



Earth Structures

A Strategy for Sustainable Management




Hampshire
County Council

Earth Structures

A Strategy for the Sustainable Management of Earth Structures

Contents

Page 2	Introduction
Page 4	Value of Earthen Heritage
Page 6	Cob Walling Characteristics
Page 7	Practical Conservation Issues
Page 8	Action Plan
Page 11	Sources of Information



"It was not until the autumn of 1977 that I visited the Test Valley in Hampshire for the first time. I was struck by the beauty of the river, its picturesque villages, cottages, farmhouses and small country houses with endless miles of meandering, white chalk walls with thatched or tiled copings. It was in this delightful part of rural England that I decided to make my home and to research the history of the local vernacular.

My interest in chalk buildings led to visits to the New Forest to examine other buildings built of earth but based on clay, sand and gravel. Geographically the chalk and clay belts lie side by side but the style and method of building was different because of the individual nature of the two materials and the way the land had been utilised. It soon became apparent that many of the earth buildings were in an appalling

condition and that they were being demolished rather than repaired. ... It became quite plain that if the beauty of these two lovely areas of Hampshire were to be conserved, to delight my grandchildren in the way they had captivated me, then advice was urgently needed."

Gordon T Pearson,
Preface to Conservation of Clay & Chalk Buildings, 1992.

Introduction

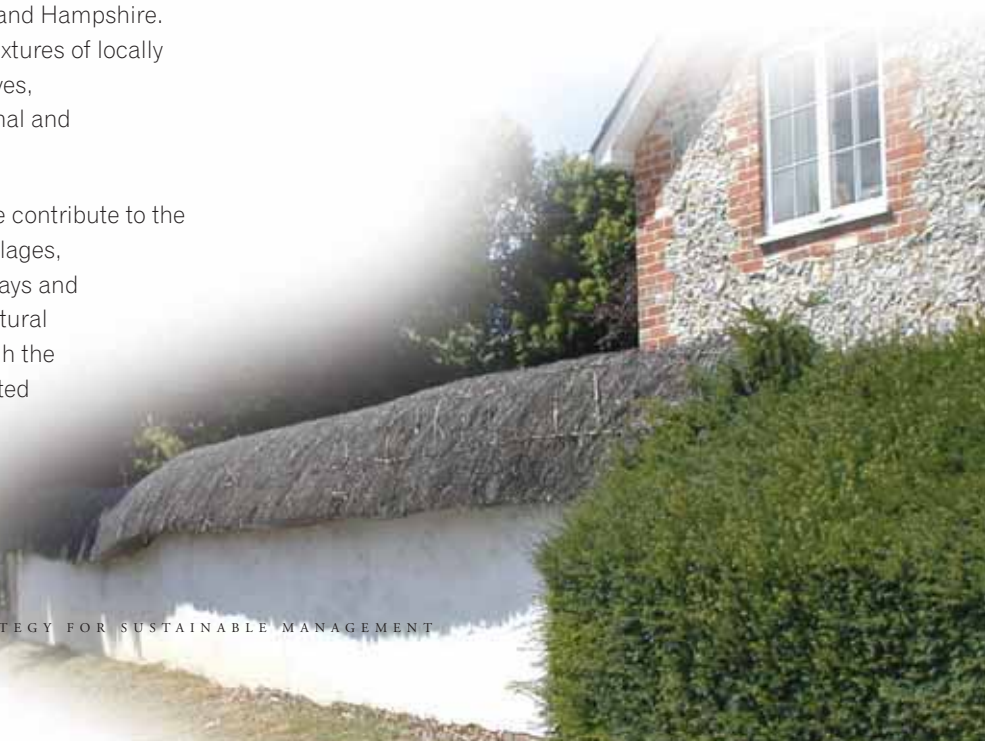
Hampshire is not rich in natural building stone but other materials won from the earth have served for centuries as important building resources for walls, roads, floors, daubs and mortars. Many historic, load-bearing and self-supporting earth walls survive. They contribute significantly to the character of mainly rural areas, principally as small houses, outbuildings and the boundary walls lining town and village roads. These historic earth structures are recognised as part of the built vernacular heritage belonging to a type and a given time that extends from East Cornwall through Devon, Dorset, Wiltshire and Hampshire. Earthen structures, made from mixtures of locally dug soils and other natural additives, are an important part of the national and international heritage.

The earth structures of Hampshire contribute to the unique local character of many villages, particularly where they line roadways and complement the colours of the natural landscape. Many travelling through the west of the county have commented on the beauty of the soft white chalk-cob boundary walls with their thatch and tile cappings.

The golden-coloured clay-mud or cob mixes used in the New Forest are equally appealing for the way they have been adapted for simple country buildings, blending with the contours of the countryside in a way no modern structures can. New developments, intense weathering, neglect, heavy traffic and inappropriate repairs all conspire to threaten the long-term survival of these structures. A strategy aimed at raising awareness of their value and ways of protecting them has been created to address these threats.

Above: King Somborne, 18th C. cob agricultural building with cob wall boundary continuous with the building line.

Cover photo: Monxton Village is cob-rich.





Right: Cob cottage, Outwick, near Fordingbridge. Some render is failing on front of cottage.

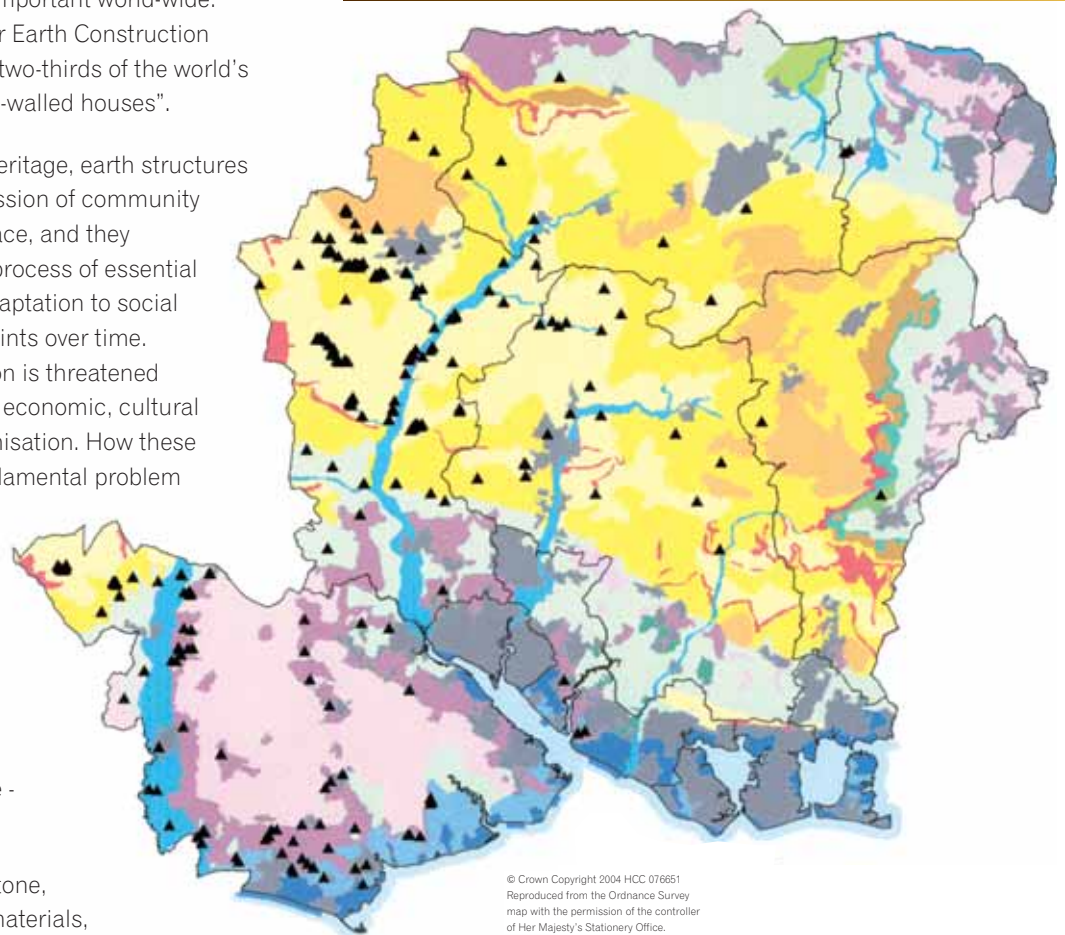
(Hampshire Photographic Project).

Historic Cob Structures in Hampshire

Earth building heritage is important world-wide. The International Centre for Earth Construction in Grenoble “estimate that two-thirds of the world’s population still live in earth-walled houses”.

As part of the vernacular heritage, earth structures are the fundamental expression of community identity and its sense of place, and they represent an evolutionary process of essential change and continuous adaptation to social and environmental constraints over time. “The survival of this tradition is threatened world-wide by the forces of economic, cultural and architectural homogenisation. How these forces can be met is a fundamental problem that must be addressed by communities and also by governments, planners, architects, conservationists and by a multidisciplinary group of specialists.” (International Committee for Vernacular Architecture - CIAV, 1996)

Unlike listed buildings of stone, brick and timber-framing materials, many earth structures have not been singled out for special recognition and protection. Small agricultural buildings and boundary walls which help shape the character of village conservation areas may go unnoticed and become at risk if they are not listed or recorded in plans or appraisals.



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Key	
▲	Historic Cob Structures
Landscape Types	
Yellow	Chalk and Clay
Orange	Clay Plateau
Blue	Coastline
Dark Blue	Cliff Coastline
Light Blue	Enclosed Coastal Plain
Green	Hangers on Greensand
Pink	Healthlands and Forest
Dark Green	Horticulture and Smallholdings
Light Green	Mixed Farmland and Woodland
Light Yellow	Open Arable
Light Green	Open Arable on Clay
Orange	Open Arable on Greensand
Dark Blue	Open Coastal Plain
Pink	Pasture on Clay
Light Green	Pasture and woodland: Health Associated
Light Green	Pasture: Hangers Associated
Blue	River Valley
Red	Scarps: Downland
Red	Scarps: Hangers
Dark Grey	Urban Area



Value of earthen heritage

Above: Deep thatch eaves protect the rendered cob walls and flint plinth hence the prescription for cob needing 'a good hat and a good pair of boots'. Longstock, Test Valley.

International & National

Serious interest in the UK's vernacular buildings began as late as 1952 with the establishment of the Vernacular Architecture Group. Pioneering work in recording threatened small vernacular buildings, which included earth structures, was carried out in the 1960s by the Royal Commission on Historical Monuments and resulted in Eric Mercer's pivotal book **English Vernacular Houses** in 1975. This important work marked a change in the Commission's policy in favour of thematic studies of lesser secular buildings. In the 1980s many vernacular earth buildings were identified, described and listed by the Department of the Environment during the re-survey of parts of the country.

In the past decade conservation work on earthen buildings in the UK has been linked to that of international committees who are committed to their study and promotion as an important part of architectural heritage. The Earth Structures Committee of the International Council on Monuments and Sites (ICOMOS/UK) was set up as a forum in 1992 to strengthen the network of those working in the field and to link it to research and information available through organisations such as the International Centre for the Study of the Preservation and the Restoration of Cultural Property in Rome (ICCROM). Two **Out of Earth** conferences, hosted by the University of Plymouth School of Architecture in 1994 and in 2000 (Terra 2000), have marked the high level of national interest. The publication of **Terra Britannica (2000)** identified, for the first time, the range and character of earthen structures and archaeological earthworks across the regions.

Publications like Terra Britannica have improved the opportunities available to academics and conservationists by raising the profile of earthen heritage as a subject worthy of scientific study. But few academic institutions currently offer courses in the conservation of earthen heritage, so knowledge of the history, technology and methods of repair is fragmented at national and international levels.

Regional

In the UK, regional groups have formed to raise awareness of the importance of conserving earth structures in East Anglia (EARTHA), East Midlands (EMESS), the Harborough and District Earth Society (HADES) and the Devon Earth Buildings Association (DEBA). A Centre for Earthen Architecture has been established at the University of Plymouth's School of Architecture, to promote the construction of new sustainable buildings in earth and to conserve historic earth buildings. The Devon Earth Buildings Association is the oldest and largest regional group, established in 1991 as a forum for discussing, advising, training and organising seminars on earth buildings. In the area of South Wiltshire, Hampshire and Dorset there is as yet no organisation devoted to the promotion of earthen heritage although the counties have similar types of earthen structures and common problems associated with their conservation.

Earthen Building Materials in the Wessex Region

The geology of the chalk belt linking Wiltshire, Dorset and Hampshire provides rich sources of soils readily exploited for building. The upper chalk that dominates the downlands is particularly suited to crushing for use in chalk-walling construction. Chalk block has been used in buildings across the south for many centuries externally and internally. Though rather soft, it is remarkably uniform in composition and has a fine, even-textured quality which makes it ideal for moulded work. As a structural material it is commonly used in combination with flint, brick and other building stones.



Although chalk masonry is not the subject of this strategy, its presence often indicates that chalk cob may also be found locally.

In Wessex, chalk block and flint was not always as readily available as ground chalk, which was easier to obtain and use locally. The chalk-walled structures common to the area are products of its geology, building traditions and the relatively high cost of other manufactured or quarried materials, which put them beyond the reach of farm workers and the majority of the rural population.

The Map of Historic Cob Structures in Hampshire shows the highest densities of cob structures in the chalk and clay areas of north-west Hampshire and pasture areas on the clay in the New Forest. This mapped distribution has been studied and selected areas have been surveyed. Several chalk walls in the west Hampshire area, built in cob, were visited and mapped by Pearson (Architectural Association, 1982) from within a roughly 10-mile radius of the village of Nether Wallop in the early 1980s. The outer eastern limits of these types of chalk-cob walls were found as far east as Overton and Twyford. The concentrations of chalk walling vary, from villages like Kings Somborne and the Wallops where they appear in profusion to those of Crawley and Stockbridge where only one example survives in each.

In north and south Hampshire the chalk is overlaid with tertiary soils of gravels, sands, silts and clays. These mixed soils contain both chalk and clay which have been combined for use as the main ingredient in the cob and chalk walling of small cottages, walls and outbuildings. In the New Forest the heavy clay soils were used in cob structures, using similar construction methods as those used for chalk-mud walls.

Some limited chalk-cob house building was carried out in the experiments of the 1930s in reviving cob building in villages such as Quarley. These experiments were encouraged by the authors Williams-Ellis and Eastwick-Fields as an alternative to post-war building in modern materials. The revival was not widespread but their book, **Building in Cob, Pise and Stabilised Earth**, sought to convince architects of the merits of building with earth. The record of traditional knowledge on practical techniques provided in the book has provided inspiration and useful guidance for revivalists and conservationists working today.

Left: New Forest cob outbuilding showing its true golden colour derived from local clays. Normally this material would be protected under a thin lime render or wash.

Cob-walling characteristics

The majority of rural cob and chalk-mud structures date from the Brick Tax of 1784 up to the Rural Workers Act of 1926, when town bye-laws were brought in to improve living conditions.

Generally the styles and overall character of these buildings did not vary greatly, as the structural limitations of the material determined their few, small openings, hipped roofs and gable walls, and wall heights. Chalk boundary walls are particularly valued for absorbing the heat and protecting and supporting fruit trees, and so were useful for many of the large agricultural estates.

Cob structures are often associated with thatch roofing. A common Devonian expression was that cob needed “a good hat and a good pair of boots” to protect it. Full gables in cob are unusual as they are structurally weak. Upper floors are usually set within attics and have small dormer windows.

As the walls depend on their thick mass to be structurally sound, window openings are few and small, and wall thicknesses are generally at least 750mm. Corners are often rounded, wall surfaces are roughly textured and eaves are low. The base of the walls is normally of flint, brick, and/or limestone to prevent walls becoming saturated. Cob boundary walls are built using similar materials and general rules, though they are thinner than walls for buildings as they only need to support the wall top frame and coping detail.

The principal materials were usually dug from the site the building was to occupy. The mixtures were of crushed chalk and/or clay, chopped straw, horse hair and other binders and aggregates depending on what was available locally at the time. The mix was then trodden, sometimes using animals, to achieve a pliable, sticky consistency. The site was prepared by laying a foundation course of mortared flint, brick or rubble to a depth that depended on weathering requirements. Clough Williams-Ellis records his observations of what constitutes a good-quality chalk mud as “a conglomerate of small chalk knobs cemented together by a matrix of plastic chalk and straw, the whole forming as dense a mass as possible”.

There were two methods of construction: piled and shuttered. In the piled method the mixture was applied in ‘lifts’ onto the underpin course, to begin to form the walls in a series of stages or ‘perches’.

The piled method involved at least two men, with one man slapping the mud into position and one treading the mass down to a level surface in courses from 18 inches (450mm) to 2 feet (600mm) high. The walls were finished by removing the rough material secreted between lifts. As the piled method was slow to dry and involved some wastage of material in the paring down of excess material, other quicker methods were adopted. The shuttered method was introduced around 1790 by Henry Holland, who used it for the estate cottages of his workmen. The shuttered method, also known as *pisé de terre* or rammed earth, was able to support loading more quickly and proved to be more efficient. The soldiers returning from the Napoleonic Wars in France had seen rammed walls being constructed in rural areas and by 1819 the method was known to be familiar to builders in Hampshire. The mix was similar to that used for the piling method but less water was needed due to the packing system. The mix was rammed down between wooden shutters which could simply be dismantled and re-erected for the next section. Spring and autumn were considered the best time to construct new walls to avoid rapid drying in the summer or freezing in winter.

Walls were traditionally protected with thin lime and chalk-based renders, slurries and whitewashes. In Hampshire coloured pigments were not normally used and white remained the traditional finish. Cement-based renders were recommended during the brief revival of cob building in the 1920s, which Williams-Ellis wrote about, though their use is no longer considered good practice. Cement-based renders are normally too dense and heavy for the softer earth core materials, which they can quickly detach from.



Above:
A well protected chalk cob boundary wall under a deep thatch with old cracks, nicely stitched together with recycled bricks.

Right below:
Cob boundary walls with thatched walltops are characteristic of north west Hampshire villages.

They may be physically linked to listed buildings and form part of the curtilage of the property.





Right: Heavy traffic on village roads can cause physical damage and cracking from vibrations to cob walls, (Monxton Traffic Group)

Left: This attractive outbuilding is protected by the deep thatch eaves, though it is vulnerable from traffic impacts, Monxton.

Roadside cob wall approaching crisis due to neglect.

Breakdown of wall-head protection permitting saturation of cob below.

Decay of cob behind water - retaining cement - based render (now largely failing)

Base of wall decaying due to soil build up covering plinth and splash back from passing vehicles.



Practical conservation issues

A considerable amount of practical conservation work has been carried out on older cob structures in the conservation areas of the county. Work relating to surveys and assessments, grant-aided repairs by county and district councils, listed-building casework and the monitoring of boundary-wall failures have built up a body of experience and skills in resolving the range of problems presented in conserving earth structures. The traditional knowledge of cob building was largely unwritten until the publication of Williams-Ellis' book in 1916. Now, organisations such as English Heritage, the Institute of Historic Building Conservation, DEBA and Pearson have all published guidance on appropriate repair techniques. Specialist building suppliers in Hampshire will provide technical advice and materials for earthen repair work.

More remains to be done in the Wessex region to consolidate and transfer existing knowledge

and experience from within this specialist area of repair to those responsible for approving repairs and maintaining earthen heritage and to those in building professions, trades and training. Given the vulnerability of earthen walls to excessively damp conditions, flooding, neglect and poor repairs, this dialogue and information sharing should be a high priority. With the wetter winters and drier, hotter summers that result from climate change, the potential for adapting old earthen walls for more extreme weather conditions needs to be explored.

The like-for-like conservation principle of repair commonly used in conservation work is difficult to achieve with earth-wall repairs as replacement mixes will be hard to match with the original. The differing proportions and character of the chalk and clay in the aggregate can mean the mixture varies in colour, degree of compaction and texture. In addition, the use of other additives such as types of lime and organic material such as straw is not always traceable in historic mixes through analysis

testing. Old renders and slurries can also be difficult to match as various recipes were used for whitening and washing cob walls. Today's aesthetics differ from earlier periods and rural villages would look very ill kept and shoddy by current standards. Lime-based renders are more appropriate today than the clay-based mud renders of the past, as they look white, are relatively easy to apply and are permeable.

Keeping water from damaging earth walls is one of the key conservation issues relating to cob structures. Wall tops and roofs must be kept watertight, with a sufficiently deep overhang to prevent water penetrating the tops and upper areas of walls. Wide eave overhangs designed to keep water off the walls should not be altered. Masonry plinths at the base of walls must be kept free of soils banked around them and invasive vegetation like ivy which can prevent them drying out. The ground at the base of cob walls can undermine the structure if it is laid with hard materials that cause splashback onto the lower zones of the wall which take maximum loads. Road traffic can splash water onto untreated cob walls adjacent to the roadside and this can lead to erosion of lower walls. Vibrations caused by heavy traffic and goods vehicles, such as farm vehicles in rural areas, can also be a major cause of cracking in cob structures adjacent to main roads.

The neglect and/or poor repair of cob boundary walls can very easily cause a sudden collapse if a sharp frost follows a particularly wet period in which a wall has become saturated. The use of cement-based renders, paints and other non-permeable finishes that trap moisture in the core of walls can exacerbate a problem in excessively damp walls and lead to render and structural failures. A series of cob-wall collapses was recorded in the Test Valley district during the particularly wet winter of 2001.

Where a structure is listed, statutory *Lists of Buildings of Special Architectural or Historic Interest* may not identify cob-walling material, where it forms the core of walls that may be rendered, painted or brick-faced. In Hampshire 350 listed earth structures have been identified and mapped from list descriptions alone, though there may be many more. A more accurate and comprehensive picture of the actual number of earth structures can only be obtained from information collected by properly informed field work and case studies.

Practical conservation issues may arise out of decisions made before the cultural value of vernacular buildings was recognised.

Unlike listed buildings of stone, brick and timber-framing materials, many earth structures have not been singled out for special recognition and protection. Earthen boundary walls and outbuildings not listed in their own right have been excluded from surveys and may not be as well maintained as part of the curtilage of listed buildings. Small agricultural buildings and boundary walls, which give village conservation areas their character, may easily be demolished and go unnoticed if they are not recorded in plans or appraisals. The local planning authority should always be consulted on the need for Conservation Area consent for demolishing such structures, before any work takes place.

Action Plan

Aim

If traditional earthen heritage is to survive in the county for the use and enjoyment of future generations, it must be managed in a more sustainable way. More discussion and accessible information is needed to raise awareness among owners, their agents, and the building trades of the value of retaining and maintaining the special characteristics of these traditional structures. Without a strategy for this area and a fuller appreciation of the contribution these structures make to the vernacular built heritage, they will continue to be damaged or destroyed through neglect or misinformed actions.

The strategy for addressing the conservation issues related to cob structures is intended to encourage all those interested to identify and record them, to carry out appropriate repairs and maintenance, to organise and share the knowledge gained from experience, and to ensure training in traditional building skills is part of locally accessible, accredited training programmes.

These action points have been developed as a result of a series of meetings with the conservation officers who are responsible for the areas with the highest number of cob buildings in the county, from Basingstoke and Deane, New Forest and the Test Valley, and with Hampshire Buildings Preservation Trust representatives. The responses to a recent survey of earth buildings groups, colleges and universities, other cob-rich counties and interested professionals with experience outside Hampshire have also been included.



New Forest creamery. Before and after reconstruction, using cob blocks made from the collapsed material.

(Bob Bennett, The Lime Centre.)

A. Mapping and recording

Objective

To identify the location of earthen buildings and boundary walls and record their character, condition and value within the context of their setting. This work is the first step if structures are to be recognised, protected and properly maintained. The information can enable planning authorities and landholders to plan for the conservation of earthen structures. There are many ways of making the information relevant through land-management plans, such as agri-environment schemes, management plans for Areas of Outstanding Natural Beauty, Conservation Area Appraisals and Village Design Statements.

This information can be obtained from an experienced contractor or building professional but homeowners can also begin to understand the nature of earth materials by looking at structures in the immediate area or village themselves. Boundary walls and outbuildings that have not been rendered can provide examples of the types of cob mixes used locally. Listed-building descriptions may include references to materials, and any building work involving repairs or alterations to walls may expose materials used behind renders. Surveys for valuation and insurance purposes should identify the construction materials. Local planning authorities may also have reports and listed building/planning files on cob structures that have been subject to planning and/or grant applications.

Action on mapping and recording

To collect and collate information on the location, character and condition of cob structures from various sources to enable further study and inform technical guidance and policy development. Hampshire County Council maintains an Archaeology and Historic Building Record and this may be a suitable repository for the information collected.

B. Monitoring and maintenance of structures at risk

Objective

To develop, promote and encourage good practice, guidance and procedures for monitoring and surveying cob structures at risk; and to ensure that unforeseen collapses are prevented or responded to, when they

occur, wherever possible. To encourage emergency recording among a network of owners, authorities and agencies responsible for responding wherever cob structural collapses occur.

The condition of earth structures is an ideal barometer of changes in climate patterns as they can be susceptible to extreme weather events. Cob structures and, in particular, boundary walls are especially at risk from a combination of poor weather, inappropriate repairs and physical impacts. When weak areas of walls are exposed to wet, windy weather and sharp winter frosts, sudden collapses often occur and can be costly and difficult to repair. Good practice in repairing collapsed walls depends on an analysis of materials and site conditions. To avoid these collapses earth walls need to be regularly monitored and maintained and, when they occur, responded to accordingly.

Action on monitoring and emergency responses

To guide and encourage local authority officers from planning and highway departments, who are working in the field, to record collapsed earth boundary walls and report on the circumstance of the collapse. To develop and promote a standard format for reporting on failures, neglected structures and total collapses to enable a record to be established.

Cob agricultural building, Hatchet Pond, Beaulieu 1952.

(Hampshire Photographic Project).



C. Guidance on the nature, characteristics and repair of earth buildings

Objective

To prepare good-practice guidance to raise awareness of the architectural and historical value of earth structures, to assist in identifying/recording their special character and vulnerabilities and ways of repairing and maintaining them in accordance with appropriate methods of repair.

Many failures and cob-wall collapses can be avoided where the materials are identified and understood well in advance of work; and where regular interventions are made to ensure a maintenance regime is in place. Long-term conservation can only be sustained if there is an awareness of the special requirements of the earth materials and if specialist materials and skilled operatives are available, given the vulnerability of earth materials to extreme weather exposure.

Action on guidance

To develop and publish guidance for property owners in consultation with those responsible for the maintenance of cob structures, on their nature and characteristics and on appropriate methods for surveying, repairing and maintaining them.

D. Problem-sharing, learning and promoting

Objective

To foster the sharing of knowledge, of evidence-based research and case studies relating to earthen architecture characteristic of Hampshire and the neighbouring counties of Wiltshire and Dorset.

In the recent survey interested professionals responded by noting that, unlike other cob areas such as East Anglia and Devon, there was a gap in the Wessex region and no earth buildings group had been established to report on common problems, current trends or areas of research and training.

Action

To found and establish an interest group of stakeholders to communicate and promote interest in and care for the conservation of earth structures within the Wessex region.

E. Training support

Objective

To enhance and develop access to opportunities for training in the maintenance and repair of earth buildings, and whenever possible to ensure that specialist repair skills are not lost and the support for maintaining standards of historic building repair continues to improve.

A recent study by the Heritage Lottery Fund revealed that employers were concerned about the apparent shortage of specialist skills needed by the heritage sector generally. The research revealed that there is a genuine national shortage of people with specialist skills where the use of traditional materials is dying out or where the training opportunities are few and far between or where the demand for skilled people had outstripped the supply. The research examined topics related to earth building such as skills in the use of thatching, lime mortars and masonry and found that there is considerable cause for concern because poor investment in training, few new apprentices and the undervaluing of building craft skills are putting the fabric of the heritage at risk.

Action on training initiatives

To work with stakeholders in the traditional building skills sector to ensure that opportunities for training are accessible in Hampshire through training organisations that are developing and delivering accredited courses on the repair of earth buildings characteristic of the county.



Further Reading

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Mercer, Eric, ***English Vernacular Houses***, Royal Commission on Historical Monuments, 1975.

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Available from Donhead Publishing by tel: (01747) 828422 or sales@donhead.com.

Institute of Historic Building Conservation, Robert Nother,

The Repair of Earth Walled Buildings, Tunbridge Wells, Kent, 2000.

Available from IHBC Technical Committee by tel.(10935) 462648 or technical@ihbc.org.uk. or www.ihbc.org.uk

Back cover photo: Cob walls were traditionally used to enclose kitchen gardens as in this Winchester example. In his 1813 Agricultural Report Vancouver, wrote about the chalk area of Hampshire with walls preserving "the young fruit and blossoms from severity of the frost, and...affording a more certain crop of fruit which ripens as early, and is equally well flavoured as that (grown) upon stone or brick walls".

Materials Supply, and Advisory Services

Bursledon Brickworks Trading Ltd./The Hampshire Building Preservation Trust

Coal Park Lane, Swanwick, Southampton SO31 7GW
Tel./Fax (01489) 576248

The Lime Centre, Long Barn, Morestead, Winchester, S021 1LZ

Tel. (01962) 713636
E-mail info@thelimecentre.co.uk
Website www.thelimecentre.co.uk

Cathedral Communications, The Building Conservation Directory 2004

Tisbury, Wiltshire, SP3 6HA
Tel: (01747) 871717
E-mail bcd@cathcomm.demon.co.uk
Website www.buildingconservation.com

Practical and Academic Training

Bursledon Brickworks (see above)

Short day course can be arranged for CPD.

Centre for Earthen Architecture, School of Architecture,

University of Plymouth,
Notte Street, Plymouth PL1 2AR
Tel: (01752) 233608

Centre for Sustainable Heritage, The Bartlett School of Graduate Studies

UCL Faculty of the Built Environment, Torrington Place Site, Gower Street, London WC1E 6BT
Tel: (0)20 7679 1665
sustainableheritage@ucl.ac.uk

The Lime Centre (see above)

Offers has short day or half day courses at least once monthly.

Weald and Downland Museum, Singleton, West Sussex, PO18 0EU

Day courses.
Tel: (01243) 811464
E-mail courses@wealddown.co.uk

West Dean College, Chichester, West Sussex PO18 0QZ

Building Conservation Masterclasses
Tel: (01243) 811301
enquiries@westdean.org.uk



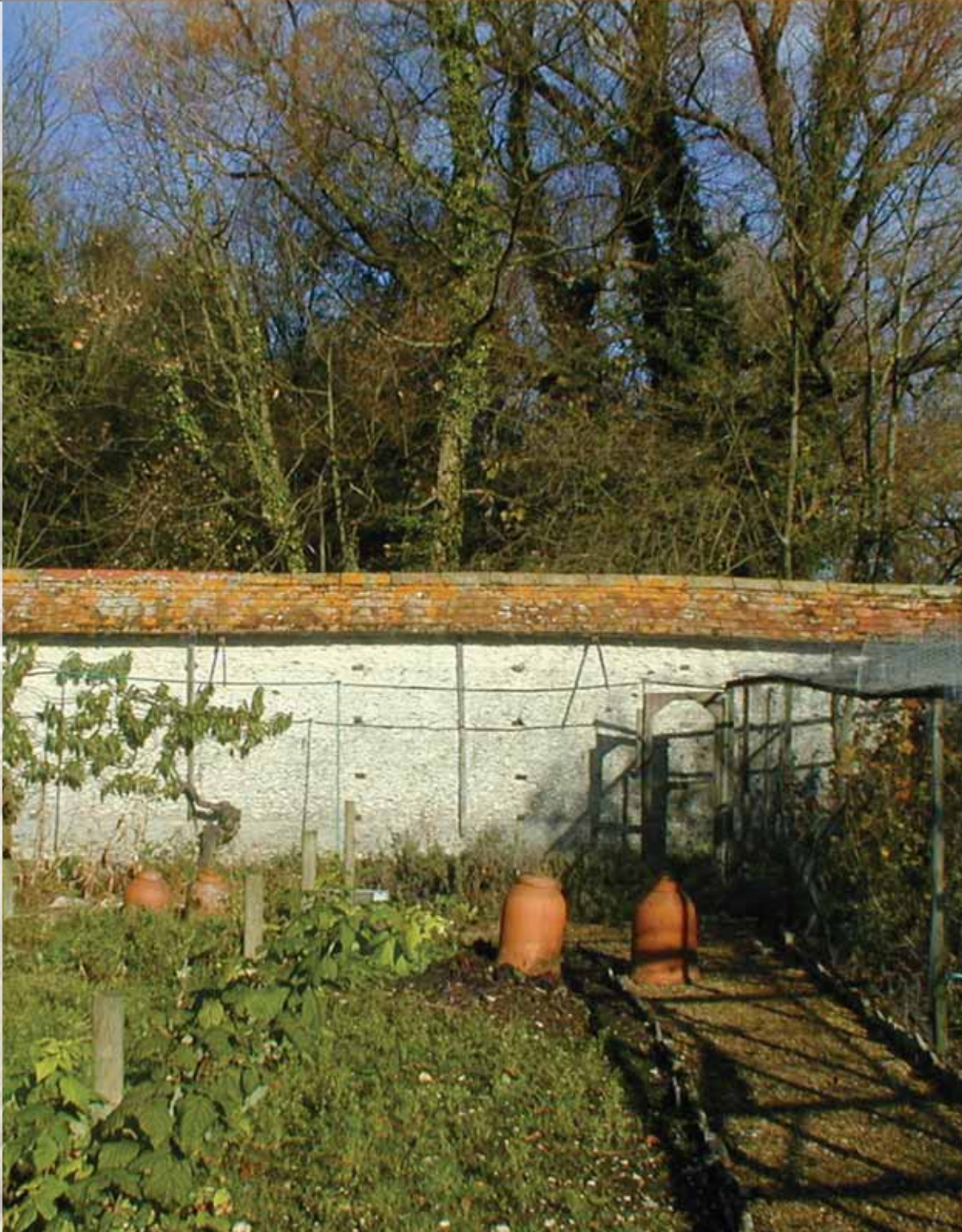
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A Strategy for Sustainable Management in Hampshire

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