The opportunities and challenges of improving the condition and sustainability of an historic building at an international tourist attraction in the UK

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Abstract

Heritage tourism has become increasingly popular, and improving the sustainability of such sites is essential both nationally and internationally. However, limited research has previously been undertaken on improving the sustainability of built cultural heritage. Through a case study approach, this paper explores the opportunities and challenges of improving the condition and sustainability of a chapel at a busy international heritage tourist attraction.

Improvements to both the condition and sustainability of such assets are essential to ensure their sustained and enhanced use, and the protection of heritage buildings. Although synergies between sustainability and conservation exist, there are also tensions and compromises.

The research identified the opportunities and challenges faced at a tourist heritage attraction. Challenges facing building professionals include project team turnover, delays due to archaeology, building condition and defects, and unfamiliarity of improvement measure. Building improvement projects create an opportunity to increase knowledge and understanding about these assets as well as enhancing opportunities for meaning-making for visitors.

Practical implications of this case study include ensuring clear project objectives and a balanced project team. These should be enhanced by a good system of information recording throughout the project to limit the impact of staff absence. Good communication within the team and with external members such as manufacturers will reduce the impact of unfamiliar products and aid in decision-making.

Keywords:

heritage, energy efficiency, refurbishment, Lawrence Waterbury Johnston, heritage tourism, Hidcote

Introduction

Heritage tourism has become increasingly popular, and demand for this type of tourism is estimated to increase by 15% annually (Durak et al., 2016). It is described as “one of the most significant types of tourism” (Timothy and Boyd, 2006, p.2). Cultural heritage is often inherently linked with physical spaces (Adger et al., 2012), with historic buildings forming part of heritage tourism (Gholitabar, Alipour and da Costa, 2018).

Cultural heritage has been shown to facilitate “sense-making and identity-building through phenomenological encounters of the self in the destination space” (Jamal and Hill, 2004, p.359). The integration of the historic built environment with the “productive living environment” to create meaning is important (Newman, 2016, p.402).

Energy efficiency and sustainability are key issues for the building stock. Indeed, it has been recognised that historic buildings are a key component in reducing carbon emissions (Pigliautile et al., 2018). Climate change poses a threat to the long-term survival and usability of built cultural heritage (Hall et al., 2016). To ensure the continued use of cultural heritage, such assets must be sustainable. However, improving the energy efficiency and sustainability of historic buildings is complex, requiring “cooperation between experts” (Dvornik Perhavec, Rebolj and Šuman, 2015, p.81) and “a multidisciplinary approach” (Roberti et al., 2015, p.189).

Built cultural heritage is a non-renewable resource and can be vulnerable to change (Philips, 2015). Such buildings have “endured climate changes over the centuries” with adjustments made to adapt these structures to their local climate (Silva et al., 2014, p.381). However, the type and speed of change are important.

For built cultural heritage open to visitors, there are additional challenges, including the consideration of visitor impact (Landorf, 2009). As visitors to built cultural heritage increase, questions relating to sustainability and conservation are raised. This includes how such assets are sustained from a conservation perspective whilst continuing to welcome increasing visitor numbers. Garrod and Fyall (2000) emphasise that by increasing the number of visitors there is a danger of negatively impacting on the property and surrounding area. This is echoed by Timothy and Boyd (2006) who identify wear-and-tear as a principal challenge. Additionally, consideration is needed about how the energy consumption of assets can be attenuated whilst increasing visitor numbers and enhancing the visitor experience.

Whilst extensive literature exists on heritage tourism (e.g. Timothy and Boyd, 2006) and improving the sustainability of heritage buildings (e.g. Yazdani Mehr and Wilkinson, 2018, Norrström, 2013), there is currently limited research on improving the sustainability of built cultural heritage at tourist attractions.

This paper aims to investigate the opportunities and challenges of improving the sustainability of a listed building at a heritage tourist attraction from the perspective of building professionals. The research questions are:

- What aspects of sustainability of a heritage building can be improved?
- What are the key opportunities and challenges of improving the condition and sustainability of a heritage building?

Background

Improving the energy efficiency of historic assets can contribute to their preservation for future generations, aligned with conservation and sustainability principles, and facilitate their continued use. However, energy and carbon savings in historic properties “are considered difficult to achieve due to limited retrofitting capability” (Forster et al., 2011, p.654). Tensions exist between the preservation of historic properties and thermal comfort. The literature describes balancing thermal comfort with building preservation as one of the greatest challenges for retrofitting heritage properties (Sunikka-Blank and Galvin, 2016). Changes to the building fabric must be carefully considered to avoid irreparably damaging the significance of heritage assets (Godwin, 2011). Therefore improvements must be done on a case-by-case basis (Goncalves de Almeida, 2014).

Current conservation philosophy and the statutory protection of built heritage are based on the principles developed by John Ruskin (1849) and William Morris (1877). Conservation policies have been strengthened further through the principles developed by global heritage bodies (Mansfield, 2008). Emphasis is placed on the importance of heritage conservation as an on-going process in a similar way to "the pursuit of sustainability" (McKercher and Du Cros, 2002, p.54).

National and international conservation principles are based on minimal intervention, reversibility of measures, authenticity (Pendlebury et al., 2014) and compatibility (Webb, 2017). 'Authenticity' is recognised as "not an easy concept" (Forster, 2010, p.94) and is described in tourism research as 'complex' (Jamal and Hill, 2004). In building conservation it can relate to the original fabric, and the development of an asset over time (Forster, 2010).

In relation to built cultural heritage, Wesener (2017) argues that authenticity can be grounded in one of two paradigms – the realist and the constructivist. The former perceives authenticity "in relation to inherent qualities or intrinsic values" of a place (Wesener, 2017, p.142). The latter considers authenticity to be "socially constructed, mutable and time-bound" (Wesener, 2017, p.142), complementing Forster's (2010) definition. The concept includes 'personal authenticity', extending to the local community and their "lived existence" with a place, and tourists and how they experience a place (Jamal and Hill, 2004, p.359). Authenticity, therefore, must not only include the original fabric of a heritage asset, but also incorporate consideration of the asset's evolution along its timeline, people's interpretation and meaning of the structure, and consequently its close association people's process of meaning-making. Norrström (2013, p.2624) argues that the preservation of different 'time layers' "generates diversity and also means preserving memory, the intangible value giving meaning to a place".

The concept of 'value' for heritage assets was introduced by Morris (1877). Where an asset is considered to embody values, it is deemed to have 'significance' and can be protected through legislation. For UK structures this can result in a listing of Grade I, II or II* being applied under the Planning (Listed Buildings and Conservation Areas) Act 1990. This protection aims to manage alterations, thus avoiding damage to an asset's' irreplaceable values. Therefore the application of measures, including energy efficiency improvements, must be carefully considered (Crockford, 2014; Mazzarella, 2015) and be, as far as possible, reversible.

Built cultural heritage, conservation, and sustainability

Existing research calls for a new definition of sustainable development to incorporate the role of cultural heritage (Pereira Roders and van Oers, 2011), recognising the role such properties have in reducing environmental impact and improving the comfort of users (Pigliautile et al., 2018). The concepts of heritage and sustainability are inextricably linked. Heritage "buildings are inherently sustainable" (Todorović et al., 2015, p.131). Whilst the social and environmental dimensions of sustainability relating to such structures include reductions in waste and the preservation of the character of a place (Todorović et al., 2015), there are further aspects of sustainability embedded in built cultural heritage. 'Inheritance' is a principal concept underlying built cultural heritage, its associated tourism, and sustainability (Garrod and Fyall, 2000).

The social dimension of sustainability is presented by Tweed and Sutherland (2007) as having the greatest pertinence to built cultural heritage. The notion of inter-generational equity (Bourdieu, 1984) not only resonates with the Brundtland definition of 'sustainable development' (World Commission on Environment and Development, 1989) but also with conservation. Historic England (2008, p.71) defines 'conservation' as "The process of managing change to a significant place in its setting in ways that will best sustain its heritage values, while recognising opportunities to reveal or reinforce those values for present and future generations".

The inter-generational factor appears in the literature to be the principal element of social sustainability underpinning the argument for sustainable improvements to built heritage tourist attractions. More than this, the social sustainability dimension of cultural built heritage contributes to "people's sense of belonging" (Tweed and Sutherland, 2007, p.63), identity (Gholitabar et al., 2018), and to authenticity.

The conservation of built cultural heritage includes maintaining the building fabric (Tweed and Sutherland, 2007). Therefore this not only contributes to the environmental dimension of sustainability through the retention of embodied energy, but it also has an economic dimension by retaining or enhancing the value of a property. Although Tweed and Sutherland (2007) highlight that tourists can boost the local and national economy, the economic dimension of sustainability also has implications for heritage organisations with paying visitors by generating income to invest in the conservation of its assets.

The National Trust

Founded in 1885, The National Trust ('NT') is a charity that works to preserve national natural and built heritage forever, for present and future generations (Cullen and Hooper, 2004). It forms part of The International National Trusts Organisation, a group of similar organisations aiming to represent international conservation and share best practice.

As an independent national organisation, NT has stewardship of 300 historic properties open to the public, over 300 holiday cottages and thousands of tenanted properties (NT, 2010). NT and other organisations such as Historic England recognise that the conservation of these assets should not be about 'stopping the clock', rather it should be about carefully managing change (Lithgow, 2011). In addition to this, NT has the objective of reducing its energy use by 20% by 2020 (NT, 2016) to contribute to greater resilience across its portfolio (NT, 2010).

Similar to other heritage organisations, NT perceives 'conservation' as "the careful management of change", aiming to reveal and share the significance and special qualities of places (Cullen and Meier, 2016, p.3). Not only is this to protect, enhance and contribute to the understanding about and enjoyment of such places by present and future generations but also to reveal and share the significance of such places (Lithgow, 2011). This aligns with the UK's Revised National Planning Policy Framework (Ministry of Housing, Communities and Local Government, 2018a). The framework outlines the UK Government's "planning policies for England and how these are expected to be applied" (Ministry of Housing, Communities and Local Government, 2018b).

Indeed, as highlighted by the internationally adopted 1964 Venice Charter, we have a duty to transfer such assets to future generations in "the full richness of their authenticity" (Cullen and Meier, 2016, p.5). The preservation of built cultural heritage is action to "prevent deterioration and prolong the lifespan of a building of cultural value" (Munarim and Ghisi (2016, p.244).

Measuring performance

Increasing knowledge of a heritage asset is important. It can result in discovering new evidence and changes to current understanding about a structure. Increasing knowledge and understanding about an asset's values and evolution" can facilitate "informed management" of changes and sensitive conservation (ICOMOS, 1996, p.49). It can lead to "a reappraisal of existing interpretations" of what is deemed to be significant about a structure (Historic England, 2006, p.9.), inform strategic planning and heritage management, and support the identification of risks associated with future alterations. It can also assist in developing a strategy to support visitors' 'meaning-making'. Indeed, it is the meanings embedded in places that "reveal who we are, how we have changed, and into what we are changing", helping us to understand ourselves (Newman, 2016, p.399).

NT measures its performance of implementing conservation into practice through its Conservation Performance Indicator (CPI) (NT, 2017). This includes increasing both the condition of and the knowledge about assets in the care of NT. The CPI provides measurable objectives against which to annually compare changes. Refurbishment projects not only enable condition improvements of such structures but also provide an opportunity to increase the knowledge and understanding we have about their historic and physical fabric.

Methodology

The paper aims to identify the challenges and opportunities during the improvement of a heritage building at a tourist attraction from the perspective of the building professionals working directly on the project. Therefore an interpretivist philosophical perspective was adopted for this research, enabling the identification of research participants' perspectives and meanings. Interpretivism acknowledges that reality is socially constructed through individuals' interpretations (Silverman, 2011) and shared meanings (Geels, 2010). Actors are "creative and continuously engaged in sense-making" (Geels, 2010, p.499). Further, this approach enables the context in which the building is situated to be considered (Bullen and Love, 2011).

Data collection

The research comprised of qualitative data, complementary to the interpretivist approach. A case study approach was adopted to investigate the phenomenon "within its real-world context" (Yin, 2013, p.16). As one of the largest charity organisations in the UK with over 5 million members, focusing on the conservation and preservation of national heritage, the NT was selected for this research (NT, 2018). There were three primary reasons for selecting Hidcote Manor Garden's chapel as a case study:

- The extent of the refurbishment works to a Grade II listed building.

- The existing poor condition and known historic complexity of the building.
- The large number of visitors to the estate.

The research was collected through a combination of semi-structured interviews and informal conversations, documentary analysis, and observations. Interviews and informal conversations were conducted with members of the project team on-site or at the interviewees' office. Interviewees (Table 1) were selected based on their level of involvement with the project – all interviewees needed to have directly worked in excess of 10 working days on the project in a professional capacity and to have been involved with key decisions regarding the project.

Interviews were facilitated using a topic guide (Bryman, 2008), exploring the decisions and challenges faced during the project. Topics within this guide are outlined in Table 2. Using an inductive approach, thematic analysis of the qualitative data was then undertaken to identify key themes (Bryman, 2008) and rival explanations sought to improve the validity of the findings (Yin, 2013). Additional strategies employed to increase the validity included having long-term involvement with the project and using different sources of information such as documentation where possible (Yin, 2015).

[insert Table 1]

[insert Table 2]

The documents used as part of this research were diverse, including schedules of works, photographs and digital scans, work tenders, product descriptions and guarantees, and archaeological reports.

Case study: Hidcote Manor Gardens

Situated in the Cotswolds in England, within an Area of Outstanding Natural Beauty (Cotswolds Conservation Board, n.d.), Hidcote Manor Gardens ('Hidcote') is an Arts and Crafts-inspired garden created by Lawrence Waterbury Johnston (1871 – 1958), an American who assumed British citizenship in 1900 (Brown, 2004). Whilst the garden is of international significance, there are multiple structures across this site that have a Grade I or II listed designation (Historic England, n.d.).

Johnston served in the Imperial Yeomanry, beginning his military career as a private, eventually becoming a major, serving in both the Second Boer War and the First World War. During the First World War he was severely wounded and left for dead (Brown, 2004).

Hidcote was bought by Johnston on behalf of his mother, Gertrude Winthrop in 1907. He created two substantial gardens: Hidcote and later the Serre de la Madone at Menton on the French Riviera. Hidcote is now considered to be one of the most influential gardens of the twentieth century (Brown, 2004; Elliot, 2000). Despite this claim, no peer-reviewed research was identified on Johnston's Hidcote during this study.

Johnston created sheltered garden ‘rooms’ and wide vistas (Brown, 2004), each ‘room’ presenting “its own style of ornament or planting” (Elliot, 2000, p.25). Johnston was involved with plant hunting expeditions, (Pearson and Pavord, 2007; Brown, 2004; Desmond, 1994). NT acquired Hidcote in 1948 (Elliot, 2000), the first asset to be obtained based on the importance of its garden alone. The site now receives around 175,000 national and international visitors annually (NT, n.d.).

Findings and discussion

A successful project should “transform the building into an asset for the wider property” (Interviewee SS), but also sustain and enhance the significance of the property (Ministry of Housing, Communities and Local Government, 2018). For this to translate in practice, a clear brief, objectives (Interviewee SS) and specification (Interviewee C1) are necessary to ensure the team can work towards common goals.

Every heritage project is “unique and bespoke” (Interviewee SS) and when managing heritage building improvements there is always an element of the unexpected (Interviewee B). Whilst there will be differences between projects (Interviewee SS), the process and principles adopted, and the lessons learnt from the challenges faced can be applied more broadly.

Knowledge and understanding – the site

Prior to the Dissolution of the Monasteries in the 16th century, the site was owned by the priory of Bradenstoke (Interviewee Cu). The original manor house was constructed as a farmhouse in the 17th century, passing into the Freeman family of Batsford, Gloucestershire by the end of the 18th century, before passing to John Tucker who put the property up for auction (Interviewee Cu). Once Winthrop had purchased the property in 1907, she and Johnston made numerous changes, including “re-siting the main entrance to the north, within a large courtyard” and extending the existing house (Interviewee Cu).

Un-consecrated chapel

Hidcote includes a Grade II listed un-consecrated chapel. The objective of the chapel refurbishment was to provide “a more flexible part of the property’s indoor space, including improving the heating, lighting, insulation, minor structural repairs and interior decoration” (Interviewee B). A further project objective was to improve the building condition, create a usable, sustainable exhibition and events space and to increase the knowledge about the building.

The listing by Historic England (n.d.) describes the original building as an eighteenth century barn. The sale particulars at the time of Winthrop’s purchase in 1907 list a ‘nag stable for 4 horses with a good room over and saddle room adjoining’ (Interviewee Cu). One possibility is that the chapel is the stable identified in the sales particulars, although this is not certain (Interviewee Cu). It is possible that building improvements were undertaken following the return of Lawrence Johnston from World War One in 1919 for his warhorses although there is currently no empirical evidence to support this (Interviewee Cu). Based on photographic evidence the building is thought to have been converted into a chapel after 1930, the conversion completed by 1939 (Interviewee Cu; Cotswold Archaeology, 2017). Further, research has been undertaken by the archivists, Building Curator and archaeologist, identifying three main phases of the chapel between 1907 and 1939 (Table 3).

[insert Table 3]

Existing condition and sustainability improvements

The chapel is constructed of porous materials. It has solid brick walls. Stone is used externally on three elevations: there is ashlar to the northeast, squared Cotswold stone to the northwest (Figure 1) and the southeast elevation is finished in brick with stone quoins. The arch brace truss roof is covered with stone slates.

The existing roof trusses and windows are thought to have been salvaged from ecclesiastical buildings and installed as part of the 1930s conversion (Interviewee Cu). The building incorporates three windows of diamond leaded lights installed by Johnston during the 1930s conversion. The door to the chapel is an unpainted studded door with decorative strap hinges, converted from a plank door which is visible on the rear side of the door (Figure 2 and 3). The retention of this door contributed to realist and constructivist definitions of authenticity, as well as providing an opportunity terms 'narrative encounters and interactions' (Jamal and Hill, 2004).

[insert Figure 1]

[insert Figure 2]

[insert Figure 3]

Condition

In recent years the chapel had limited usability due to cold and damp (Interviewee SS) and therefore was being utilised as storage space (Interviewees SS, B and C1). It was experiencing significant damp penetration from its southeast brick elevation. The original condition was summarised by Interviewee B:

> "*The building was cold and damp, even in the summer, and whilst not unusable, it would have been difficult to expand the uses of the building or improve its internal condition without improving the pointing, roofing and heating*".

The project extended beyond simply repairing the building – it was also about improving the "thermal performance for its potential increased use, and in doing so [we] learnt more about the history of the building" (Interviewee SS). This contributed to the objective of increasing the knowledge about and condition of the building.

The building was exposed to wind-driven rain and condensation. The poor condition of the bricks was thought to have been exacerbated by "puddles from the old adjacent lane being splashed up the face of the wall over a number of years" and "rising damp from the soil contact of the grass verge” (Interviewee C1). As the moisture within the pores of the masonry increases, in colder weather this can increase the likelihood of freeze-thaw action. At the chapel it was not possible to reduce wind-driven rain or change the brickwork on the southeast elevation for a less porous alternative due to conservation principles. However, work could be undertaken to reduce the level of condensation to avoid the condition of the chapel diminishing at an accelerated rate.

The chapel previously included an optional plug-in heating device (Interviewee SS) but had no permanent heating. The mains gas network does not currently extend to the estate and therefore heating is provided by oil and electricity. The decision to install underfloor heating following the raising of the brick floor was to provide adequate thermal comfort without detracting from the chapel’s aesthetics and authenticity.

Whilst Silva et al. (2014) suggests that a tension exists between building users’ thermal comfort needs and conservation requirements, the building professionals interviewed did not identify this as an issue at the chapel. Instead, it was recognised that there was a tension between user needs and environmental sustainability – the increased use of the building will result in increased heating and lighting and therefore increasing the carbon and environmental footprint of the building and wider estate (environmental sustainability). However, by improving the building condition and increasing the use of the chapel, the intention was to improve building sustainability holistically. The aim was to mitigate future repair costs (economic sustainability), and preserve a historic asset for future generations whilst contributing to visitors’ meaning making (social sustainability).

Improvement project

The project comprised of two phases, with Phase One enabling Phase Two.

Phase One

As a consequence of extensive moisture ingress and frost attack, Phase One in 2016 saw the replacement of 350 bricks in the southwest elevation. These replacements were sourced from a reclamation centre to match the existing bricks by a specialist contractor (Interviewee C1) (Figure 4). A 3.5 natural hydraulic lime mortar was used as this was considered to be best suited to “the weather conditions” rather than putty lime (Interviewee C1). During Phase One some of the stone slates were replaced to ensure the roof remained watertight (Interviewees B, C1 and SS). Flaunching was replaced and lime mortar pointing was completed on the north elevation (Interviewee C1). During this phase, improvement works were also required to the adjoining boiler house.

[Figure 4 here]

Phase Two

External insulation on the chapel was not considered an appropriate solution due to the aesthetic qualities of the external fabric. Although internal insulation was installed, it is recognised that this has the potential to isolate the external walls from the internal heat source. This would enable the moisture content of the bricks to remain higher following wet weather for longer periods, and increase the risk of frost attack (King and Weeks, 2016; Zagorskas et al., 2014). Further, internal insulation could result in building behavioural changes in relation to moisture and heat (Zagorskas et al., 2014). The condition of the walls will, therefore, be monitored as part of an on-going process.

Specification of improvements

The original specification was developed for interventions to be reversible, breathable, and compatible with the existing fabric whilst causing the least loss of the existing fabric. This is in line with conservation principles, also reducing the loss potential of embodied energy and contributing to environmental sustainability. Table 4 provides the key materials provided in this original specification.

[insert Table 4]

Breathability was increased removing materials such as concrete. Original finishes were selected with the intention of reflecting Johnston's chapel concept, which was considered to take precedence over the older agricultural building. Whilst this took precedence, the existing fabric would be retained, thus avoiding the 'physical erosion' of the building through visual interferences resulting in "the essential character of the building becomes thoroughly obscured" (Royal Institution of Chartered Surveyors, 2009, p.5).

Amendments to the original specification were required with changes primarily including A1, B6 and B7 (Table 4). With regards to A1, only the southeast wall required a new initial plaster coat beneath the cork insulation. This was due to this wall suffering from the greatest levels of damp penetration (Interviewee C1) and consequently the existing plaster was in an inadequate condition to retain. For B7, the cork insulation to the walls was extended to 300mm below the floor level rather than the 40mm specified in the original specification to ensure an adequate overlap was maintained due to the deeper archaeological excavations.

Improvements, challenges, and opportunities

Clear objectives and an overarching vision are essential for the delivery of a successful project. This can be provided by a strong leader, capable of drawing together the project team, property staff, and interest groups (Interviewee B). Professionals within the interdisciplinary team should have "appropriate skills and respect for everyone else's skills" (Interviewee SS). This supports the findings of Rehman Toor and Ogunlana (2009) and Chua, Kog and Loh (1999), who highlight the importance of project team competence, and Dvornik Perhavec, Rebolj and Šuman (2015) who highlight the importance of an interdisciplinary approach.

A "healthy working relationship between the property manager and building surveyor so that any issues that arise do not linger and cause later issues in the project" is essential (Interviewee C1). This working relationship extended to the wider team, supporting Rehman Toor and Ogunlana (2009).

The contractor was able to approach both the Building Surveyor and the Senior Surveyor for guidance on unfamiliar materials. Whilst this supported the existing literature finding that good working relationships are crucial (Chua, Kog and Loh, 1999), it contests the importance of experience (Rehman Toor and Ogunlana, 2009). Where necessary, surveyors drew on expertise external to the project team by approaching product manufacturers for clarification. This highlights the importance of drawing on the knowledge of experts outside the project team to attain the project objectives.

During the works there was a change in the surveyor overseeing the project. This resulted in a period with no surveyor or project manager assigned to the works. Despite thorough project notes from the previous surveyor to guide project team decisions (Interviewee B), project progress slowed following unexpected discoveries requiring technical knowledge to better inform decisions. Once appointed, the new surveyor needed to closely liaise with the client, contractor, building curator and wider consultancy team to understand the project history and the previous decisions made. Towards the end of Phase Two there was a change in building curator, which resulted in the need to work as a team to provide this member with a complete history of the project. Although the project timescale was impacted, the chapel refurbishment works were delivered against the project objectives. Previous research suggests that project success can be influenced by project team turnover, but Chua, Kog and Loh (1999, p.149) highlight that importance of team turnover is "outweighed by the capability of key personnel".

Boiler house

To provide heat to the underfloor heating system a 4kW electric boiler was installed in the adjoining building known as the 'boiler house'. During Phase One, the boiler house roof was found to be enabling water ingress. This had resulted from historic works to the boiler house roof leading to the decay of the wall plate and battens, subsequent tile slippage and water ingress. The outward thrust of the rafters had resulted in the walls becoming pushed out of vertical alignment. The wall plate, battens and, where necessary, slates were replaced prior to the installation of the new electric boiler.

The floor and archaeology

Unexpected findings were uncovered during the excavation of the floor, halting works to the floor. An archaeological watching brief was performed which highlighted:

> "*a history which was previously unknown revealing at least a number of development stages […] prior to conversion into a chapel. There is some evidence for even earlier use*" of the building (Interviewee Cu).

This discovery, in addition to further research by the Building Curator and volunteer archivists, has meant that the "understanding of the building will continue to evolve as further research is undertaken", "helping to shed light on the history of the courtyard development during Lawrence Johnston's time" at Hidcote (Interviewee Cu). Therefore, whilst the findings resulted in delays, and required amendments to the original specification, it also presented an opportunity to expand knowledge and understanding about the building.

The initial 190mm concrete slab was lifted to reveal a 'black concrete' layer up to 40mm thick (Cotswold Archaeology, 2017) over Staffordshire blue bricks (Figure 5). This surface was undulating, sloping to an open gulley at the front of the internal area, and then sloping downwards to the bottom left-hand corner. The floor incorporated a number of vertically protruding timbers (Figure 6). Due to their size, the timber posts were identified as likely to have previously been structural and likely to have formed the front of horse boxes (Cotswold Archaeology, 2017) within stables. This provided the opportunity to develop an understanding of the evolution of the building.

[Figure 5]

[Figure 6]

Through discussion with the local authority conservation officer it was agreed to lift and relay bricks flat instead of the original intention to use a tiled finish. This was to showcase the bricks and indicate the history of the chapel and present this brick floor as an opportunity for time-bound (Wesener, 2017) narrative encounters (Jamal and Hill, 2004). A full digital scan of the floor's original brickwork was undertaken by the archaeologist to provide an exact archaeological record and a guide for relaying the floor.

Upon lifting the brick flooring, the mortar transpired to be cement-based rather than lime-based as anticipated. The strength of the mortar resulted in a number of the bricks breaking when lifted, and it was not possible to successfully remove this mortar from any bricks lifted intact.

Due to the difficulty in retaining the existing bricks, the contractor sourced bricks matching the period and type of the original Staffordshire blue bricks from local reclamation centres. Using a digital scan of the original floor produced by the archaeologist prior to lifting the original bricks, the contractor was able to lay the reclaimed brick floor to follow the same pattern. With agreement from the conservation officer, the new floor was laid flat rather than reinstating undulations. The primary reason for this was three-fold:

(1) To avoid a highly uneven surface which could result in trip hazards for visitors, giving consideration to the legal case Taylor v English Heritage [2016] EWCA Civ 448 (BAILII, 2016);

(2) Conform to conservation principles by avoiding falsification and promoting honesty of the works, whilst integrating with the building as a whole, and without detracting from Johnston's original concept. It also aimed to reveal the aesthetic and historic value of the floor and wider building under Article 9 (International Council on Monuments and Sites, ICOMOS, 1965); and

(3) To provide a space suitable and sufficiently flexible for events which may require tables, chairs or freestanding stands.

The extent of the excavation works meant that 5-tonnes of hardcore was needed to raise the ground level (Interviewee C1) before the Ty Mawr insulating lime floor could be laid. This insulating lime floor was an unfamiliar product to both the surveyors and contractors. The insulating lime floor consisted of 7 tonnes of insulating hardcore (Interviewee C1) – recycled foam glass, was unusual in that, unlike traditional hardcore, individual pieces had a diameter of between 20mm and 40mm (Interviewee C1) (Figure 7). To reach the manufacturer's designated compaction ratio of 1.3:1 the contractor spent two hours with a vibrating-plate compactor across the floor. However, there was concern that the insulating hardcore had slight movement when the project team walked across the surface. Where hardcore is insufficiently compacted, it will settle over time (Holland, 2012) and can result in cracking occurring in the screed (Pye and Harrison, 2003). On liaising with the manufacturer's technical team, a technical video with the wider project team, and the insulating hardcore was compacted for a further two hours with the geo-textile placed between the hardcore and vibrating-plate compactor. This sufficiently stabilised the hardcore in preparation for the underfloor heating pipes in clips to be laid. The video also highlighted that the lime screed (Figure 8) specified was thicker than traditional screeds. This additional time required in inspecting the insulating hardcore and liaising with the contractor and manufacturer is the risk identified by Pulaski et al. (2006) that unfamiliar products can lead to inefficiencies in the construction process.

[Figure 7]

[Figure 8]

Concern was expressed by the heating engineer about the insulating lime floor build up. This related to the length of time the internal environment would take to heat due to the floor build up. The heating engineer suggested alterations to the floor design to reflect the heat back into the room for a quicker thermal response. The decision was made by the surveyor not to amend the original floor design for three primary reasons:

(1) The intention was to increase the thermal mass in the building to facilitate a slower thermal response. This would enable heating to be run at lower temperatures over long periods of time with the aim of contributing to the long-term health of the building;

(2) To avoid the building suffering from large changes in temperature which could impact on the condition of the building and avoid 'peaks and troughs' in energy use; and

(3) To avoid voiding the floor manufacturer guarantee.

The underfloor heating pipes included no joints within the floor. This was to avoid potential leaks beneath the brickwork as the likely place for a leak is proposed to be at a connection between pipes (Bleicher and Vatal, 2016). Instead, these pipes only included joints once they had penetrated the wall into the boiler house. If a leak were to occur, due to the way the heating pipework joints have been installed it is likely that this will be more easily accessible.

The building is not rectangular and this became a challenge when laying the reclaimed Staffordshire blue brick floor. With one end of the chapel 20mm shorter than the other, there were tapered bricks included in the original floor, likely to have been obscured by the horse stable partitions. Although the floor was re-laid in accordance with the archaeological digital scan, one amendment was made to the original pattern to avoid detracting from the aesthetic - the tapered bricks were placed at the edge of the wall perpendicular to the door. A “neat 3.5 hydraulic lime grouting” was used between the brick joints to facilitate slight flexibility, breathability and heat transfer from the underfloor heating (Interviewee C1).

Timber inserts were positioned above the original timber posts which were found during floor excavation (Figure 9). These timber inserts reflect the history of the building with its changing uses, providing visitors with opportunities for narrative encounters and ‘place-making’, through the representation of a timeframe (Newman, 2016) both spatially and temporally (Jamal and Hill, 2004). This representation of time and space as part of the narrative is important. It is an attempt to (1) avoid a reductionist approach by prioritising space over time, which thus represents a place with a series of discontinuous events, (2) provide visitors with objective, constructive and personal authenticity (Jamal and Hill, 2004), and (3) enable the creation of a functional, adaptable space. It was considered particularly important to feature the brick floor with timber inserts to represent the changes the chapel underwent under Johnston.

[Figure 9]

Walls

To avoid significant time delays, when the initial works to the floor halted due to archaeological findings, works to the roof and walls continued. A number of through-timbers (Figure 10) and changes in brickwork type - indicating historic changes to the building height, were discovered. Changes to the building height are thought to have occurred during the conversion into a chapel (Cotswold Archaeology, 2017). The through-timbers were identified as most likely used to attach boarding to the walls (Cotswold Archaeology, 2017) to protect Johnston’s horses against injury.

[Figure 10]

During an inspection following the installation of the insulating lime floor, horizontal cracking was identified through the bed joints in the wall at low level. Located in the southeast elevation which previously had repointing and 350 bricks replaced, the cause of the crack was likely to be from two probable causes: (1) the settlement of the ground beneath the wall or (2) the settlement of the lime mortar. Both possibilities were a result of the length of time a vibrating-plate compactor had been used to compact the insulating hardcore. The decision was made to repoint and monitor the cracking to identify whether these reopened. The reopening did not occur after twelve months although monitoring will continue.

Door and windows

The chapel door (Figures 2 and 3) presents a narrative, outwardly appearing to be a chapel door, and inwardly presenting an agricultural appearance. This door required a new locking mechanism, having previously been padlocked from the outside. A carpenter specialising in heritage work was consulted and developed a solution to be sensitive to the aesthetics of the chapel, enabling the building to be suitably secured without the loss of the original door or wall fabric, and without negatively impacting visually on the door.

When the door swung inwards it pressed into the new lime plaster. Consequently, the main contractor tapered the lime plaster to avoid constant damage from occurring. The alternative would have been to alter the original door and opening which was decided to be inappropriate from a conservation perspective, as this contributed to the overall narrative of the building.

The option of installing secondary glazing behind the existing windows was discussed. The decision was that secondary glazing would detract from the overall aesthetics, and potentially lead to increased condensation and the accumulation of insects between the window and secondary glazing. Due to the smaller surface area of the window relative to the surface area of the walls, improving the thermal performance of the walls was deemed to be a priority over the windows (Interviewee C1). Instead, the windows and the surrounding stonework were cleaned (Figure 11), including lightly brushing the stone (Interviewee SS).

[Figure 11]

Roof

In addition to ensuring the roof was watertight, roofing works included the replacement of tiles where necessary. However, many of the existing stone slates to the chapel were retained. Internally, 50mm rigid insulation was installed between the rafters with a 25mm continuous air gap between the insulation and tiles (Interviewee C1). The purpose of this was to ensure adequate ventilation to remove accumulated moisture, and reducing the likelihood of timber decay. The incorporation of a 25mm air gap follows guidance from Stirling (2002) and Historic England (2016). The insulation was fitted tightly against the rafters to avoid gaps from forming which could result in cold bridging, and local formation of condensation and black spot mould (Historic England, 2016). The underside of the insulation was finished with plasterboard and a plaster skim, leaving the roof trusses exposed thereby retaining the appearance of a chapel roof. The roof trusses were cleaned down by hand with water and a soft cloth and oiled following guidance from the building curator (Interviewee SS).

Sustainability

The project demonstrated the importance of flexibility and compromise to attain a holistic sense of sustainability. The original building was unheated and therefore the introduction of a heating system increased the carbon footprint and energy bills of the building and wider estate, negatively affecting the dimensions of environmental and economic sustainability. However, the heating is intended to better sustain the condition of the building thus retaining much of the embodied energy of the existing fabric in the long-term, contributing to environmental sustainability. Further, the building was well insulated to reduce the demand for heating, limiting the negative impact on environmental and economic sustainability.

The building has become more functional and flexible, contributing to social and economic sustainability. Utilising traditional materials and skills also contributed to social sustainability. Facilitated by this improvement project, increasing the understanding and knowledge of the building and wider site has provided the project team, organisation and estate visitors with opportunities for further meaning-making, enhancing heritage values for present and future generations, further contributing to social sustainability.

The discovery of alterations and additions made by Johnston including the use of 'hard plaster and concrete' guided decisions made within the improvement project. Harder materials such as concrete and cement were deemed to be detrimental to the building's condition aiding the retention of moisture. Decisions were therefore based on improving the longevity and health of the overall building, in line with conservation principles of reversibility and breathability, thus increasing the physical sustainability of the building. It is intended that this will subsequently contribute to the reduction in long-term maintenance costs and therefore to economic sustainability. Economic sustainability, for heritage and charitable organisations, as with other organisations, is a key consideration. Further, by also ensuring heritage assets are provided in a good and as complete a condition as possible for present and future generations, this contributes to one aspect of social sustainability.

Project team and communication

Effective communication, collaboration, and good working relationships within an interdisciplinary team are crucial for the successful delivery of an improvement project of a cultural heritage asset at a tourist attraction. The importance of adequate communication for project success has also been identified on large-scale construction projects (Rehman Toor and Ogunlana, 2009). This is particularly important when less familiar measures are being installed.

Clear communication is critically important when team members leave the project prior to completion. Project notes can, however, guide the project team and enable new team members to gain a good knowledge of the project history to provide appropriate professional advice. Further, there is a need to go beyond collaboration to foster understanding and the respect of the different perspectives and priorities within that team, facilitating the selection of the most appropriate solution where changes are required.

Existing condition

Improving building condition was essential in addition to increasing sustainability. Improving the condition was a key objective of the project and needed to be completed in two phases. The first phase enabled the second phase.

Conservation principles favour the retention of as much of the original fabric as practical. This has a sustainability dimension by retaining as much of the embodied energy within the materials of the existing building, thus limiting the need for new materials, which has an environmental dimension. The challenge was to make the roof watertight by performing repairs to specific tiles rather than wholesale replacement of the roof covering. This highlights the importance of employing suitably skilled contractors with an understanding of conservation principles to form part of the project team, but who are also willing to potentially engage with unfamiliar materials.

Unintended consequences

As part of the works, there were two unintended consequences identified. The first related to compaction of the insulating hardcore, resulting in the formation of horizontal cracking in the bed joints of the wall. The cracks were repointed and following twelve months of monitoring, no cracks have reformed.

The second unintended consequence was that, whilst a flexible space has been created, sound reverberation appears to be an issue. Mitigation measures that are visually obvious will detract from the visual aesthetic that the project has achieved and are therefore not appropriate. However, future intervention will include investigations into how this reverberation can be attenuated without impacting on the internal aesthetic of the building.

On-going monitoring is taking place at the chapel to understand its performance following the works. The project appears to have achieved the requirements of the brief – to create a usable, comfortable space whilst improving the condition of the building.

Conclusion

The paper has sought to investigate the opportunities and challenges of improving the sustainability of a listed building at a cultural heritage tourist attraction from the perspective of building professionals. The chapel improvement project aimed to convert a building being used for storage into a flexible, usable space. This incorporated improving the condition of the building and improving the overall sustainability. Enhancing and revealing the significance of heritage is a key aim of policy and modern conservation philosophy. However, in the context of climate change heritage assets must also adapt to ensure their continued sustainability.

Whilst each heritage asset is unique, the findings of the present research can be applied to other sites to identify whether they apply to other built cultural heritage tourist sites.

By investigating the renovation of the chapel at NT's Hidcote Manor Gardens, four primary opportunities and five challenges have been identified when improving the sustainability of a heritage asset. Opportunities were (1) increased knowledge and understanding about the heritage asset; (2) enhancement of values for present and future generations; (3) improved condition, increased usability; and (4) increased sustainability. The challenges of improving the sustainability of a heritage asset included (1) project team turnover; (2) delays resulting from archaeological findings and subsequent amendment of the specification; (3) previous work resulting in building defects; (4) the existing building condition; and (5) unfamiliarity and the uncertainty of the team regarding particular measures.

To successfully overcome the challenges presented during such projects, there is a need for a strong, balanced team with respect for each team member's skills. There is a need for strong leadership and common objectives for the team to work towards. Of greater importance than experience, the team must be capable of communicating clearly to ensure that, where challenges arise these can be effectively and expediently resolved. This complements findings of previous research on project management of non-heritage projects.

The opportunities for performing an improvement project on buildings with heritage values and significance include increasing the knowledge and understanding of the building in the context of the wider site. This can enhance or shift the meaning, significance or the values represented by the asset. At a tourist site this provides an opportunity to enhance visitors' narrative encounters with the property.

Successful projects should enhance and reveal the embodied values and significance of built cultural assets for present and future generations. This intergenerational concept provides a common thread between conservation principles and sustainability. In the context of the wider debate focused on reorientating the definition of sustainable development, this shared concept should not be overlooked. Enhancing values at heritage tourism sites should facilitate greater meaningful encounters between visitors and the cultural asset.

The project improved the condition of the listed building, facilitating its usefulness as a flexible space for events and exhibitions, whilst improving its sustainability. Works were performed in two phases, using breathable materials that are compatible with the building in line with conservation principles. This included increasing the watertight-ness of the chapel and adjacent boiler house, reducing dampness in the buildings before improvements to the sustainability of the building could be undertaken.

Sustainability in historic buildings at tourist sites requires careful balance in relation to economic, environmental and social sustainability, but also with conservation principles. Heritage buildings have inherent sustainability through their embodied energy (environmental sustainability) and their embodied meanings and values (social sustainability). Sustainability and conservation were considered to be complementary, both broadly considering the use of resources from an inter-generational perspective. However, tensions between these concepts also exist. Sustainability must not result in the loss of significance in the building and therefore improving the sustainability of the building was approached holistically. Further conservation compromises regarding heritage features may be needed if a usable space is to be created. In this sense, the original undulating floor was laid flat to ensure the space was not only flexible and usable but also that visitors' wellbeing was maintained.

The sustainability of built cultural heritage can be improved through different dimensions of sustainability. From an environmental sustainability perspective, retaining much of the original fabric, and the use of some materials from reclamation centres mitigates the potential impact of the works and building in relation to its environmental footprint and embodied energy. However, by installing and running an electric heating system in the chapel and increasing the use of the space, the energy consumed within the building has a negative impact on environmental sustainability. Through the introduction of heating, the expectation is that the condition of the building will diminish less rapidly. This has positive implications for environmental sustainability in the avoidance of losing building fabric where it becomes defective and economic sustainability in avoiding potentially more costly and invasive repairs in the future.

There are also challenges relating to sustainability. The negative implication in relation to economic sustainability in installing heating is that the running costs of the space have increased. However, the space can now be used for events and exhibitions. This supports planning policy in the aim to find a compatible and useful function of historic buildings and also provides the opportunity to generate revenue to invest back into the building and wider site.

Increased running costs resulting from energy consumption have been mitigated through the improvement in energy efficiency within the building. This has environmental and economic sustainability implications, but also implications for social sustainability. The creation of a usable, flexible space that is thermally comfortable is considered here as a branch of social sustainability. However, social sustainability also extends to increased meaning-making opportunities for visitors to the chapel.

The loss of team members during the project presented a key challenge. However, through clear communication, a competent, interdisciplinary team and strong leader with clear objectives the effects of project team turnover can be alleviated.

Although archaeological discoveries resulted in delays to the project timetable, these discoveries during the project resulted in identifying a historically significant period in the evolution of the site during the early twentieth century. It has also further catalysed archival research to develop this knowledge further. The significance of the findings particularly relates to the use of the building as a horse stable prior to its conversion into an un-consecrated chapel, marking a significant change during the life of Johnston.

Previous works and the existing building condition can result in the need to undertake additional or enabling works to ensure the building is weather-tight. This can, however, increase uncertainty about the extent of the improvement works required.

Where the project team is unfamiliar with particular products or measures, this can increase the time the project team spends on ensuring the correct installation. This supports previous research which has found unfamiliarity with products increases time inefficiencies. However, it also emphasises the importance of clear communication and good working relationships, supporting the findings of previous research on factors influencing the success of construction projects. This is particularly pertinent for improving the sustainability of built cultural heritage where there is likely to be a higher level of uncertainty and some unfamiliar products. This can also result in the potential for unintended consequences.

The present research has implications for policy relating to sustainability in building conservation and building professionals working with built cultural heritage at tourist attractions. It highlights the potential challenges and opportunities facing professionals and the importance of a strong leader and project team to ensure the success of the project.

The project findings are limited to the case study presented, however this provides analytical generalisability. Further research opportunities include the applicability of these findings to other built cultural heritage tourist attractions, and whether such projects enhance the meaningful encounters tourists have with the building and wider site.

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Figure 1: northwest and northeast elevations of chapel

Figure 2: Chapel door externally

Figure 3: Chapel door internally

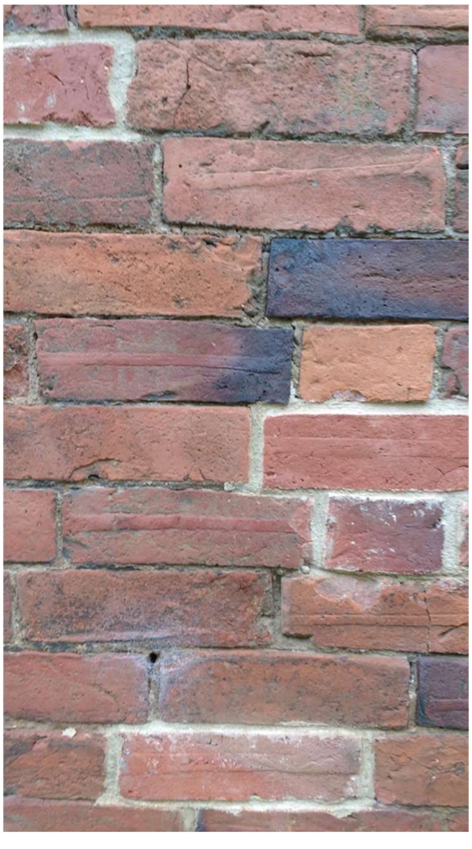

Figure 4: Bricks to southeast elevation including surface irregularities

Figure 5: Original Staffordshire blue brick floor

Figure 6: Chapel floor with existing timber posts

Figure 7: Chapel floor insulating hardcore

Figure 8: Chapel floor lime screed

Figure 9: Relaid brick floor with timber inserts above original timber posts discovered during excavation

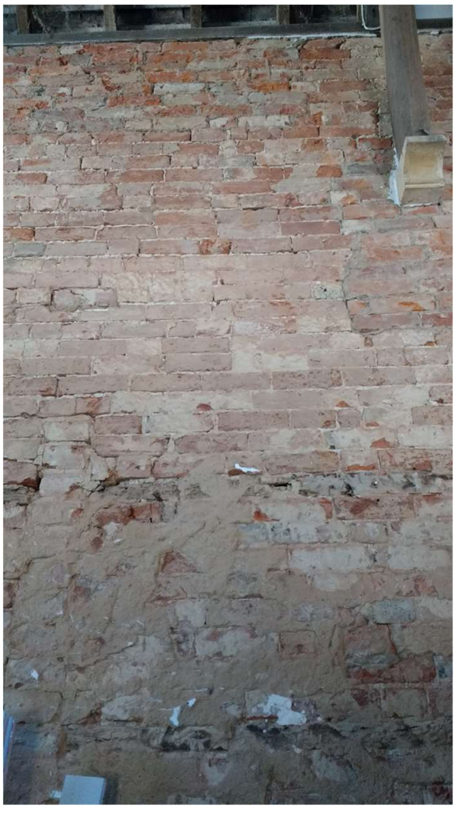

Figure 10: Chapel wall through-timbers and change in brickwork

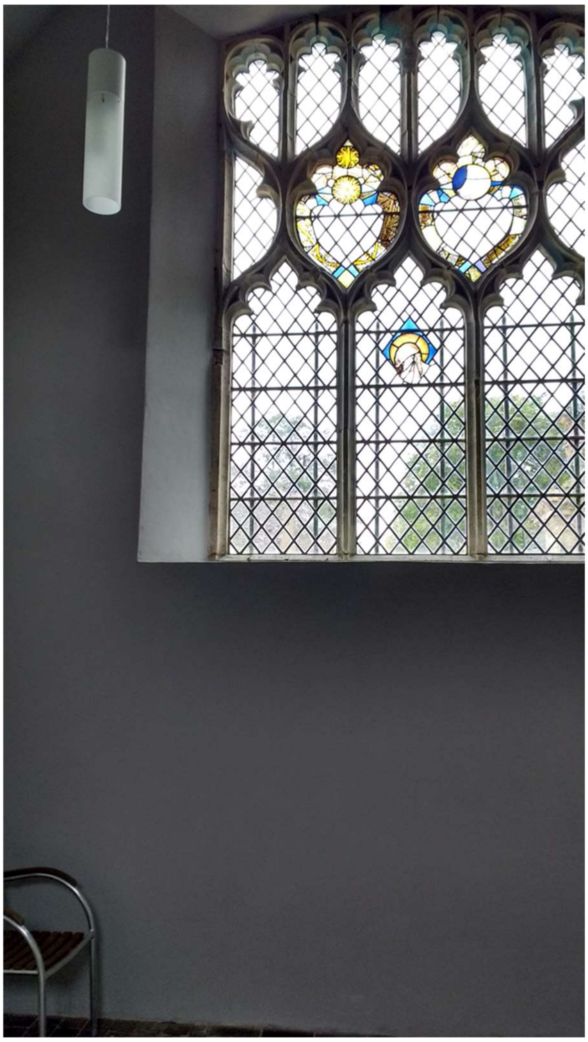

Figure 11: One of the chapel windows after cleaning

Table 1: Interviewees and project role

Interviewee	Code	Role and key decisions
Building curator	Cu	Guided decisions on conservation-related aspects during the latter phases of the project
Main contractor	C1	Undertook both main refurbishment works (Phase Two), and previous phase of repairs (Phase One)
Senior Surveyor	SS	Occasional inspection and overview of the project and support to the lead surveyor.
Business Support	B	Provided support to the project team and an overview of the project, with guidance from the senior surveyor undertook project management in the absence of a surveyor during the project.

Table 2: Outline of interview topics

Topic	Interview sub-topics
Background and history	• Background of the building and wider site, including historical meaning and usage. • Project information. • Role within the project team.
Project team	• The key team members in making decisions
Physical properties of the building and the project works	• Physical properties and condition of the building • Works performed to components of the building including the windows, walls, roof, floor, door. • Factors influencing the adoption of the selected measures and approaches. • Aspects for successfully delivering this type of project
Challenges	• Identification of challenges pertaining to the project

Table 3: Main phases of the chapel since 1907

PHASE	**DATE**	**DESCRIPTION**
1	1907	Four box stable with room over and adjoining room
2	By 1930	Two box stable with blue brick floor
3	By 1939	Chapel

Table 4: Specified works by building elements

Element	Original specification
A. Walls	Tŷ Mawr internal insulation system to achieve a minimum of 0.3 W/m^2K consisting of: (1) lime plaster to even the internal surface; (2) 10mm adhesive mortar – a combination of natural hydraulic lime and cork aggregates (Ty-Mawr, n.d.); (3) 40mm cork insulation applied to the walls fixed with insulated fixings; (4) Lime plaster - 6mm basecoat of putty lime with hemp, mesh and a 3-4mm putty lime with silver sand topcoat; and (5) Decoration with clay paint.
B. Floor	Tŷ Mawr insulating lime floor with underfloor heating system was specified, including: (1) Geotextile layer 1; (2) Insulating recycled foam glass hardcore to a minimum depth of 120mm, compacted to a ratio of 1.3:1; (3) Geotextile layer 2 and geogrid; (4) Clip rails and underfloor heating system; (5) 60mm hydraulic lime screed; (6) A glazed tile finish based on internal curatorial and local authority conservation officer approval. (7) A 40mm cork downstand on the wall to lap the insulating hardcore was also specified as recommended by Tŷ Mawr.
C. Roof	(1) 50mm thick rigid thermoset phenolic insulation was used between rafters below a 25 - 50mm air gap to maintain adequate ventilation, using timber battens. The insulation boards were taped, including at the perimeter with an aluminium foil tape. (2) Rigid thermoset phenolic insulating plasterboard was specified to finish the ceiling, fitted tight to the wall and rafters, and taped and jointed. A multi-finish plaster skim was provided.
D. Windows	The specification required the window reveals to be insulated with 20mm cork as specified for the main walls.