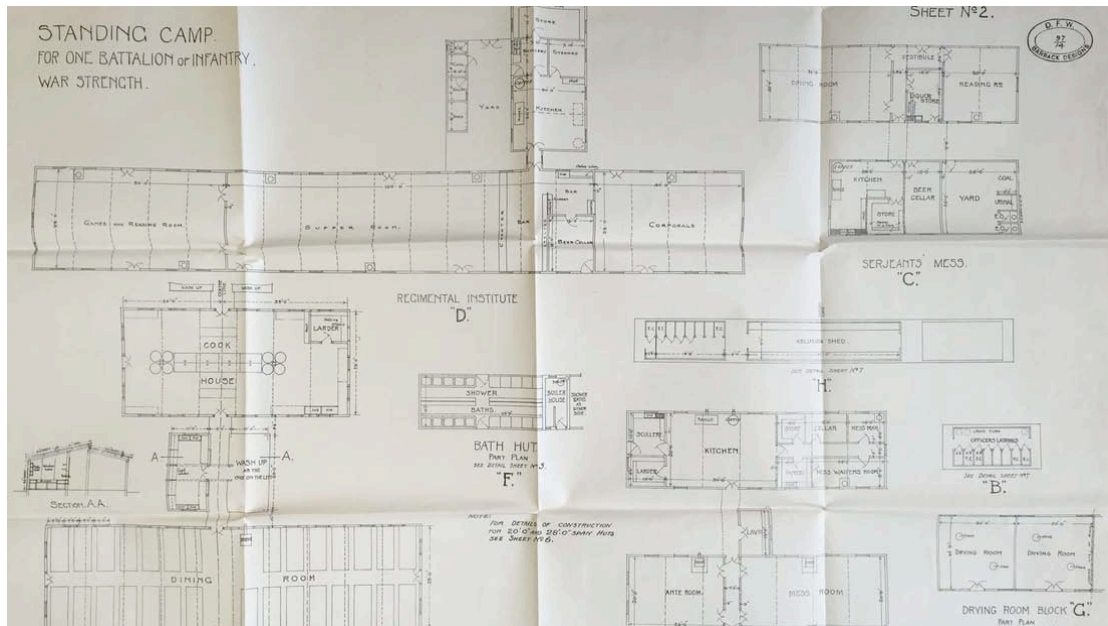
REFERENCES

1. *Work of the Royal Engineers in the European War, 1914-1919.*
2. George Scott-Moncrieff, 'The Hutting Problem in the War,' *Royal Engineers Journal*, (September 1924), 361-380 (p. 361).
3. Great War Huts museum.
4. Suffolk Records Office and the archive of builder R.G. Hogg.
5. J. Schofield, *England's Army Camps*, English Heritage, 2006.
6. Baker Brown, pp. 423-425.

PLANS



Rare survival of original type plan drawings. Suffolk Record Office. Archive of R.G. Hogg.



Standing Camp plan for Armstrong's 17 designs for his Type Plan hut. Suffolk Record Office. Archive of R.G. Hogg.

PHOTOGRAPHS



Drinkstone Village Hall: A repurposed timber Armstrong Hut.

The Armstrong Hospital Hut

Designer: Major B.H.O. Armstrong, Royal Engineers

Alternative Names: The Armstrong Huttred Hospital

Period Built: First World War. Introduced in October 1914.

Location: Britain and France

Patent: None found

NO IMAGE

IDENTIFICATION NOTES

Released type plans for huttred hospitals in mid-October 1914. (Scott-Moncrieff, 1924) Those in England could care for 600 patients, the ones in France were larger with enough wards for 13,000 beds. Built in both England and France. An entire medical site.

USES

Hospitals to be used in England and in the field.

REFERENCES

Scott-Moncrieff, p. 375.

PLANS

None found.

The Armstrong Hut No. 4

Designer: Major B.H.O. Armstrong, Royal Engineers

Alternative Names: The Armstrong Hut

Period Built: First World War. Introduced in early 1916.

Location: Britain and France

Patent: None found



IDENTIFICATION

A timber hut 'constructed in sections, made in workshops and sent out ready made to any proposed site and rapidly erected.' (Scott-Moncrieff, 1924) Unknown if any survive. These may be the huts confused with the Type Plan hut, but these came later. 'Small wooden huts of a new type... very light hut made of flat boards.' (Baker Brown, 1925).

USES

Designed for use in the field, to be portable, easily constructed and quickly erected.

REFERENCES

W. Baker Brown, 'Notes by a Chief Engineer During the Great War of 1914-1918, *Royal Engineers Journal*, September 1925, pp. 417-425.
Institution of Royal Engineers, *Work of the Royal Engineers in the European War, 1914-1919: Work Under the Director of Works (France)*, Chatham: MacKay and Co., 1924.

The Armstrong Timber and Canvas Hut

Designer: Major B.H.O. Armstrong, Royal Engineers

Alternative Names: The Armstrong Hut

Period Built: First World War

Location: Most likely France

Patent: None found



Royal Engineers move a hut during the Battle of the Somme, Sept 1916. IWM (Q 1204) This is possibly an example of an Armstrong Canvas and Timber Hut.

IDENTIFICATION

A collapsible, canvas and timber hut that was an amalgamation of both Armstrong's Type Plan Hut and a canvas tent. Simplistic design with timber frame and canvas cover. It was designed to be a portable alternative in the field, as the Type Plan was too heavy and not portable. Reports by soldiers that they were 'heavy and awkward to construct and transport [...] also proved extremely cold for the occupants.' (Mallory and Ottar, 1973) Two sizes: 24 ft. L x 15 ft. W and 12 ft. L x 9 ft. 3 in. W. The smaller huts more commonly used. (Schofield)

USES

Designed for use in the field, to be portable, easily constructed.

REFERENCES

K. Mallory and A. Ottar, *Architecture of Aggression*, p. 77.
Schofield, p. 7.

PLANS

None found.

The Armstrong Timber and Canvas Tent Hut (Unconfirmed)

Designer: Major B.H.O. Armstrong, Royal Engineers

Alternative Names: The Armstrong Hut

Period Built: First World War

Location: Abroad. Possibly France and Africa?

Patent: None found



These soldiers from the 4th Battalion Yorkshire Regiment referred to this as an Armstrong Hut. (Great War Forum)

IDENTIFICATION NOTES

A collapsible, canvas and timber hut. Timber A-frame with a canvas cover. More like a field tent. It was designed to be a portable alternative in the field, as the Type Plan was too heavy and not portable.

USES

Designed for use in the field, to be portable, easily constructed.

REFERENCES

Great War Forum.

PLANS

None found.

The Aylwin Hut

Designer: Francis Percival Aylwin (Canadian)

Alternative Name: Aylwin Hut-Tent

Period Built: First World War

Location: England and France

Patent: GB191420825A, (10 October 1914).



Aylwin Huts at Hamilton Camp, Salisbury Plain, Wiltshire, 1915. (From the collection of Terry Crawford)

IDENTIFICATION

Timber frame covered in stretched canvas. Roof sloped upwards to one side, giving the appearance of a lean-to. Windows constructed of mica. Each hut slept 6 men. Aylwin went into partnership with the Continever Tent Company, thus it was marketed as the Aylwin Continever Hut.

USES

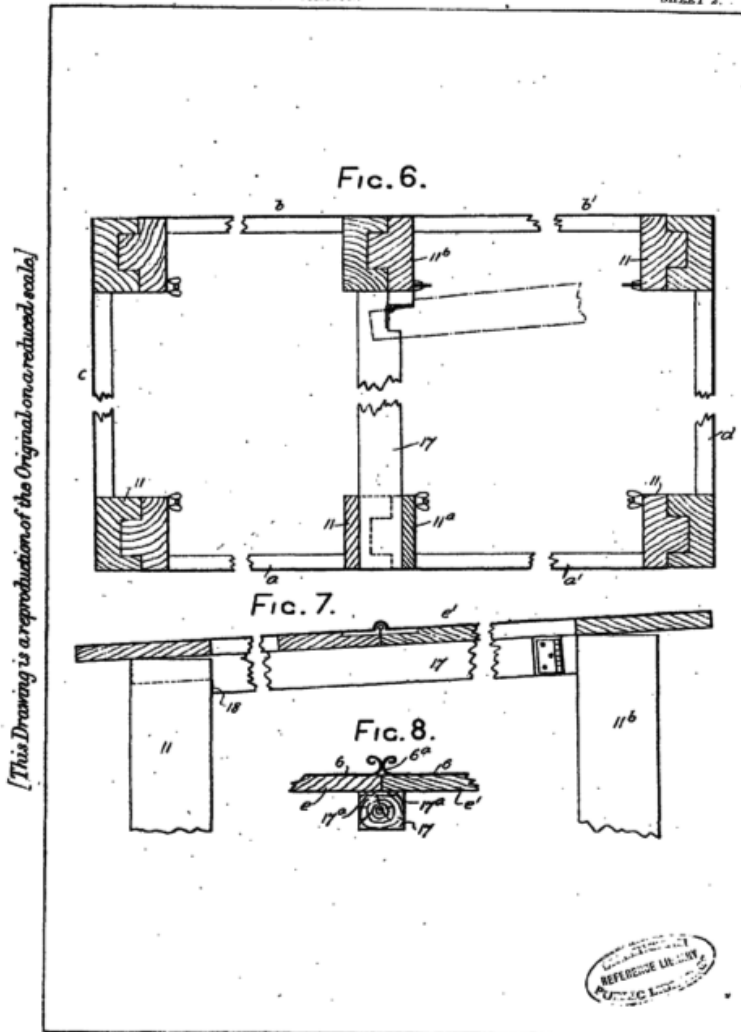
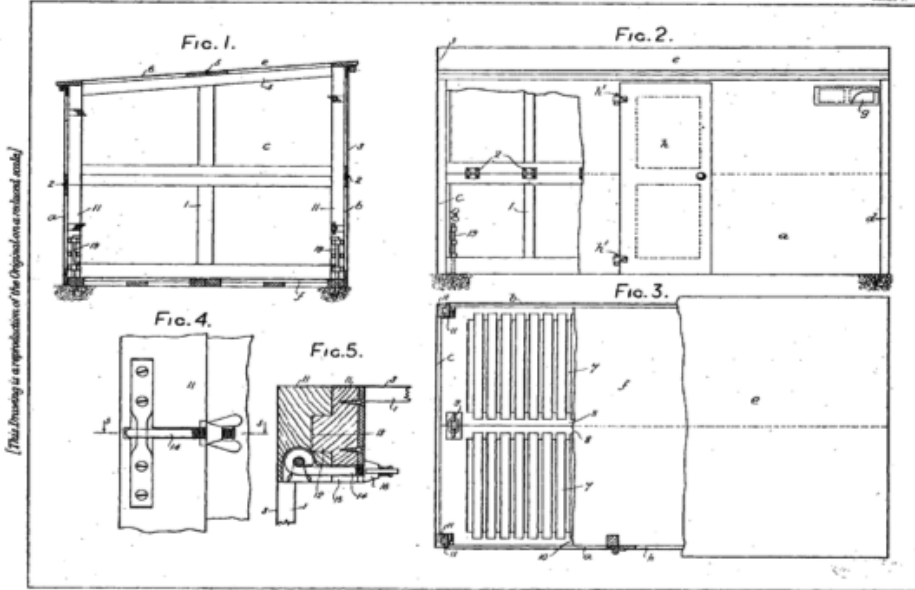
Designed to be portable accommodation, easily erected for use in camps in England and France.

REFERENCES

'A Debtor's Inventions', *The Times*, 25 January 1916, p. 3.
Crawford, p. 47.
Institution of Royal Engineers, *Work*, p. 9, 63.

PLANS

(See next page)



The Cavanna Hut

Designer: Unknown

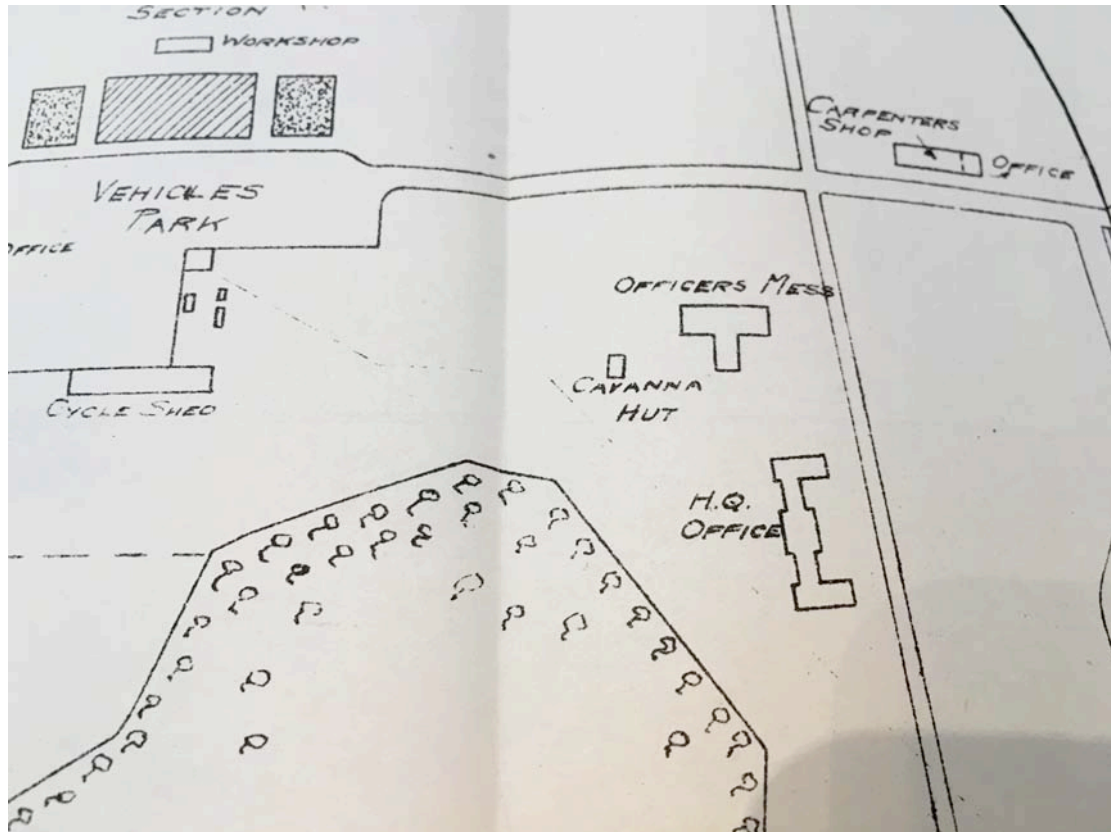
Alternative Name: Unknown

Period Built: First World War

Location: France

Patent: None

Photo:



IDENTIFICATION

Unknown

USES

Unknown but used on an airfield at RAF Vron, France.

REFERENCES

Institution of Royal Engineers, *Work*. A reference to a Cavanna Hut on Plate XVI at RAF Vron, France.

No Plan

The Forest Hut

Designer: R.G. Brocklehurst, R.E.

Alternative Name: None

Period Built: First World War

Location: France

Patent: None

No Photo

PLAN

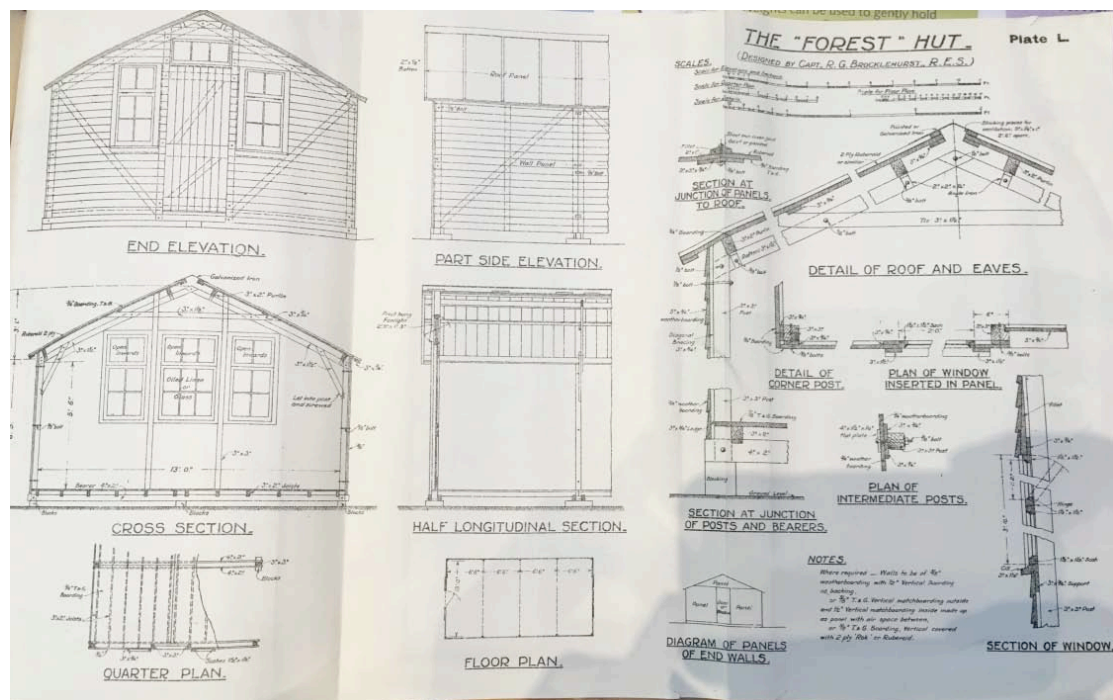


Plate L, Work of the RE in the European War.

IDENTIFICATION

Timber construction with a rubberoid roof. Designed by Royal Engineer to provide accommodation in forested areas. Measured 13 ft wide by 26 ft long.

USES

Accommodation in forested areas.

REFERENCES

Work, Plate L.

The Liddell Portable Hut

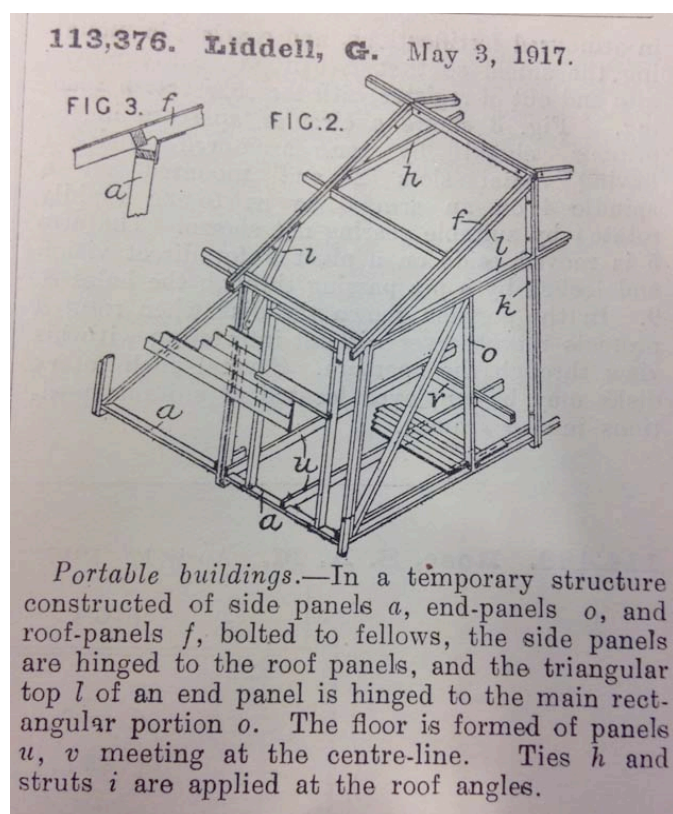
Designer: Lt. Col. Guy Liddell, R.E.

Alternative Name: The Liddell Hut

Period Built: First World War

Location: France

Patent: GB113376, (3 May 1917).



IDENTIFICATION

A timber hut with hinged panels that could be easily collapsed, transported and erected again. Two sizes: 16.5 ft by 25 ft and 16.5 ft by 60 ft.

USES

Accommodation

REFERENCES

Schofield, p. 7.

Patents for Inventions: Abridgements of Specifications 1916-1920 (London: HMSO, 1923)
Work, Plate LI.

The Nissen Bow Hut

Designer: Peter Norman Nissen, R.E.

Alternative Name: The Nissen Hut

Period Built: First World War (1916-1918) and Second World War

Location: England and France

Patent: GB105468 (26 June 1916), GB1377500 (10 May 1921).



©IWM Q11192

IDENTIFICATION

Wooden purlins jointed to steel T-shaped ribs, covered with corrugated iron sheeting, with corrugations running in vertical lines. Interior walls constructed of matchboard lining, or corrugated iron. Timber floors, with ends constructed in timber. Central doorway on both ends, with a 4 light window on either side of door. Measured 16 ft wide by 27 ft long by 8 ft high.

USES

Accommodation

REFERENCES

McCosh, p. 77.
Work, Plat LII.

PLANS

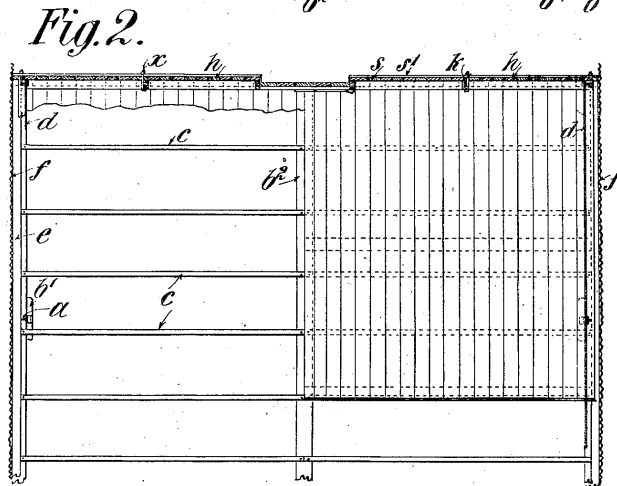
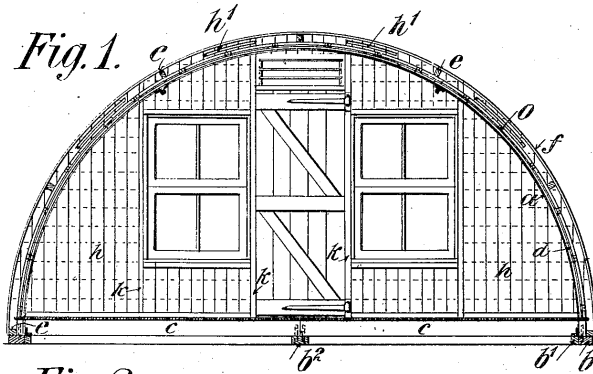
P. N. NISSEN.
PORTABLE BUILDING.
APPLICATION FILED MAR. 12, 1917.

2 Sheets
Sheet No. 1.

1,377,500.

Patented May 10, 1921.

4 SHEETS—SHEET 1.



INVENTOR.
P. N. Nissen.
By Robert E. Hedley

The Nissen Hospital Hut

Designer: Peter Norman Nissen, R.E.

Alternative Name: Unknown

Period Built: First World War

Location: England and France

Patent: GB118442, (27 August 1918).



© IWM Q3168

IDENTIFICATION

Similar to the Nissen Bow Hut with the added feature of a clerestory along the apex of the roof. Measured 20 ft wide by 60 ft long b 10 ft high.

USES

Medical hospital.

REFERENCES

McCosh, p. 91.

The R.G.B. Standard Light Portable Hut

Designer: Unknown

Alternative Name: Unknown

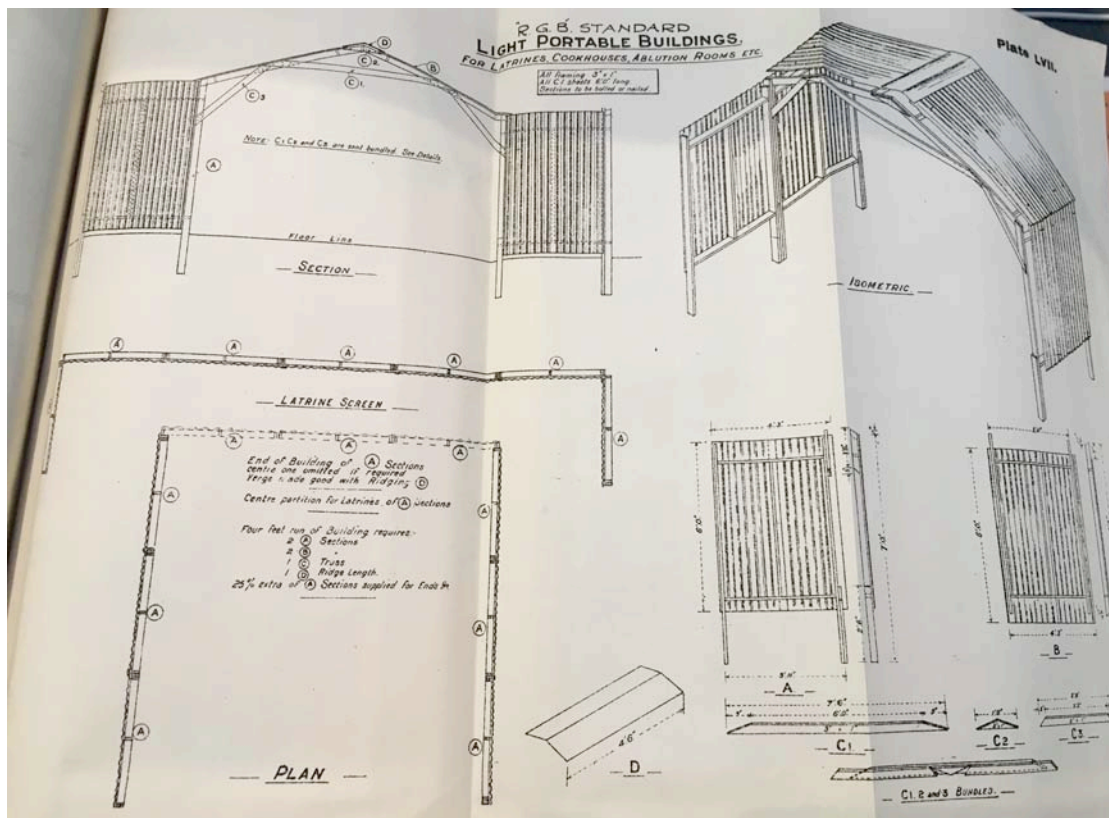
Period Built: First World War

Location: France

Patent: None Found

No Photo

PLAN



IDENTIFICATION

Timber frame with 4 ft 3 in. wide by 6 ft long sheets of corrugated iron affixed to the frame. Could have a center partition for dividing the room. Sat atop the ground with just over a 2 ft opening between the ground and the cladding.

USES

Latrines, cookhouses, ablution rooms.

REFERENCES

Work, Plate LVII.

The Somerville Hut

Designer: Daniel Gerald Somerville

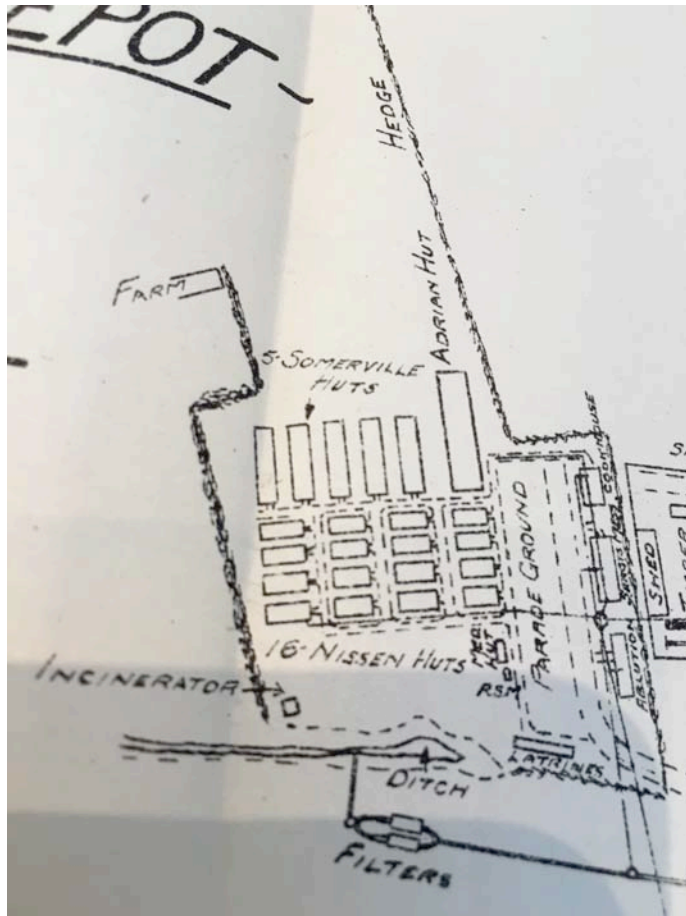
Alternative Name: Unknown

Period Built: First World War

Location: France

Patent: GB150866 (4 July 1919)

Photo:



From a map in *Work of a Kite Balloon Depot and No. 1 A.D. Camp in Arques, France* showing Somerville Huts next to Nissen Huts and an Adrian Hut.

IDENTIFICATION

Timber portable hut manufactured in sections, with walling that fit together using tongues and grooves so that the parts were interchangeable.

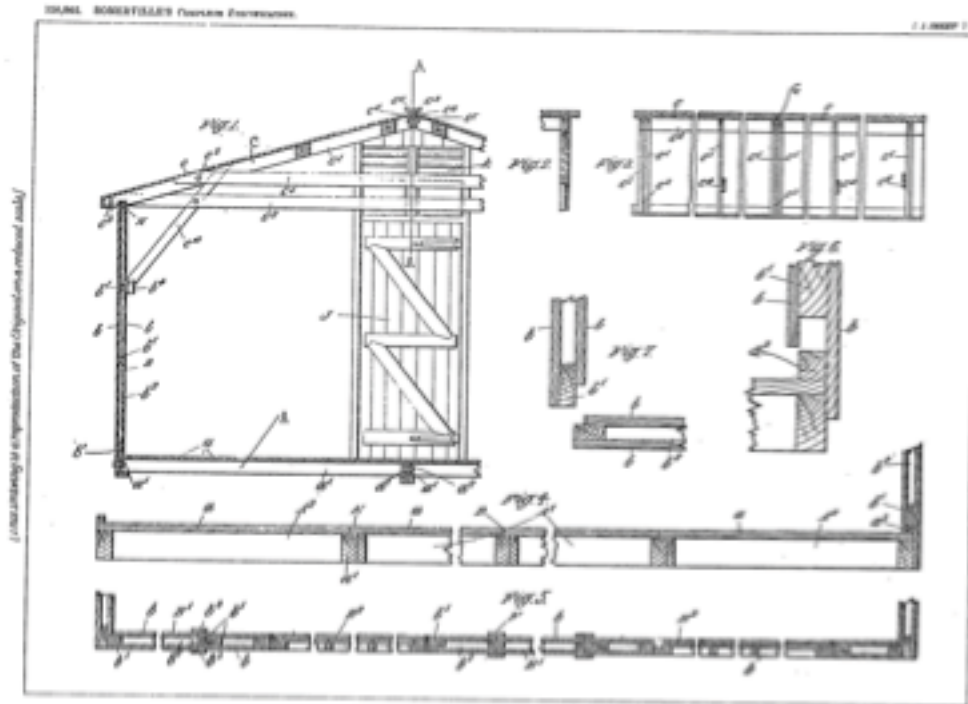
USES

Likely as accommodation.

REFERENCES

Espacenet
Works

PLAN



The Swiss Liddle Hut

Designer: Unknown

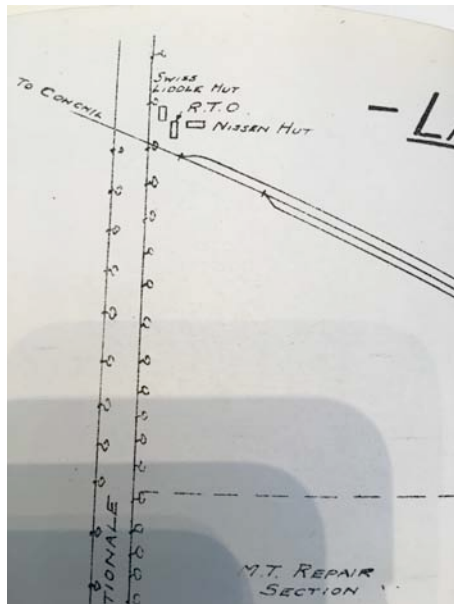
Alternative Name: Unknown

Period Built: First World War

Location: France

Patent: None found

Photo:



The only documentation of this hut is on a camp layout map for RAF Vron, France. Plate XVI, *Work*.

IDENTIFICATION

Unknown

USES

Unknown. Perhaps as a guard hut based on its distant location from the main camp.

REFERENCES

Work, Plate XVI.

PLANS

None

The Tarrant Dechets Portable Hut

Designer: W.G. Tarrant Sons & Co.

Alternative Name: Unknown

Period Built: First World War

Location: France and possibly England

Patent: Not found

Photo:



A Tarrant Dechet Hut made from packing cases in France. ©IWM Q109797

IDENTIFICATION

Measured 16 ft wide by possibly 24 ft in length although it could potentially be lengthened in increments of 4 ft sections. The plan specifies corrugated iron for the roofing. Some of these huts were constructed with leftover packaging cases in lieu of timber for cladding.

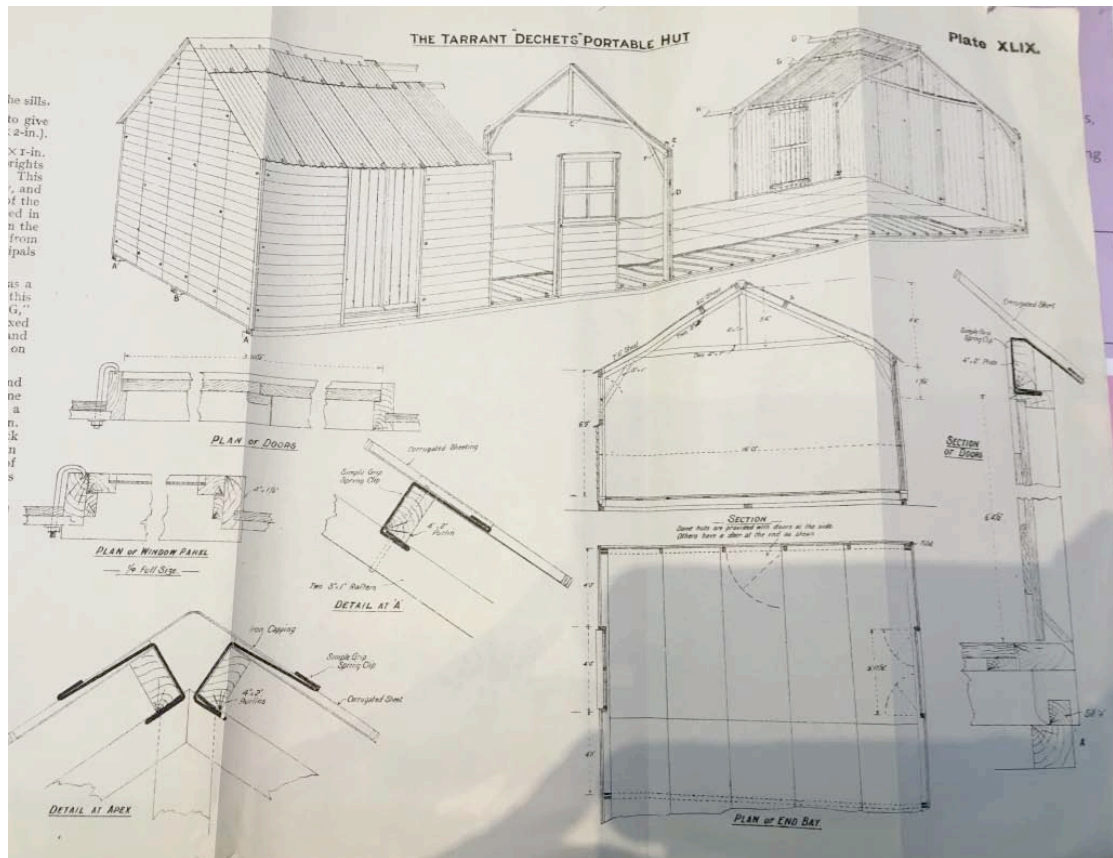
USES

Probably as accommodation

REFERENCES

Work, Plate XLIX

PLAN



The Tarrant Light Portable Sleeping Hut

Designer: W.G. Tarrant Sons & Co.

Alternative Name: Unknown

Period Built: First World War

Location: France and possibly England

Patent: GB191517799 (20 December 1915).

Photo:



Walter George Tarrant and some of the women carpenters he brought from England who made 37,000 of these huts in a camp three miles from Calais, 30 June 1917. © IWM Q2467.

IDENTIFICATION

Timber construction with weatherboarding. Roof covered with Ruberoid. Measured 15 ft 6 in. wide by possibly 25 ft 1.5 in. in length. The plan specifies corrugated iron for the roofing. Some of these huts were constructed with leftover packaging cases in lieu of timber for cladding.

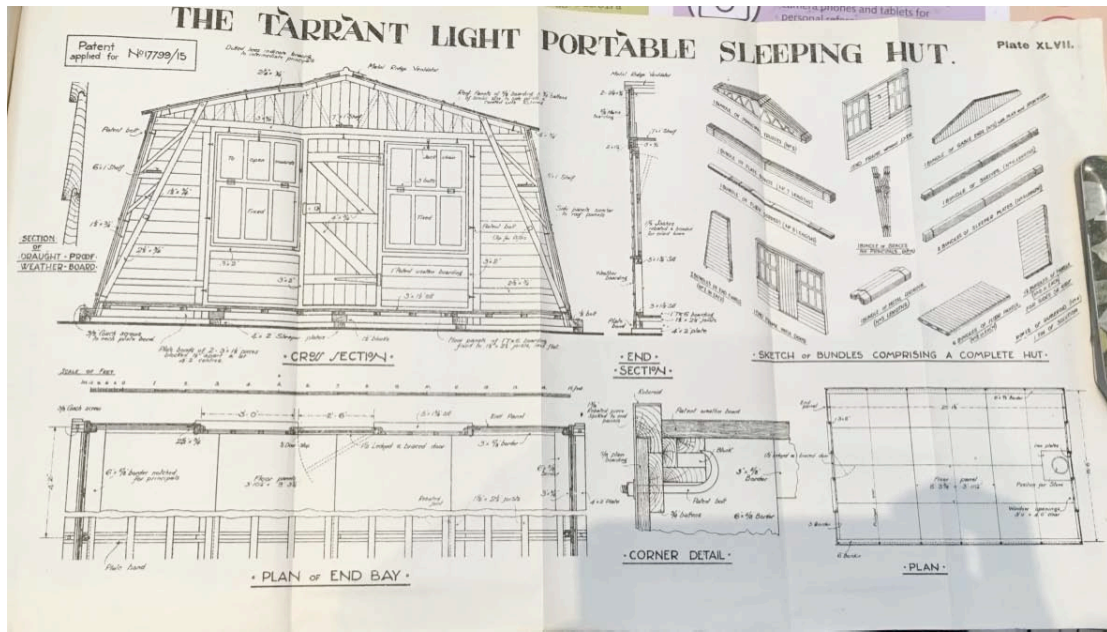
USES

Probably as accommodation

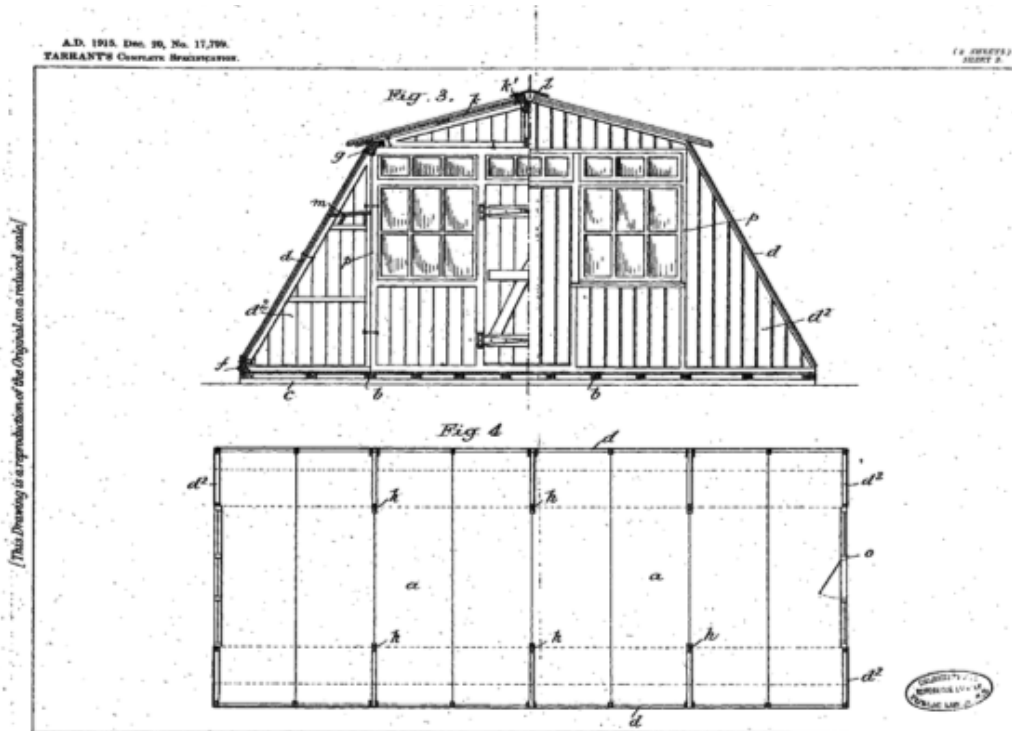
REFERENCES

Work, Plate XLVII

PLANS



Work, Plate XLVII



Patent application drawing for GB191517799.

The Tarrant Portable Mark II Hut

Designer: W.G. Tarrant Sons & Co.

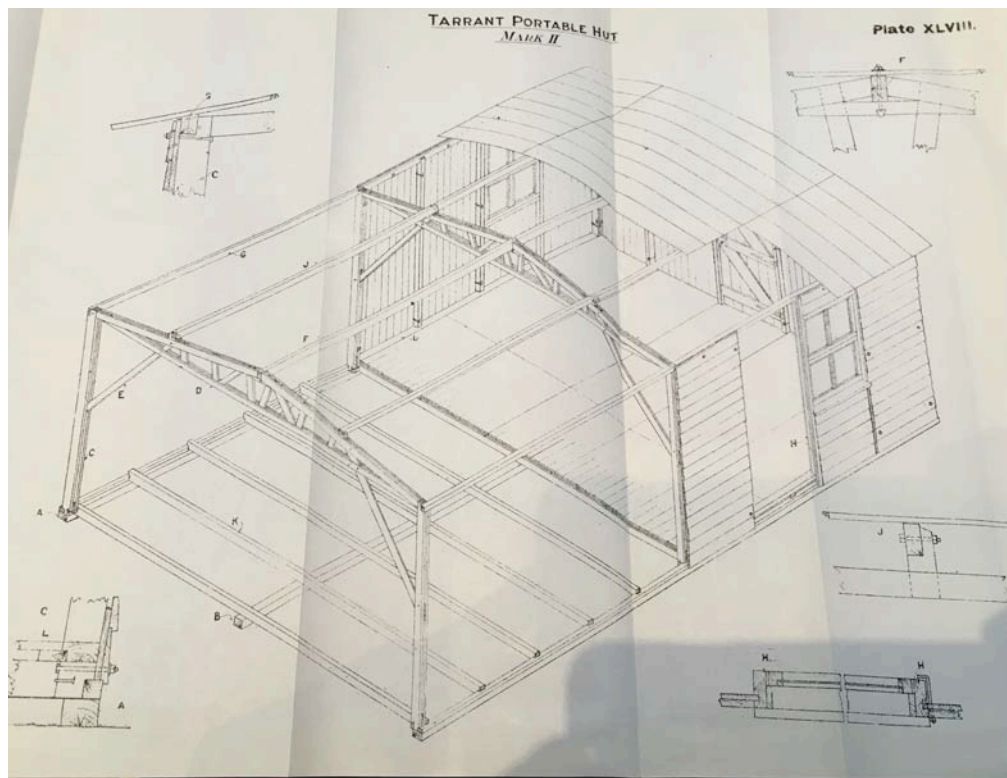
Alternative Name: Unknown

Period Built: First World War

Location: France and possibly England

Patent: GB191507994, (25 May 1915).

Photo:



IDENTIFICATION

A portable timber hut built in sections using hooks or claw headed bolts with rebated weatherboarding exterior. Unknown size.

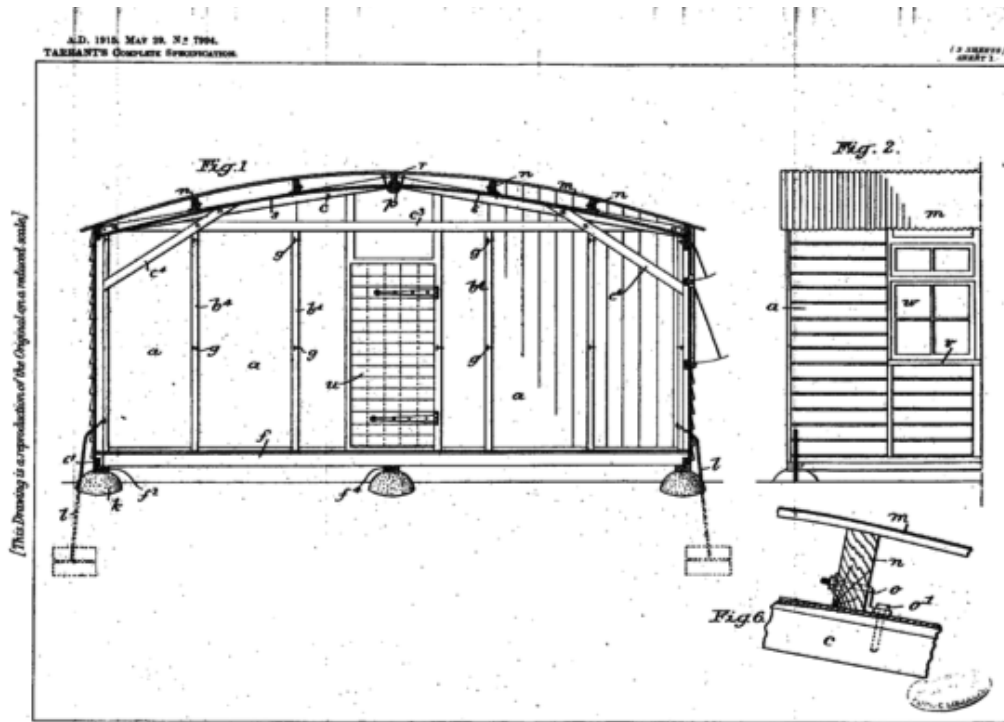
USES

Probably as accommodation

REFERENCES

Work, Plate XLVIII

PLANS



Drawing from Patent Application GB191507994

The Weblee Interlocking Hut

Designer: Felix J. Leather and Frederick J. Webb

Alternative Name: The Weblee Hut

Period Built: First World War

Location: France and possibly England

Patent: GB122026, (10 January 1918).

Photo:



IDENTIFICATION

A portable timber hut consisting of a series of interchangeable panels. Measured 16 ft wide by 28 ft long, it could be erected by four unskilled workers in one hour and dismantled in 15 minutes.

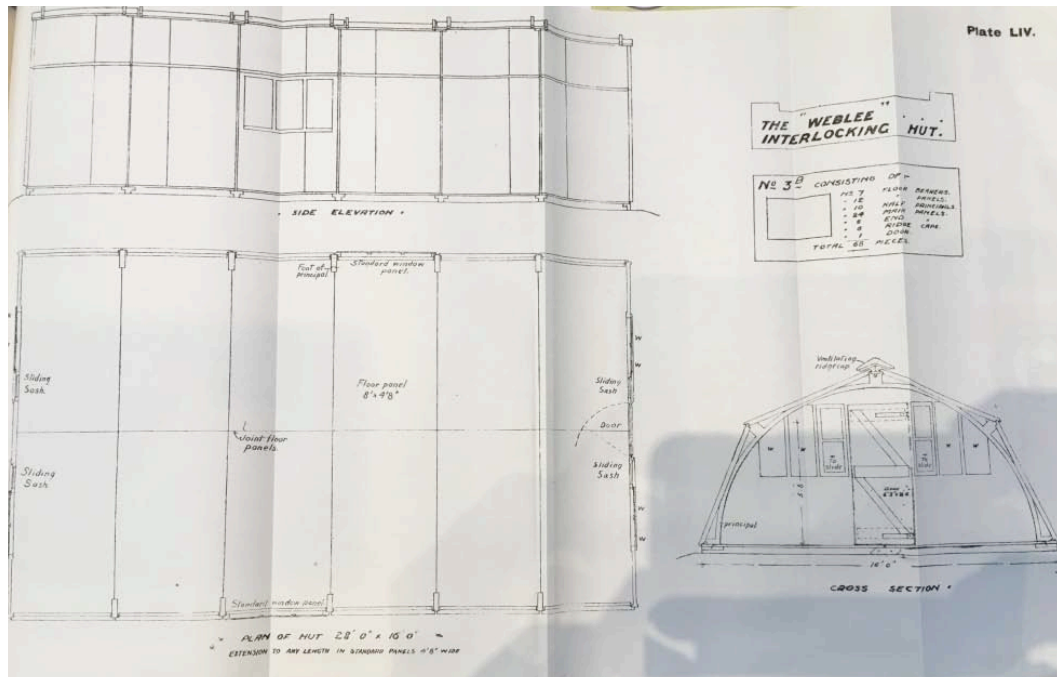
USES

Probably as accommodation

REFERENCES

Work, Plate LIV.

PLANS



Appendix B

Second World War Huts

1. Air Ministry Revised Laing Hut	B3
2. Air Ministry Type A Hut	B5
3. Air Ministry Type B Hut	B6
4. All Timber Guard Hut	B7
5. The Army Type Portable Hut	B8
6. The Asbestos Arch Hut	B9
7. The B.C.F. Clear Span Hut	B10
8. The B.C.F. Light Hut	B13
9. The Blister Hut	B15
10. The C'tesiphon Hut	B17
11. The Cubbitt System	B20
12. The Curved Asbestos Hut	B22
13. The Fidler System	B23
14. The Half Brick Hut	B25
15. The Handcraft Hut	B26
16. The Hessolite Hut	B28
17. The Iris Hut	B29
18. The Jane Hut	B30
19. The Marston Shed	B31
20. The Ministry of Supply Laing Hut	B32
21. The Ministry of Supply Living Hut (aka Thorn/Thorbox)	B34
22. The Ministry of Supply Maycrete Hut	B36
23. The Ministry of Supply Padmos Hut	B38
24. The Ministry of Supply Plasterboard Hut	B40
25. The Ministry of Supply Timber Hut (aka Magnet)	B42
26. The Ministry of Works Hall Hut	B43
27. The Ministry of Works Maycrete Hut	B44
28. The Ministry of Works Standard Hut	B45
29. The Mopin Hut	B48
30. The Nashcrete Hut	B49
31. The Nissen Hut	B51
32. The Nofrango Hut	B52
33. The Orlit Hut	B54
34. The Patrick Portable Hut	B56
35. The Plycrete Hut	B58
36. The Plywood Hut	B60
37. The Precast Paving Slab Hut	B62
38. The Quetta Hut	B64

39. The Quonset Hut	B66
40. The Romney Hut	B68
41. The Seco Hut	B70
42. The Semi-Romney Hut	B72
43. The Stancon System	B74
44. The Standard Army Hut	B76
45. The Steel Construction Hut	B78
46. The Tarran Hut System	B80
47. Transportable Timber Hut Type A	B85
48. Transportable Timber Hut Type B	B86
49. Turner's Everite Hut	B87
50. The War Office Abbey Hut	B88
51. The War Office Tufton Hut	B90
52. The X,Y, and Z Huts	B92

The Air Ministry Revised Laing Hut

Designer: Unknown

Alternative Name: Unknown

Period Built: Second World War (From 1942)

Location: England

Patent: None found.

No Photo (See Plan)

IDENTIFICATION

A revised edition of the earlier Laing Hut, this model was constructed with home-grown timber and clad in corrugated iron sheeting.

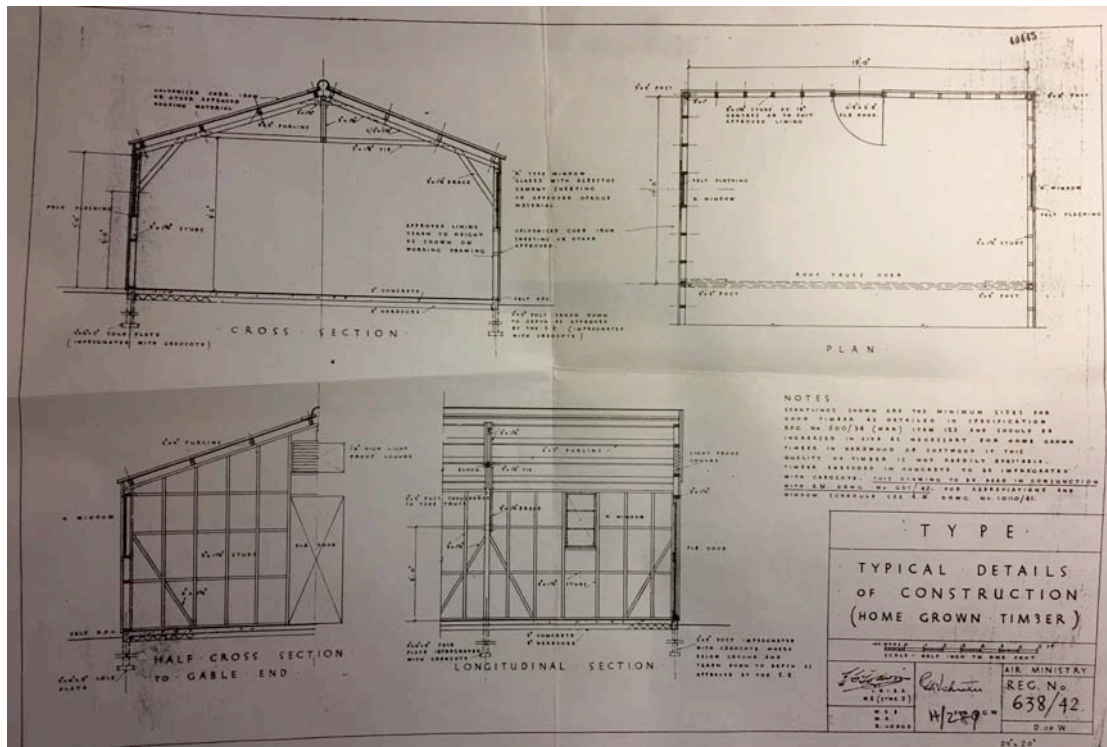
USES

Accommodation

REFERENCES

P. Francis, R. Flagg and G. Crisp, *Nine Thousand Miles of Concrete: A Review of Second World War Temporary Airfields in England* (Swindon: Historic England, 2016).

PLAN



This seems to be a Revised Laing Hut plan dated 1942. (Airfield Research Group)

The Air Ministry Type A Hut

Designer: Air Ministry

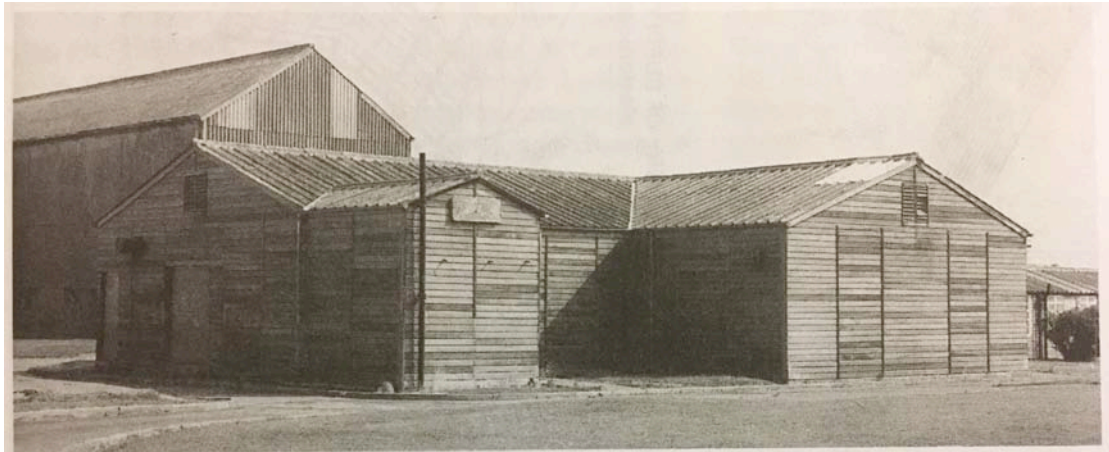
Alternative Name: Unknown

Period Built: Second World War (From 1935)

Location: England

Patent: None found.

Photo:



(Photos by Paul Francis, *British*, p. 206.)

IDENTIFICATION

Francis says these were sectional and could be bolted together to form any length. Covered with Canadian cedar weatherboarding and lined internally with plasterboard. Came in spans of 10, 18, 20 and 28 ft. Lifespan of 10-15 years.

USES

Accommodation

REFERENCES

Francis, *British*, p. 206.

The Air Ministry Type B Hut

Designer: Unknown

Alternative Name: Unknown

Period Built: Second World War (From 1935)

Location: England

Patent: None found.

Photo:



Photo by Paul Francis

IDENTIFICATION

Similar to the Air Ministry Type A Hut with external weatherboarding and internal plasterboard in a gabled timber frame, except that the roof was timber covered in felt. It also had a shorter lifespan of 5 years.

USES

Accommodation

REFERENCES

Francis, *British*, p. 206.

The All-Timber Guard Hut

Designer: Air Ministry?

Alternative Name:

Period Built: Second World War (from 1940-42)

Location: Britain

Patent: Unknown

No Photo

IDENTIFICATION

Very little is known about this hut except that it is mentioned in the Air Ministry Works book as being called the All Timber Guard Hut, which came in two sizes. 10 ft by 10 ft and 15 ft by 36 ft. The smaller size may have been a working space, while the larger was a barrack/living space. They were constructed between 1940 and 1942. Of the smaller size, 792 were built, and of the larger, 458 were built in 1940 only.

USES

Living and work quarters.

REFERENCES

Air Ministry, *The Royal AirForce Builds For War (Works)*, (1956).

The Army Type Portable Hut

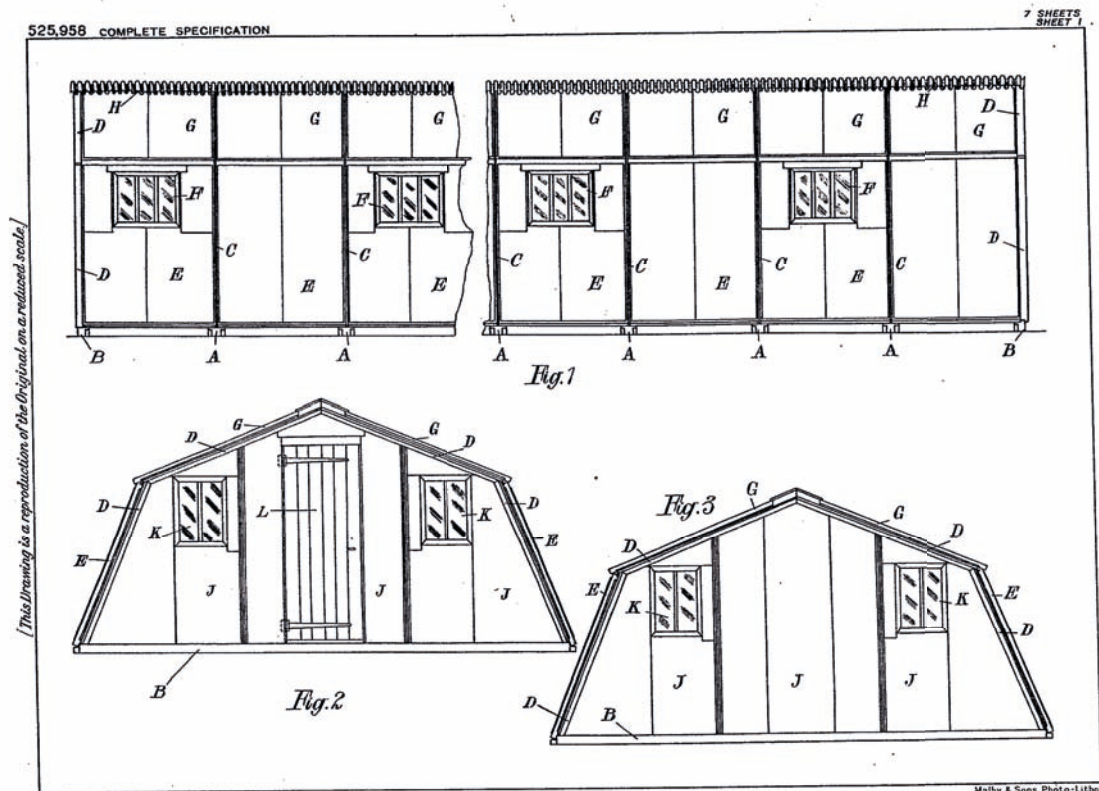
Designer: F.J. Leather

Alternative Name: Unknown

Period Built: Second World War

Location: England

Patent: GB525958, (5 January 1939).



IDENTIFICATION

A portable timber hut made up of wall panels that were secured together using hook-bolts.

USES

Accommodation

REFERENCES

Architects' Journal, 25 Jan 1940, p. 123.

The Asbestos Arch Hut

Designer: Possibly Turner's Everite

Alternative Name: Possibly Turner's Everite Hut

Period Built: Second World War

Location: England

Patent: None found.

Photo:



Photo by Paul Francis

IDENTIFICATION

Similar in appearance to the Nissen Hut, but with curved asbestos sheets. There is a possibility this could be the same as the Turner's Everite Hut.

USES

Accommodation, offices, workshops.

REFERENCES

Mallory, p. 197.

The B.C.F Clear Span Hut

Designer: British Concrete Federation

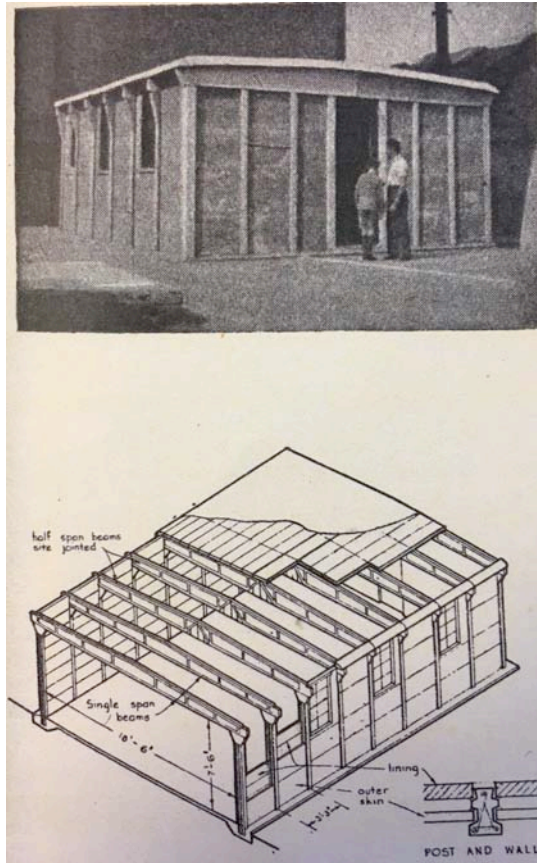
Alternative Name: Unknown

Period Built: Second World War (From 1942)

Location: England

Patent: None found.

Photo:



IDENTIFICATION

A concrete hut of reinforced concrete posts, into which wall panels are inserted. The inside panel is lightweight breeze concrete and the exterior panels are dense-pressed concrete. Roofing material is breeze concrete slabs. Measured 18 ft 6 in. by 26 ft.

USES

Hostels, accommodation, offices, clinic, emergency housing.

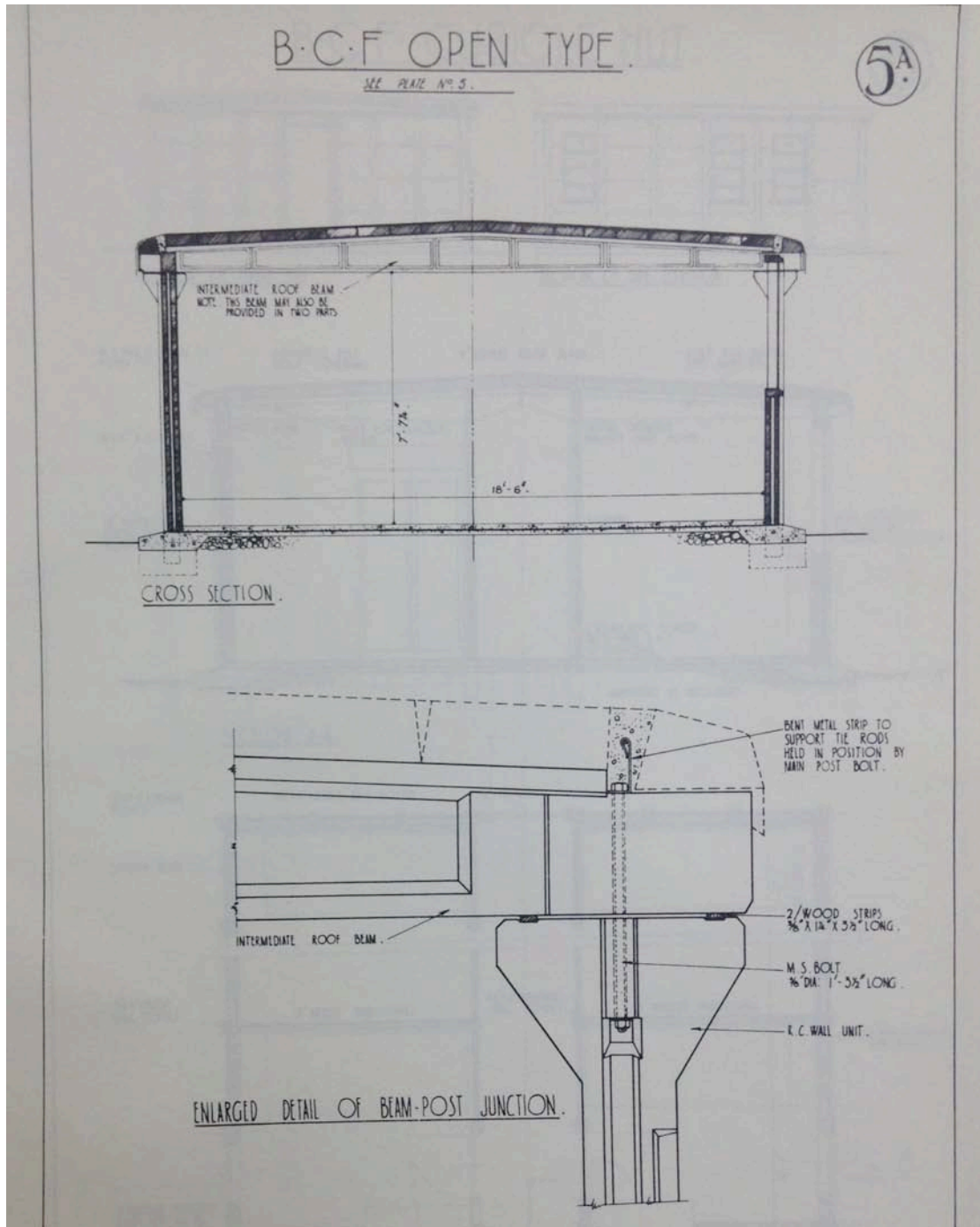
REFERENCES

The Builder, 13 March 1942, p. 236.

The Architect and Building News, 6 March 1942, p. 177.

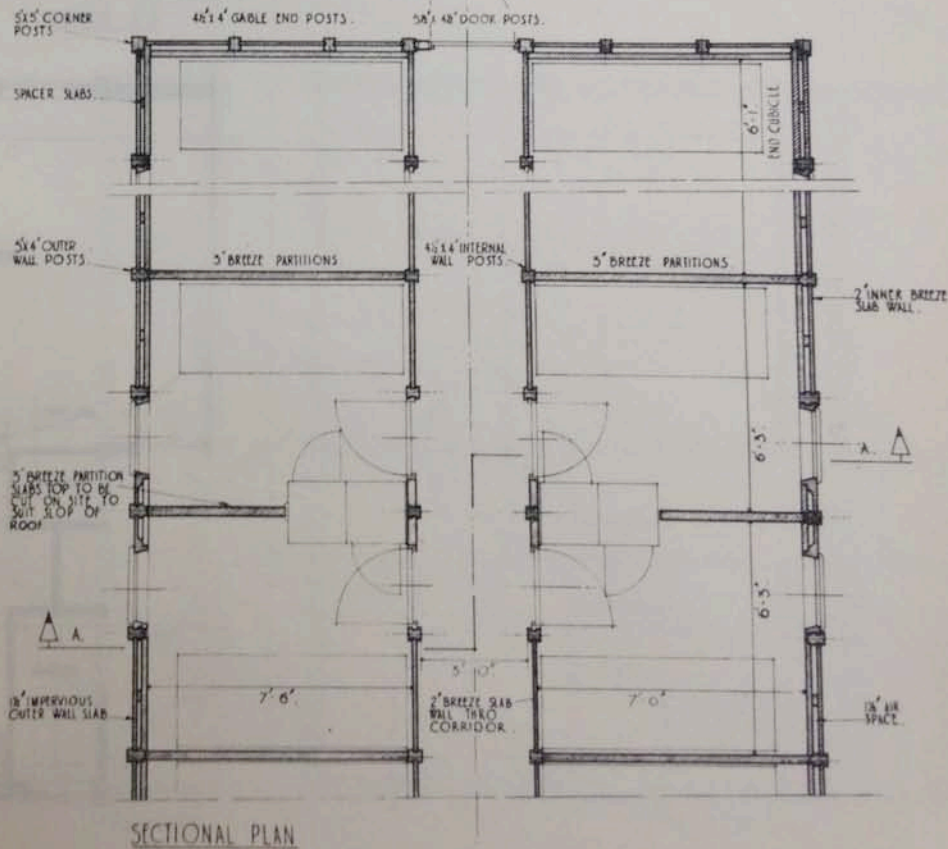
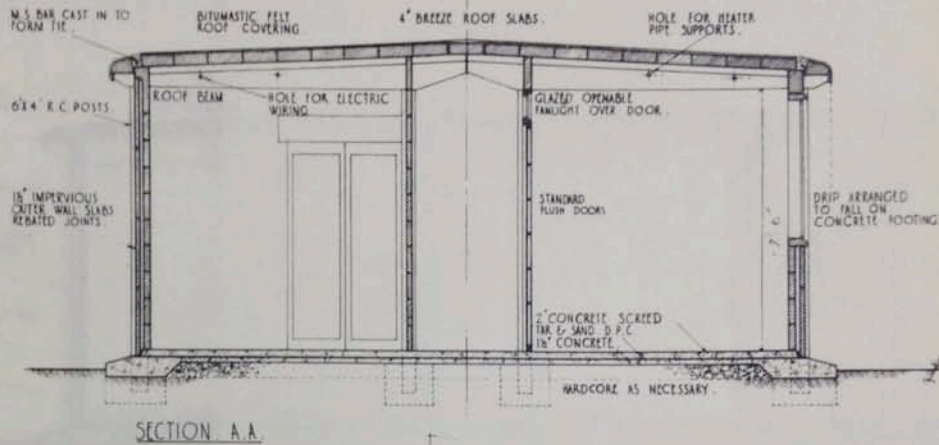
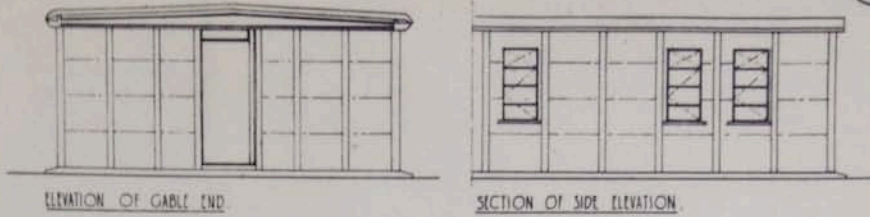
The Architects' Journal, 9 April 1942, p. 262.

PLANS



B.C.F. CUBICLE HUT.

6



The B.C.F Light Hut

Designer: British Concrete Federation

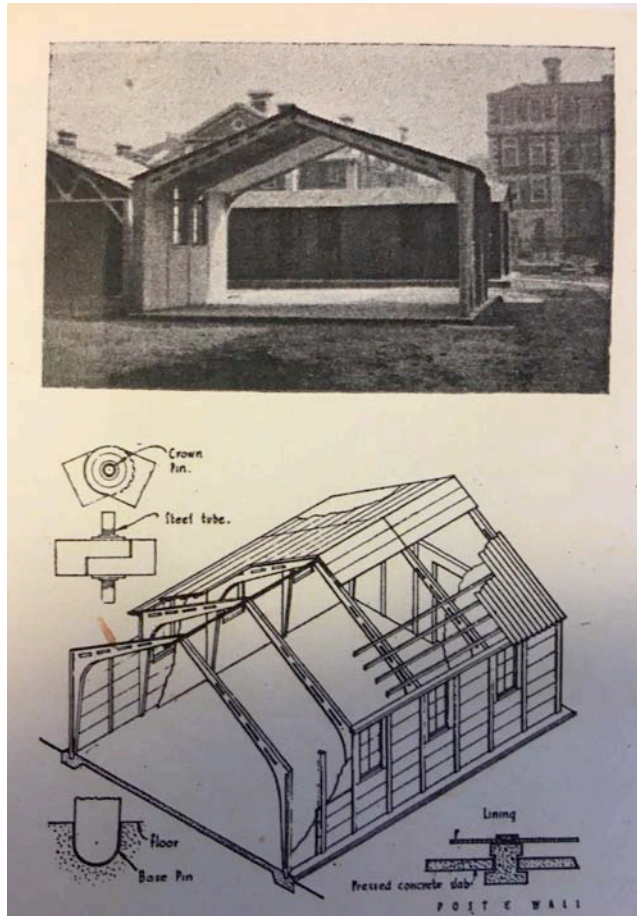
Alternative Name: Unknown

Period Built: Second World War (From 1942)

Location: England

Patent: None found.

Photo:



IDENTIFICATION

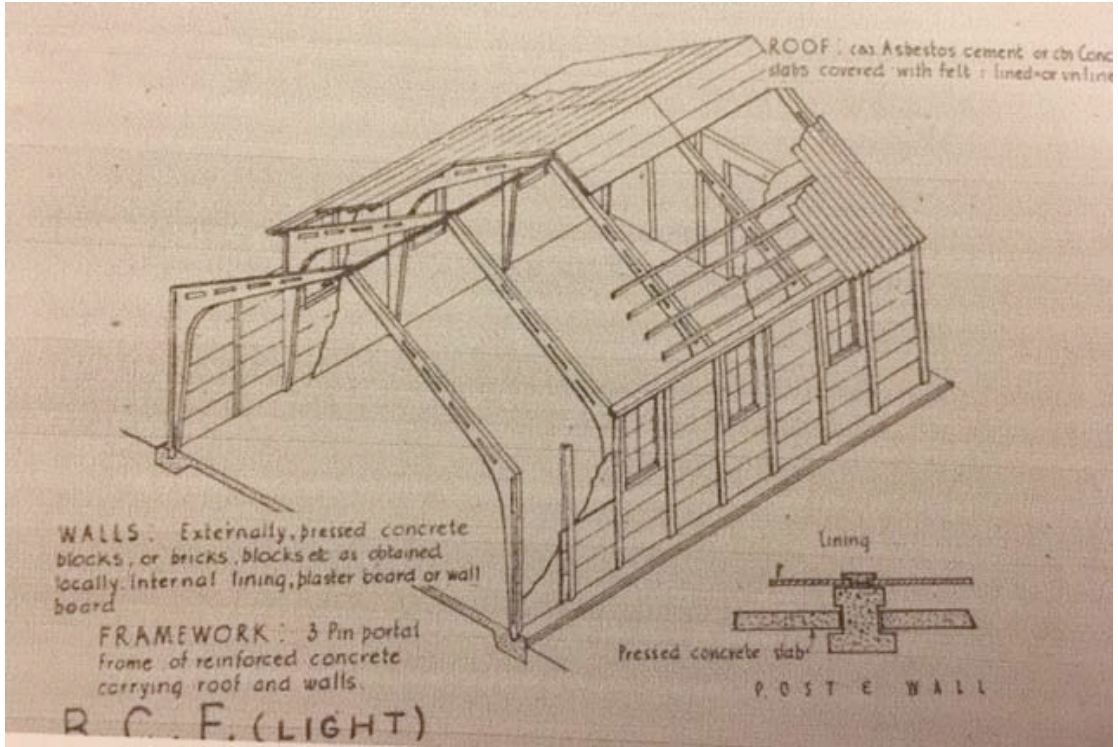
Reinforced concrete. External walls made of pressed concrete blocks or bricks. Internal walls made of plasterboard or other wallboard. Frame is a 3 pin portal frame of reinforced concrete that holds the roof and walls. The roof is asbestos cement slabs covered with felt.

USES

Hostels, accommodation, offices, clinic, emergency housing.

REFERENCES

RIBA Journal, June 1942, p. 129.



The Blister Hut

Designer: William C. Inman, Graham Dawbarn

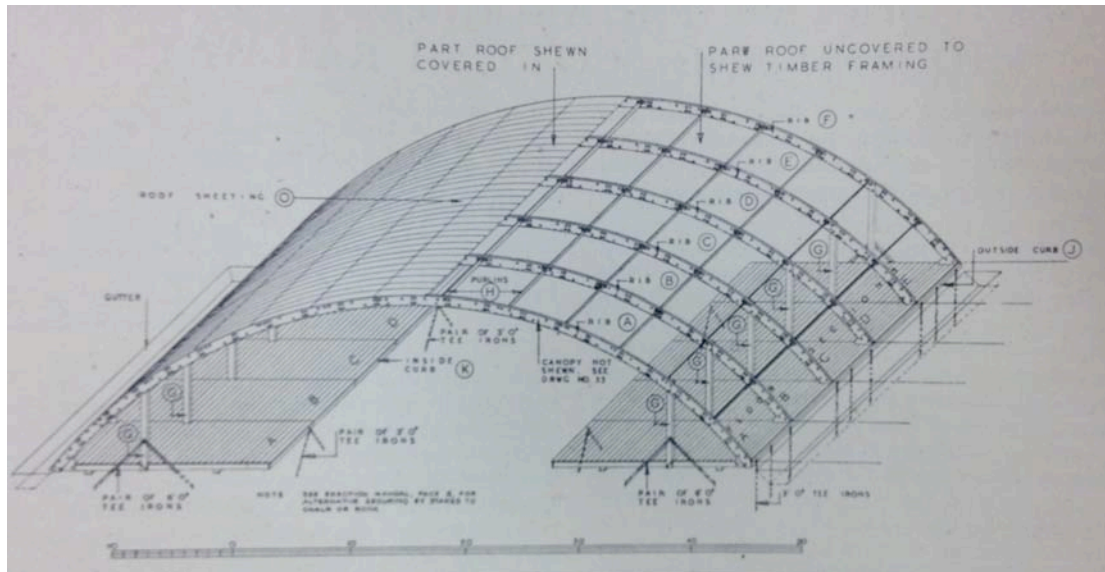
Alternative Name: Unknown

Period Built: Second World War (From 1939)

Location: England

Patent: GB538429, (28 November 1939)

Photo:



IDENTIFICATION

Long span structure first used as military hangars. Timber and steel, sometimes concrete. Prefabricated welded steel units are bolted together on site. Requires on a derrick pole to erect. Framework of arched ribs, ground bearers and vertical posts. Three standard sizes: 59 ft 11 in.; 86 ft 6 in.; 91 ft. 1 in.

USES

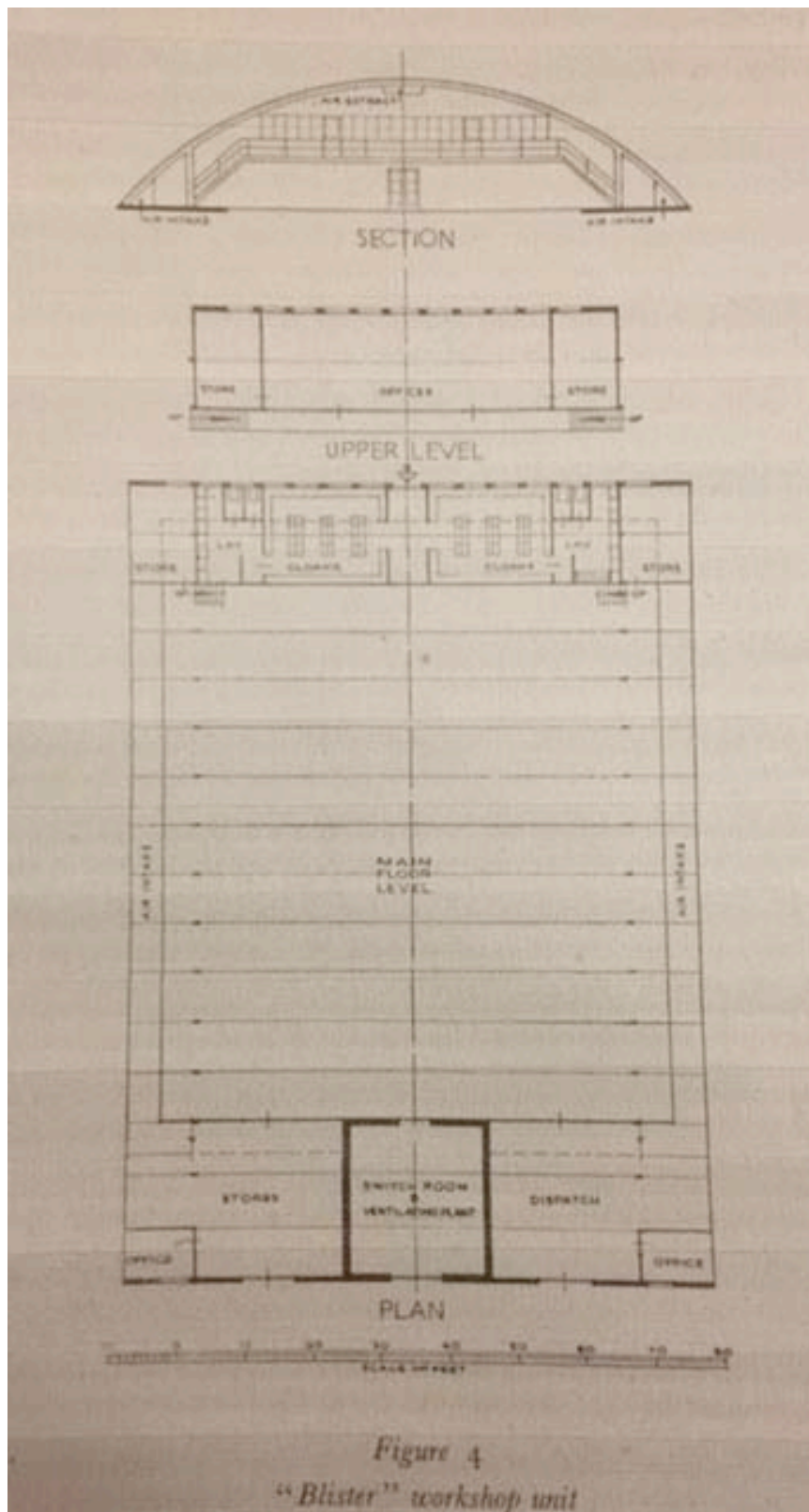
Aircraft hangar, workshop, accommodation.

REFERENCES

RIBA Journal, April 1941, pp. 108-110.

The Architect and Building News, 27 June 1941, p. 182.

PLAN



The C'tesiphon Hut

Designer: J.H. de W. Waller

Alternative Name: Unknown

Period Built: Second World War (From 1941)

Location: England

Patent: GB790968, (9 January 1941)

Photo:



Photo by Paul Francis.

IDENTIFICATION

The first use of an all compressive thin concrete shell structure. Cement grout applied to fabric until it reached final thickness of 50 mm. One hut could be erected by 16 men in 12 hours. Measured 16 ft wide by 36 ft long.

USES

Accommodation, storage.

REFERENCES

Mallory, p. 197.

Nov. 4, 1952

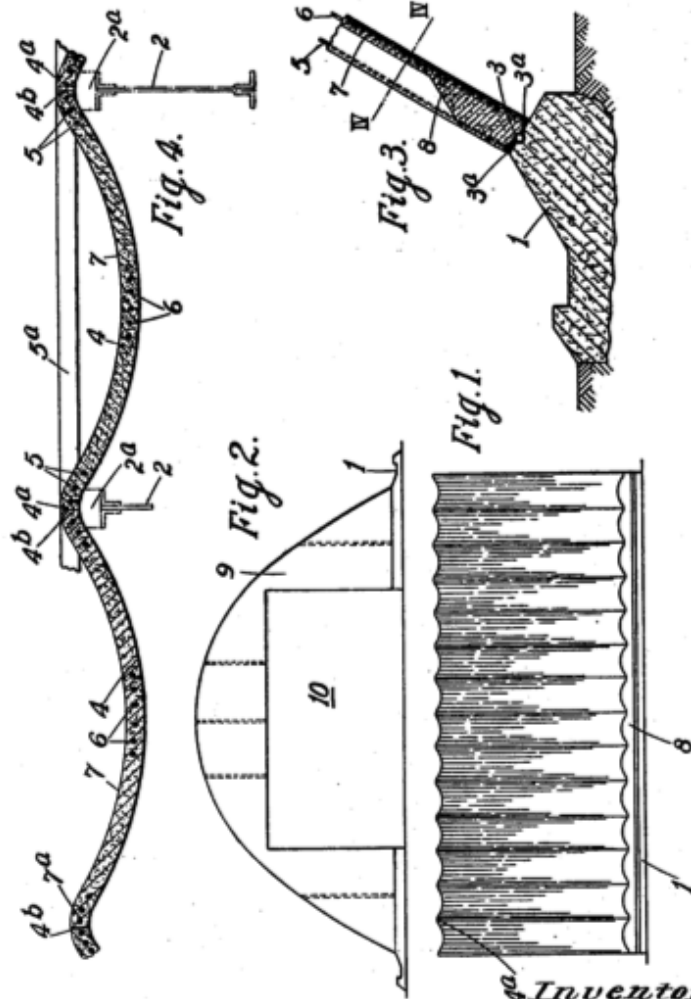
J. H. DE W. WALLER

2,616,149

METHOD OF MOLDING IN SITU CONCRETE ARCHED STRUCTURES

Filed Dec. 11, 1947

2 SHEETS—SHEET 1



Inventor
J. H. De W. Waller
By *Gleason Downing* Att'y

Nov. 4, 1952

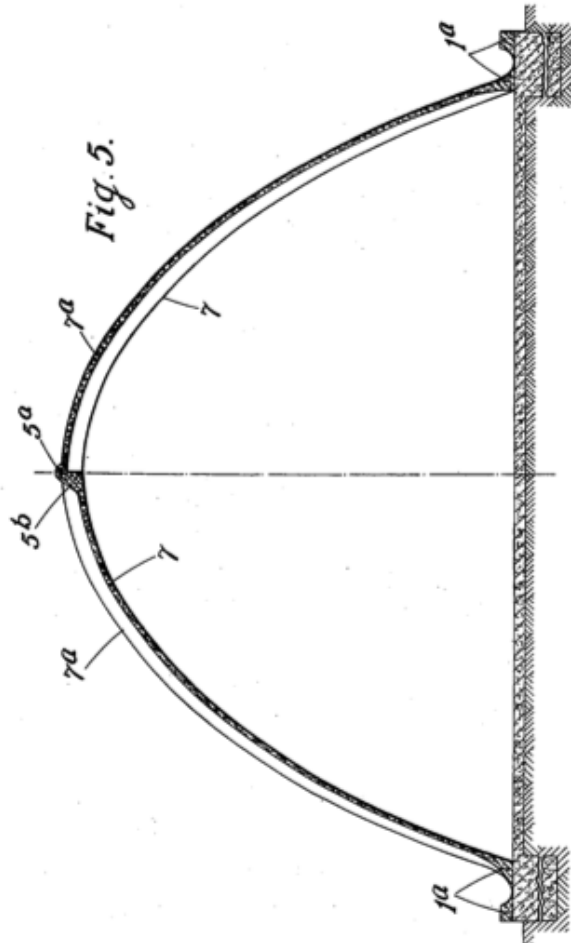
J. H. DE W. WALLER

2,616,149

METHOD OF MOLDING IN SITU CONCRETE ARCHED STRUCTURES

Filed Dec. 11, 1947

2 SHEETS—SHEET 2



Inventor
J. H. DeW. Waller
By *Glenn Downing* *Hubble* Attys.

The Cubbitt System

Designer: Holland, Hannen and Cubbitts, Ltd.

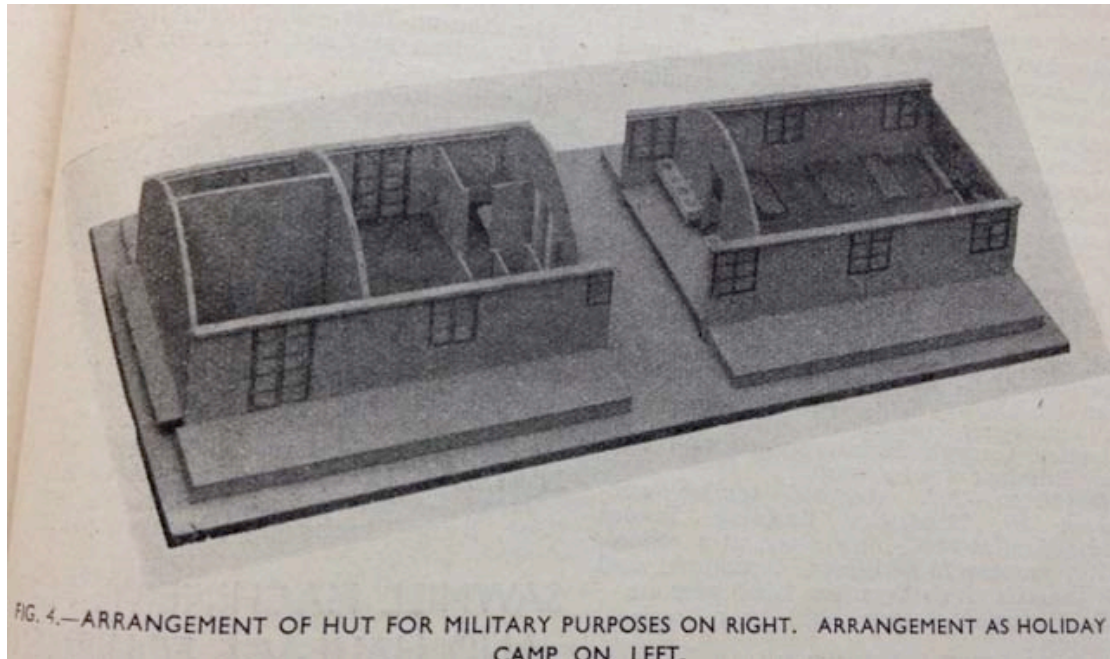
Alternative Name: Unknown

Period Built: Second World War

Location: England

Patent: None found

Photo:



IDENTIFICATION

Concrete with steel shuttering. Special due to use of concrete pumps and plan for conversion from military camp to post-war holiday camp. Price included electric wiring, heating by slow combustion stoves, jointless floors, plaster interior finish and two coats of bitumen on roof. It is unknown whether these were ever actually built.

USES

Accommodation

REFERENCES

The Builder, 27 Dec 1940, pp. 625-627.

The Curved Asbestos Hut

Designer: Unknown

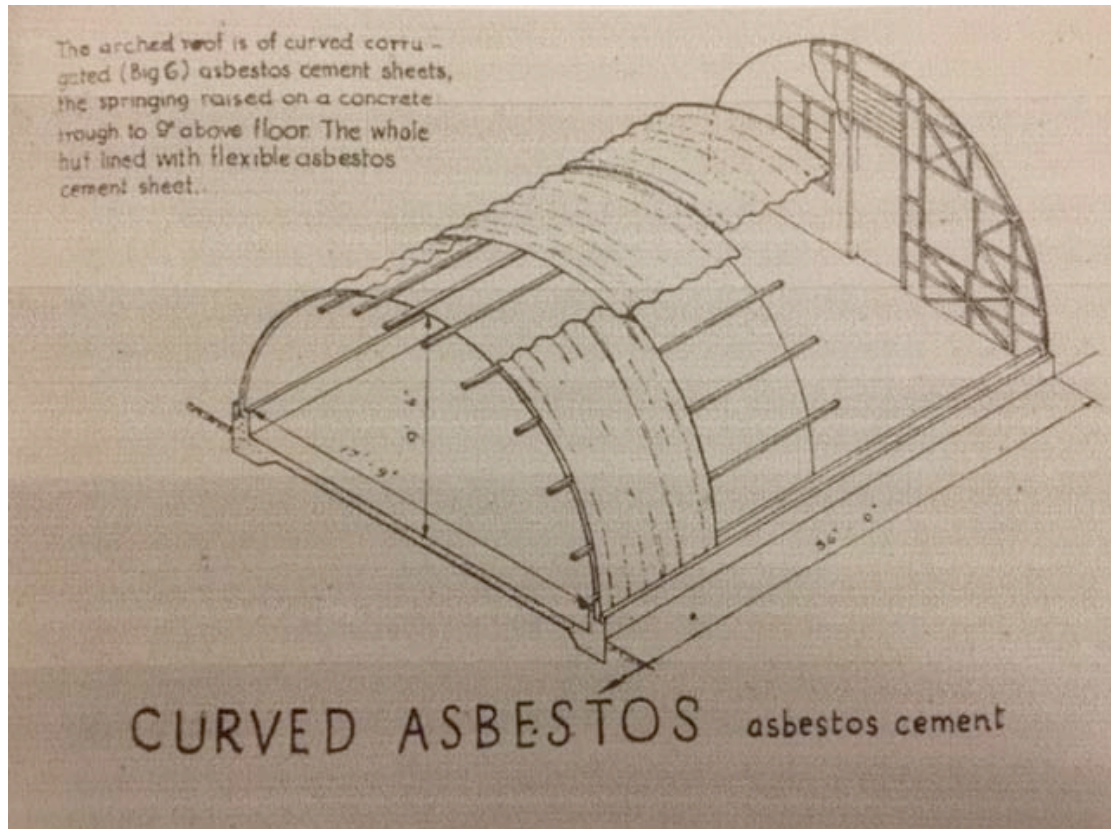
Alternative Name: Unknown

Period Built: Second World War

Location: England

Patent: None found

Photo:



IDENTIFICATION

Arched roof of curved, corrugated (Big 6) asbestos cement sheets. Springing from a raised concrete trough nine inches above the floor. The whole hut is lined with flexible asbestos cement sheets. Measured 17 ft 9 in wide by 36 ft long.

USES

Accommodation

REFERENCES

RIBA Journal, June 1942, p. 129.

The Fidler Hut

Designer: Douglas Charles Fidler

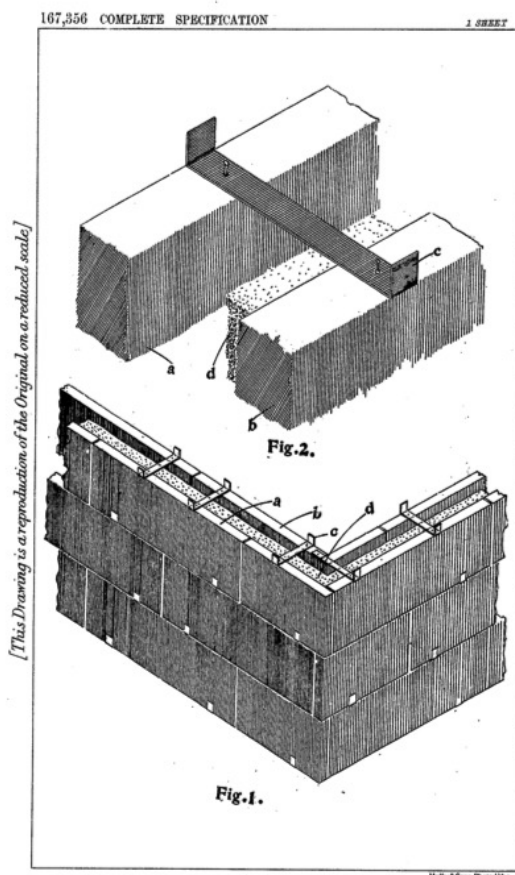
Alternative Name: Unknown

Period Built: Second World War

Location: England

Patent: GB167356, (11 August 1921).

Photo:



IDENTIFICATION

Clinker concrete blocks 2.5 in. thick with metal spacers; the cavity between is filled with 4 in. of poured concrete. It is then covered with cement render applied by a cement gun.

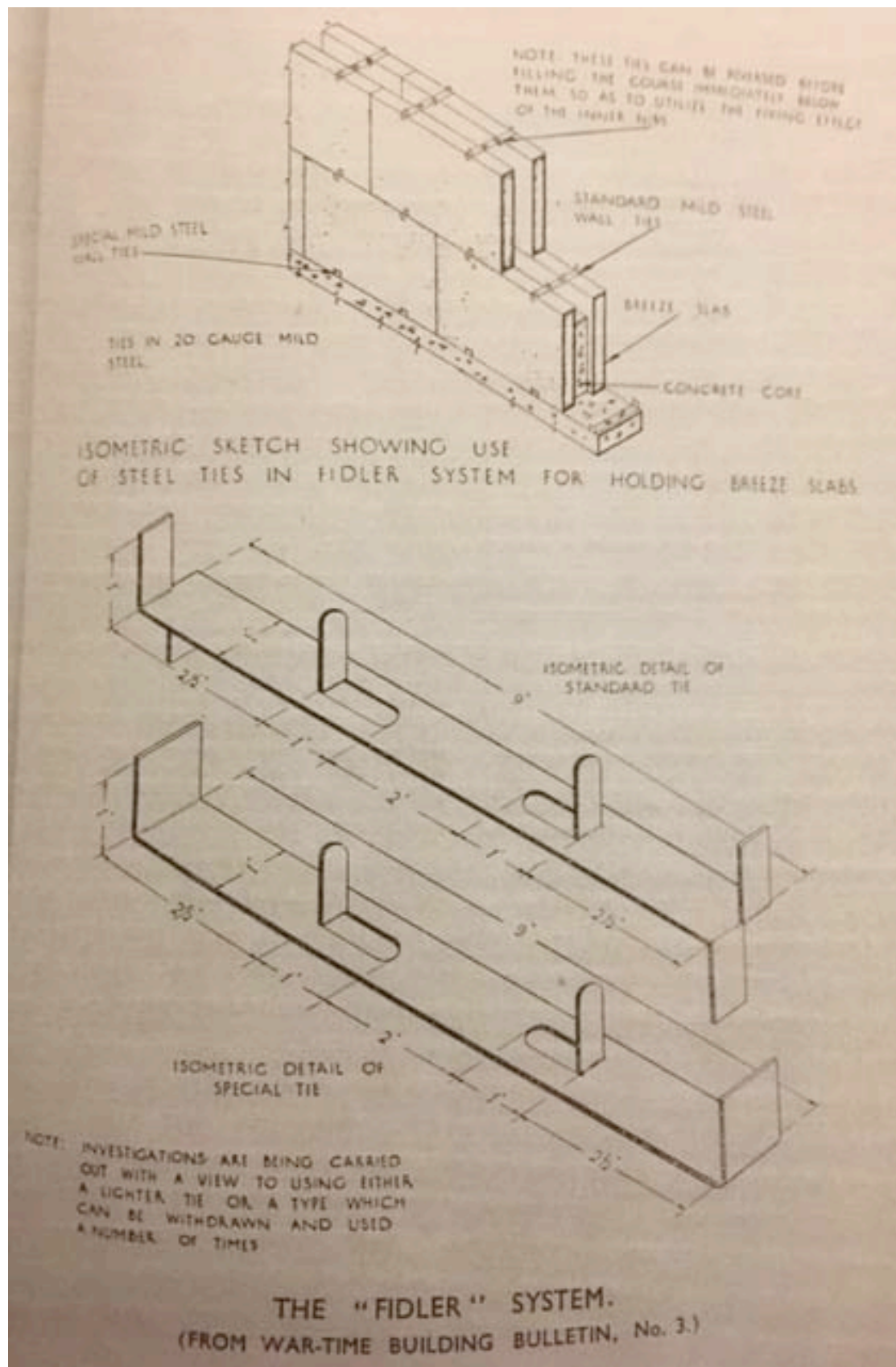
USES

Probably accommodation.

REFERENCES

The Builder, 19 June 1940, p. 705. Also in Wartime Building Bulletin No. 3 (BRS).

PLAN



The Half Brick Hut

Designer: Unknown

Alternative Name: Temporary Brick Hut

Period Built: Second World War

Location: England

Patent: None found

Photo:



IDENTIFICATION

Bricks laid in a single layer of stretcher bond, thus wall would only be 4.5 in. thick. Francis says it had external brick piers support light steel trusses, with external facing rendered with cement. Roof is corrugated asbestos sheeting. Came in two spans (18 ft and 28 ft) and could be any length.

USES

Accommodation

REFERENCES

The Architects' Journal, 11 September 1941, p. 181.

Francis, *British*, p. 207.

The Handcraft Hut

Designer: Universal Asbestos Manufacturing Co.

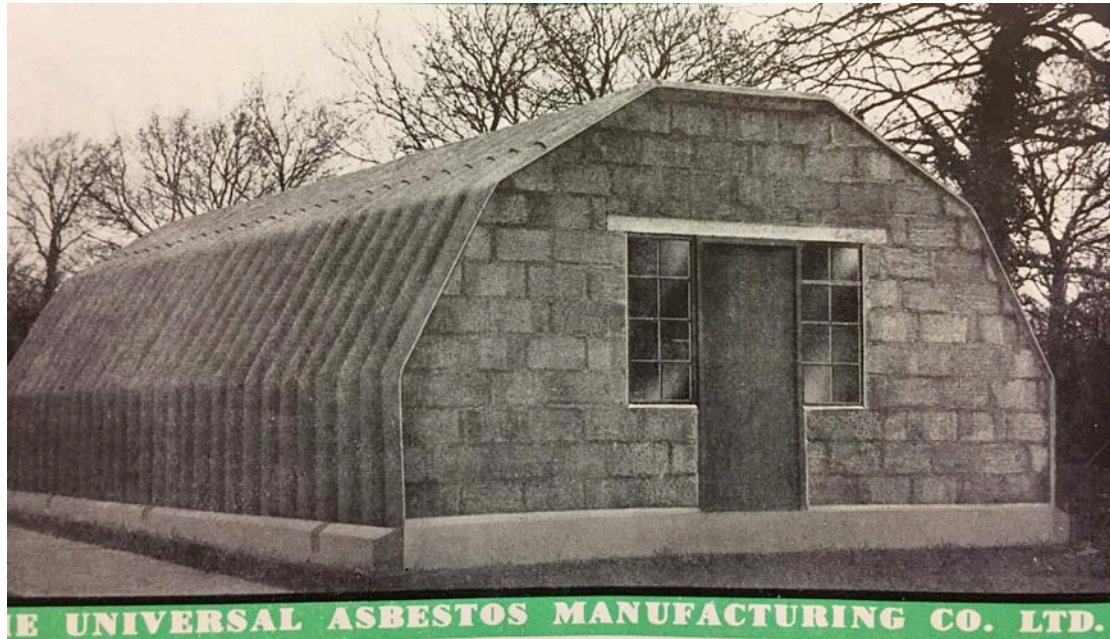
Alternative Name: Unknown

Period Built: Second World War (From May 1942)

Location: England

Patent: None found

Photo:



IDENTIFICATION

Asbestos cement sheets with wide vertical corrugations forming seven sides at angles in a roughly semi-circular shape. Ends of concrete blocks or brick. Measured 18 ft by 35 ft 9 in.

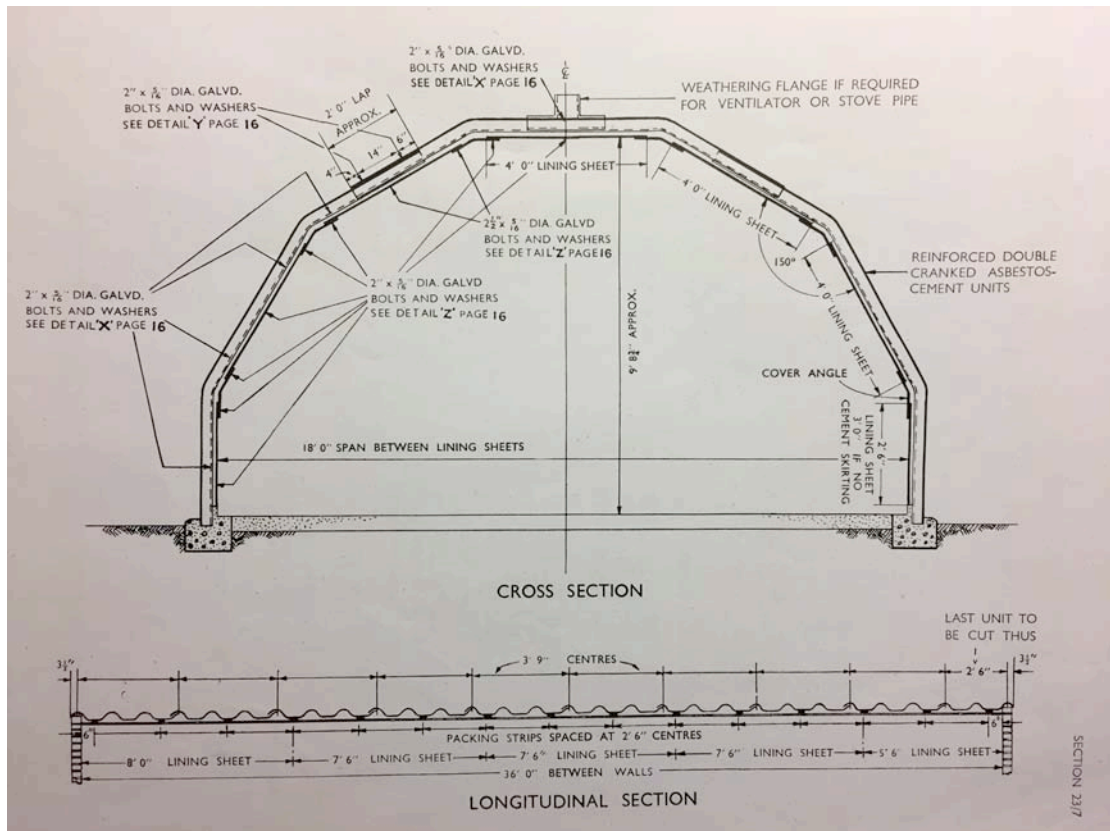
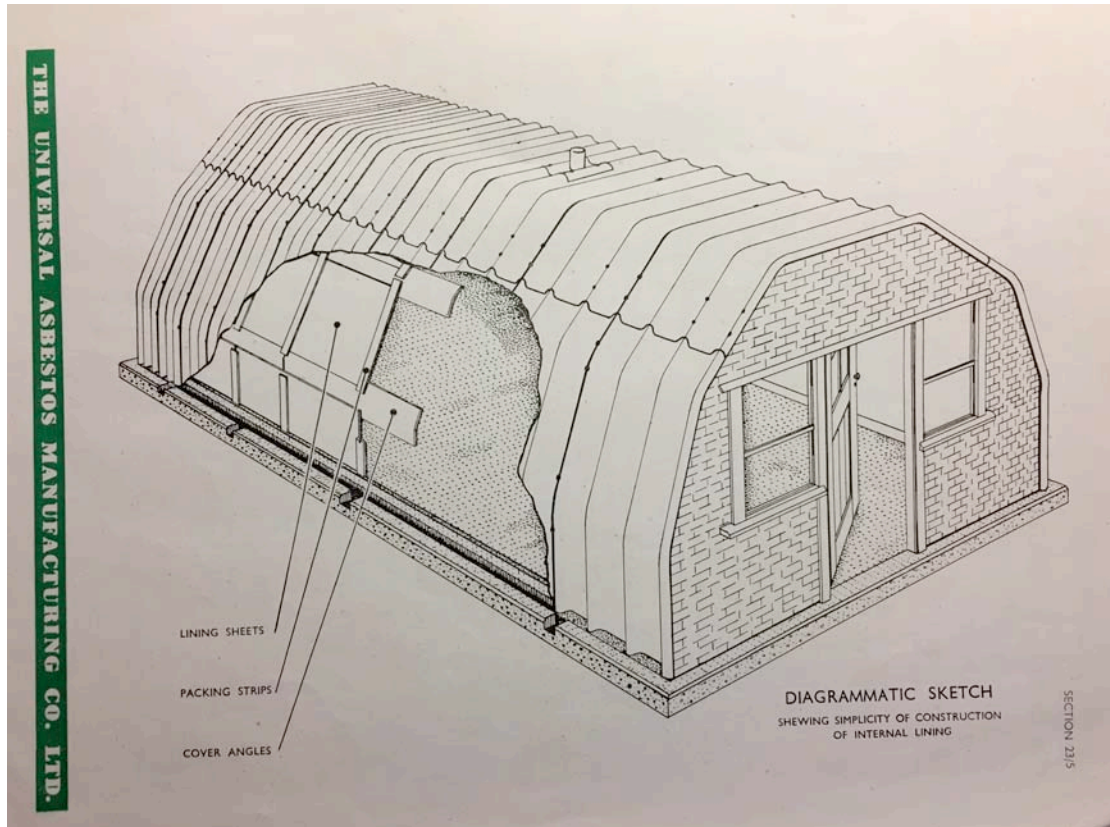
USES

Accommodation

REFERENCES

Francis, *British*, p. 207.
Handcraft brochure (Airfield Research Group).

PLAN



The Hessolite Hut

Designer: James H. de W. Waller

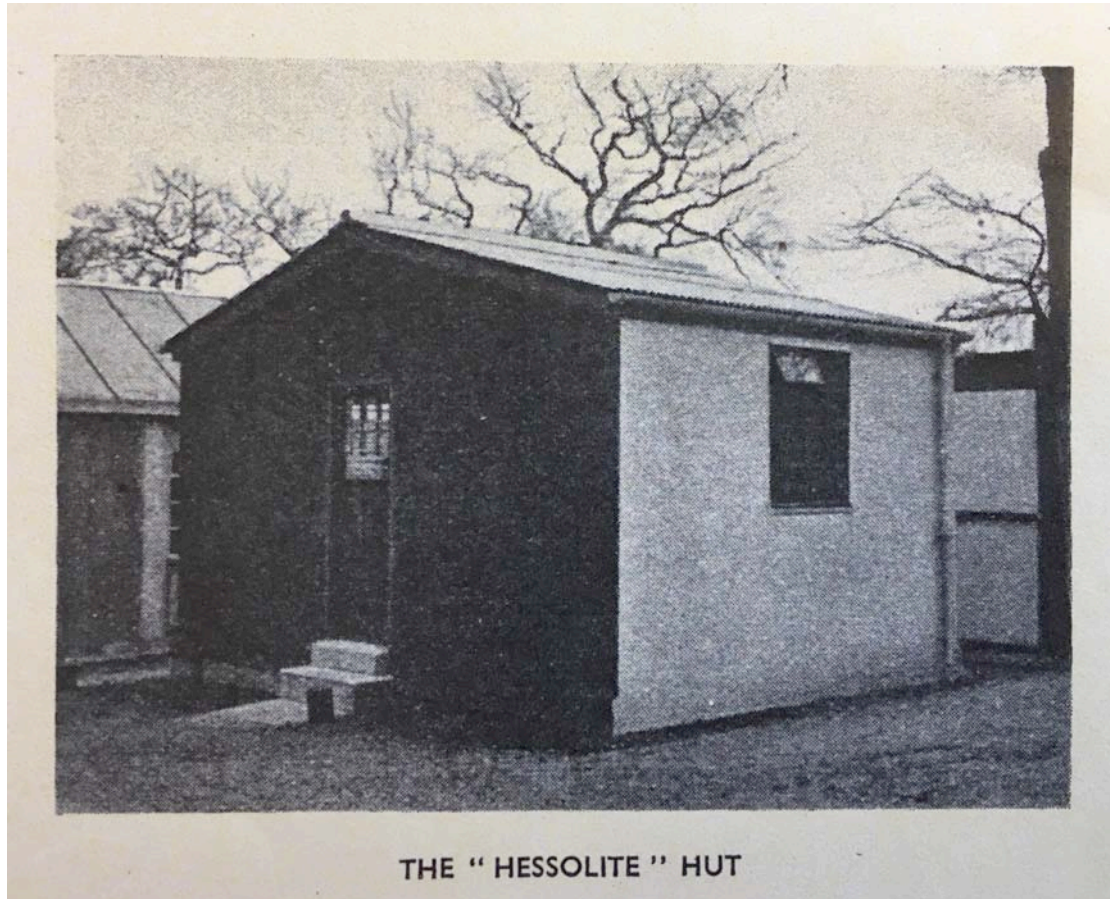
Alternative Name: Unknown

Period Built: Second World War (From Dec 1939)

Location: England

Patent: None found

Photo:



IDENTIFICATION

First erected in Dec 1939 at Coombe Hill Golf Course to showcase concrete hutting. It was a concrete hut covered in cement render with a corrugated iron or asbestos sheet roof. It is unknown if this ever went into production.

USES

Accommodation

REFERENCES

The Builder, 5 January 1940, pp. 5-8.

The Iris Hut

Designer: Directorate of Fortifications and Works

Alternative Name: The Iris Shed

Period Built: Second World War (From 1941)

Location: England

Patent: None found

Photo:



IDENTIFICATION

A modification of the Nissen, the Iris Hut used 2 in. tubular steel ribs and purlins, covered in corrugated iron sheeting. Unlined. Francis says that it was too flimsy of a design, so was soon discontinued to be replaced by the Romney Hut. Measured 35 ft wide by 96 ft long.

USES

Storage, workshops, canteens, cinemas.

REFERENCES

The Architects' Journal, 19 November 1942, p. 330.

Francis, *British*, p. 213.

The Jane Hut

Designer: Boulton and Paul (?)

Alternative Name: Unknown

Period Built: Second World War (From 1942)

Location: England

Patent: None found

Photo:

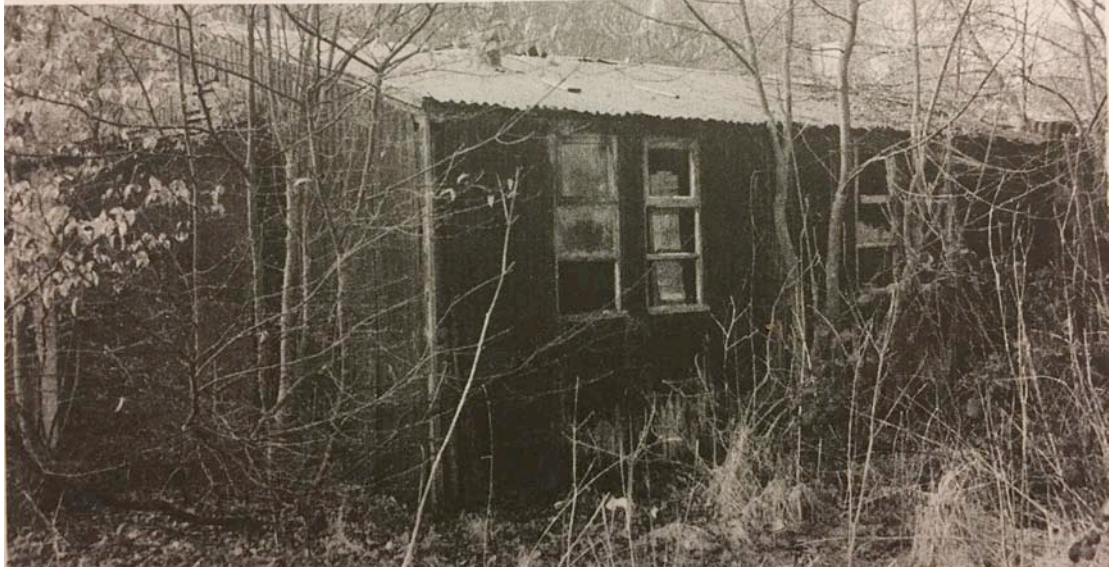
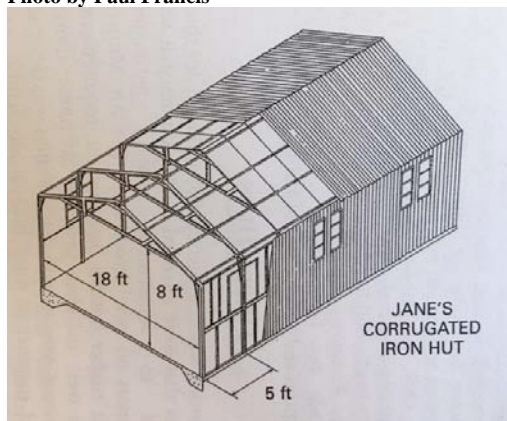


Photo by Paul Francis



Drawing by Paul Francis.

IDENTIFICATION

Lightweight, timber frame, originally manufactured using plasterboard for cladding, replaced later with corrugated iron. Span was 18 ft and length could be extended in 3 ft sections.

USES

Accommodation, offices.

REFERENCES

Francis, *British*, p. 209.

The Marston Shed

Designer: Unknown

Alternative Name: Unknown

Period Built: Second World War

Location: England

Patent: None found

Photo:



Photo by Paul Francis.

IDENTIFICATION

Steel frame clad in corrugated asbestos sheets with a roof of corrugated iron/steel. Measured 45 ft wide with lengths in any multiple of 25 ft, so could be quite large. Francis says there were two types: 'High shedding for use when an overhead travelling crane was required; and low shedding for other uses such as gunnery and crew procedure centres.' (p. 210)

USES

Technical building, workshops, etc.

REFERENCES

Francis, *British*, p. 210.

The Ministry of Supply Laing Hut

Designer: Ministry of Supply

Alternative Name: Thorn, Thorbex, Thorber

Period Built: Second World War (from 1940)

Location: Britain

Patent: Unknown

Photo:



Photo by Evelyn Simak. (Geograph.co.uk)

IDENTIFICATION

In production from January 1941 to April 1942. The Air Ministry erected 12,540 Laing huts over this period. They measured 18 ft by 60 ft. Alternative material hut employed felted plasterboard panels for walling and corrugated asbestos sheets for roofing. A Revised Laing Hut was produced from May 1942 to June 1943, which was the same size but covered with corrugated steel, lined hardboard or plyfelt.

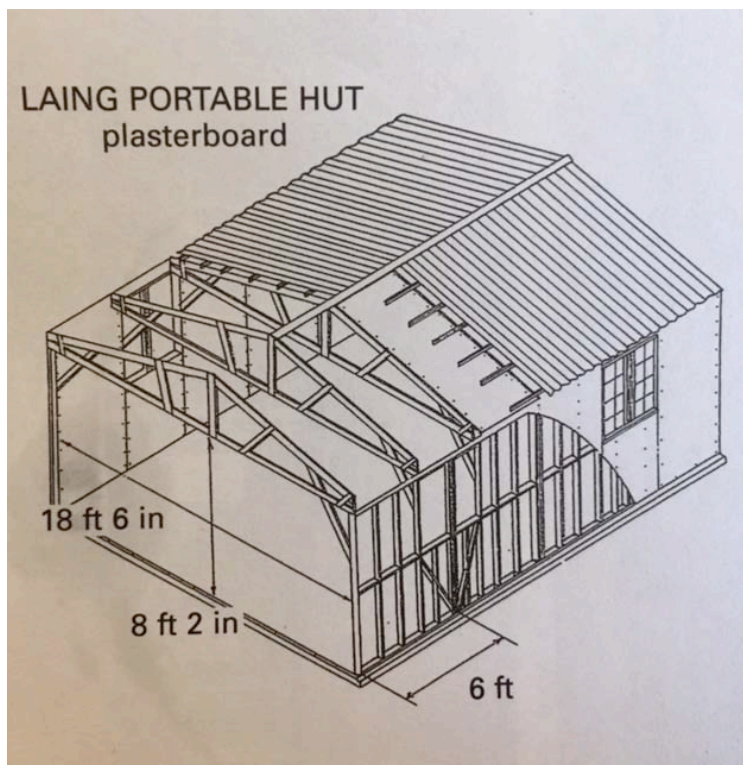
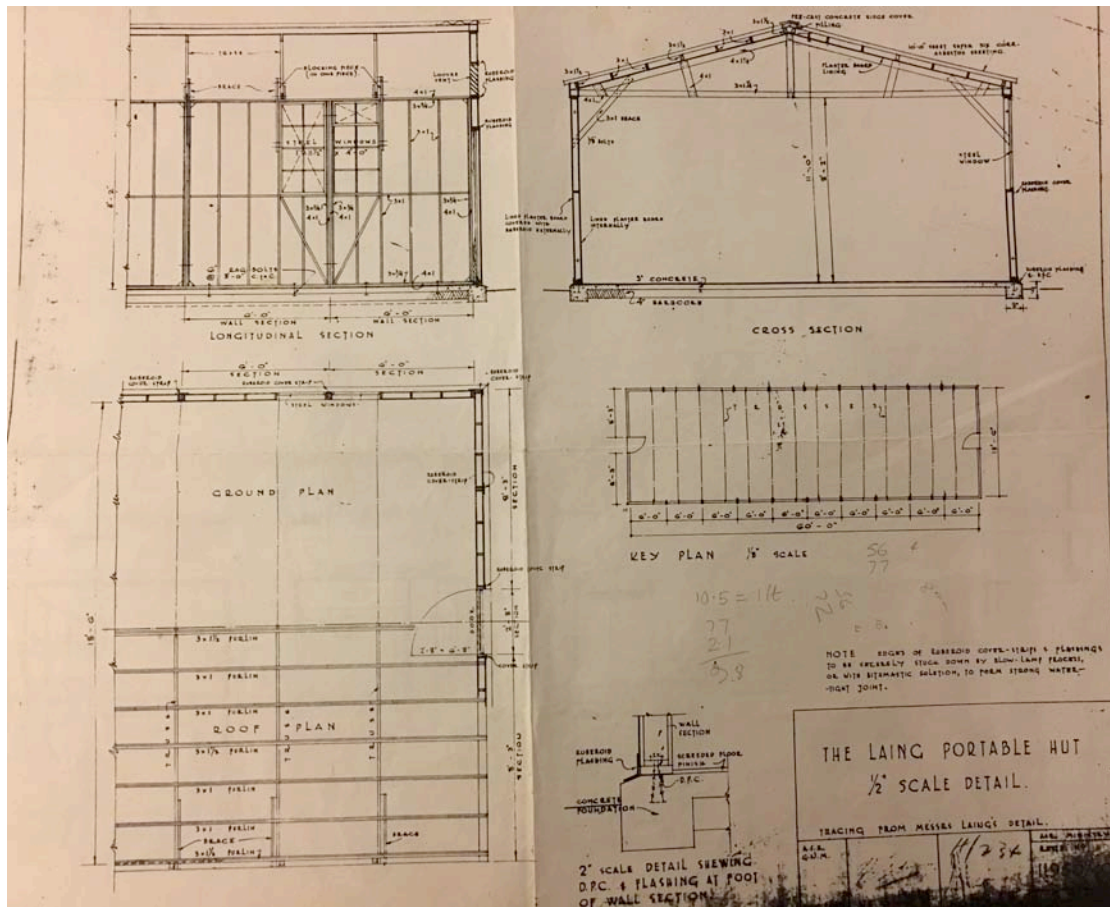
USES

Living accommodation: barracks, dormitory, quarters.

REFERENCES

Air Ministry, *The Royal Air Force Builds For War (Works)*, (1956).
Airfield Research Group.

PLAN



Drawing by Paul Francis.

The Ministry of Supply Living Hut

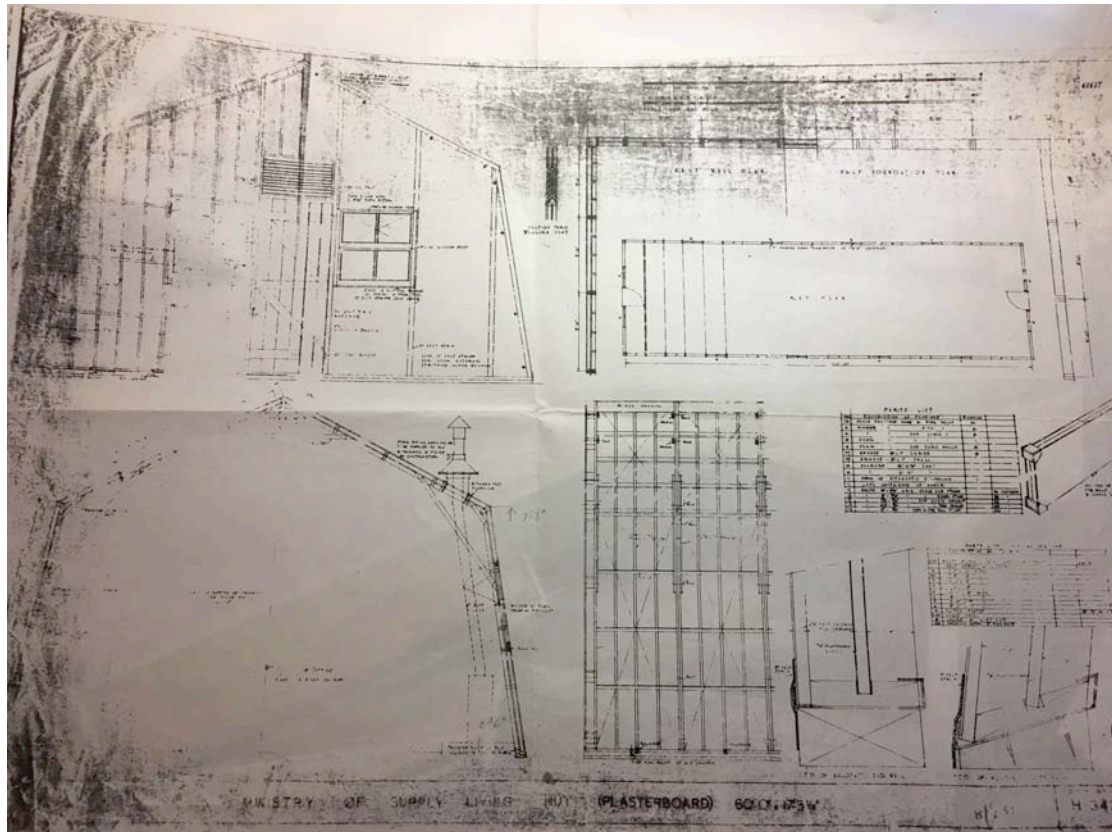
Designer: Ministry of Supply

Alternative Name: Thorn, Thorbex, Thorber

Period Built: Second World War (from 1940)

Location: Britain

Patent: Unknown



IDENTIFICATION

Measured 17 ft 3 in. wide by 60 ft long. Timber framed with cant-sided walls, covered externally with felted plasterboard. In production from January 1941 to July 1941, with 500 erected by the Air Ministry alone over this period.

USES

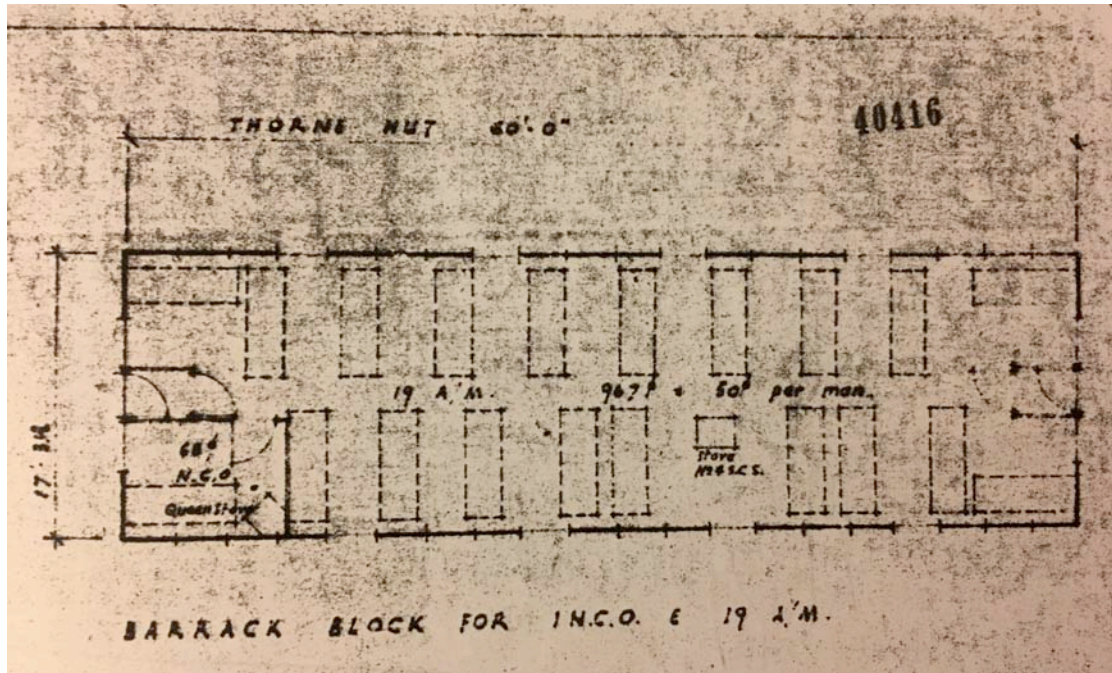
Living accommodation: barracks, dormitory, quarters.

REFERENCES

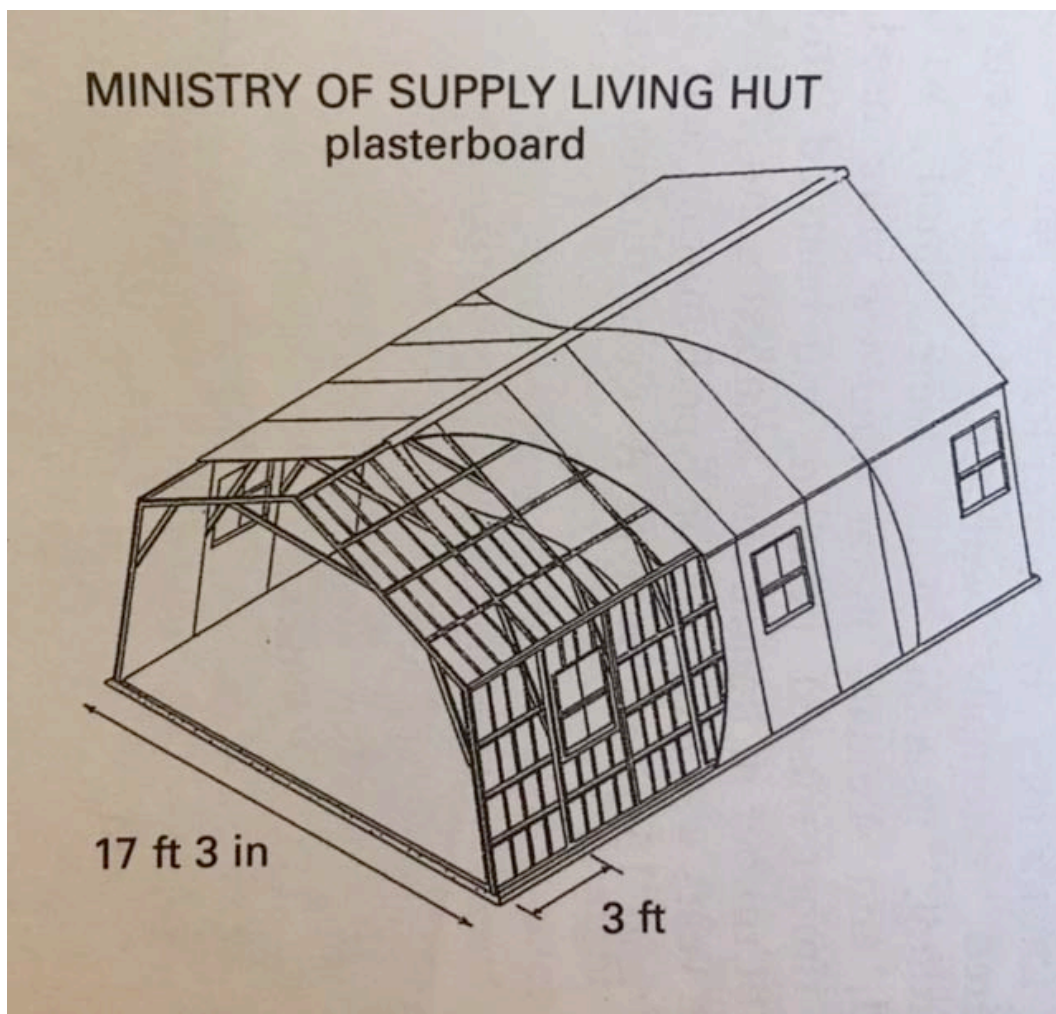
Francis, *British*, p. 208.

Air Ministry, *The Royal Air Force Builds For War (Works)*, (1956).

PLAN



The MoS Living Hut (aka Thorne, Thorbex, Thorber) arranged as a barrack block. (Airfield Research Group)



Drawing by Paul Francis.

The Ministry of Supply Maycrete Hut

Designer: Maycrete Ltd. (and possibly John Lintott)

Alternative Name: MoS Timber and Maycrete Hut

Period Built: Second World War (from 1940)

Location: Britain

Patent: Possibly GB349629, (22 April 1952).

Photo:



Photo by Paul Francis.

IDENTIFICATION

A timber and concrete building that used moulded sawdust concrete panels as the internal wall filling between reinforced concrete posts. Could be clad externally by corrugated asbestos sheets and internally with plasterboard. Roofing was corrugated asbestos cement sheets. There were two versions: one made for Ministry of Supply and another for the Ministry of Works. The MoS Maycrete had a smaller span of 15 ft 7 in. and length of 53 ft 5 in.

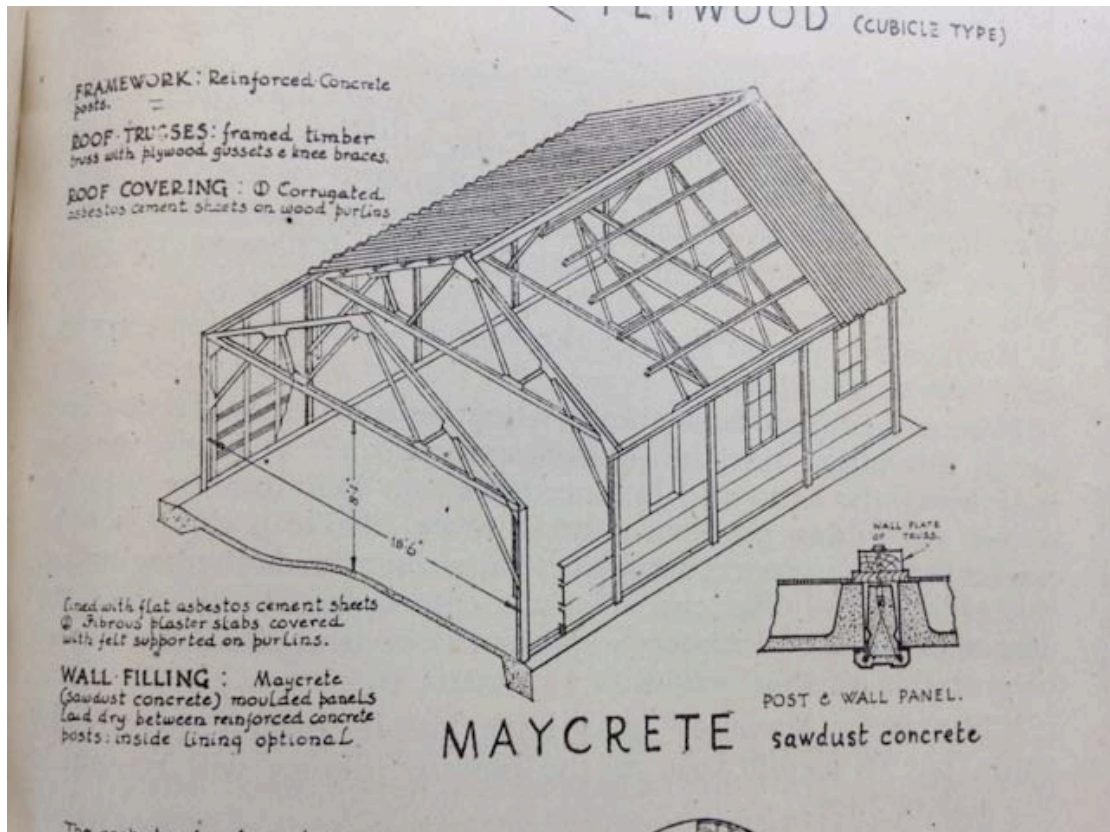
USES

Living accommodation: barracks, dormitory, quarters.

REFERENCES

Journal of the Royal Institute of British Architects, June 1942, p. 129.
Francis, *British*, p. 219.

PLAN



The Ministry of Supply Padmos Hut

Designer: Ministry of Supply

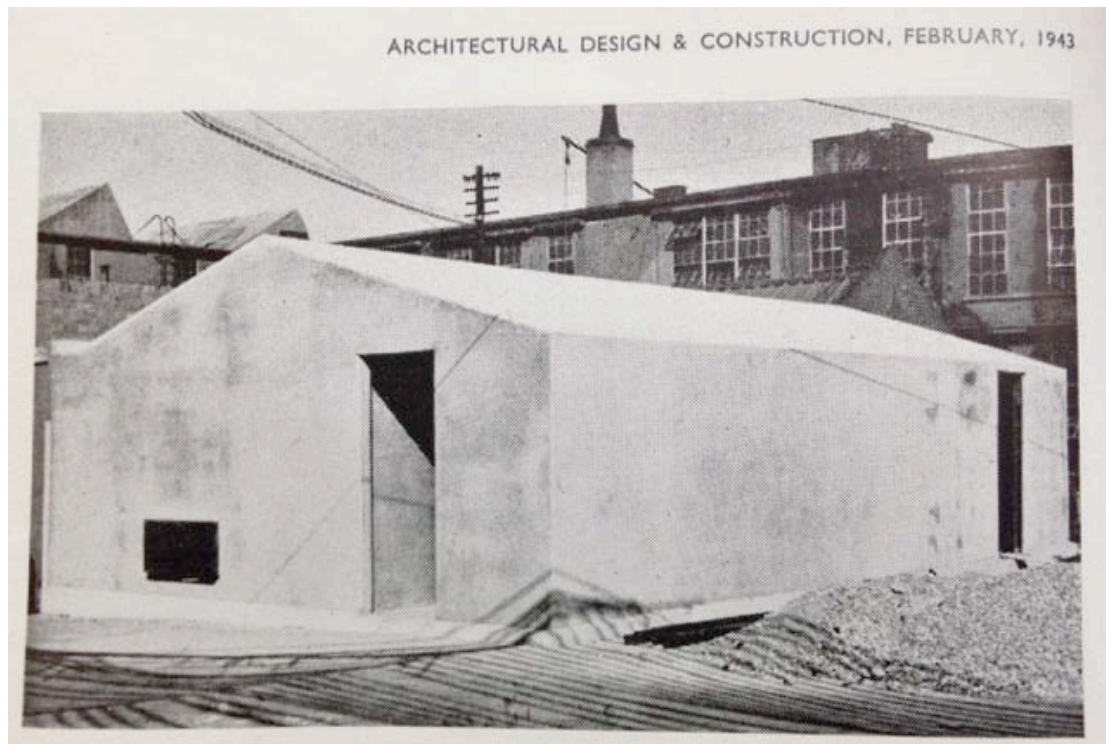
Alternative Name: The Padmos Hut

Period Built: Second World War (from 1943)

Location: Britain

Patent: Unknown

Photo:



IDENTIFICATION

Constructed of rendered metal mesh supported on a lightweight steel portal frame. The mesh is attached to the frame with small hook-type bolts. The cement render is applied until it reaches a thickness of 1.25 to 1.5 in. It is said to require half the steel as a Nissen Hut. Three men were said to be able to construct one of these huts in four weeks. Measured 16 ft by 30 ft.

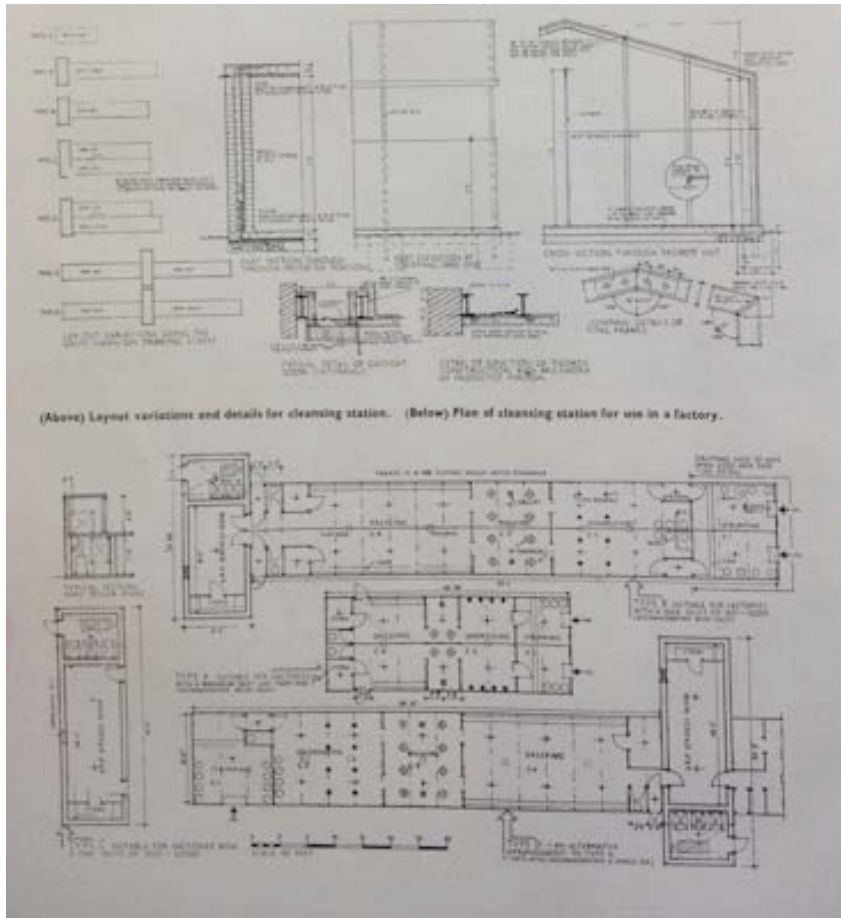
USES

Cleansing stations, accommodation, canteens, nurseries.

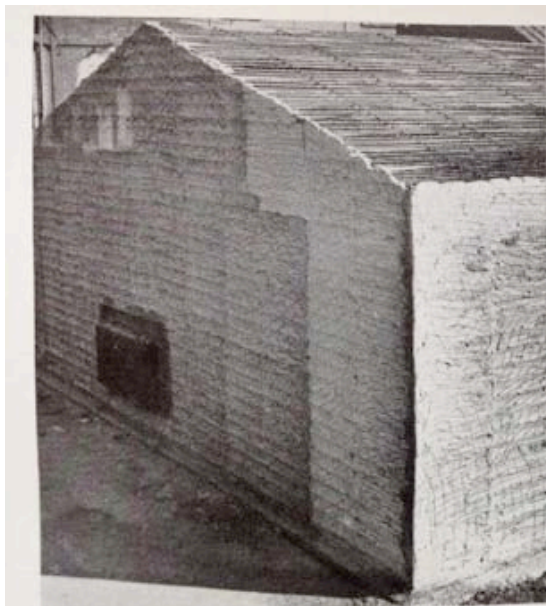
REFERENCES

Architectural Design & Construction, February 1943, pp. 40-41.

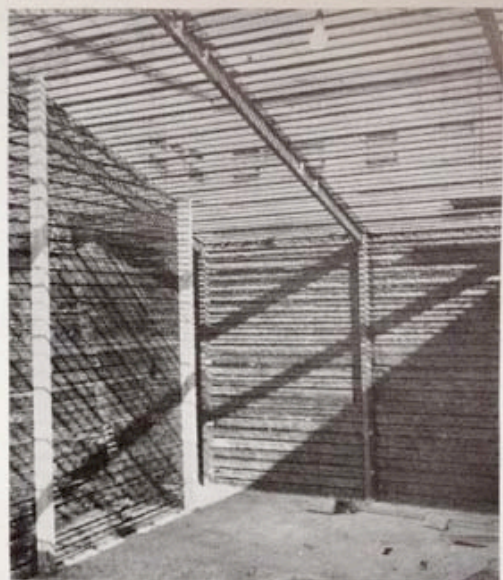
PLAN



(Above) Layout variations and details for cleaning station. (Below) Plan of staking station for use in a factory.



Exterior under construction.



Interior of hut showing Hy-rib type of construction.

The Ministry of Supply Plasterboard Hut

Designer: Ministry of Supply

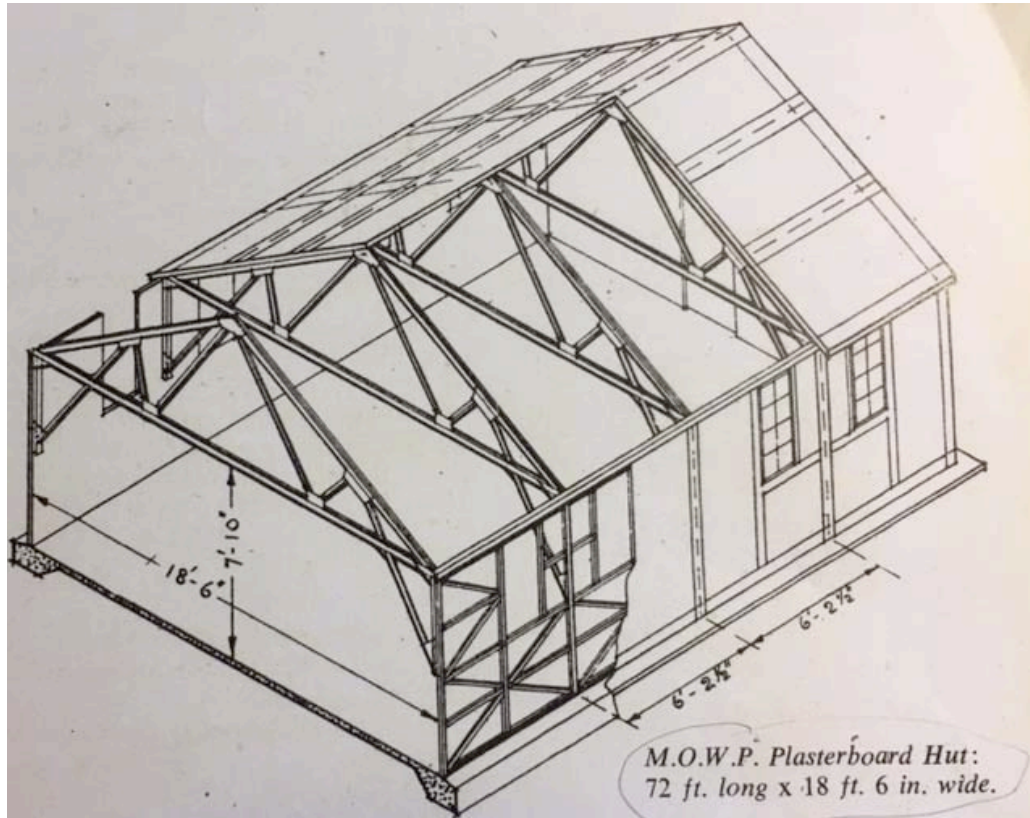
Alternative Name: Unknown

Period Built: Second World War (1941)

Location: Britain

Patent: Unknown

Photo:



IDENTIFICATION

Timber framed with felted plasterboard panels covering the exterior and roof, and plain plasterboard walls for interior. Measured 18 ft 6 in. by 60 ft. or 72 ft in length. Constructed for the Air Ministry between October and December 1941 with 355 huts erected over this period. Very similar to the Hall Hut.

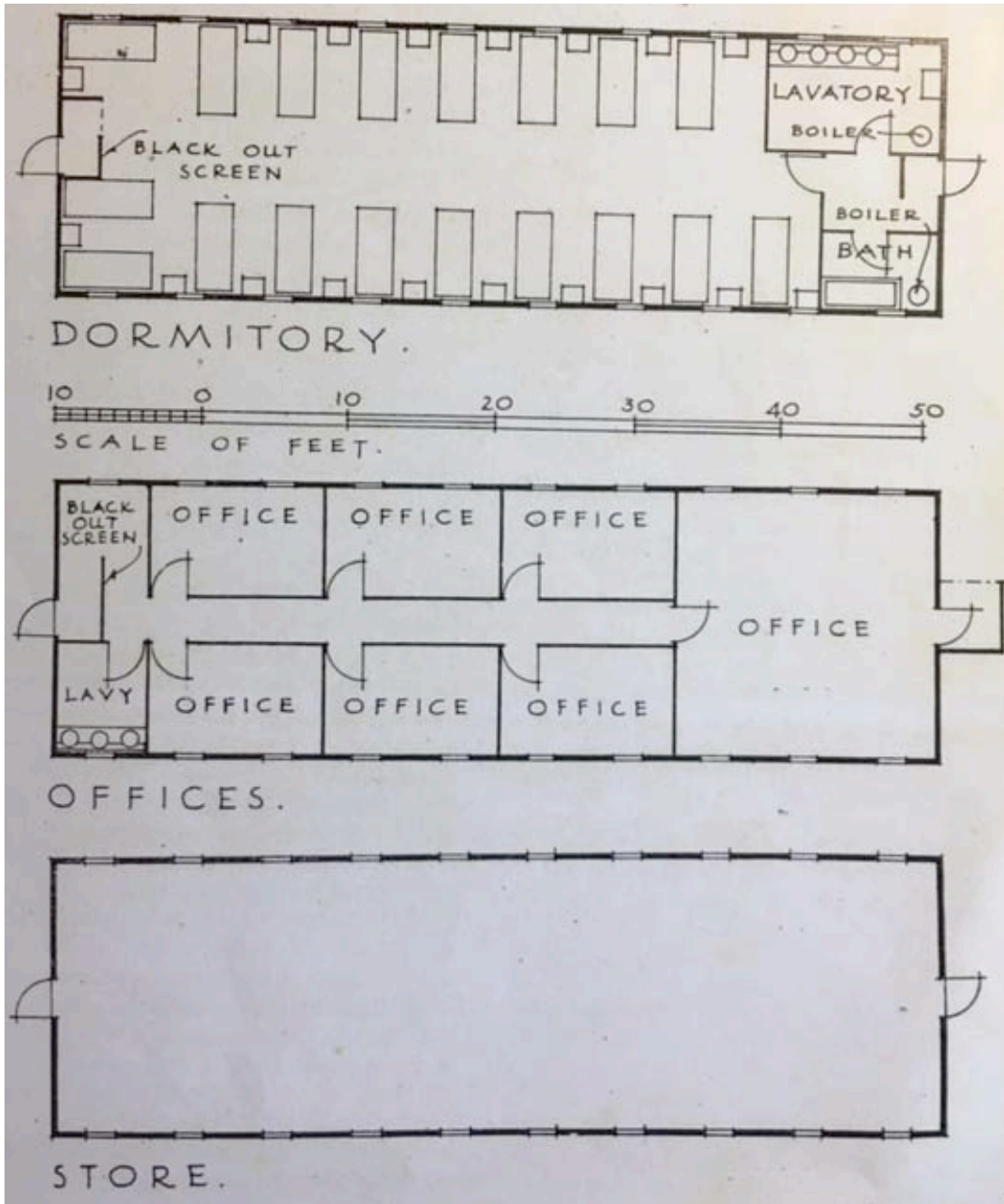
USES

Unknown but likely living accommodation.

REFERENCES

Air Ministry, *The Royal Air Force Builds For War (Works)*, (1956).
The Architect and Building News, 31 July 1942, p. 73.

PLAN



The Ministry of Supply Timber Hut

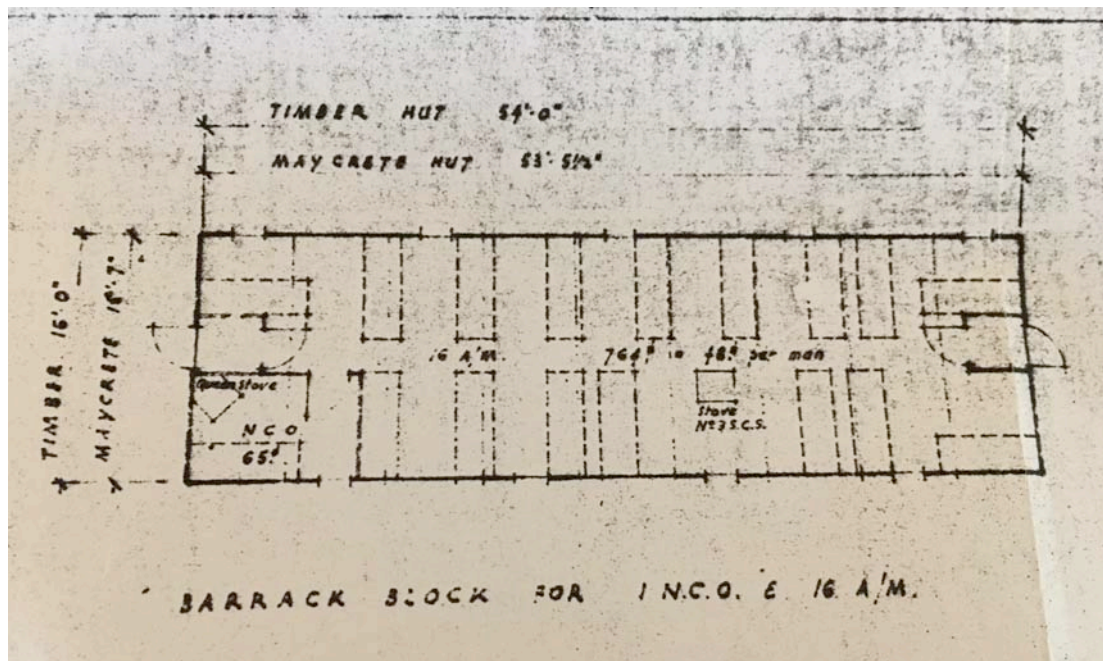
Designer: Magnet Limited

Alternative Name: The Magnet Timber Hut

Period Built: Second World War (from January 1941)

Location: Britain

Patent: Unknown



IDENTIFICATION

The Ministry of Supply Timber Hut, also known by its manufacturer name of the Magnet Timber Hut. Designed to be an improvement upon the X, Y, and Z huts. Measured 16 ft by 54 ft. Timber framed, weatherboarded walls, concrete floors and a felt roof. Only in production for six months with an estimated 1,015 huts erected in this period.

USES

Accommodation.

REFERENCES

Air Ministry, (1956).

Francis, *British Military Airfield Architecture*, (1996).

Airfield Research Group Archive Drawings 16056/40 and 16227/40.

The Ministry of Works Hall Hut

Designer: Ministry of Works

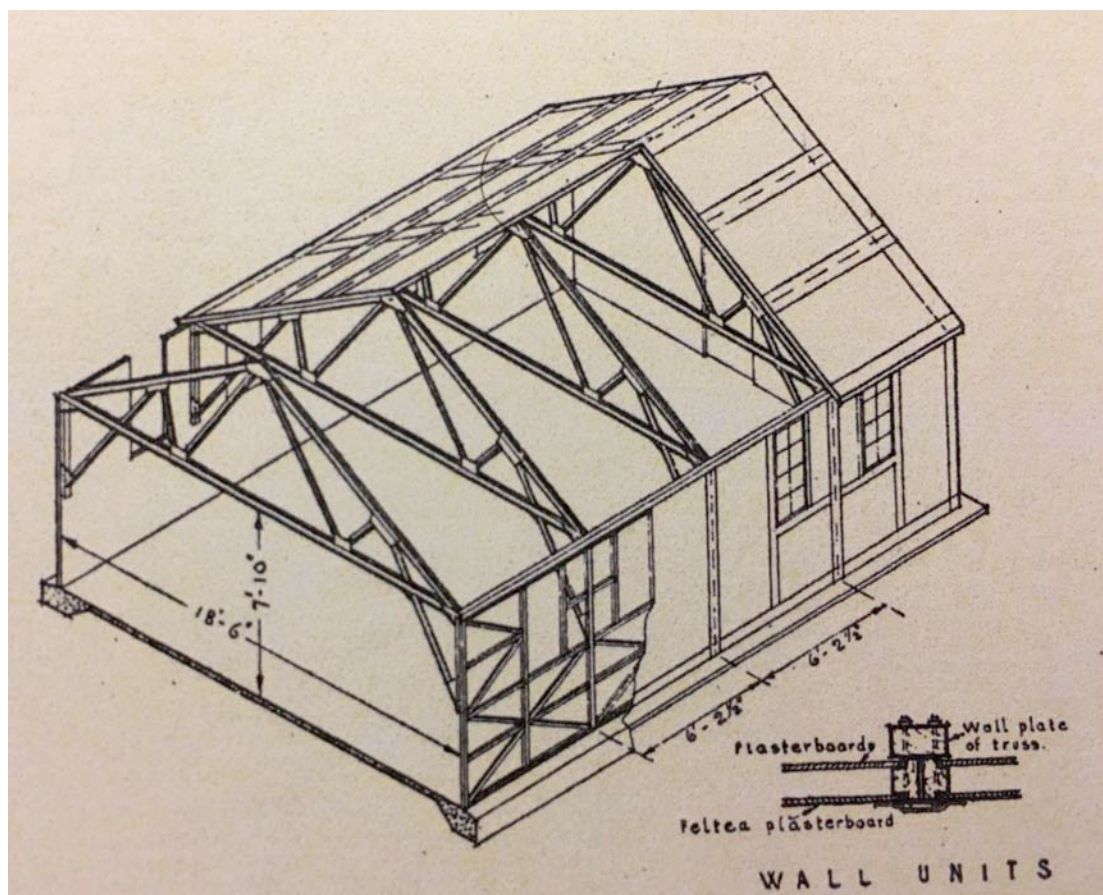
Alternative Name:

Period Built: Second World War (from 1942)

Location: Britain

Patent: Unknown

Photo:



The Architects' Journal, 13 August 1942.

IDENTIFICATION

Timber framed with felted plasterboard panels covering the exterior and roof, and plain plasterboard walls for interior. Measured 18 ft 6 in. and could be extended to any length in increments of 6 ft 6 inches. Constructed for the Air Ministry between July 1942 and February 1943 with 810 huts erected over this period.

USES

Multipurpose: Living and office

REFERENCES

Air Ministry, *The Royal Air Force Builds For War (Works)*.

Francis, *British*, p. 209.

The Architects' Journal, 13 August 1942.

The Ministry of Works Maycrete Hut

Designer: Maycrete Ltd.

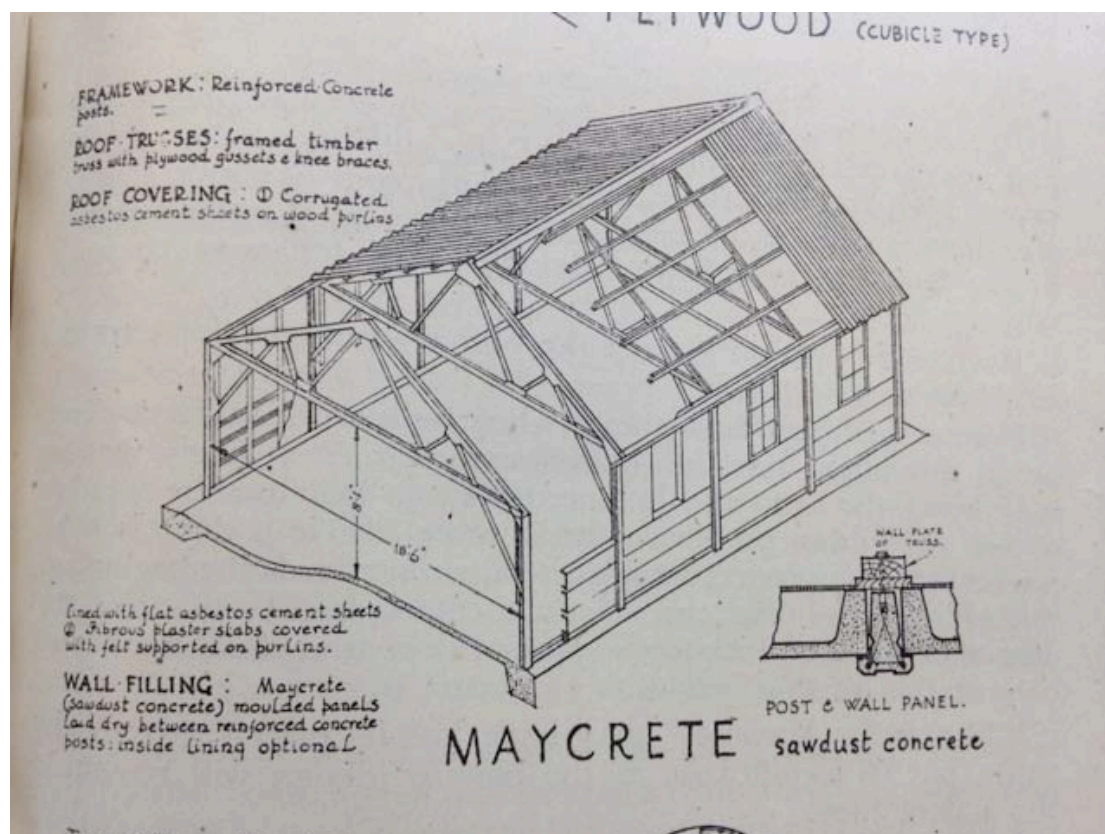
Alternative Name: MoS Timber and Maycrete Hut

Period Built: Second World War (from 1940)

Location: Britain

Patent: Unknown

Photo:



IDENTIFICATION

A timber and concrete building that used moulded sawdust concrete panels as the internal wall filling between reinforced concrete posts. Could be clad externally by corrugated asbestos sheets and internally with plasterboard. Roofing was corrugated asbestos cement sheets. There were two versions: one made for Ministry of Supply and another for the Ministry of Works. The MoW Maycrete had a larger span of 18 ft 6 in. and length of 60 ft.

USES

Living accommodation: barracks, dormitory, quarters.

REFERENCES

RIBA Journal, June 1942, p. 129.

Francis, *British*, p. 219.

The Ministry of Works Standard Hut

Designer: Ministry of Works

Alternative Name: Unknown

Period Built: Second World War (from 1943)

Location: Britain

Patent: Unknown

Photo:



Photo by Paul Francis

IDENTIFICATION

Designed by the Ministry of Works to allow for a versatile range of materials depending on whatever was locally available. Thus, could be found constructed of clay bricks or concrete blocks. It came in two sizes: 18 ft 6 in. by 60 ft and 24 ft by 120 ft, although presumably the length was adjustable based on requirements. Francis said the average cost was £210 per hut, or £375 for carriage, foundation work and complete erection.

USES

Multipurpose: Living and office

REFERENCES

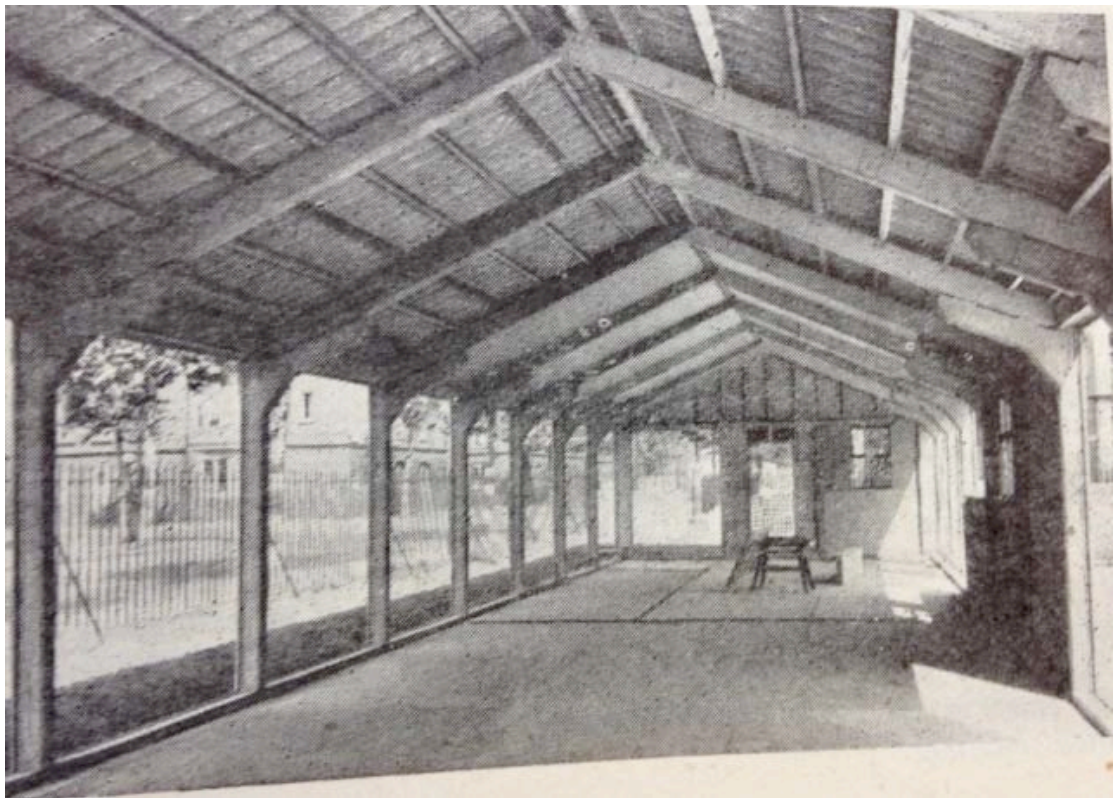
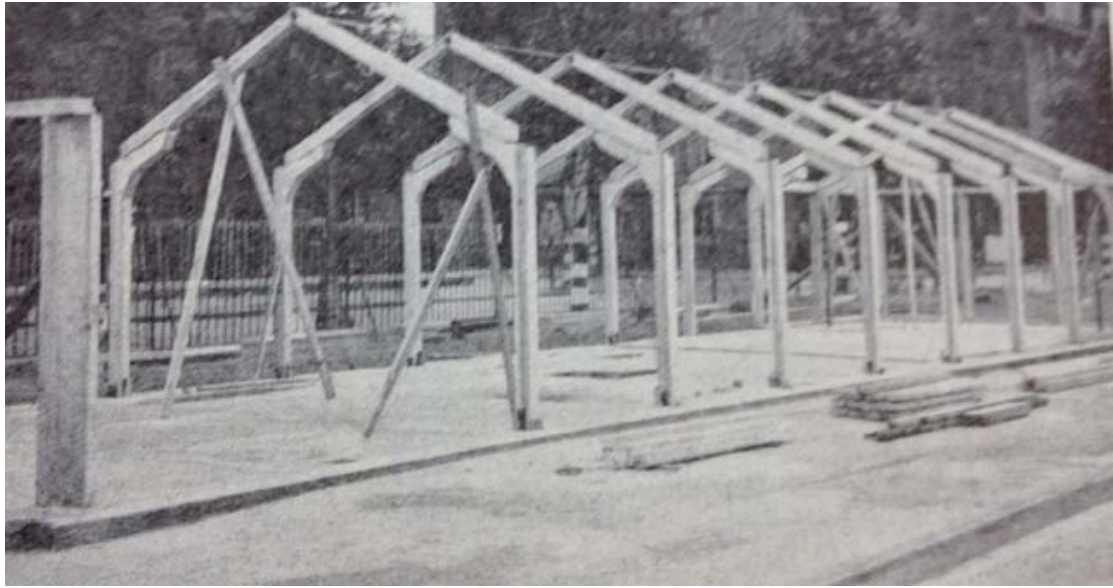
Francis, *British*, pp. 219-220.

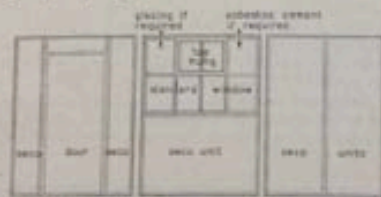
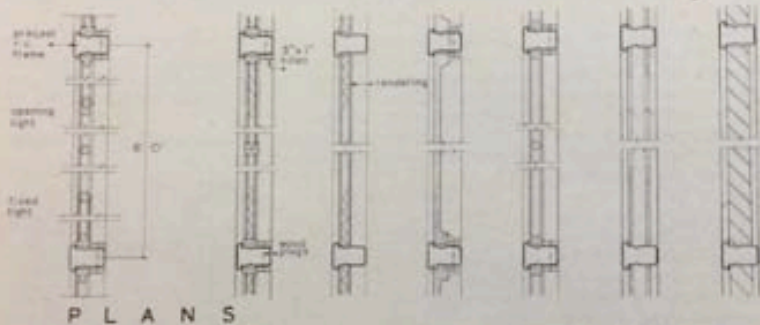
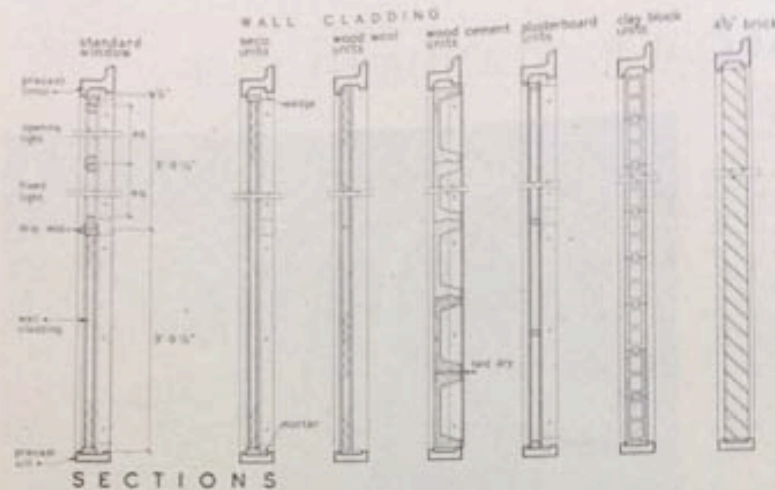
RIBA Journal, Sept 1942, p. 194.

Mallory, *Architecture*, p. 189.

The Builder, 14 April 1944, p. 208.

The Builder, 15 February 1945, p. 166.





NOTE ON THE ILLUSTRATIONS

The design of the hut is full of interest to students of prefabrication. Hitherto hut needs have been met, chiefly, by designs exploiting one or another material to the exclusion of others. Now the Ministry have, as it were, shaken the hut design problem into a new freedom. Without any less respect for standards—indeed there is rather more—a greater freedom is allowed in choice of material and hence in design, character and the functional properties of the structure.

Another and most significant feature which requires our attention is the demonstration here of the new importance in building of the "rigger." The characteristics of the design of the hut cannot be illustrated except by reference to the actual process of building and the physical and intelligence functions demanded of the workmen. What is needed here may not be craftsmanship in the old sense, but the rigger technique certainly requires as high a degree of control, balance and team work and understanding of the physical properties of the materials being handled as was ever required in the past.

The illustrations on this page show the erection of the frame, the tightening of the ridge connector and the connection at eaves. On the left are sections showing the use of various fillings.



The Mopin Hut

Designer: E. Mopin Ltd.

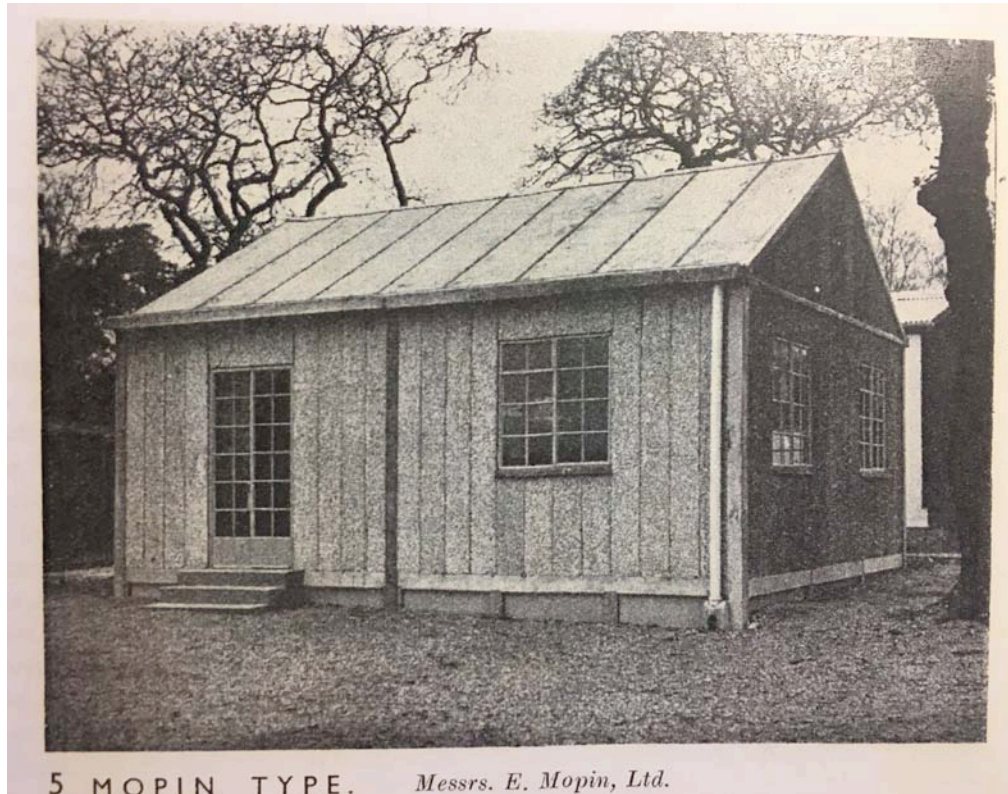
Alternative Name: Unknown

Period Built: Second World War (from 1939)

Location: Britain

Patent: Possibly GB410371, (31 August 1933).

Photo:



IDENTIFICATION

Floors and walls constructed of precast concrete. Floors consist of thin concrete slabs of approximately 18 in. wide by 6 ft long. 'The wall is divided into 12 ft bays by precast concrete columns and formed of vertical hollow units keyed and grouted together.' (*The Builder*) Uses minimal steel. It's possible this was designed by the Frenchman Eugene Mopin of Paris who has several patents issued in the 1930s.

USES

Possibly accommodation but no evidence this was manufactured on a mass scale.

REFERENCES

The Builder, 5 January 1940, pp. 5-8.

The Nashcrete Hut

Designer: T.F. Nash (Investment) Ltd. Of Uxbridge Rd, Hayes, Middlesex

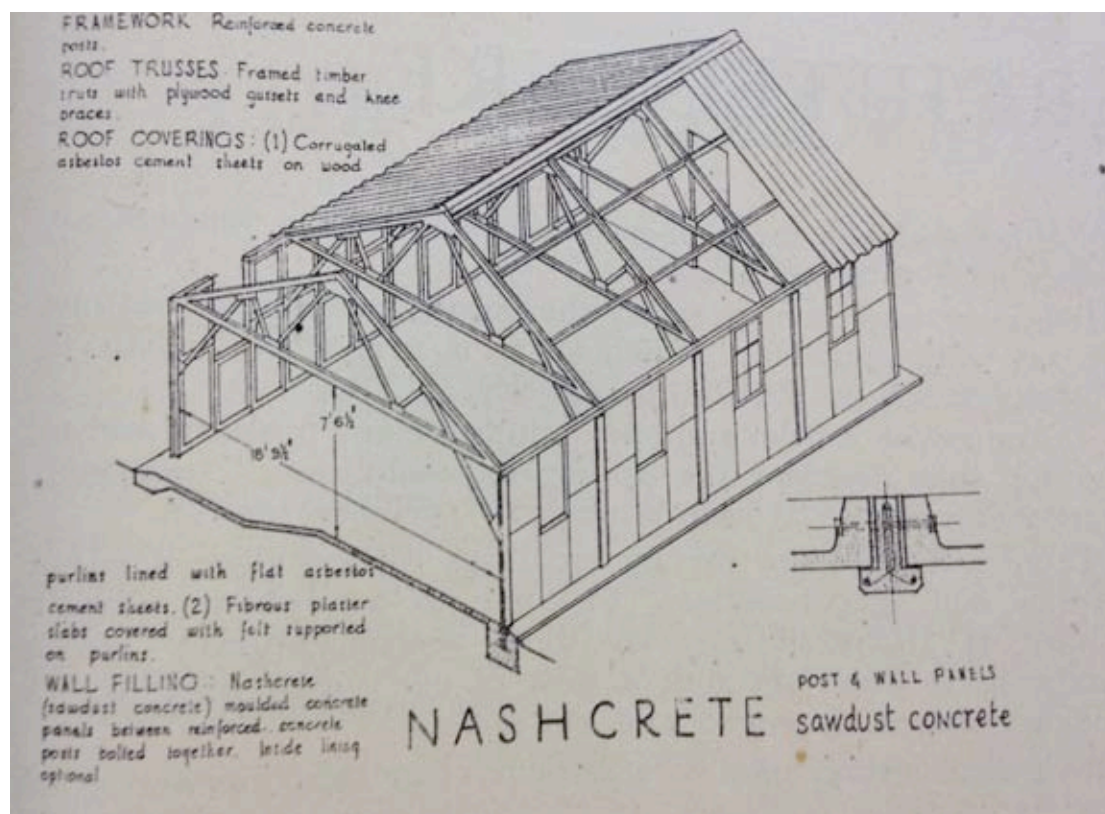
Alternative Name: Unknown

Period Built: Second World War

Location: Britain

Patent: None found

Photo:



IDENTIFICATION

Reinforced concrete frame with timber roof trusses covered with corrugated asbestos sheets. Nashcrete sawdust concrete moulded concrete panels were inserted between the concrete posts and then bolted together. Could be made in spans of 18 ft 9.5 in. or 24 ft. Lengths could be extended in multiples of 12 ft 2.25 in.

USES

Accommodation

REFERENCES

RIBA Journal, June 1942, p. 129.

MASCRETE HUT "24'0" SPAN HUT

1. Manufacture The hut is manufactured by T.F. Nash (Investment) Limited of Uxbridge Road, Hayes, Middlesex.
2. Description The design is illustrated in Plate No. 23 and photographs of the hut are shown on page . It is an open hut of 24'1" clear span, a length of 121'4 1/2" which may be varied by multiples of 12'2 1/2" and a height of 9'11" to the eaves.
3. Form of Construction
 - (a) Framework. The framework consists of precast reinforced concrete transverse frames at 12'2 1/2" centres with intermediate posts in each bay. The frames and posts are similar to those used in the M.O.W. Standard 24'0" span hut, but the apex connection is made by means of bent steel ridge plates bolted to the underside of the ribs.

Steel angle purlins span between the frames and are connected to angle cleats bolted to the ribs.

The end walls are constructed of posts, of the same section as the intermediate side posts, extending the full height and supporting the gable rafters.
 - (b) Wall Panelling. This consists of 5'8" x 1'3" flanged wood cement units and fixed to the posts by means of wood fillets.
 - (c) Roof Covering. "Rigsix" or similar corrugated asbestos cement sheets are used as an external roof covering. The lining is of asbestos cement flat sheets laid over the purlins and seam-bolted to the corrugated sheeting through packing pieces.
 - (d) General. The design incorporates the use of alternative standard metal industrial sashes with steel sills; standard double or single doors may be introduced in any 6'0" bay.
4. Stability of the Design The design complies with the requirements of the approved specification.
5. Drawings etc. Details of the hut are given on Drawing No. 351 obtainable from T.F. Nash (Investment) Limited, Uxbridge Road, Hayes, Middlesex.

The Nissen Hut

Designer: Nissen Buildings Ltd.

Alternative Name: None

Period Built: Second World War

Location: Britain

Patent: GB105468 (26 June 1916), GB1377500 (10 May 1921). See also GB540809 (26 July 1940).

Photo:



Photo by Paul Francis.

IDENTIFICATION

Wooden purlins jointed to steel T-shaped ribs, covered with corrugated iron sheeting, with corrugations running in vertical lines. Interior walls constructed of matchboard lining, or corrugated iron. Concrete floors, with ends constructed in brick or concrete blocks. Central doorway on both ends. In the Second World War, these huts came in three spans: 16 ft, 24 ft and 30 ft, in a length of 36 ft 8 in. or any multiple of 6ft.

USES

Accommodation

REFERENCES

McCosh, p. 77.
Work, Plat LII.

Francis, p. 210.

The Nofrango Hut

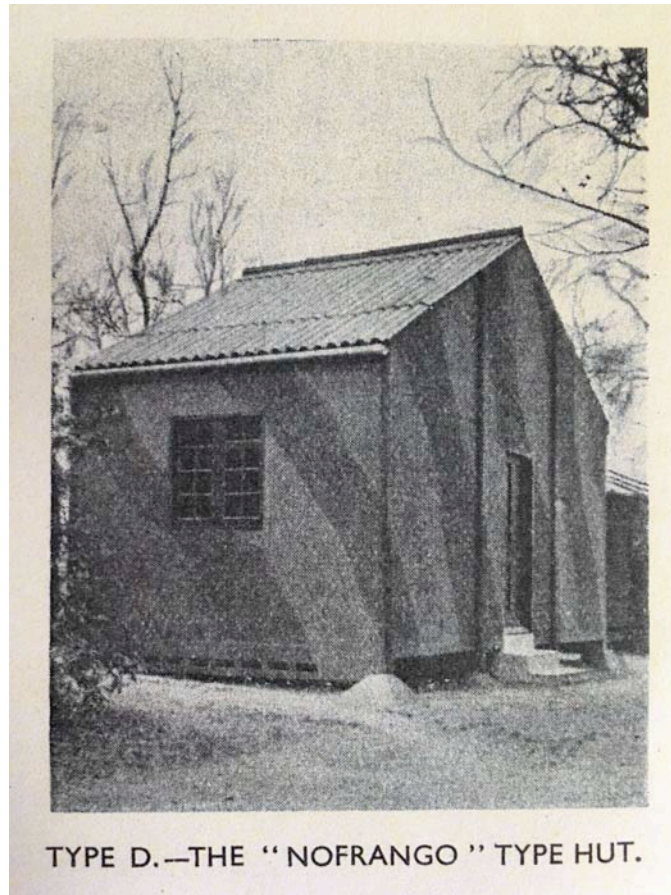
Designer: Nofrango Ltd., Dublin and J.H. de W. Waller

Alternative Name: None

Period Built: Second World War (from Dec. 1939)

Location: Britain

Patent: Possibly GB426098, (11 April 1934).



IDENTIFICATION

Constructed of light 24-gauge steel framework, covered with cement rendered fabric.

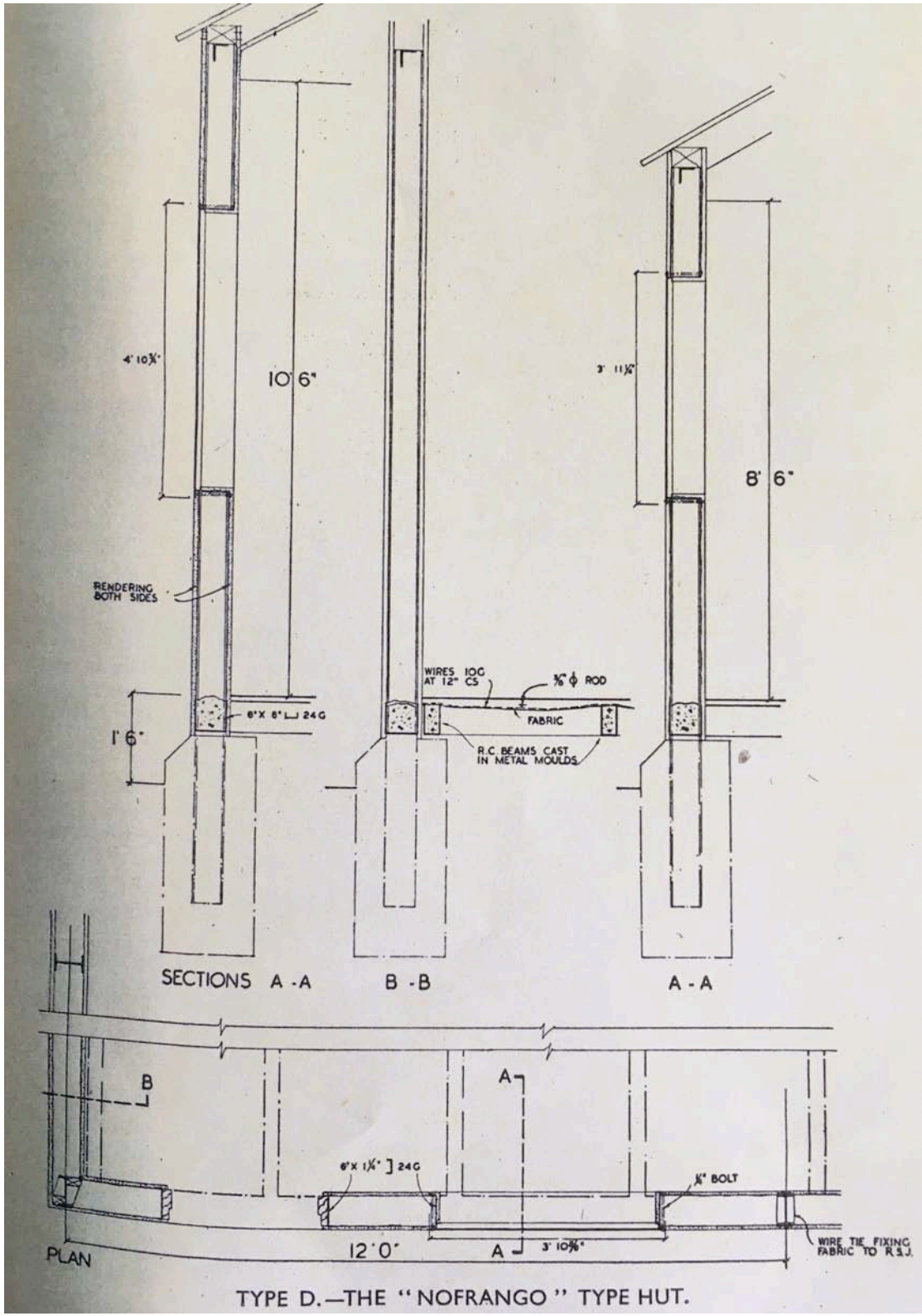
USES

Accommodation

REFERENCES

The Architect & Building News, 22 December 1939, p. 267.

The Builder, 5 January 1940, p. 5.



TYPE D.—THE "NOFRANGO" TYPE HUT.

The Orlit Hut

Designer: Orlit Ltd. and Jan Korbel

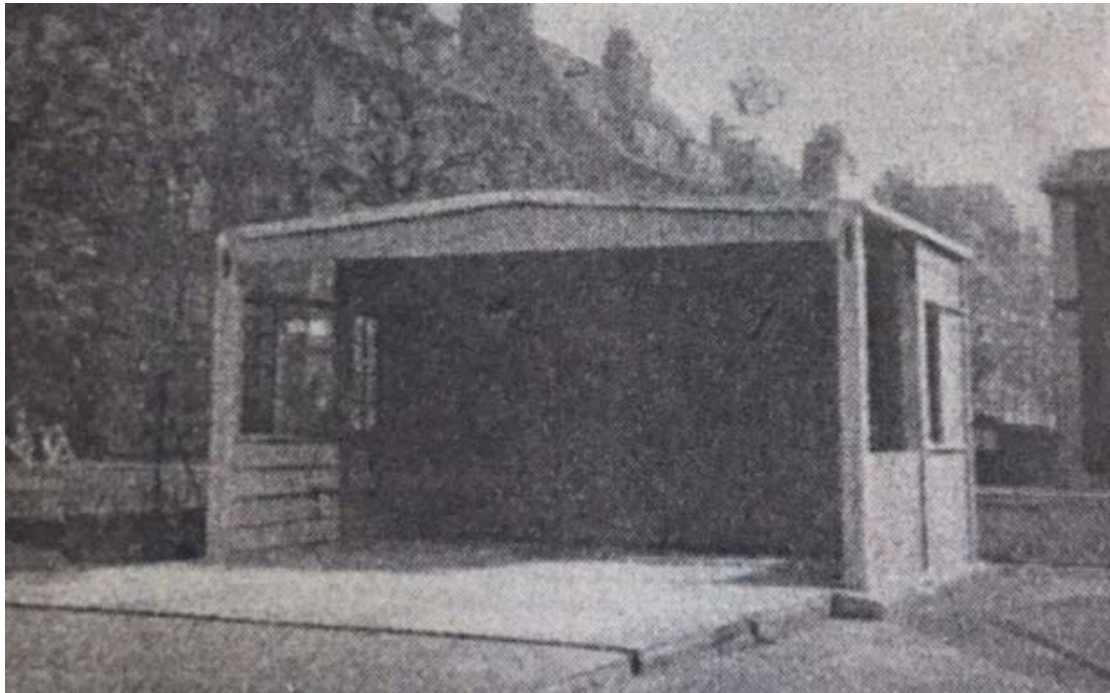
Alternative Name: None known

Period Built: Second World War (from 1942)

Location: Britain

Patent: GB559489, (21 August 1942).

Photo:



IDENTIFICATION

Reinforced concrete frame with an exterior of two layers of pre-stressed concrete planks with a cavity in between. Interior could be left unlined. Roof was reinforced concrete slabs spanning felt covered beams.

USES

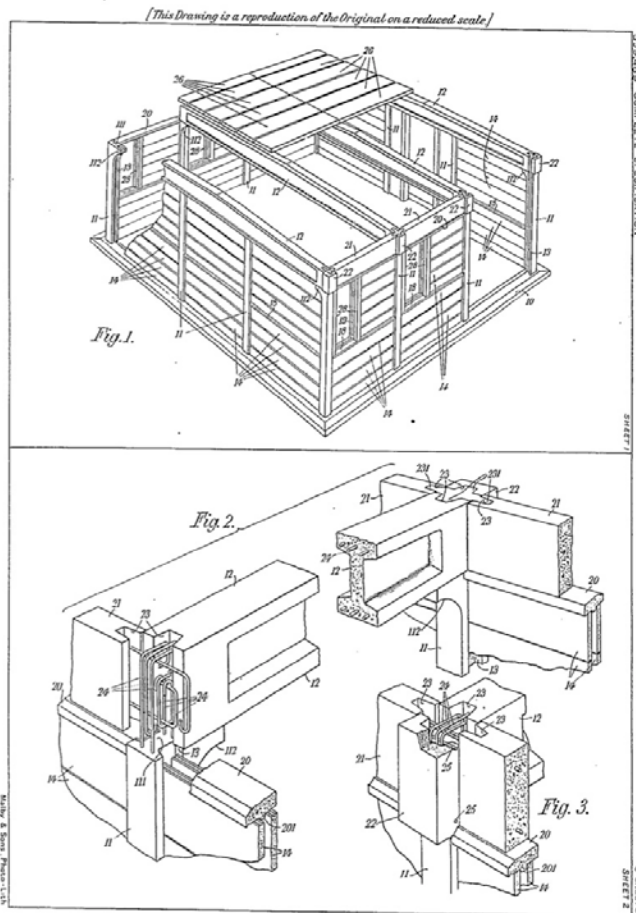
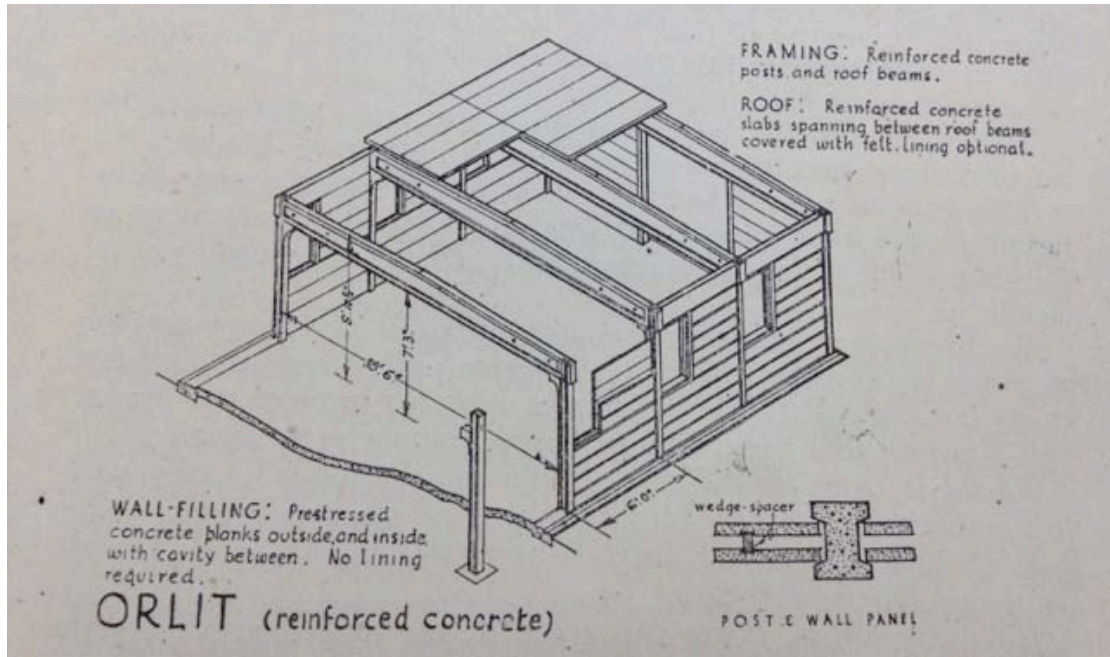
Accommodation

REFERENCES

The Architect & Building News, 29 May 1942, p. 121.

The Architects' Journal, 13 August 1942, p. 109.

PLAN



The Patrick Portable Hut

Designer: J. H. de W. Waller

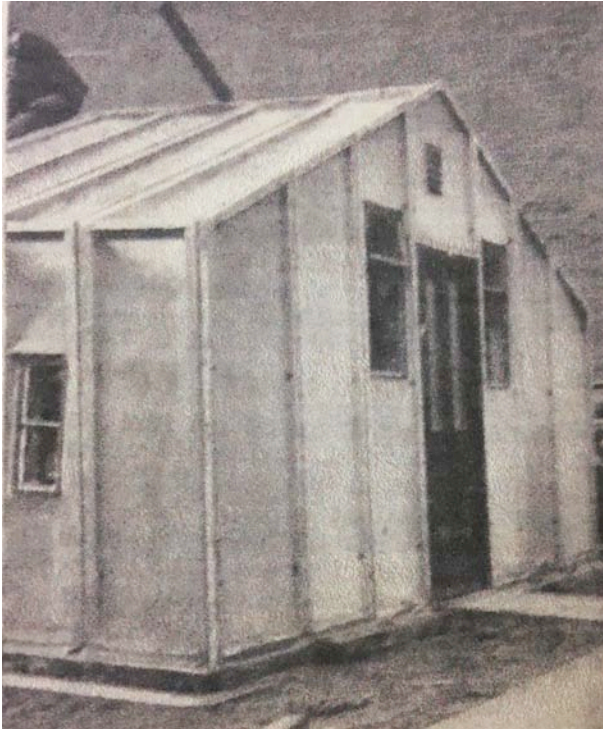
Alternative Name: None known

Period Built: Second World War (from 1940)

Location: Britain

Patent: Unknown

Photo:



IDENTIFICATION

Reinforced concrete frame with 'Flexiform' roofing. Measured 16 ft 5 in. by 36 ft. Cost £166 per hut, plus transport. It is unknown whether these were manufactured on a wide scale.

USES

Accommodation

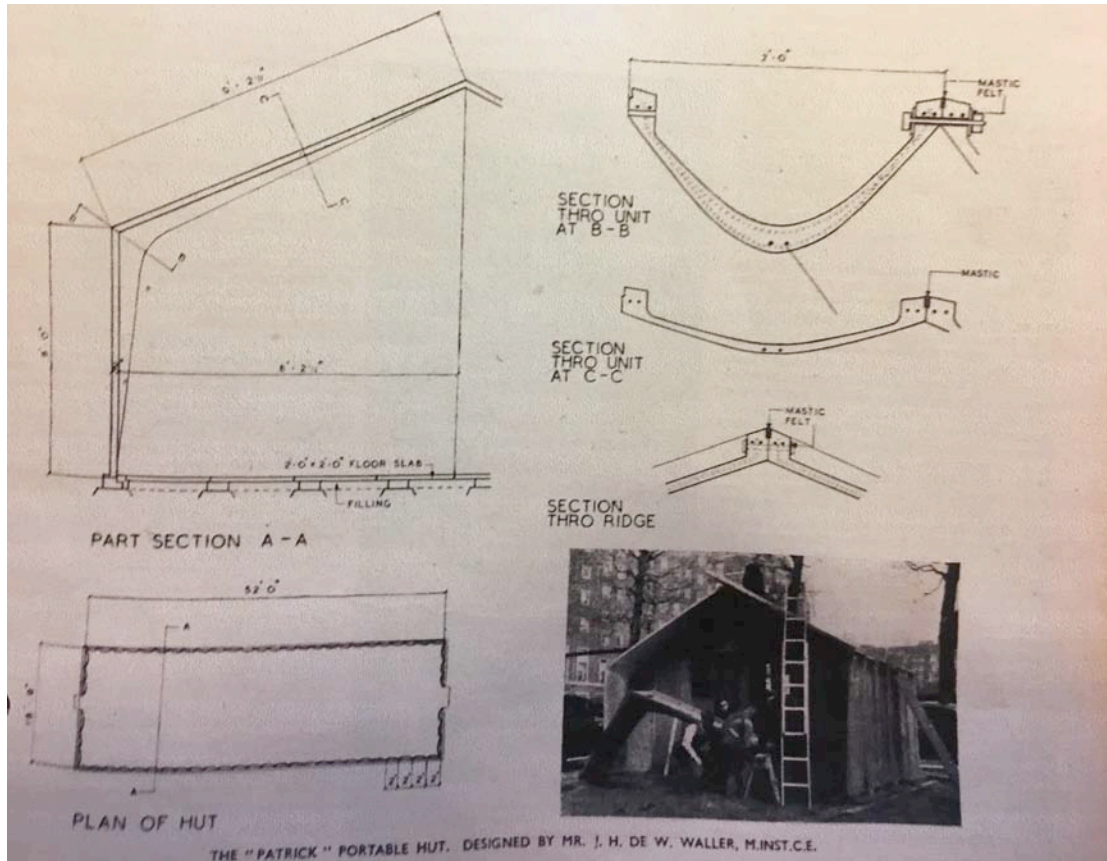
REFERENCES

The Architect & Building News, 10 May 1940, p. 120.

The Architect & Building News, 27 June 1941, p. 184.

The Builder, 6 June 1941, p. 553.

PLAN



The Plycrete Hut

Designer: Cowdell and Stewart

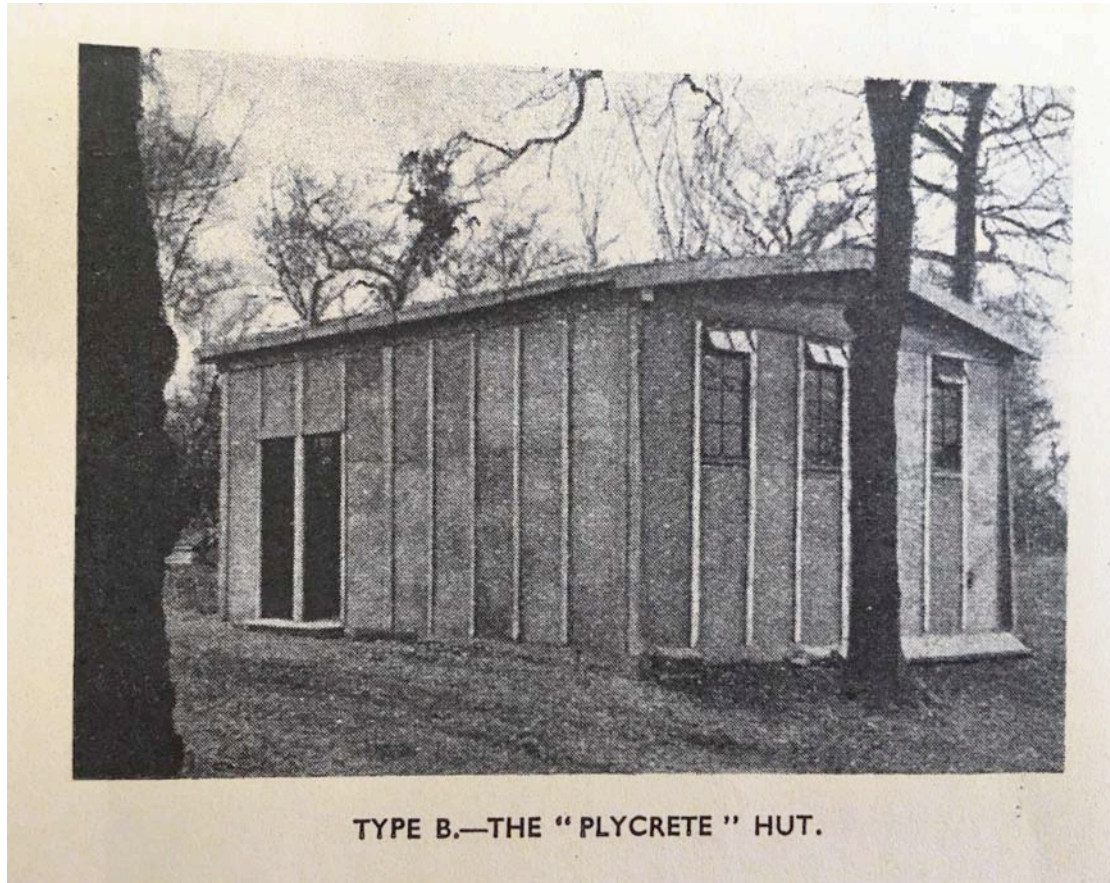
Alternative Name: None known

Period Built: Second World War (from 1940)

Location: Britain

Patent: None found

Photo:



IDENTIFICATION

Very light, hollow concrete block wrapped in pre-coated cement mortar paper, and laid between vertical precast wall units, then rendered inside and out. The blocks also make up the flooring.

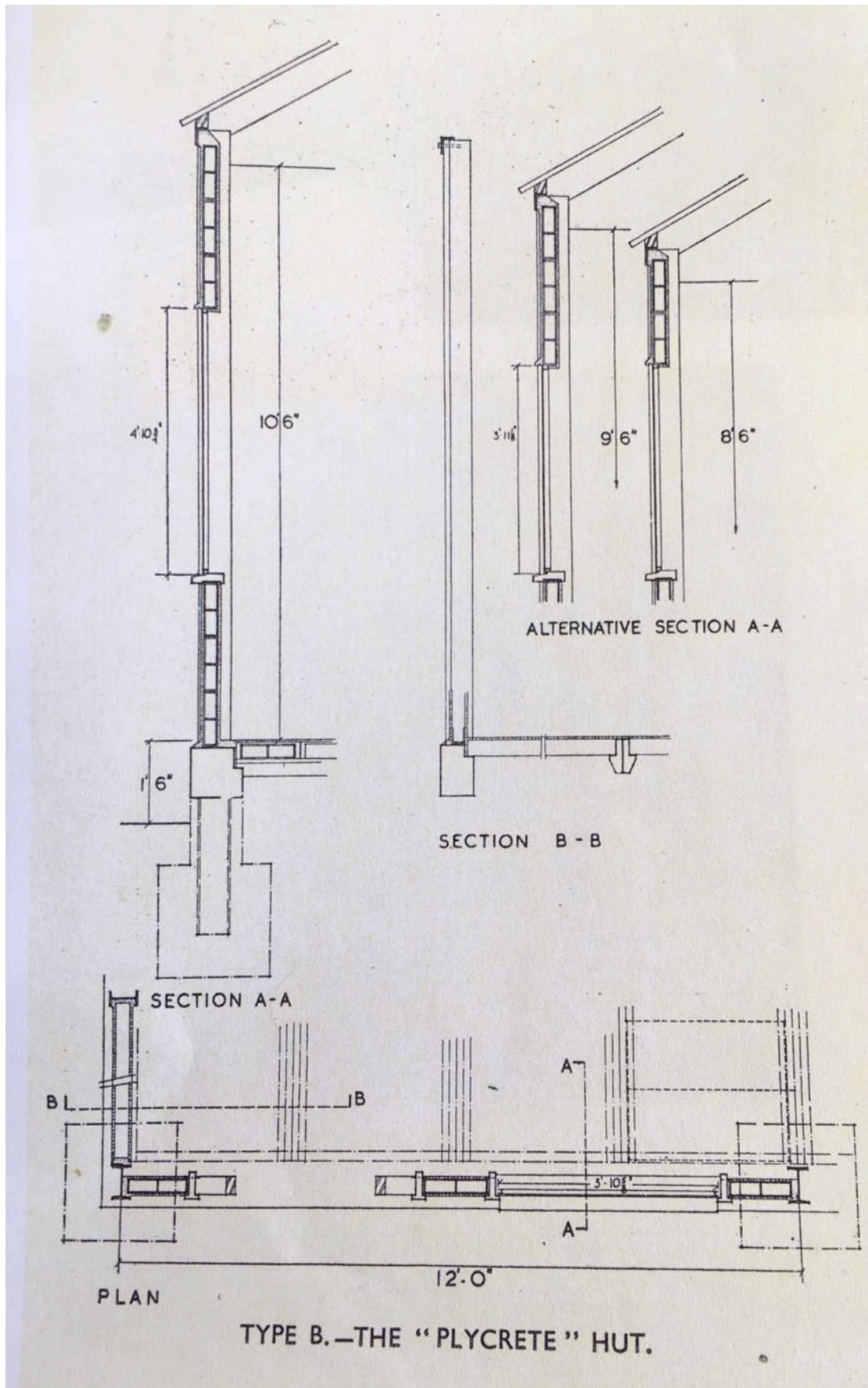
USES

Accommodation

REFERENCES

The Builder, 5 January 1940, pp. 6-7.

PLAN



The Plywood Hut

Designer: Ministry of Works

Alternative Name: The All-Ply Hostel

Period Built: Second World War (from 1942)

Location: Britain

Patent: None found



IDENTIFICATION

Built entirely of plywood, with resin bonded plywood for exterior walls and ordinary plywood for interior, attached to a light timber framework. Concrete foundation. Plywood panels were prefabricated. Measured 18 ft 6 in. wide by 72 ft in length. Interior designed into cubicles for housing workers.

USES

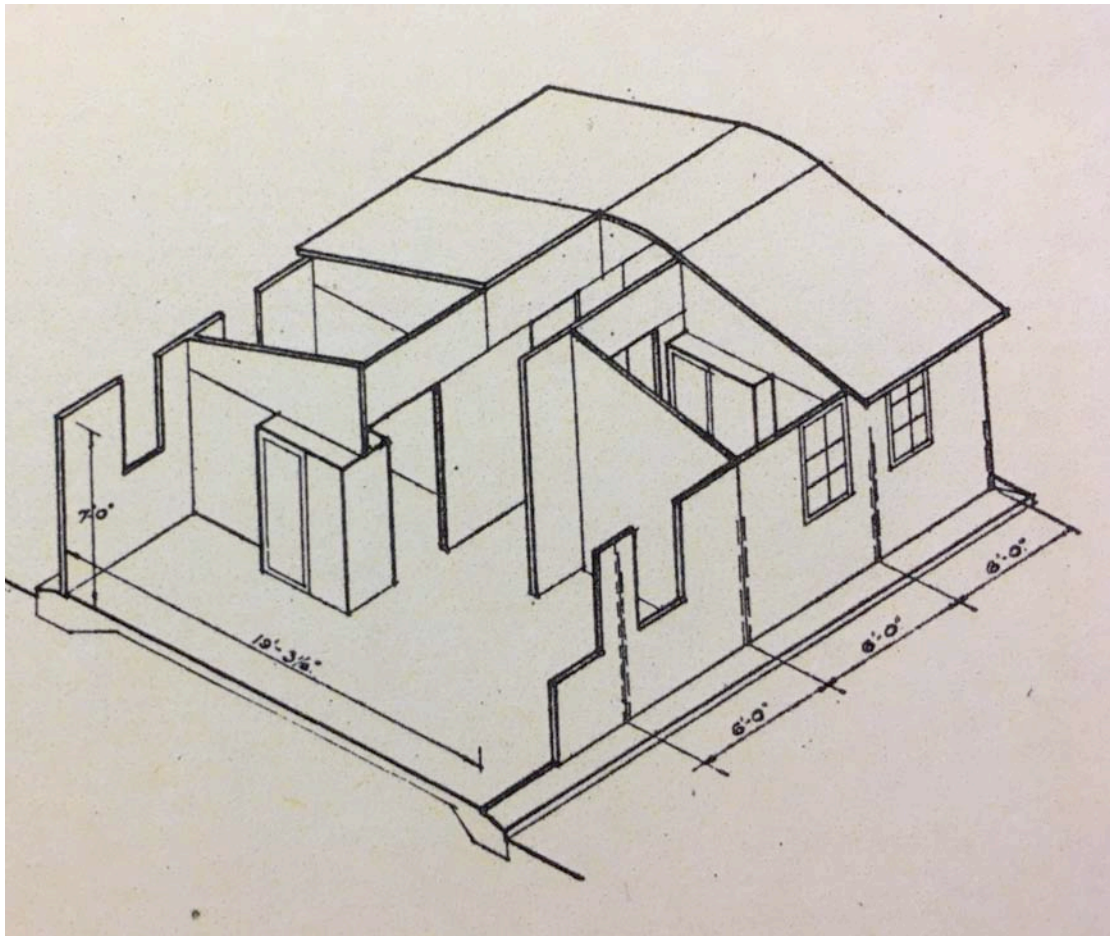
Accommodation

REFERENCES

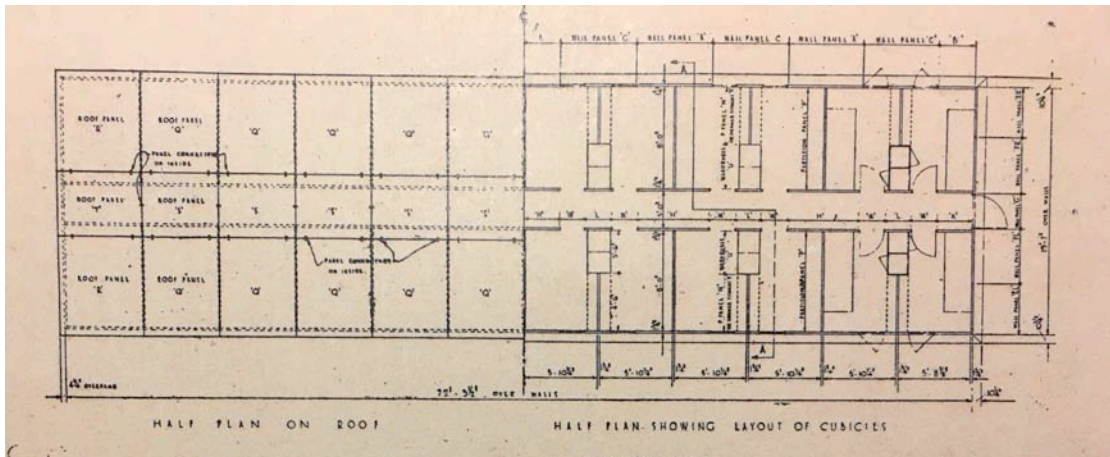
The Builder, 20 February 1942, pp. 169-171.

The Architects' Journal, 13 August 1942, pp. 107-110.

PLAN



The Plywood Hut as advertised in *The Architects' Journal*, (13 August 1942)



The half plan showing the plan of the roof with its 6 ft sections (left), and the layout of the worker's cubicles (right). *The Builder*, 20 February 1942

The Precast Paving Slab Hut

Designer: British Concrete Federation

Alternative Name: Unknown

Period Built: Second World War (from 1940)

Location: Britain

Patent: None found

No Photo (see Plan)

IDENTIFICATION

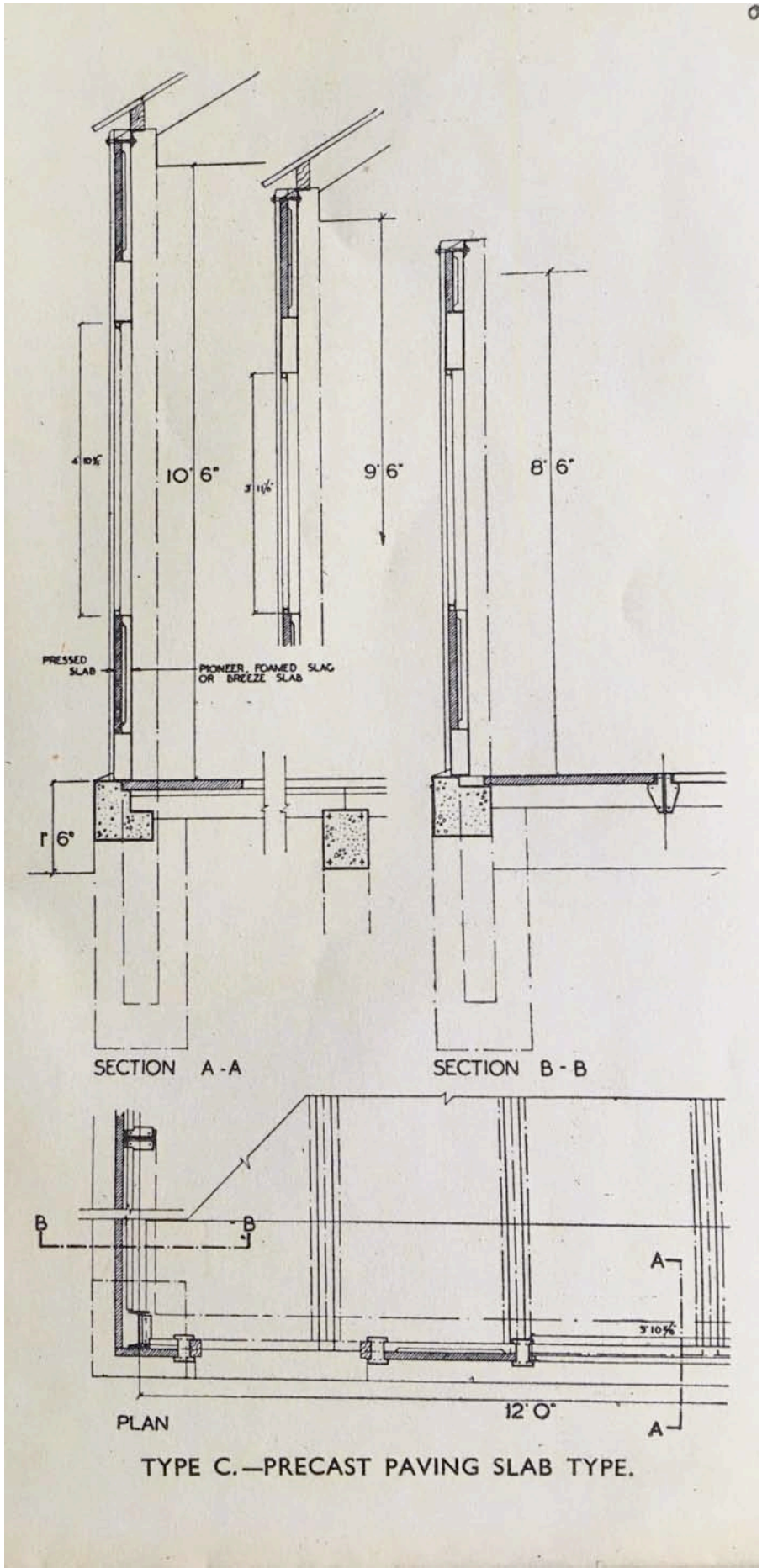
Concrete paving slabs used as a filling within a concrete frame. The surface is then rendered weatherproof by the insertion of pre-moulded bitumen strips between adjacent slabs.

USES

Accommodation

REFERENCES

The Builder, 20 February 1942, pp. 169-171.



The Quetta Hut

Designer: J.H. de W. Waller

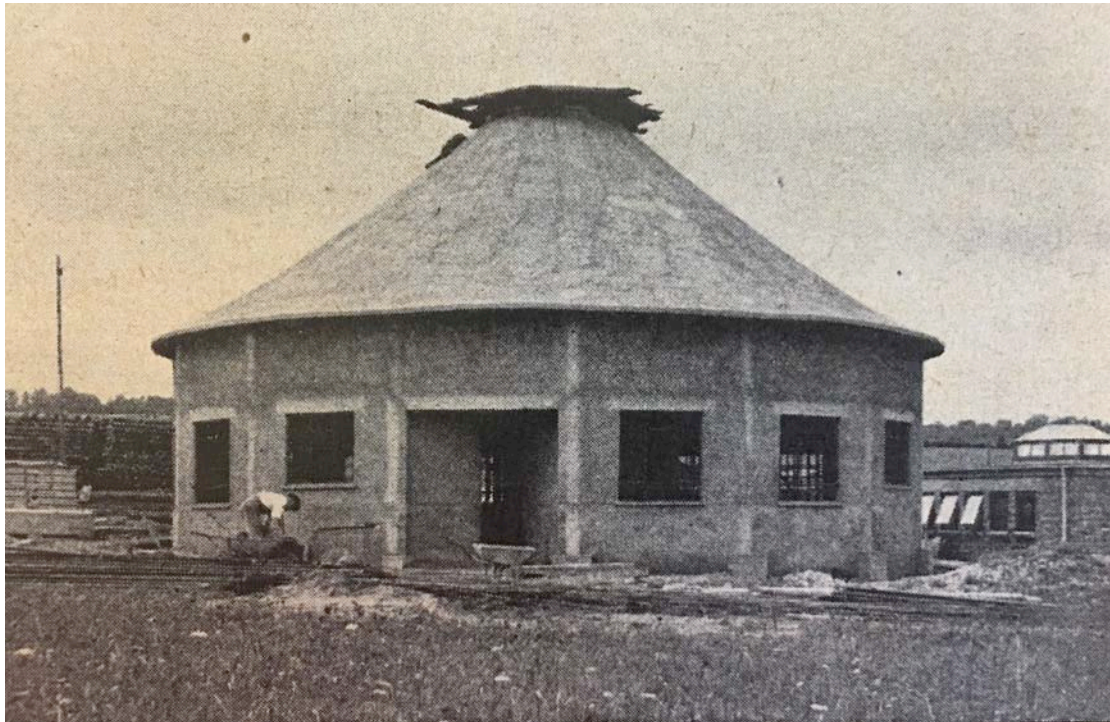
Alternative Name: The Circular Hut

Period Built: Second World War (from 1941)

Location: Britain

Patent: None found

Photo:



IDENTIFICATION

Precast concrete frame in a duodecagonal plan. Jute fabric was stretched on both sides of wall frames and rendered with a cement-sand mix. Conical roof formwork with jute stretched over and rendered. Central vent or flue.

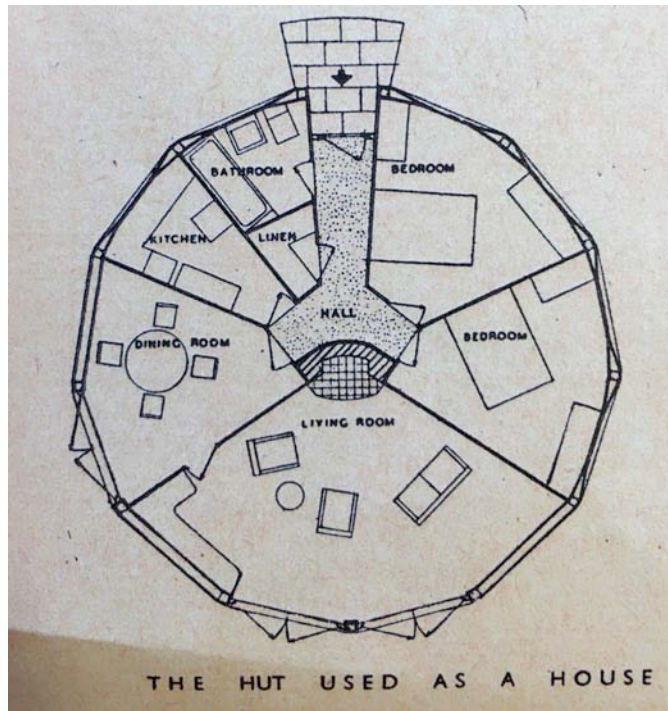
USES

Accommodation, guard house.

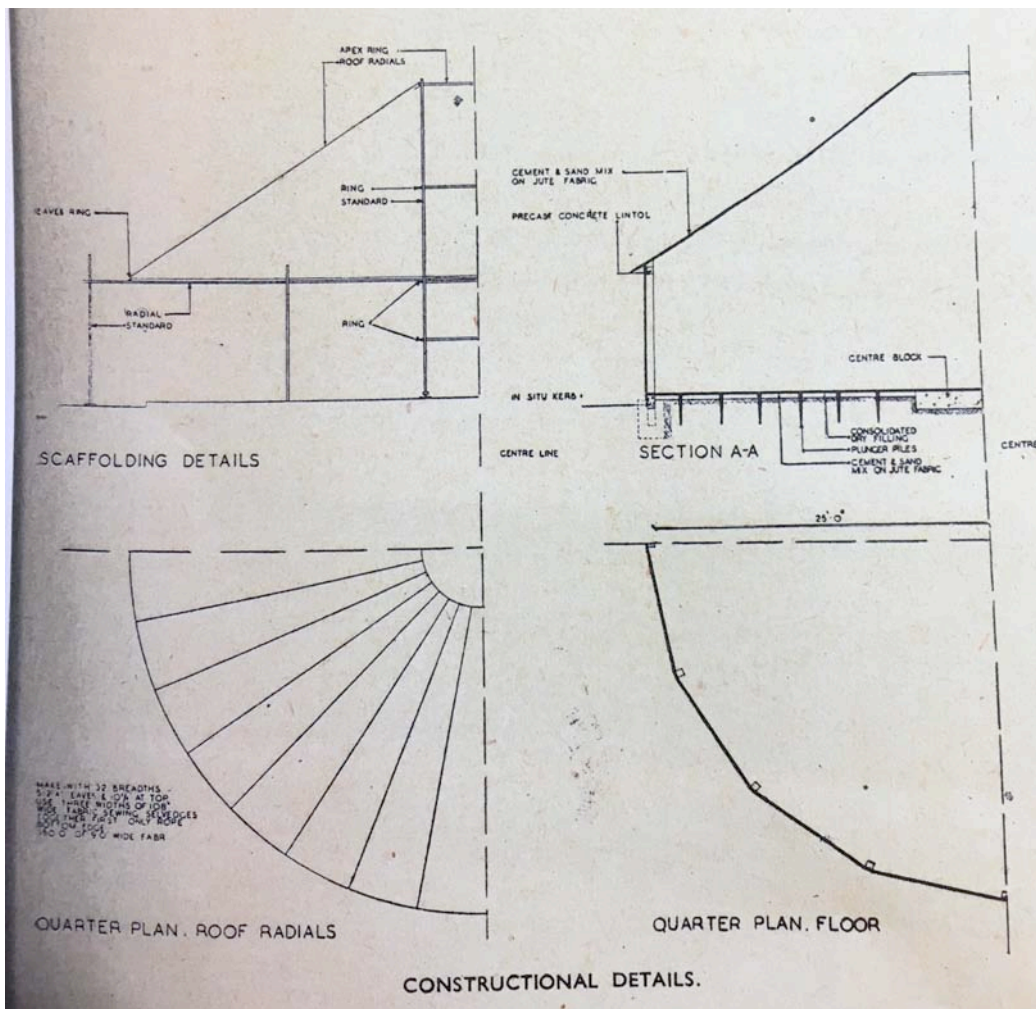
REFERENCES

The Builder, 25 July 1941, pp. 79-80.
Mallory, p. 192.

PLAN



THE HUT USED AS A HOUSE



The Quonset Hut

Designer: Otto Brandenberger, George A. Fuller and Co. **Alternative Name:** None.

Period Built: Second World War (from 1941)

Location: Britain

Patent: None found

Photo:



IDENTIFICATION

Based on the Nissen Hut, with a simplified interior. T-rib arch, corrugated metal exterior. Used wading paper insulation with a thin pressed wood lining of Masonite.

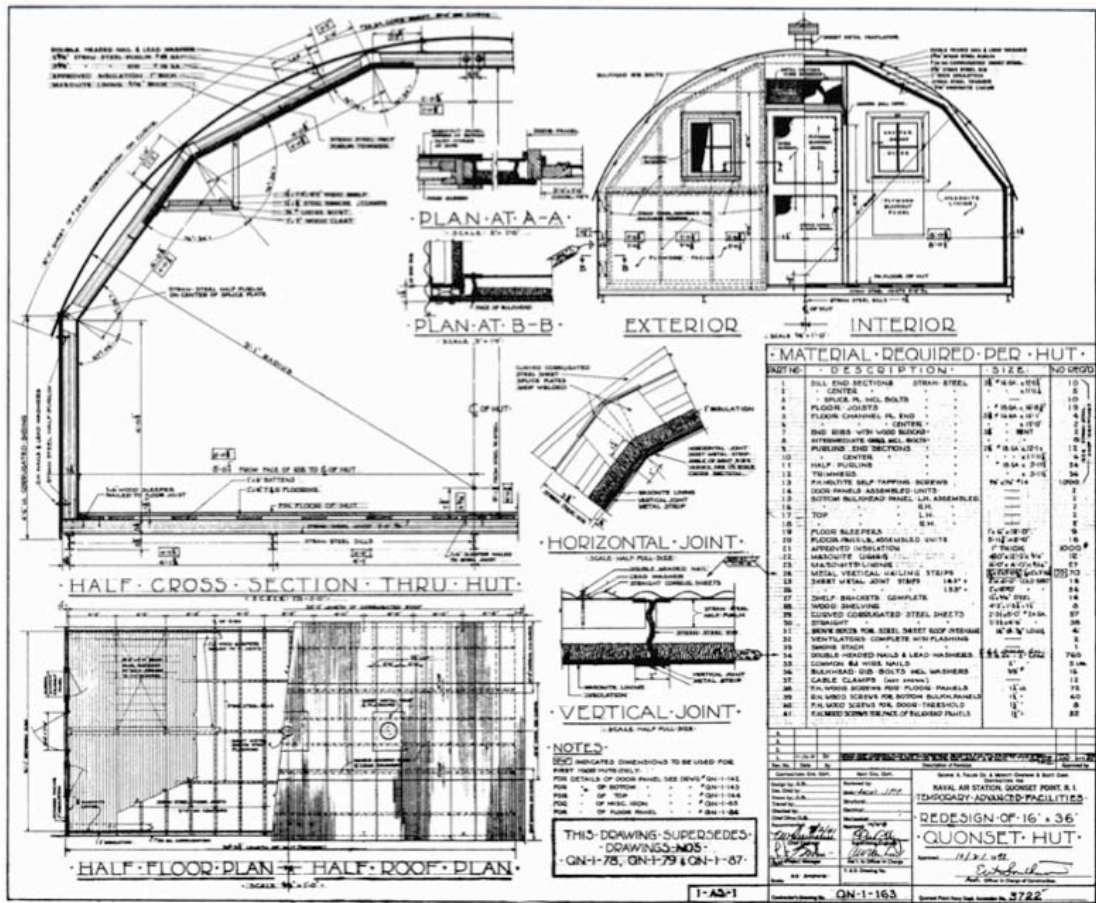
USES

Accommodation, workshops, offices.

REFERENCES

Decker and Chiei, *Quonset Hut*, p. 7.

PLAN



The Romney Hut

Designer: Directorate of Fortifications and Works

Alternative Name: None

Period Built: Second World War (from 1941)

Location: Britain

Patent: None found

Photo:



Photo by Paul Francis.

IDENTIFICATION

Semi-circular, like the Nissen Hut, with a span of 35 ft and a typical length of 96 ft. Built in sections of 8 ft widths. The main ribs consisted of 2.5 in. tubular steel sections that curved to a radius of 17 ft 6 in. and then secured into a concrete foundation. Corrugated steel sheeting attached to steel purlins formed the roof. Massive sliding doors provided an opening of 10 ft 8 in. wide and 13 ft high.

USES

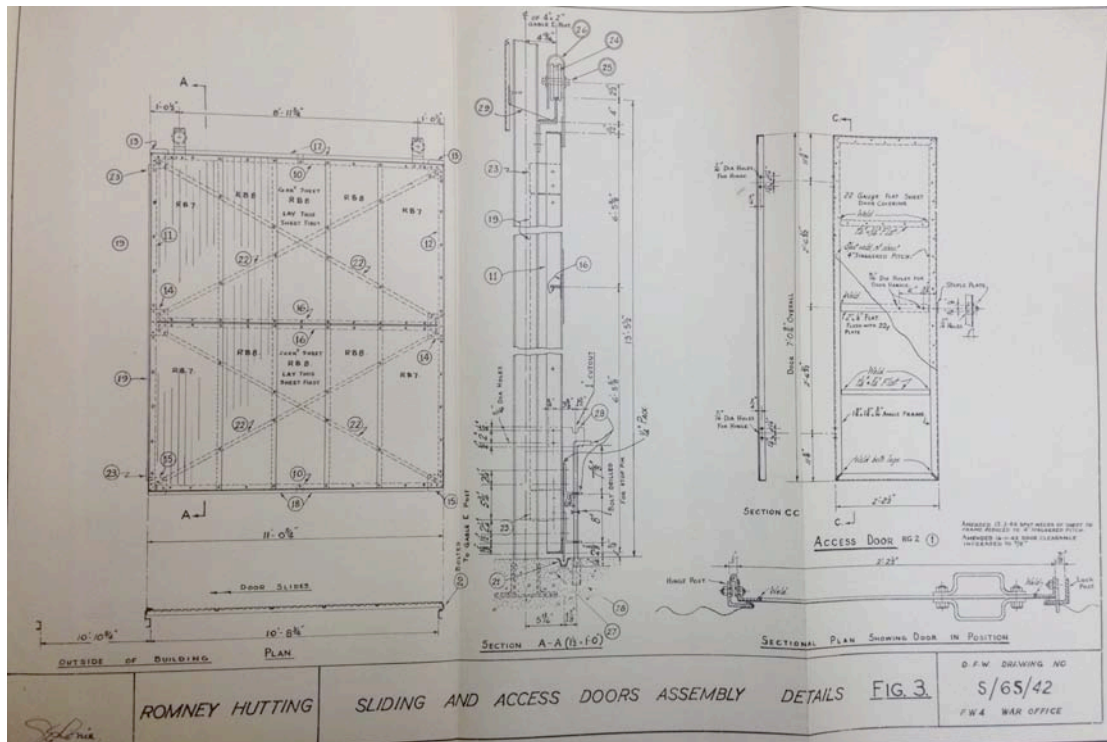
Storage, workshops, canteens, cinemas.

REFERENCES

Francis, p. 213.

Romney Hut Instruction Manual (Airfield Research Group)

PLANS



The Seco Hut

Designer: Uni-Seco Structures Ltd

Alternative Name:

Period Built: Second World War (from 1942)

Location: Britain

Patent: GB437296, (30 April 1941).



Seco Huts at the En-Tout-Cas factory near Leceister. (Airfield Research Group)

IDENTIFICATION

A prefabricated building system based on standard units. Huts measured 19 ft by 24 ft and were constructed of plywood columns and roof beams supporting a roof of wood wool slabs covered with felt. The walls were also made up of wood wool slabs covered in asbestos cement.

USES

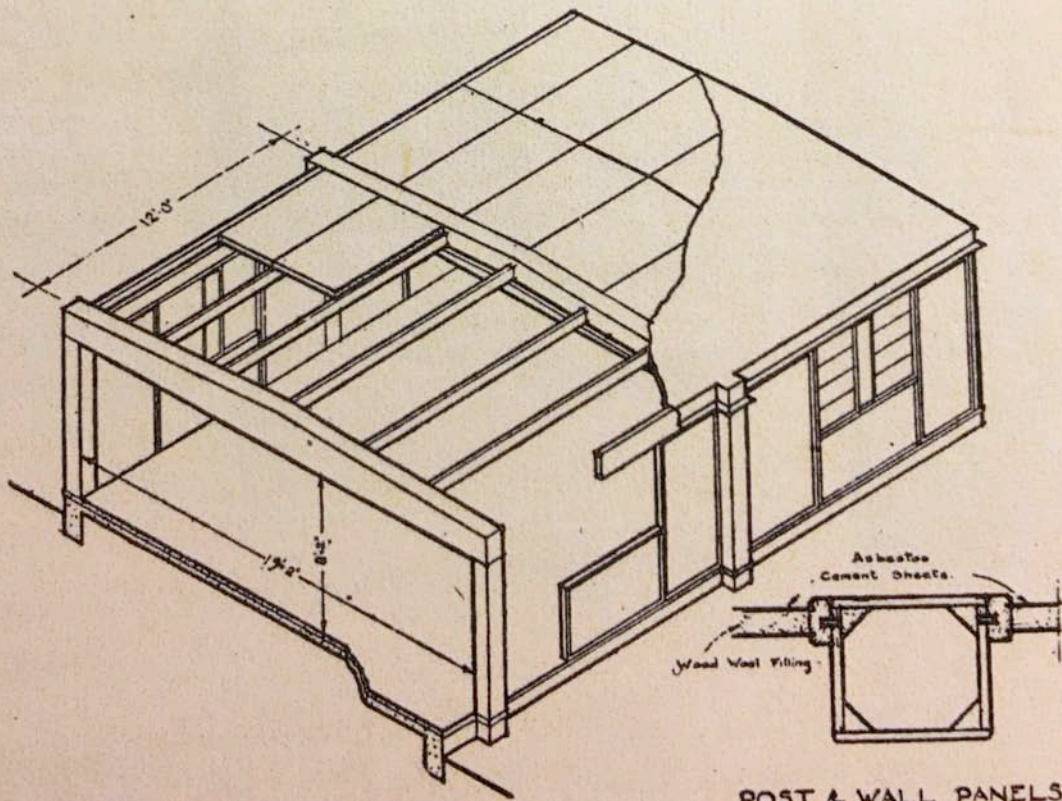
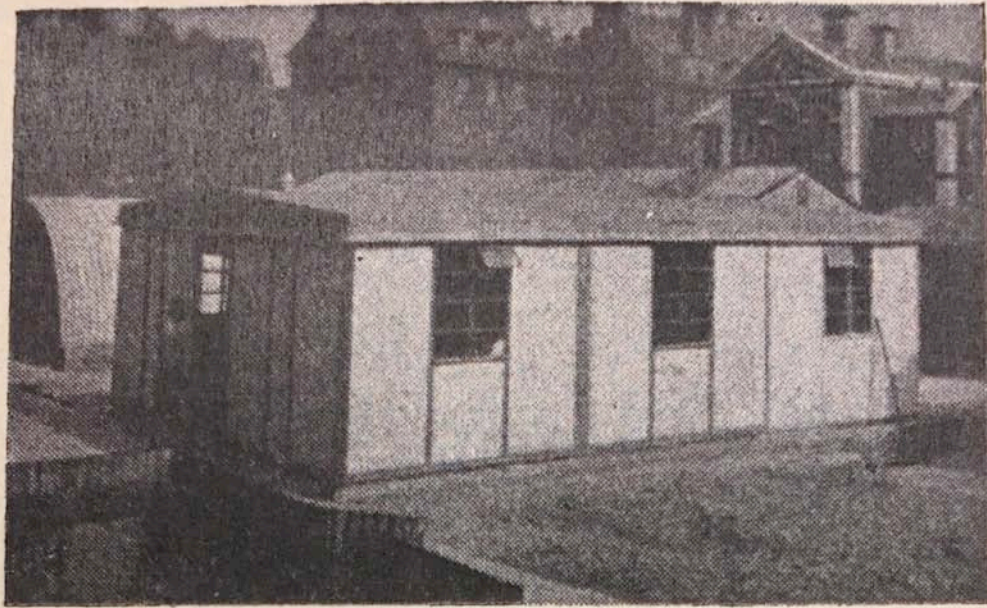
Multipurpose: Living, office, hospital and recreation.

REFERENCES

Air Ministry, *The Royal AirForce Builds For War (Works)*, (1956).

Francis, p. 214.

The Architects' Journal, 13 August 1942, pp. 107-110.



The Semi-Romney Hut

Designer: Directorate of Fortifications and Works

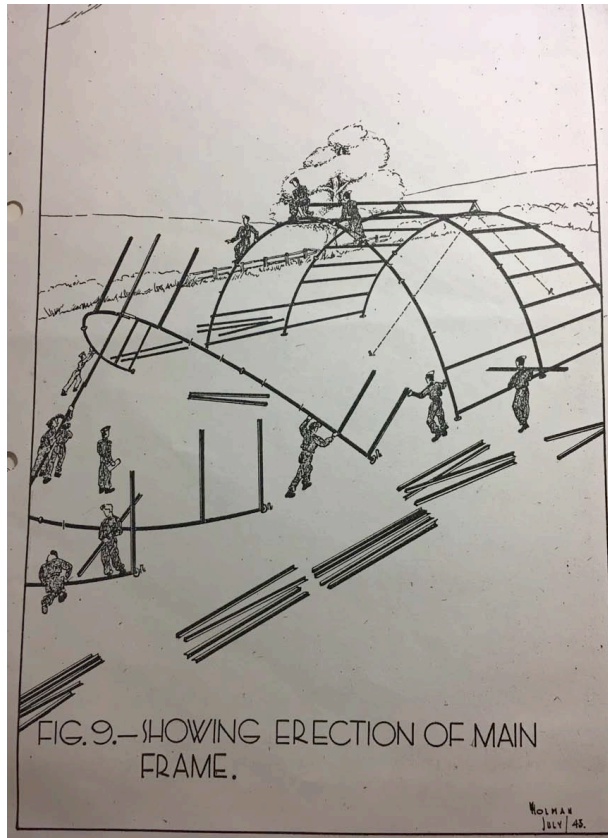
Alternative Name: None

Period Built: Second World War (from 1941)

Location: Britain

Patent: None found.

Photo:



IDENTIFICATION

A more portable version of the Romney Hut, but covered with canvas instead of corrugated iron. A Semi-Romney could be converted to a Romney with the addition of steel-end frames and replacing the canvas with corrugated iron sheeting. Span of 35 ft and a length of 96 ft.

USES

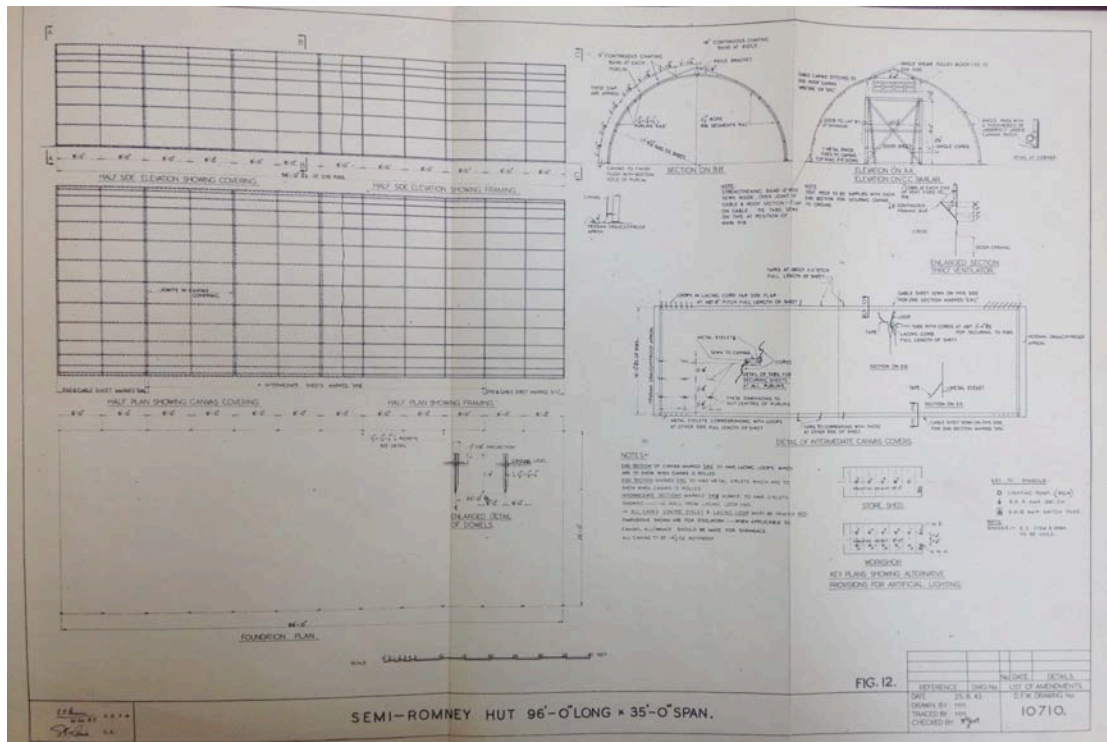
Storage, workshops, canteens, cinemas.

REFERENCES

Francis, p. 213.

Romney Hut Instruction Manual (Airfield Research Group)

PLAN



SEMI-ROMNEY HUT 96'-0" LONG x 35'-0" SPAN.

The Stancon System

Designer: Stanley Hamp

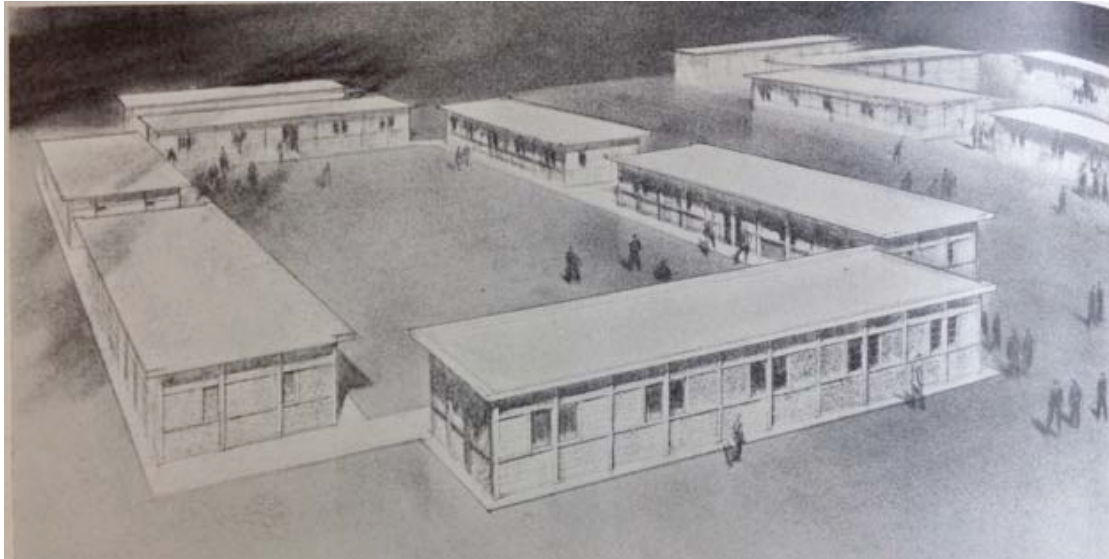
Alternative Name: None

Period Built: Second World War (from 1940)

Location: Britain

Patent: None found.

Photo:



IDENTIFICATION

A precast concrete design for a hutted military camp that could be converted into post-war housing. Wall units are constructed of 1 in. thick concrete slabs, separated by a 1.5 in. cavity, and reinforced with wire. The roof is also constructed of precast concrete slabs covered in asphalted paper.

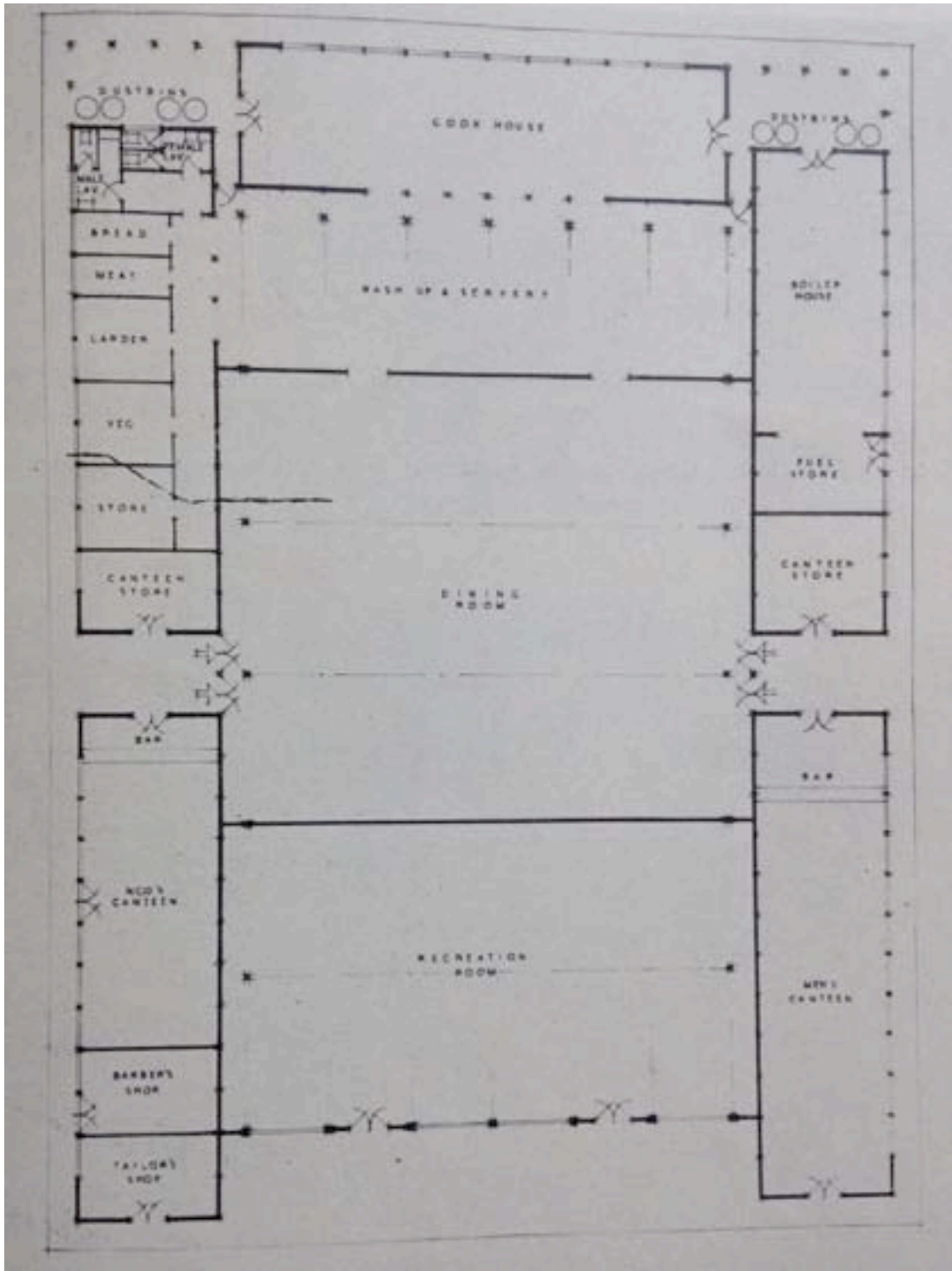
USES

Accommodation, canteen, kitchen, storage, dining hall.

REFERENCES

The Architect & Building News, 3 May 1940, p. 94.

PLAN



The Standard Army Hut

Designer: George Coles

Alternative Name: Precast Unit Construction Hut

Period Built: Second World War (from 1940)

Location: Britain

Patent: GB537187, (14 December 1939).

Photo:



IDENTIFICATION

A precast concrete design measuring about 19 ft by 60 ft but could be adapted up to a 30 ft span. 'All units are dry jointed with strips of bitumastic felt between the horizontal joints, which are bolted together, giving speed in erection.' (*The Builder*, 17 Jan 1941, p. 90).

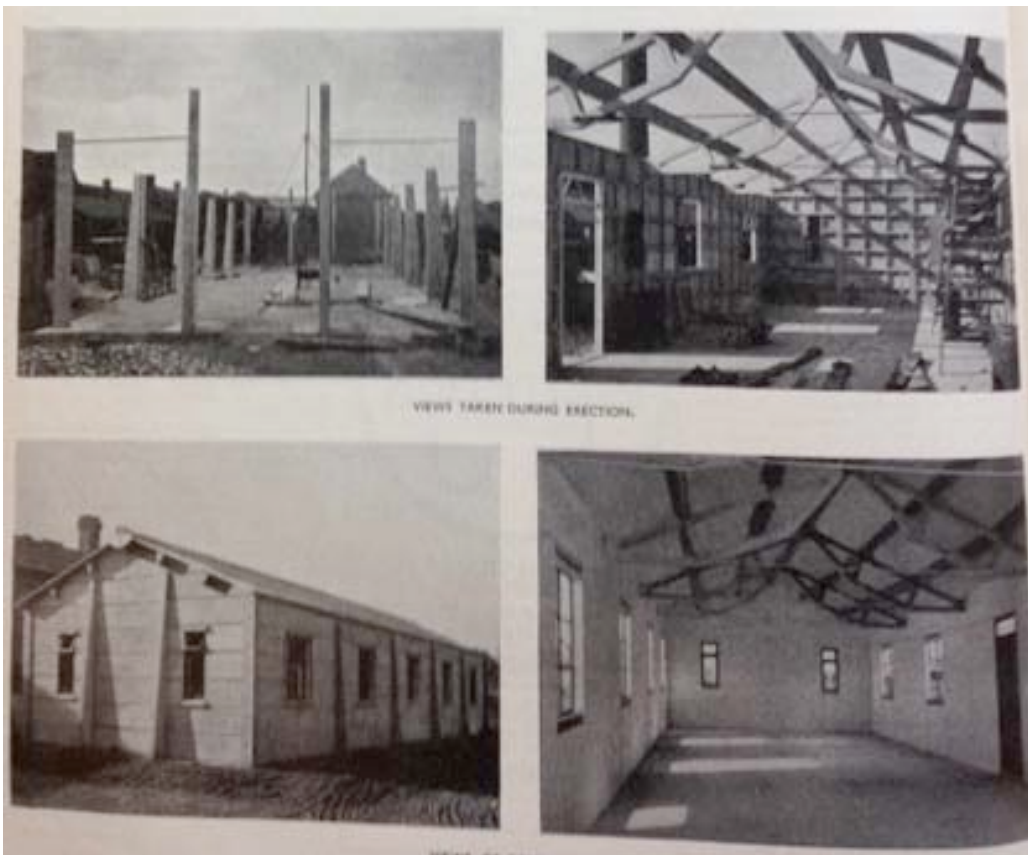
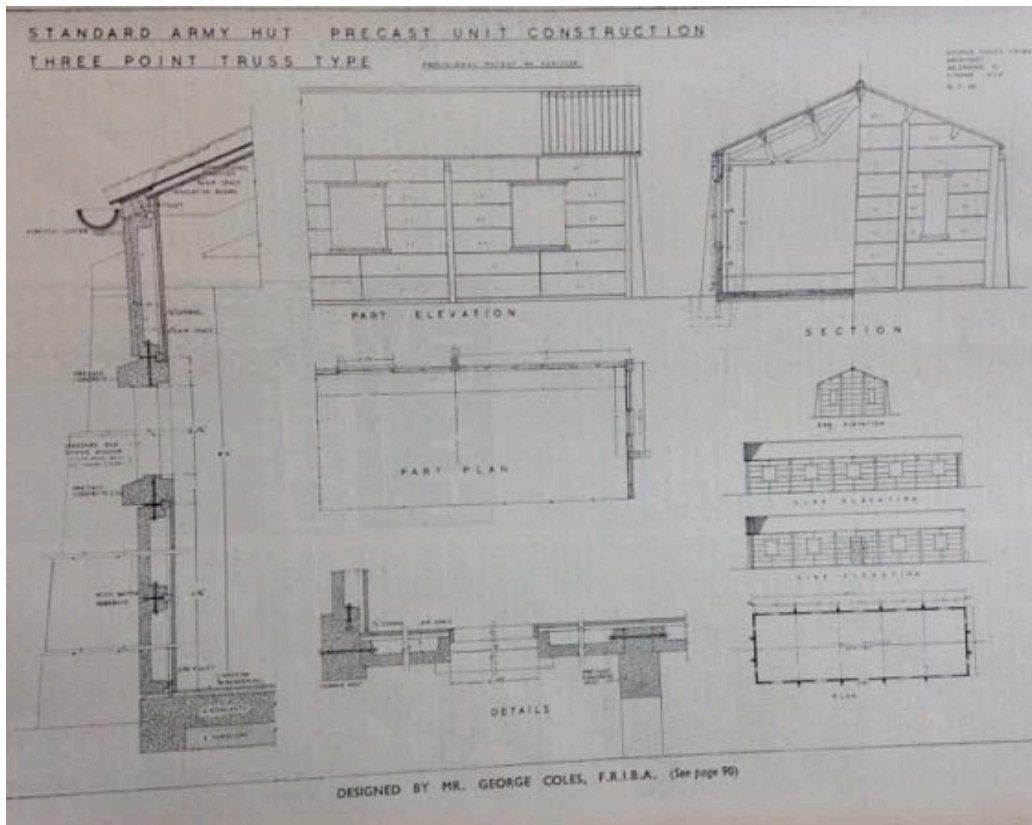
USES

Accommodation.

REFERENCES

The Builder, 17 January 1941, pp. 90-91.

PLAN



The Steel Construction Hut

Designer: G. Bacher, Alister MacDonald

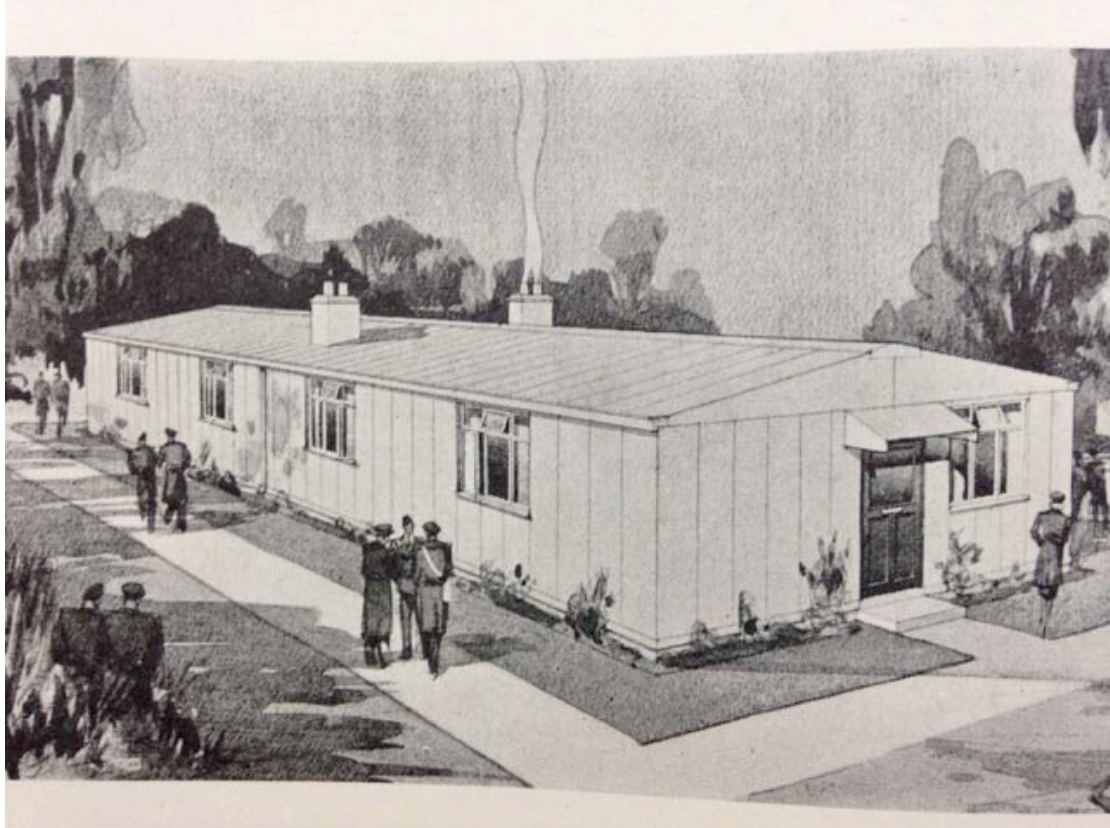
Alternative Name: Unknown

Period Built: Second World War (from 1940)

Location: Britain

Patent: None found

Photo:



IDENTIFICATION

Pressed steel interlocking units with a concrete floor. No bolts or screws are used except for fixing doors and windows. Based on a French prototype. External finish is a chromate paint used by the RAF for seaplanes.

USES

Accommodation, offices.

REFERENCES

The Architects' Journal, 25 January 1940, p. 123.

Other Photos:



The Tarran Hut System

Designer: Tarran Industries

Alternative Name: Unknown

Period Built: Second World War (from 1940)

Location: Britain

Patent: GB540881, (4 November 1941)

Photo:



IDENTIFICATION

Green hardwoods and cement sawdust panels. Originally parabolic in shape (1940). Later, (1942) it was redesigned with vertical walls. Each panel was made up of Lignocrete, a mixture of cement and chemically treated sawdust, cast on wires running between two arched timber ribs. It was publicized to take 5.5 hours to erect with skilled labour, or 9 hours with semi-skilled. Measured 16 ft by 36 ft or 19 ft by 62 ft.

USES

Accommodation.

REFERENCES

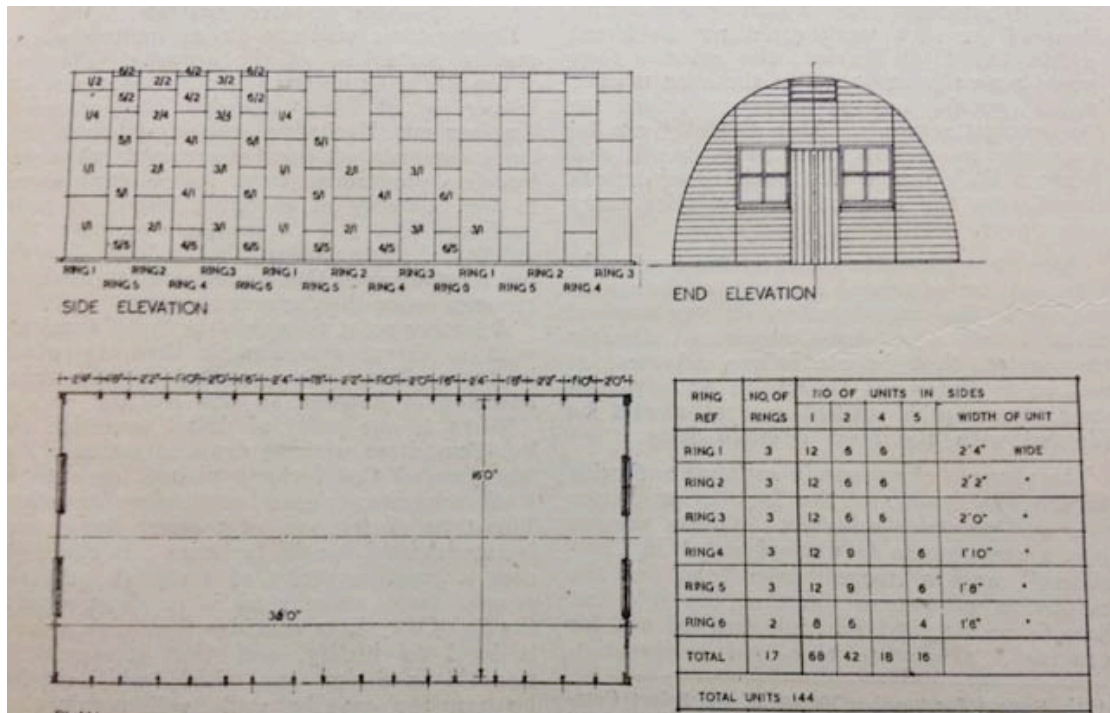
The Builder, 4 April 1941, p. 346.

The Architect & Building News, 10 May 1940, p. 120.

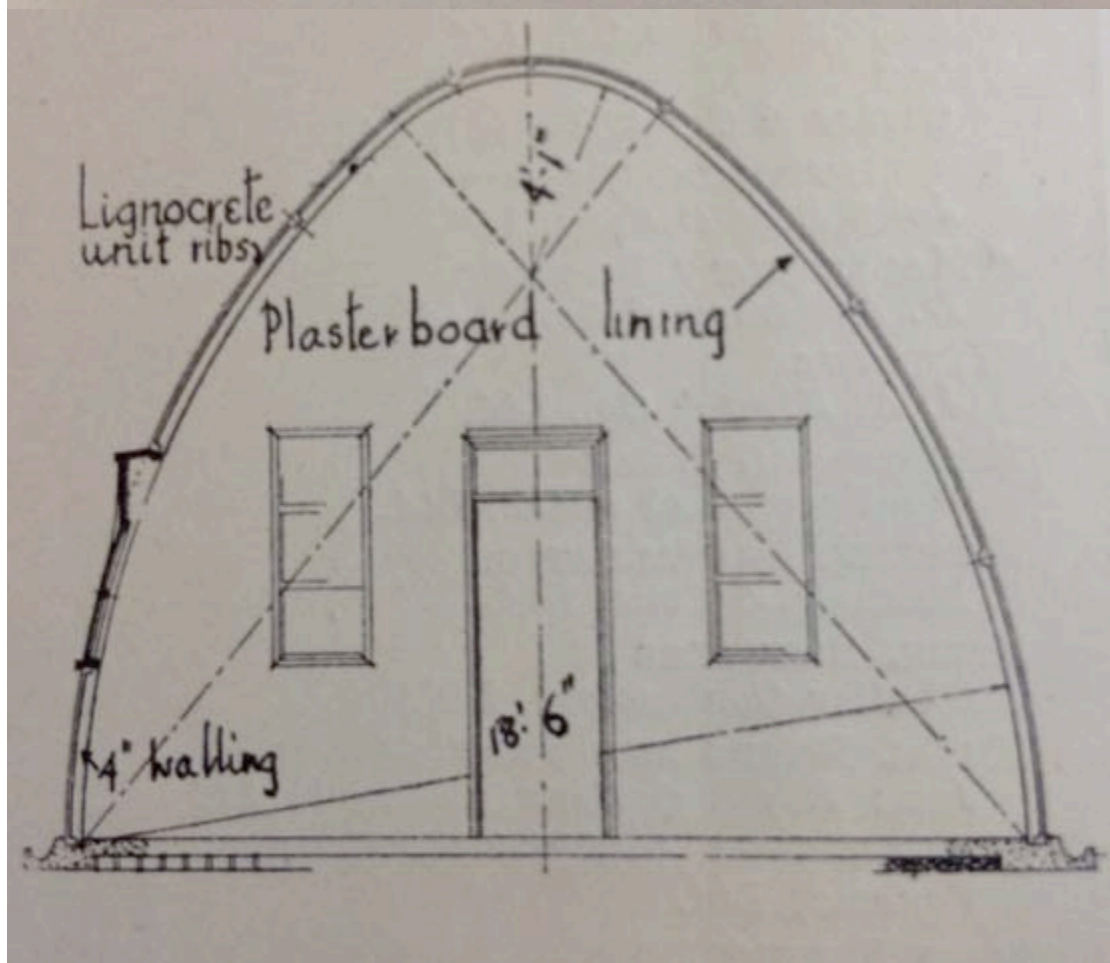
The Builder, 10 May 1940, p. 568.

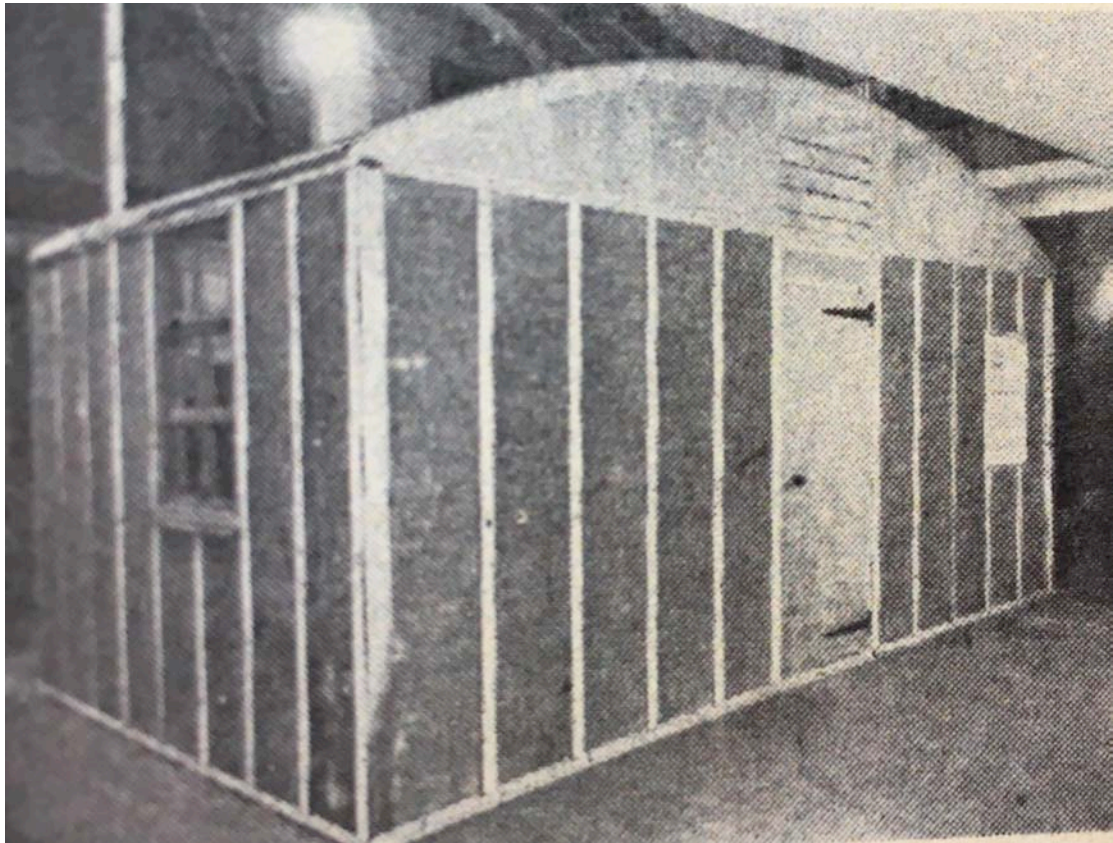
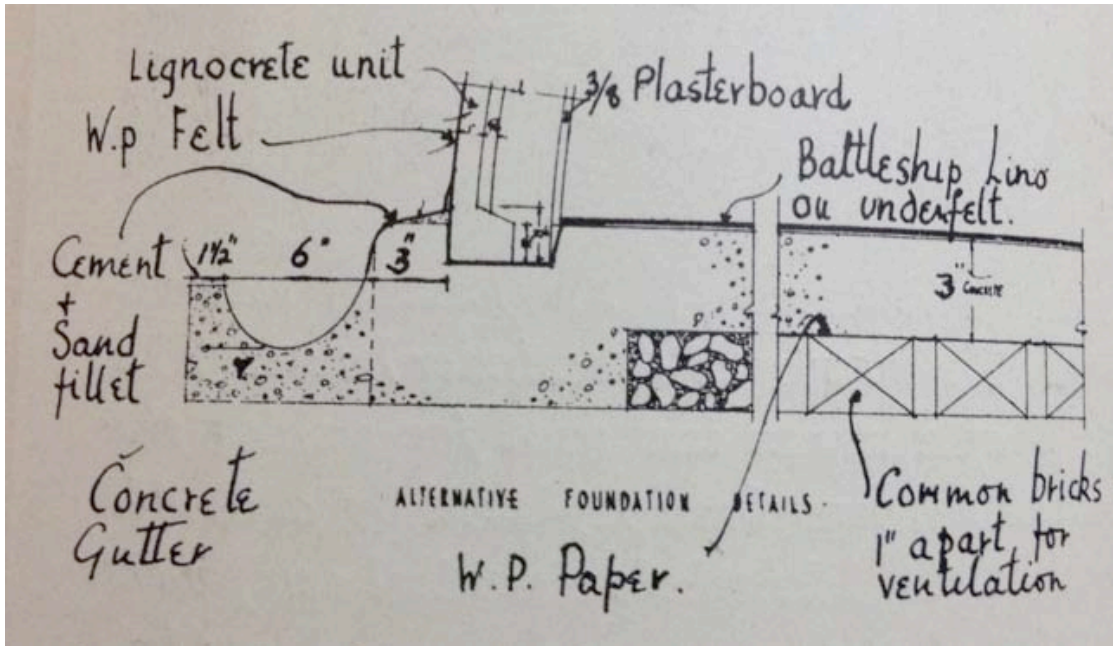
Architectural Design and Construction, October 1943, pp. 212-214.

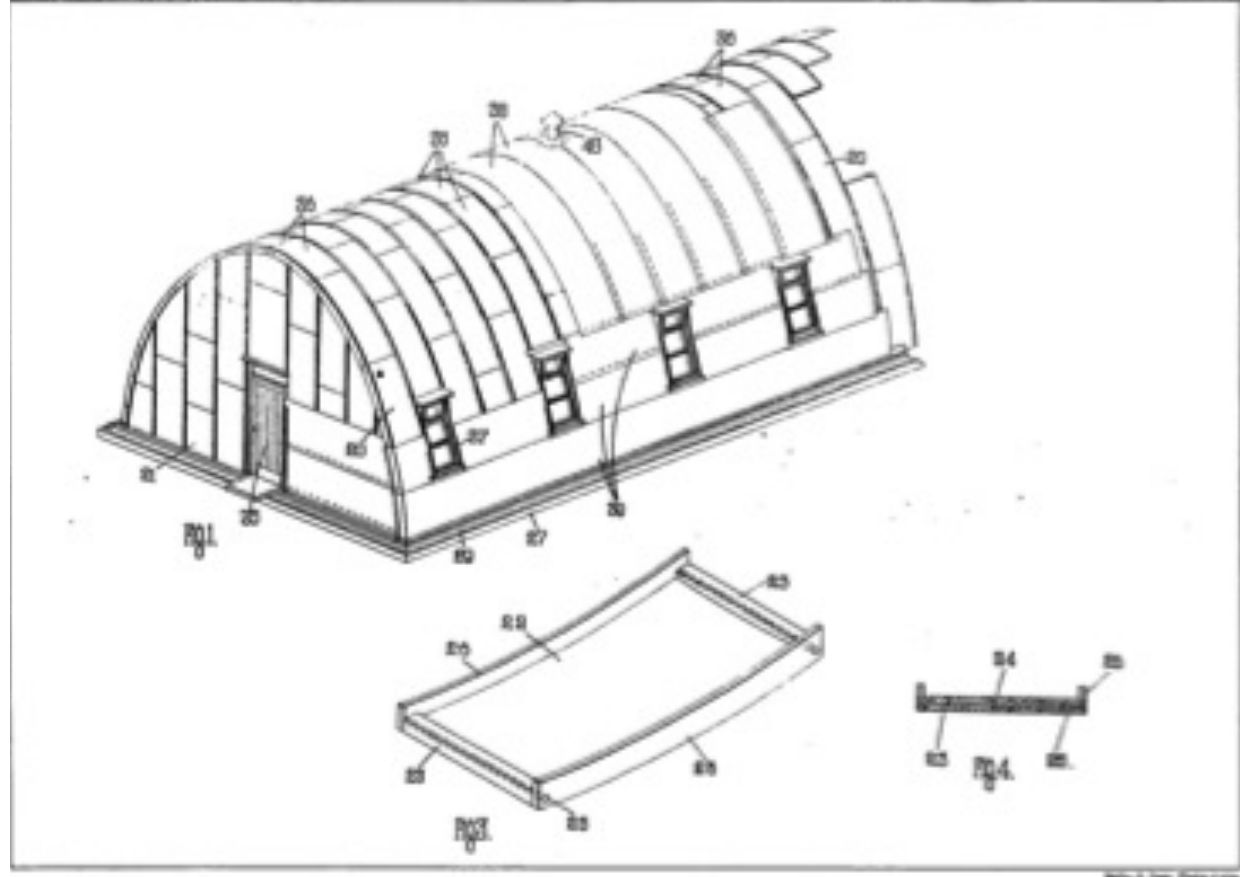
PLANS



PLAN AND ELEVATIONS AND DETAILS OF UNITS.







Transportable Timber Hut Type A

Designer: Alan Best and H. Dalton Clifford

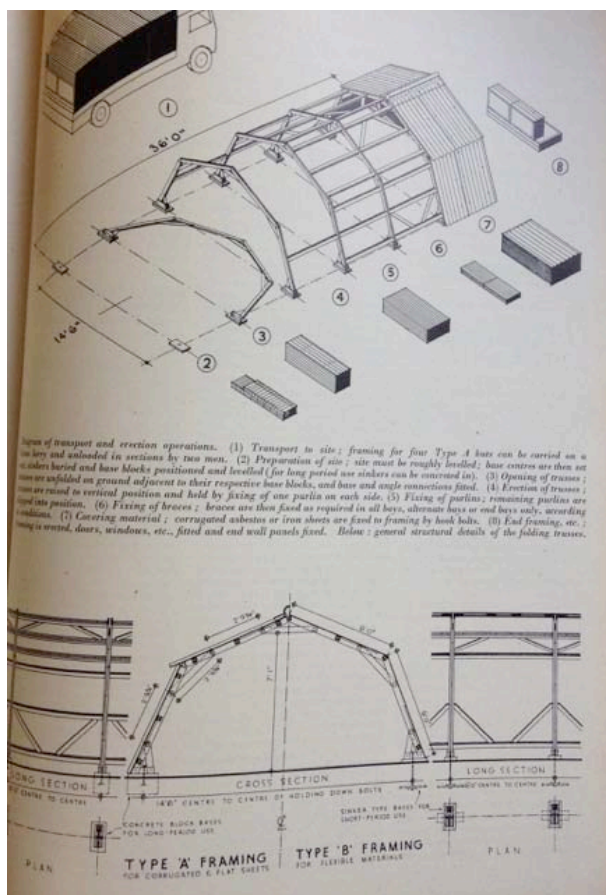
Alternative Name: Unknown

Period Built: Second World War (from 1943)

Location: Britain

Patent: GB561315, (18 January 1943).

Photo:



IDENTIFICATION

Collapsible timber trusses covered with sheet material such as corrugated asbestos or steel, wallboard or plywood. Four huts could be carried on one 3-ton lorry. Erection time was 35 hours. Measured 14 ft 6 in. by 36 ft.

USES

Accommodation.

REFERENCES

The Architects' Journal, 29 April 1943, p. 286.

Transportable Timber Hut Type B

Designer: Alan Best and H. Dalton Clifford

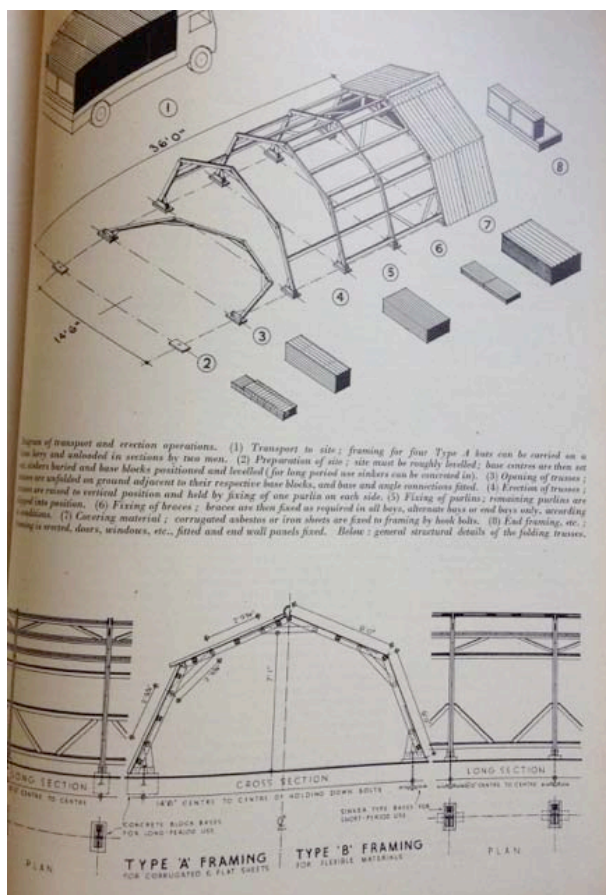
Alternative Name: Unknown

Period Built: Second World War (from 1943)

Location: Britain

Patent: GB561315, (18 January 1943).

Photo:



IDENTIFICATION

Collapsible timber trusses covered with canvas or other flexible material. Four huts could be carried on one 3-ton lorry. Erection time was 10 hours. Measured 14 ft 6 in. by 36 ft.

USES

Accommodation.

REFERENCES

The Architects' Journal, 29 April 1943, p. 286.

Turner's Everite Hut

Designer: Turner's Asbestos Cement Co. Ltd

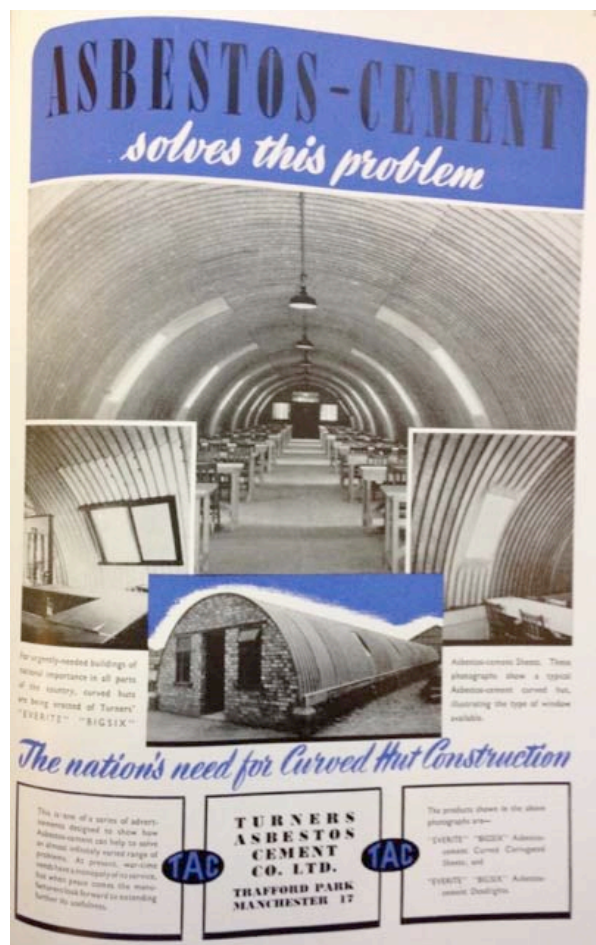
Alternative Name: Unknown

Period Built: Second World War

Location: Britain

Patent: None found

Photo:



IDENTIFICATION

A curved hut construction using Everite 'Big Six' curved asbestos cement corrugated sheets, but without the ends or foundation included in the 117- part kit. It could be erected straight off the ground or from brick/concrete curbs. Measured 16 ft by 36 ft.

USES

Storage, accommodation, offices, workshops.

REFERENCES

Royal Engineer Museum Archive. Report about Hutting.

The War Office Abbey Hut

Designer: Directorate of Fortifications and Works

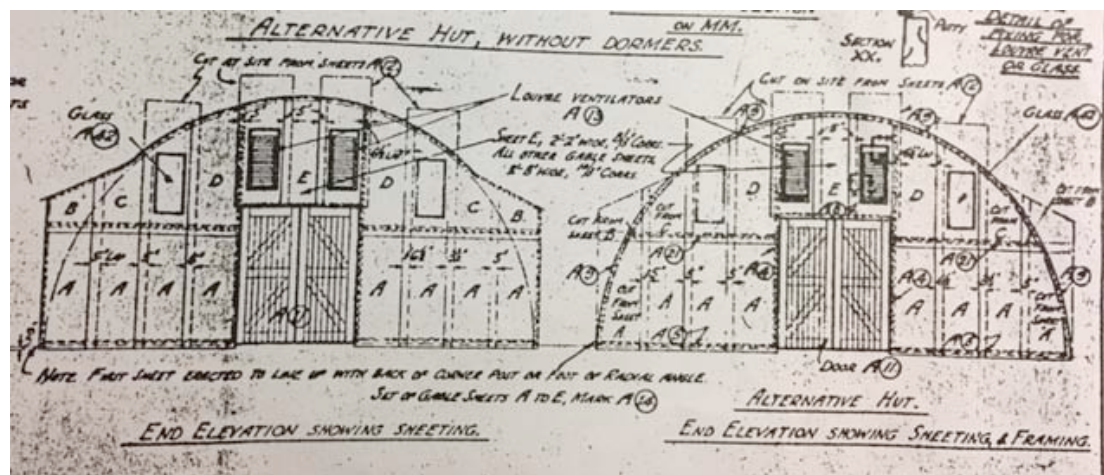
Alternative Name: Unknown

Period Built: Second World War

Location: Britain

Patent: None found

Photo:



IDENTIFICATION

Similar to a Nissen with a 24 ft span. Could be built to any length in 6 ft increments. Clad with corrugated steel sheets, could have dormer windows as an alteration. Gabled ends. Internal height 12 ft 3 in.

USES

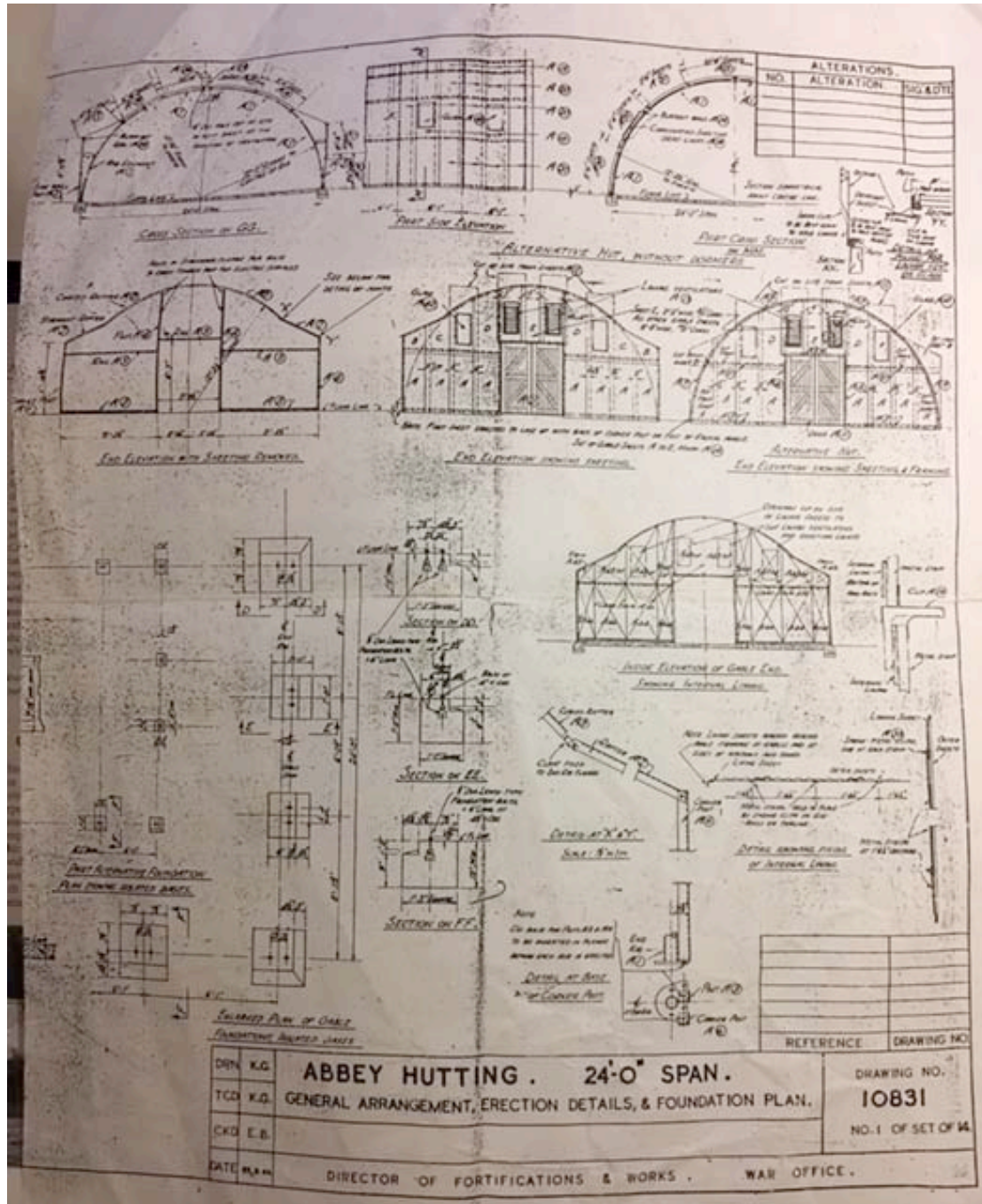
Storage, accommodation, offices, workshops.

REFERENCES

Drawing number 10831, Directorate of Fortifications and Works, War Office. (Airfield Research Group)

Paul Francis, *Appendix 26: Hut & Shed Types*. (Airfield Research Group)

PLAN



The War Office Tufton Hut

Designer: Directorate of Fortifications and Works

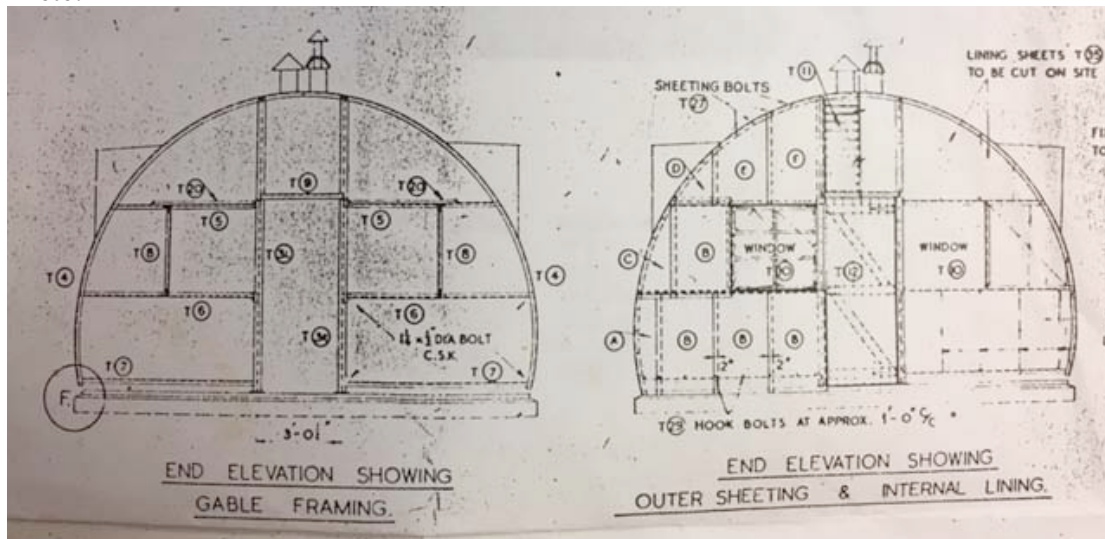
Alternative Name: Unknown

Period Built: Second World War

Location: Britain

Patent: None found

Photo:



IDENTIFICATION

Similar to a Nissen with a 16ft span. Could be built to any length in 6 ft increments. Clad with corrugated steel sheets, could have dormer windows as an alteration. Gabled ends. Slightly less in height than the Abbey Hut at 8 ft 3 in.

USES

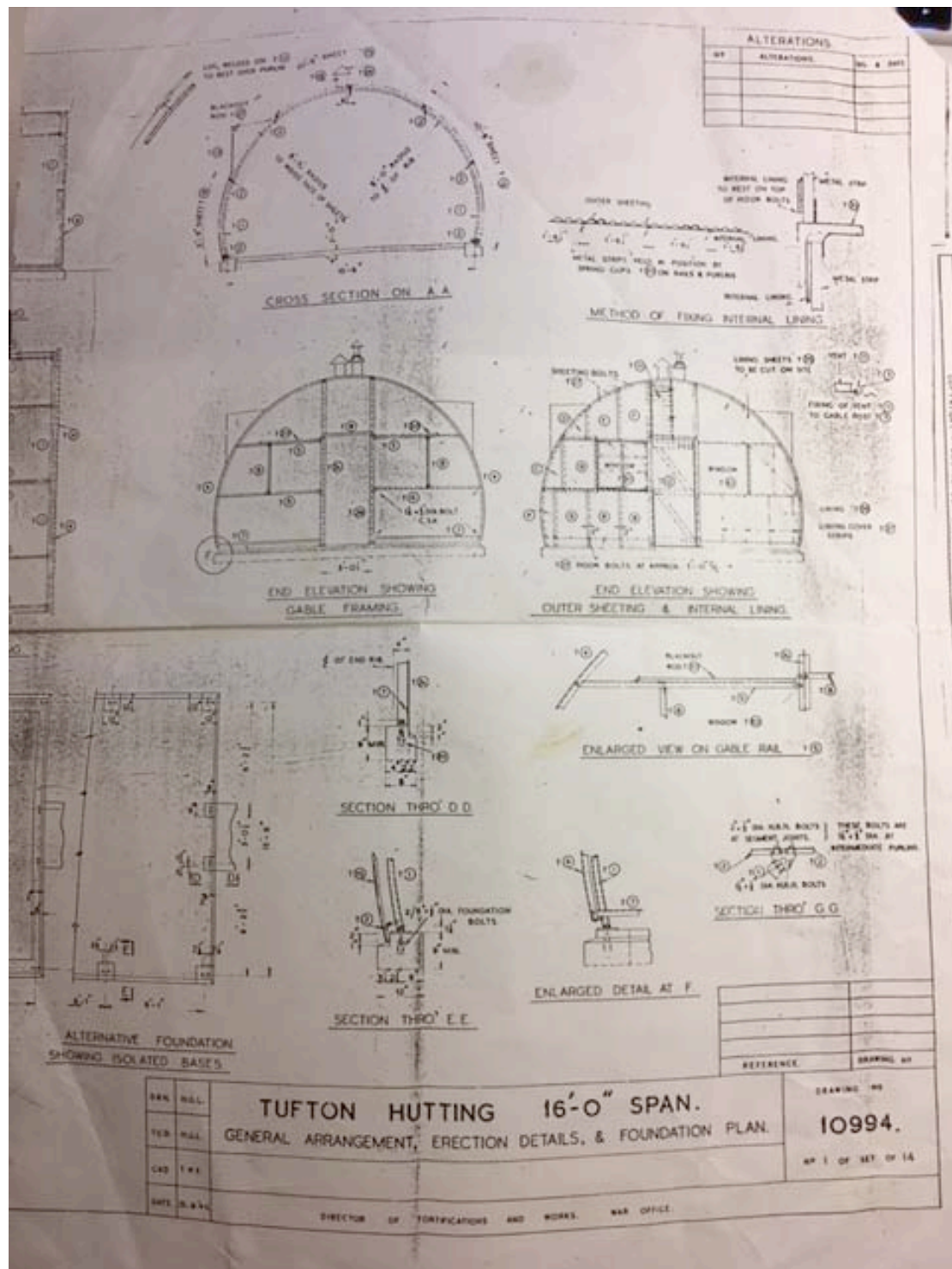
Storage, accommodation, offices, workshops.

REFERENCES

Drawing number 10994, Directorate of Fortifications and Works, War Office. (Airfield Research Group)

Paul Francis, *Appendix 26: Hut & Shed Types*. (Airfield Research Group)

PLAN



The X, Y, and Z Huts

Designer: Gerrard & Sons

Alternative Name: Unknown

Period Built: Second World War (from September 1939)

Location: Britain

Patent: None found



Gerrard & Sons Y Hut at RAF Chivenor. Photo by Paul Francis.

IDENTIFICATION

Timber huts utilising reduced timber quantities compared to the Air Ministry Type A and Type B huts produced before the war. These were manufactured for the Air Ministry from 1939-1942. The X hut measured 18 ft by 50 ft, the Y hut 18 ft by 70 ft, and the Z hut 18 ft by 50 ft. The Z hut provided an extra foot of height at 8 ft versus the X and Y huts which were 7 ft high. During their sixteen months of manufacture, over five thousand were produced for the Air Ministry.

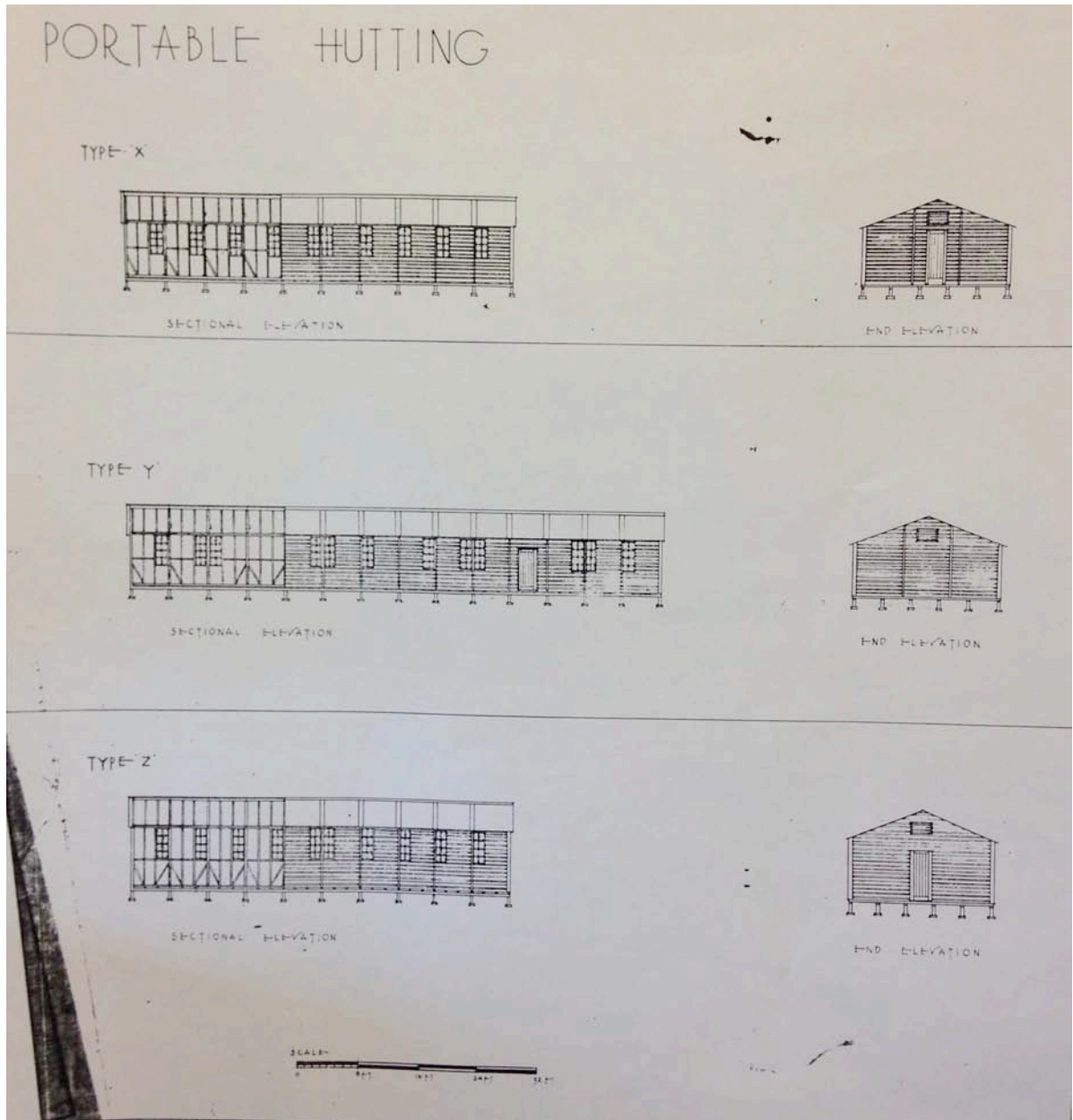
USES

Accommodation.

REFERENCES

C.M. Kohan, Works and Buildings (1952).
Francis, p. 207.
Air Ministry Drawing Number 14543/39.

PLANS



The Gerrard & Sons X, Y and Z Huts. Air Ministry Drawing Number 14543/39. (Airfield Research Group).