van Heyningen & Haward Architects

Passivhaus and Heritage
Leicester Cathedral

Kingspan

MUNSTER JOINERY

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THE INTELLIGENT BUILDING SYSTEM

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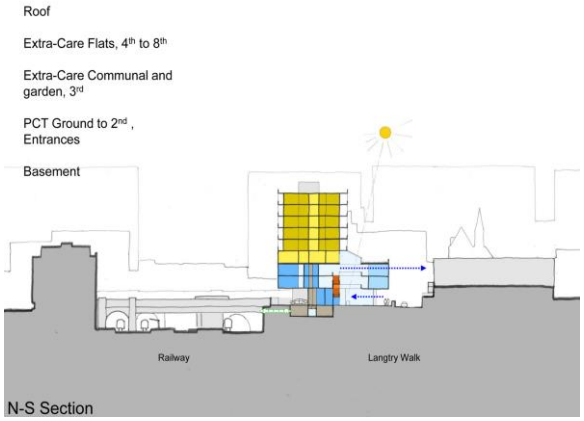
2009: West Camden PCT

Extra-care and PCT tower

Feasibility Study and Business Case



2011: Vicarage Gardens

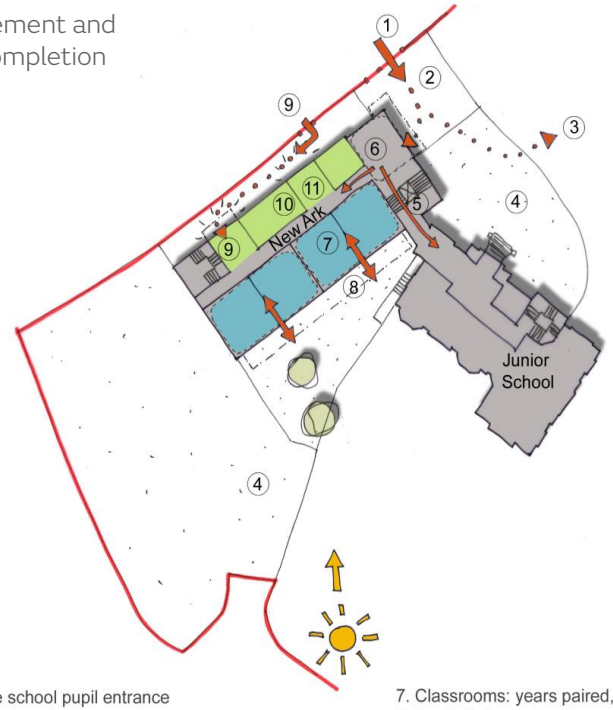
Chelmsford College, Row Houses

Planning Application and PHPP feasibility

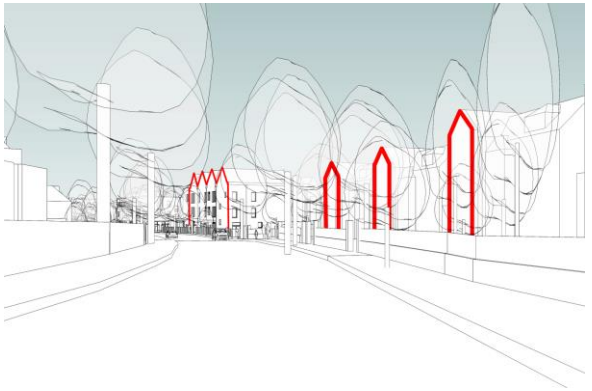
2013: St Benedict's School, Ealing

Phased school master plan. Junior school building extension to a Victorian block

Full Design, traditional procurement and Contract Administration to Completion



1. Whole school pupil entrance
2. New external extrance place
3. Pupil route to senior school
4. New hard play area
5. New vertical circulation, including lift, serves both existing junior school and new ark.
6. New main entrance into junior school, leads to generous foyer space
7. Classrooms: years paired, all facing south
8. South facing external area accessed directly from ground floor (early years) classrooms
9. Dedicated nursey entrance
10. Ancillary spaces to the north
11. Break-out/ resources areas face the street



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2018: St Benedict's School, Ealing

The New Ark occupied September 2018,
Passivhaus certification ongoing (!)

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2018: Rugby Radio Station

Conversion of a large historic building with three new, very low energy, blocks to create a new secondary school for Urban& Civic PLC

Stage 3 design ongoing

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Leicester Cathedral

- Reordering Master Plan 2008-09

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- Cathedral Gardens 2012-2014

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- Reordering Phase I - Richard III: 2013-15

- Reordering Master Plan 2008-09
- Cathedral Gardens 2012-2014
- Reordering Phase I - Richard III: 2013-15
- Reordering Phase II – 2015 to present

Reordering Phase II

Internal Reordering and a new Building

- Liturgical reordering of nave and aisles
- Renewal of all building services
- Creation of visitor and support facilities
- Provision of good heritage interpretation

The Heritage Learning Centre, a new extension, to provide everything that couldn't be accommodated in the historic cathedral.

“We believe that responding to climate change is an essential part of our responsibility to safeguard God’s creation”

(at https://www.churchofengland.org/more/policy-and-thinking/our-views/)

In the 21st century, in an interconnected world, practicing love of neighbours means that we are committed to mitigate the effects of climate change which will fall disproportionately on the poor and vulnerable in the world“

(The Bishop of London, the Rt Revd and Rt Hon Richard Chartres at http://www.churchcare.co.uk/shrinking-the-footprint/about-shrinking-the-footprint)

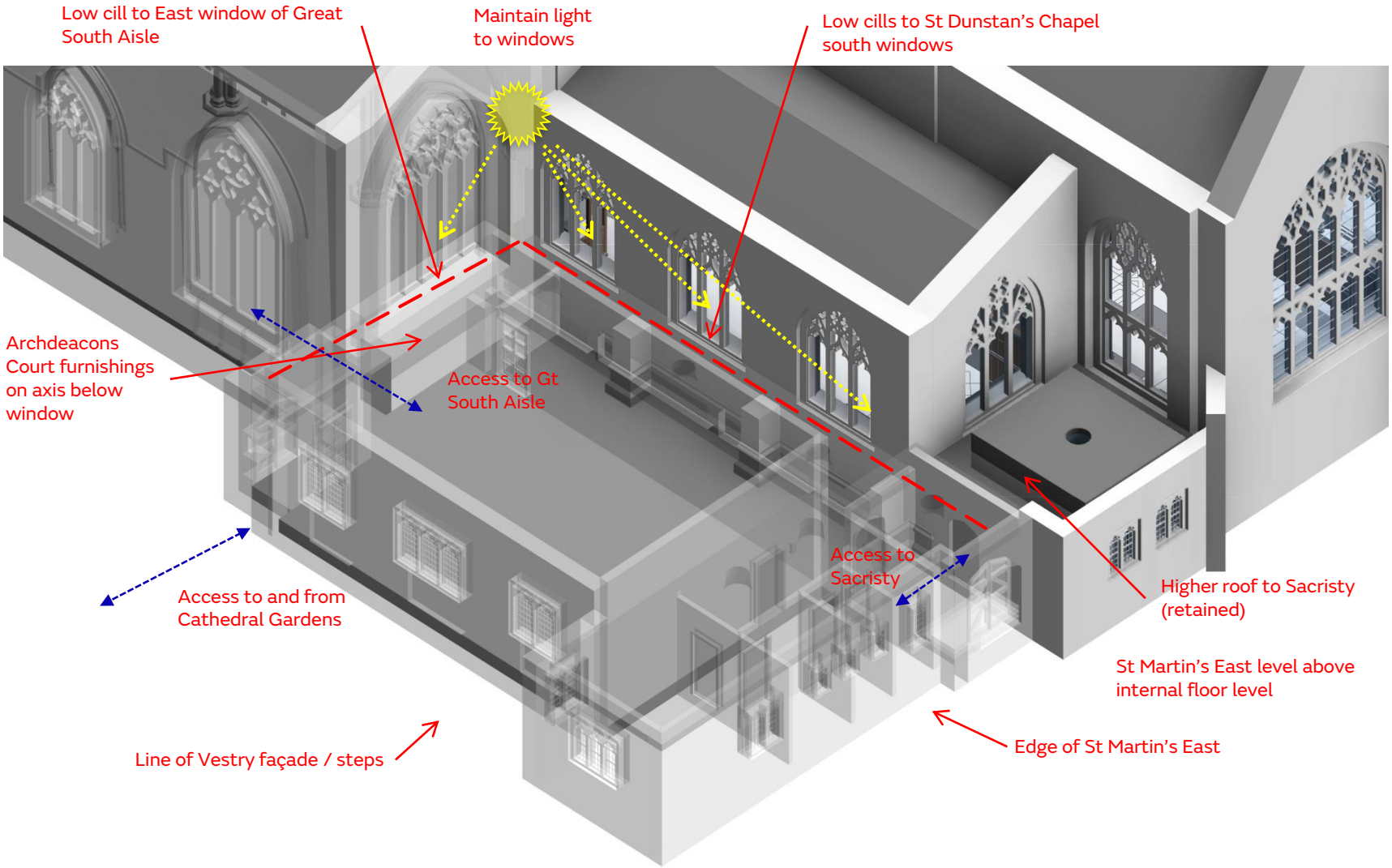
"Actions have to change for words to have effect”

(The Archbishop of Canterbury Justin Welby, at http://www.churchcare.co.uk/shrinking-the-footprint)

“any new development on the site of the 1930s vestries should be to *passivhaus* standards, in keeping with environmental best practice, and its style and quality should properly complement both the cathedral and its immediate environs”

(Dean and Chapter of Leicester Cathedral, LCR Project Brief July 2017)


Site


Low cill to East window of Great South Aisle
Maintain light to windows
Low cills to St Dunstan's Chapel south windows
Archdeacons Court furnishings on axis below window
Access to Gt South Aisle
Access to and from Cathedral Gardens
Access to Sacristy
Higher roof to Sacristy (retained)
St Martin's East level above internal floor level
Line of Vestry façade / steps
Edge of St Martin's East

vHH van Heyningen & Haward Architects

Heritage Lottery Fund R1 bid

Feasibility Stage – RIBA stage 1

- Education and research base
- Orientation / Exhibition gallery
- Public WCs
- Interpretation
- Passivhaus aspiration

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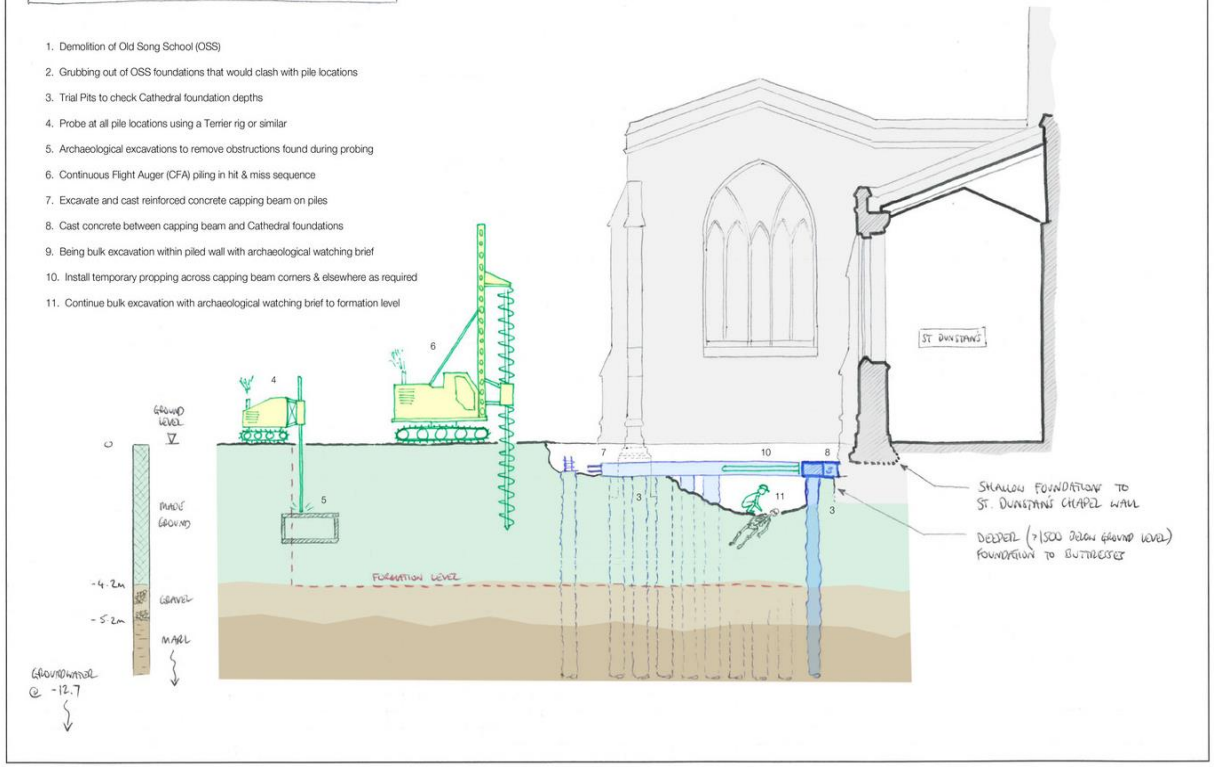
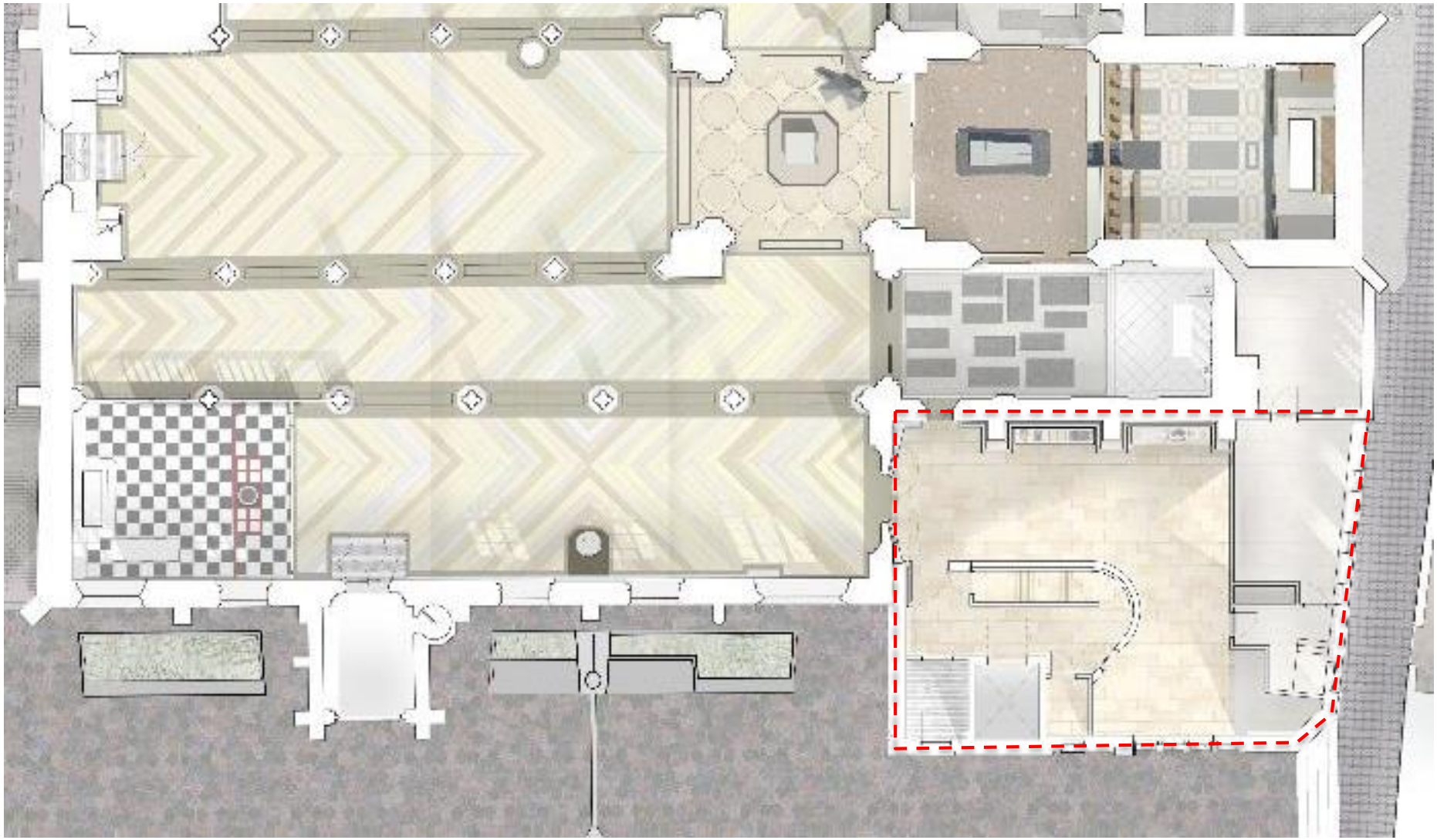
PRICE&MYERS
Consulting Engineers

Job No 22521.1 Page SK17 Rev P1
Date JAN 17 Eng JS Chd
Job LEICESTER CATHEDRAL

CONSTRUCTION SEQUENCE THOUGHTS

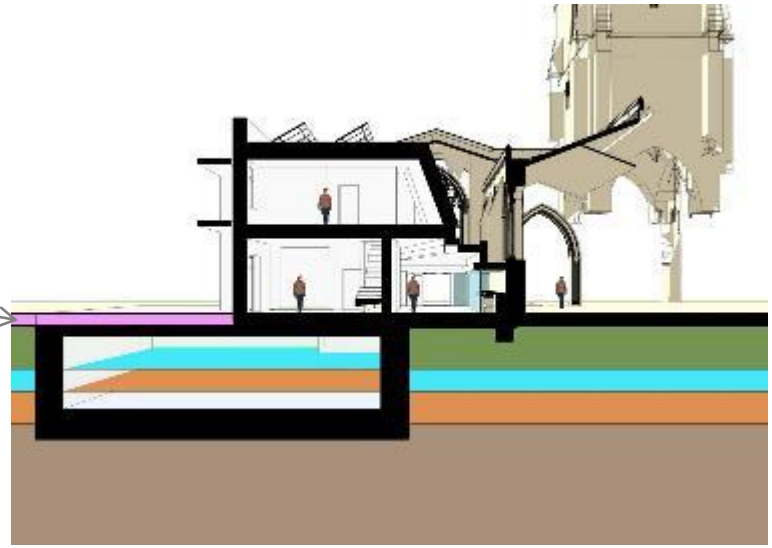
1. Demolition of Old Song School (OSS)
2. Grubbing out of OSS foundations that would clash with pile locations
3. Trial Pits to check Cathedral foundation depths
4. Probe at all pile locations using a Terrier rig or similar
5. Archaeological excavations to remove obstructions found during probing
6. Continuous Flight Auger (CFA) piling in hit & miss sequence
7. Excavate and cast reinforced concrete capping beam on piles
8. Cast concrete between capping beam and Cathedral foundations
9. Being bulk excavation within piled wall with archaeological watching brief
10. Install temporary propping across capping beam corners & elsewhere as required
11. Continue bulk excavation with archaeological watching brief to formation level



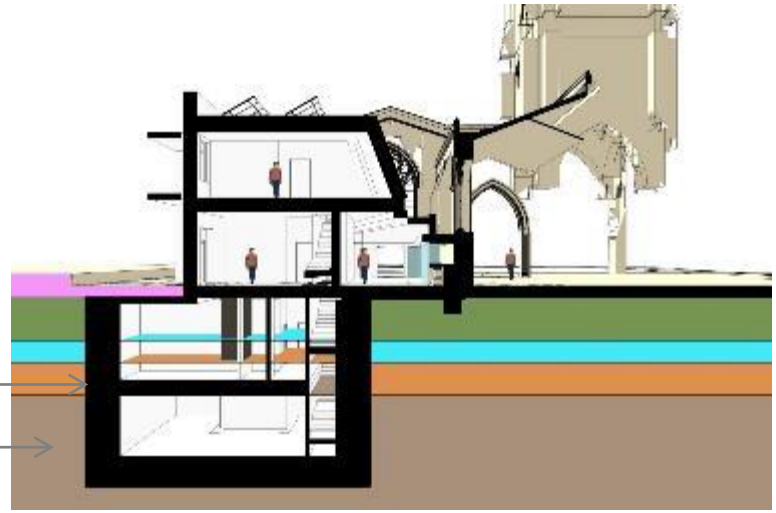


Archaeology v. form factor

Single level basement, greater offset,
RIBA Stage 2



Double level basement, offset,
RIBA Stage 3

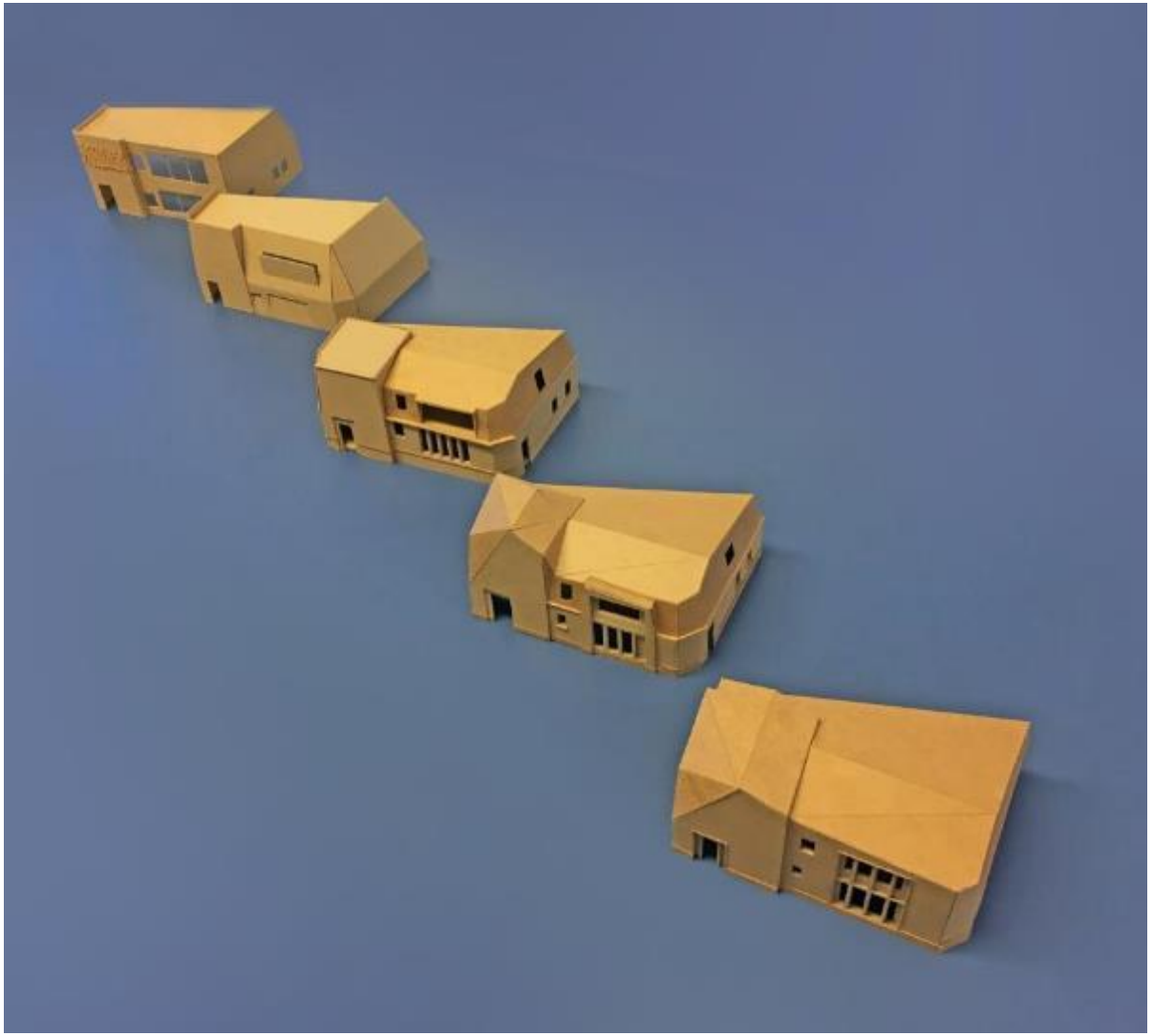


Statutory Consultees

“There are several concerns arising from your choice of Passivhaus for your extension. The most basic is that, because the new building will be connected to the historic cathedral, it may not work in the way that you want it to”

“The main concern remains the influence of Passivhaus on the design of the new building …all the Commission can say at this stage is that meeting the demands of Passivhaus will not be taken to justify or mitigate design decisions that it does not otherwise consider to be suitable”

“(the) member of the Commission with expertise in this field has consistently advised that it will be very difficult to apply Passivhaus principles effectively in the context of your new building”



"Passivhaus has an enormously stringent requirement for minimal air exchange: the target is both arbitrary and very difficult and expensive to achieve, requiring special design details and materials such as sealing tapes."

"…to bring in enough fresh air, Passivhaus requires a special ventilation unit (an MHVR) to bring in air from outside and pre-warm it. This unit needs to be adjusted for demand, which will differ according to the season and the number of people using the building."

"Passivhaus was originally developed as a way of heating houses for a low cost, although it has more recently been quite aggressively promoted as an energy saving 'eco' methodology. Passivhaus only looks at energy use in one form (heating), and does not consider other uses of energy, nor at use of carbon."

"…it is important to consider whole-life energy and carbon costs: ….Short-lived items like double-glazing are likely to actually increase energy use over time. Studies have clearly shown that triple-glazed units can never be justified in energy terms…"

"Whereas we working in the historic environment are used to building materials and systems that can survive for hundreds of years with minimal maintenance, we have much less information on the materials used for modern construction – except that their lifespans are certain to be very much shorter."

"Glues, tapes and plastics will degrade, particularly if there is any moisture ingress; and the building would have to be taken apart to get at them for maintenance or repair – demolition and rebuild are therefore the likely long-term scenarios for these buildings."

"Hollow-wall construction is intrinsically less robust than solid-wall."

"Passivhaus restricts the number and to some extent the location of windows, which must be rectangular or square because of the need to use triple-glazed units."

"Fabric construction constraints (especially the need for meticulous sealing) will make it difficult to alter or adapt the extension to meet changing needs…"

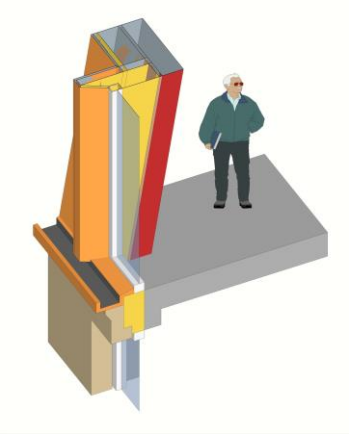
Letter to CFCE, July 2018

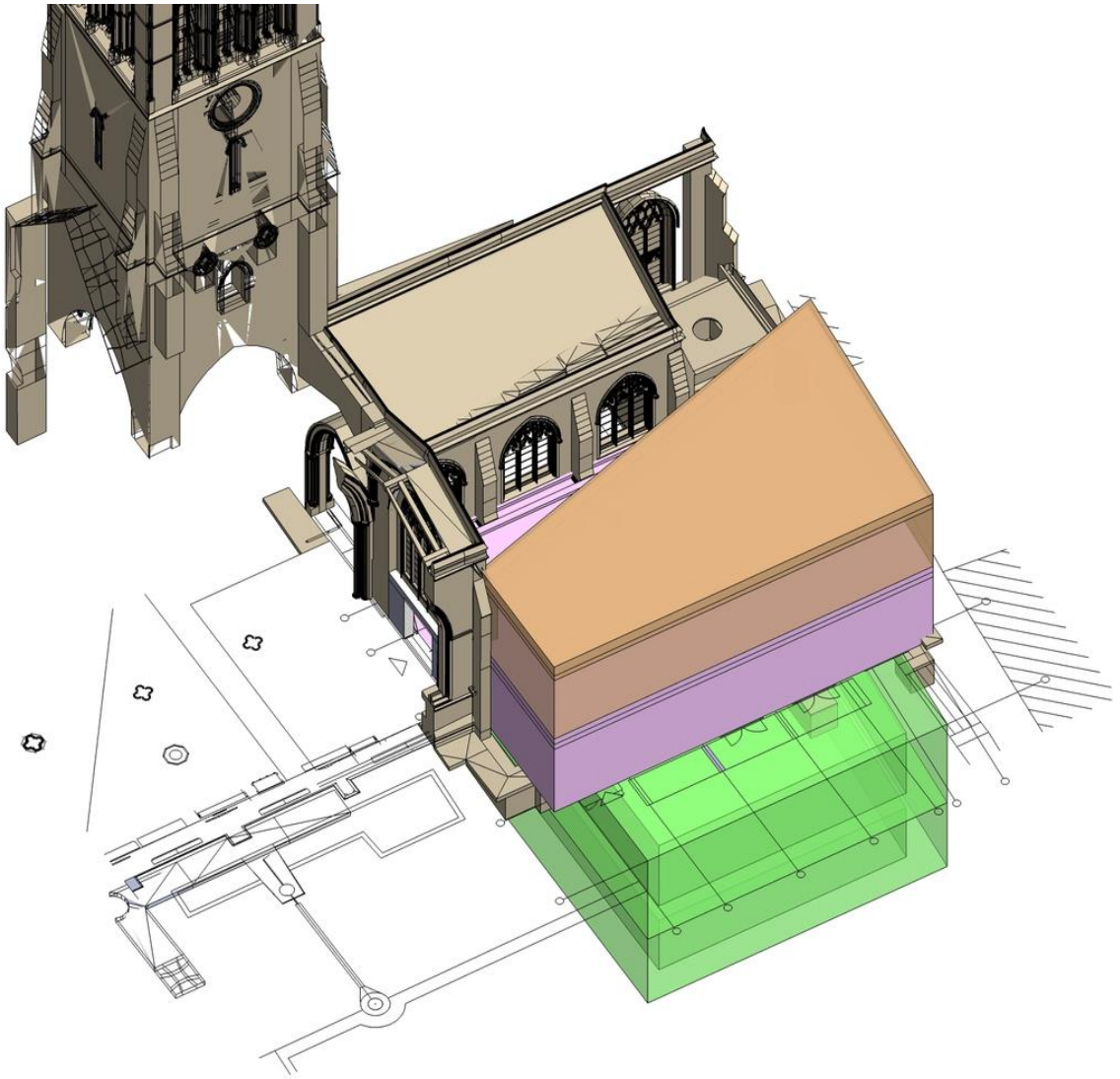
By Dr Robyn Pender, Head of Environment at Historic England and Member of CFCE

Design development

vHH – Architects
Etude – Energy/passivhaus advisors
Martin Thomas associates – MEP
Price and Myers – structure

- Offset deep basement
- Simplification of upper volume
- MVHR and natural vent strategies
- Consideration of construction details





“Having reviewed the HLC Passivhaus Feasibility Study Rev B (Etude, Jan 2018) and the Stage 2 Thermal Comfort and Energy Consumption Report (Etude, April 2018) we are confident that the ambition to meet the Passivhaus standard on this site is consistent with these objectives and, given an appropriate fabric and services design, entirely feasible. The sheltered site and predominantly South facing aspect of the HLC (with only modest over shading) make this an ideal site upon which to achieve the Passivhaus standard.

In conclusion, as experts in the field of high performance buildings we fully support the proposal by vHH Architects to achieve exemplary energy and thermal performance targets in conjunction with the LCR project and specifically their ambition to ensure that The Heritage Learning Centre is built to the Passivhaus standard.”

Dr Robert McLeod and Prof Malcolm Cook
Loughborough University, School of Civil and Building Engineering.
September 2018

RIBA Stage 3 Proposals

- Coordinated structural, MEP and passivhaus stage 3 design
- Construction strategies established
- PHPP shows predicated pass
- Within budget

Results

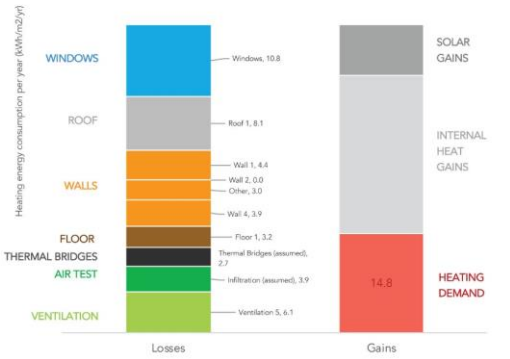
The heat loss breakdown of the current building design and the predicted heating demand are shown in the figure below. This shows an estimate for all heat energy flowing into and out from the building over one year. The left hand bar is the total heat losses from the building, and the left hand bar are all the gains into the building. All values are given in energy per year per unit floor area (kWh/m²/yr).

The annual heating demand is calculated as 14.8kWh/m2/yr. This achieves the Passivhaus requirement of 15kWh/m2/yr, but leaves very little margin. It is recommended that improvements are sought at Stage 4 to give some safety margin during tender.

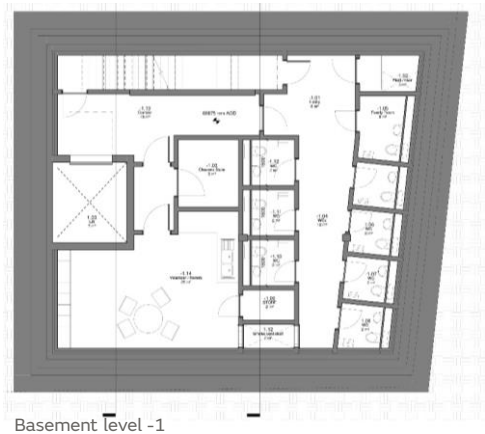
Heating energy demand target: 14.8 kWh/m²/yr ✓

Primary energy demand target: 121 kWh/m²/yr ✓

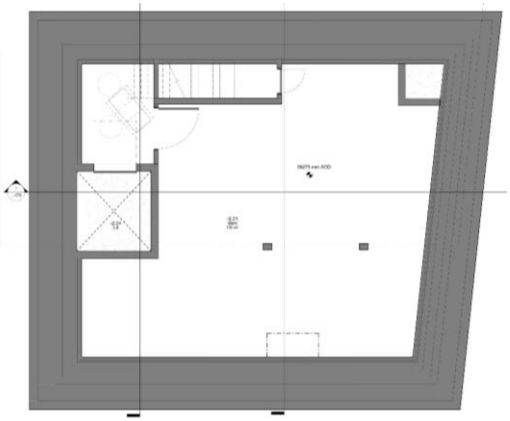
The heating demand does not include for the heating system efficiency. Including an estimate for total heating system efficiency of 87% gives an estimated heating consumption of 7550kWh/year.



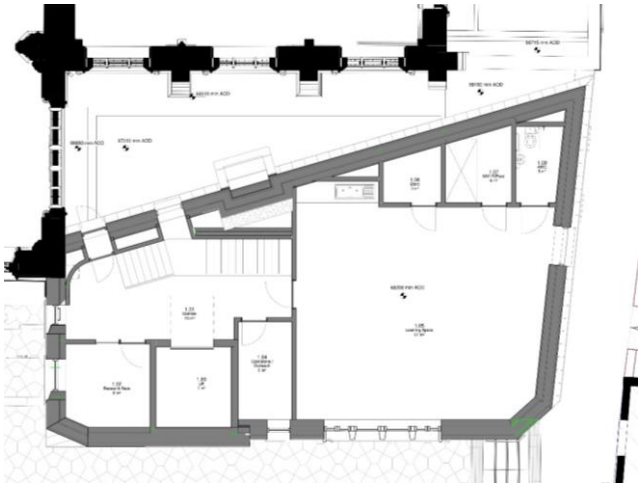
Annual heating energy balance for Heritage Learning Centre at Stage 3. Showing total heat energy into and out from the building, and indicative calculation uncertainty.



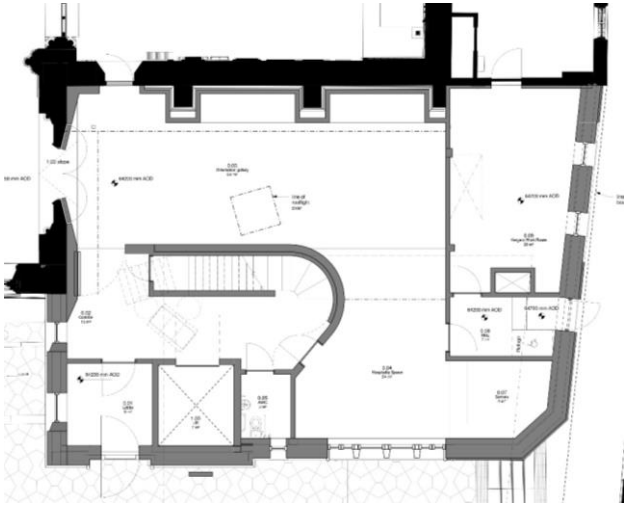
Basement level -1



Basement level -2



First Floor



Ground Floor

Passivhaus and Heritage

- Many statutory heritage and planning consultees do not yet understand the principles or practicalities of passivhaus buildings:
- They are intuitively opposed /prejudiced against the adoption of passivhaus as they see it contrary to the nature of historic buildings
- There is a perception that dependence on mechanical ventilation reduces comfort and increases maintenance
- There is a perception that the passivhaus methodology over-complicates and/or limits construction and design
- There is a perception that passivhaus buildings have to look a certain way

Our experience at Leicester Cathedral is that

- a passivhaus methodology can be successfully employed in a very complex historic environment.
- it would be extremely challenging to retrofit a historic building where the interior and exterior are both significant
- that is no reason not to adopt it for new buildings and extensions that abut and/or are linked to historic buildings
- Consideration of this link and its details is very important to safeguard the historic fabric and maintain the desired performance
- you need an exceptionally supportive client as heritage stakeholder consultation is likely to be challenging.....

vHH van Heyningen & Haward Architects

http://www.vhh.co.uk/about-us

https://vimeo.com/vhharchitects

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