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Retention not demolition: how heritage thinking can inform carbon reduction

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ABSTRACT
Two key benefits of building retention and adaptation, over demolition and new build are identified in the academic literature as: the conservation of heritage, and reductions in embodied greenhouse gas emissions from construction materials. A four-year research project, including expert interviews, focus groups and three detailed case studies, developed extensive data on how these benefits are considered in decisions to demolish or retain buildings within larger urban development sites. The research found that heritage and embodied impacts are considered quite differently. Heritage is frequently a key driver towards retaining individual buildings, whilstembodied emissions are rarely key considerations. Where there are insufficient arguments based on heritage value, many buildings are therefore demolished and replaced rather than retained. To reduce the impact of construction on the environment it is crucial that we calculate the embodied as well as operational impacts of demolition decisions and retain and refurbish buildings where this is the lower carbon choice. Using heritage arguments as a basis, this paper proposes that the introduction of policy drivers for retention and against demolition, and the conversion of environmental value into economic uplift, are likely to be necessary conditions to encourage the retention of buildings for lower whole life carbon.

KEYWORDS
Heritage conservation; heritage value; embodied carbon; greenhouse gas; adaptation

Introduction

When a building becomes obsolete, a decision that will face building owners and property developers is whether to retain and adapt, or demolish and replace with a new building.[1] A similar decision – which buildings should be retained, and which demolished and replaced – presents when larger urban sites are redeveloped, often as part of a regeneration strategy. If an existing building is in good condition and has good adaptation potential, studies show that the use of fewer materials and shorter construction times can result in the retention option being more economical.[2] However, in many cases, owners/developers prefer to demolish an existing building to start from a blank canvas

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as this gives them 'free rein' on the design of the new structure, its services and layout.[3] Beyond the economic argument, Baker documented the advantages and disadvantages of building retention and adaptation, and found that the two benefits most commonly cited in the academic literature are the conservation of heritage, and savings in material and therefore reduced embodied energy and greenhouse gas emissions.[4]

This paper focusses on these two most commonly cited benefits of retention, and compares if and how they are included in decisions to retain or demolish existing buildings. The paper reports the results from a four-year research project which developed three case studies of urban regeneration projects containing former industrial sites, in the UK, the Netherlands, and Australia. In each site some of the buildings were chosen to be retained while others were demolished. The case study analysis is supported by additional interviews with built environment experts based in the UK and two focus group discussions.

The paper considers the development within the literature of first heritage conservation and then climate change mitigation. The research method and case studies are then described.

The analysis is explained in sequence, first covering the understanding and application of heritage in practice, and then the consideration of carbon emissions. The final section explores the underlying reasons for why heritage considerations were a key driver towards retaining buildings, while environmental impacts, in particular embodied energy, were not. Two key requirements which could enable this to change are then proposed.

Heritage conservation

Heritage conservation is a term which has multiple values attached to it including architectural, historic, social, technological, aesthetics and a sense of identity.[5] Perceptions and interpretations of heritage have changed overtime and are reflected in the development of heritage policy, which has served as a way of framing development activities.[6] While early to mid-twentieth century heritage charters, such as the Athens Charter 1931 privileged 'historic, scientific and aesthetic values', a shift was seen later in the century.[7] A key document was the Burra Charter, first adopted in 1979, in which social values became an explicit component of conservation policy, as it theoretically placed social values on an equal footing with historic, scientific and aesthetics values.[8] The Council of Europe's 2005 Faro Convention on the Value of Cultural Heritage for Society is also provided as an example of taking this emphasis on social values a step further, as the focus of the convention was on 'ascribed values' instead of the material fabric of buildings. These ascribed values go beyond those determined by heritage specialists and should be the product of self-defined heritage communities.[9] Due to these ongoing developments, the modern contemporary philosophy and practice of conservation therefore recognises 'the importance of intangible heritage (spiritual, cultural, ethnographic, etc.)' according to Blagojević and Tufegdžić.[10]

Socially constructed values will depend on people's past experiences in relation to the building and/or area.[11] For example, industrial buildings and sites can be important milestones in human history due to their knowledge base and the historical technological developments that occurred there.[12] In some cases, industrial buildings/sites are seen as an integral part of a city's identity reflecting the 'genius loci'/spirit of a place and common connection for the community.[13]

A key part of retention and demolition decisions is a tension between the need for economic growth and conservation.[14] The retention of built heritage can help to provide a competitive edge to cities, especially under the forces of globalisation, by providing local character to a site.[15] Consequently, retention can act as a catalyst for further redevelopment in an area, also known as heritage-led regeneration.[16] Considering these economic arguments for heritage as a market driver is important to acknowledge as redevelopment decisions are often market dominated.[17]

Climate change mitigation

One of the most critical issues facing the world today is anthropogenic global warming, resulting in international efforts to reduce greenhouse gas emissions. If not mitigated, there is scientific consensus that the climate will continue to experience an increase in the frequency and intensity of extreme events such as flooding, droughts and cyclones.[18] The building and construction sector have an important role to play as together they account for 39% of energy related carbon dioxide emissions.[19] Two mitigation measures identified by the Intergovernmental Panel on Climate Change for the building sector to reduce their carbon emissions contribution are (1) reducing individual buildings' operational impacts and (2) reducing individual buildings' embodied impacts.[20]

Operational energy is the energy consumed through the day to day running of a building and maintaining the internal environment, including space heating and cooling and lighting.[21] Lower operational impacts of new buildings in comparison to existing are regularly cited as a barrier to retention, and therefore often used as an argument in favour of demolition and new build.[22] However, embodied impacts also need to be considered when assessing the whole life cycle environmental impact of retention and demolition decisions for a building. Embodied impacts occur throughout the life of a building, including the production of materials and components, their transportation to site and construction activities, their maintenance, repair and replacement, and their final demolition, processing and disposal as shown in Figure 1.[23] Some of these stages are therefore 'one-off costs' and others are recurring. If an existing building can be retrofitted to reach the same or similar operational energy standards as a new building, it is highly likely the life-cycle impact for the retrofitted building will be lower since considerably fewer materials will be required in the construction phase for a refurbishment project compared with demolition and new build.[24]

However, data for and individual calculations of the additional embodied impacts of retrofit measures and the resultant savings in operational impacts are limited.[25] Variations in existing designs and proposed interventions alongside methodological choices have therefore resulted in different conclusions on energy and carbon impacts when comparing retention or demolition life cycle analyses (LCAs) in the academic literature.[26] Design choices include materials and operational energy levels. Heritage buildings are highly varied in building materials, and the standard software used to calculate their operational energy use is frequently inadequate.[27] Other methodological uncertainties and inconsistencies include (but are not limited to) different modelling approaches, data sources and temporal and/or physical system boundaries. British Standards, including EN 15978 use a process-based approach to quantify embodied emissions.[28] This approach traces the environmental impacts of all materials, components and processes

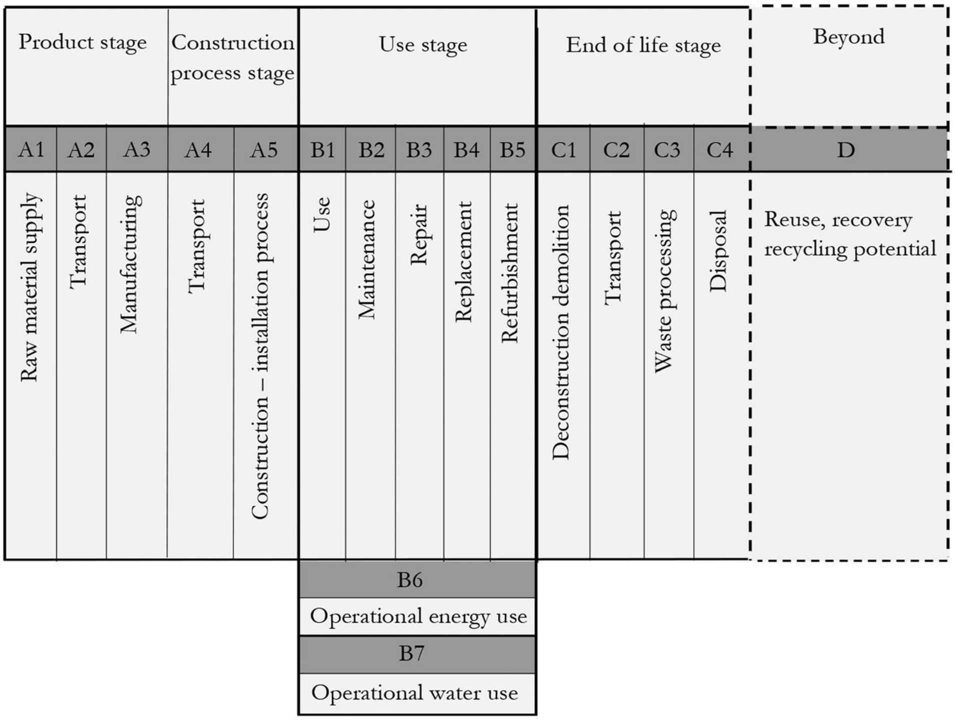

Figure 1. Life cycles stages of a building or construction work. Embodied impacts (stages A1-A5; B1-B5, C1-C4 and D). Operational impacts (stages B6-B7). Reproduced from Moncaster et al. and adapted from BS EN 15978: 2011 (Moncaster, 'Why Method Matters', see note 24; and BSI, *Sustainability of Construction Works*, see note 23).

which form the buildings. An alternative method is input-output models which assess the total economic or environmental inputs to and outputs of a specific industry or sub-sector.[29] If using a process-based approach, the environmental impacts associated with materials can vary depending on the data source. Results can also differ depending on which life cycle stages are included, and how wide a boundary is considered for the building's fabric and its surroundings.[30] Moncaster et al. found that 'the impact of difference in methodology, for calculations on a single building, can be higher than the impact of different design using the same methodology'.[31]

Policy, industry and to an extent academia have focused for the last 30 years or more on improving the operational energy efficiency of buildings.[32] However, academic interest in embodied impacts has steadily grown since the publication of the European Committee for Standardisation (CEN) standards on Sustainability of Construction Works from 2011, as well as an accepted approach to the life cycle assessment of a building (Figure 1).[33] The standards include a methodology for Environmental Product Declarations (EPD) for construction materials and have led to these being produced by manufacturers in rapidly increasing numbers.[34] Ibn-Mohammed et al. argued that embodied emissions were likely to become key metrics that will need to be addressed when considering the whole-life sustainability of a building, and it looks as if this was a prescient observation.[35]

Policy has been slow to follow academic research in its interest in embodied emissions, but there are clear signs that this is changing in some nations.[36] Within the UK, the Inventory of Carbon and Energy (ICE) database of construction materials embodied impacts was first published in 2007, and has been used across the world. It has recently been updated by its original author to include some of the increasing quantity and quality of materials data that the EPD offer.[37] For whole building assessments, the publication of the 2017 RICS Professional Statement has moved the UK industry towards a more unified methodology and has been a key step towards persuading local government, at least, that embodied impacts are both important and measurable.[38] In Australia, a database has also been produced for construction materials.[39] However, by requiring the calculation of embodied impacts in its building regulations since 2013, the Netherlands is further ahead than the UK and Australia.[40] Globally this issue has been encouraged by bodies such as the International Energy Agency through Annexes 57 and 72, and the World Green Building Council in its report 'Bringing embodied carbon upfront'.[41] Additionally, some architectural practices, including ones with international reputations, have begun to endorse retrofit as a more sustainable option than demolition and rebuild, evident within the UK through campaigns such as 'UK Architects Declare Climate and Biodiversity Emergency' and RetroFirst championed by the Architect's journal.[42]

Method

A four-year research project has developed extensive data on how decisions were arrived at to demolish or retain individual buildings within larger urban development sites. A mixed methods approach included the development of three detailed case study investigations. The selected case studies (shown in Figure 2) are called CB1 (Cambridge, UK), Strijp-R (Eindhoven, Netherlands) and Central Park (Sydney, Australia). The sites were selected using purposive sampling techniques, and the three locations allowed decisions to be explored in different regulatory and cultural contexts. The parameters and applicability of the case studies are shown in Table 1.

Methods included in the case study investigations were a review of available documentation such as planning documents and media articles, as well as interviews with stakeholders (Table 2). Stakeholder categories were identified from a variety of sources.[43] Interviews were transcribed verbatim and then analysed using an inductive coding technique (codes were not pre-defined). The analysis was then used to develop thematic ideas by identifying regularly discussed topics (more detail provided in Baker).[44] The case studies were supported by 33 additional interviews with UK experts in the built environment and two focus group discussions about the inclusion of embodied energy and carbon in retention/demolition decisions which were held as part of an Embodied Energy symposium.[45]

Understanding heritage in practice

Heritage is a broad and heterogenous term and interviewees from the case studies and supporting expert interviews discussed a range of values, including (but not limited to) historical and social values. The historical development of individual buildings and

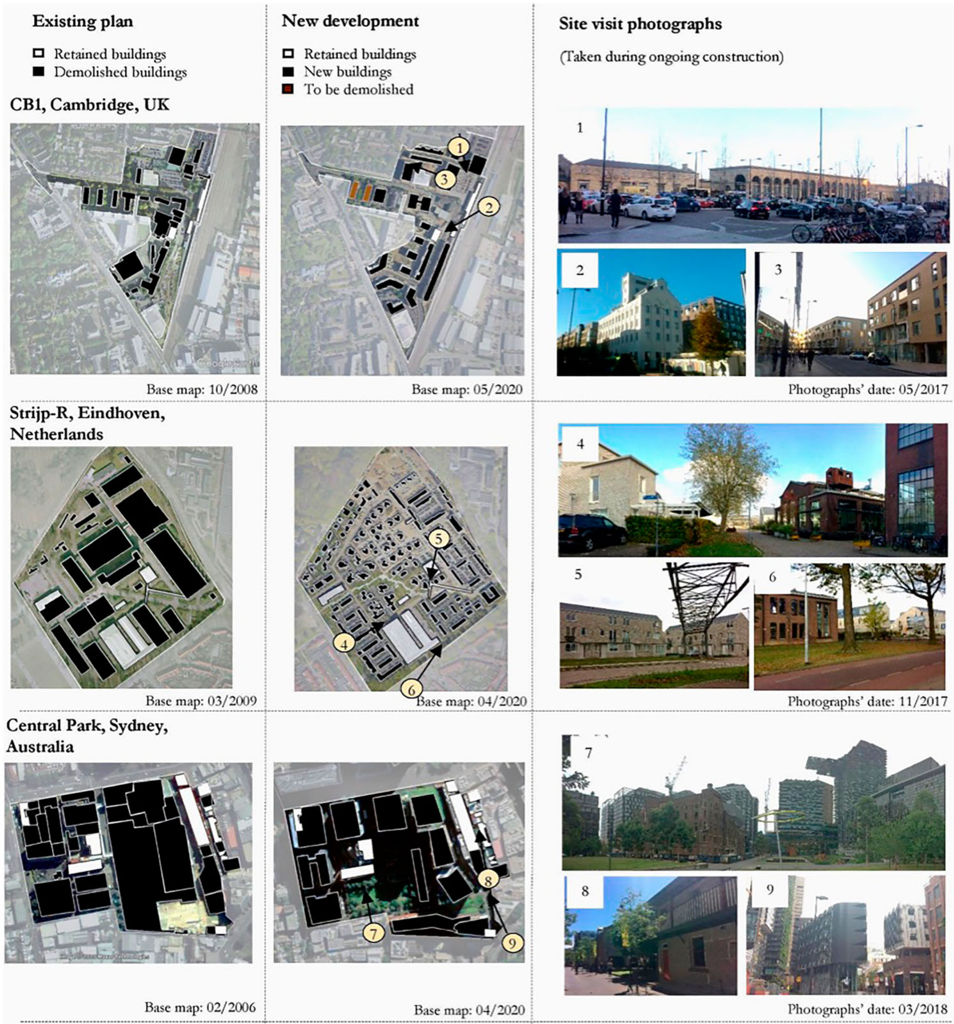

Figure 2. Figure ground plans and photographs of case study sites. Adapted from Baker, 'The Adaptation and Demolition of Existing Buildings', see note 4. Map data: Google 2021 / Infoterra Ltd.; Bluesky; Aerodata International Surveys; Mazar Technologies. Shapes of buildings added by author using information from: Ashwell CB1 Ltd., 'Planning. Application Summary. Planning application reference: 06/0008/OUT' (Cambridge, UK: Cambridge City Council, 2006); Gemeente Eindhoven, 'Ontwerp Strijp-R' (Eindhoven, the Netherlands: Gemeente Eindhoven, doc. 4286782/1/StrijpR, 2010); and NSW Department of Planning, 'Major Project Assessment. Carlton United Brewery Site. Director-General's Environmental Assessment Report. Section 75I of the Environmental Planning and Assessment Act 1979' (New South Wales, Australia: NSW Government. Department of Planning, doc. MP 060171, 2007). Photographs taken by author.

urban development sites was regularly referred to in the expert interviews with the one interviewee saying that 'the first stage of anything is to understand historical development'. For industrial buildings, it was suggested that the historical value of the buildings/sites is related to the technical and scientific developments of their former use and the production procedures. One industrial heritage expert explained this as 'the

Table 1. Case study parameters.

Parameter	CB1	Strijp-R	Central Park
Former function: significant proportion of the development site contains former industrial land/ buildings	Railway station, and the former Rank Hovis industrial area contains flour mill, grain silo and goods yard.	Previously occupied by Philips to manufacture television tubes.	Previously used as a brewery. Last owners Carton and United Breweries. (CUB)
Proposed function: the final use of buildings on site must be mixed-use and therefore include more than one property type	Approximately 300 residential dwellings and 1250 student bed spaces and over 53,000 sqm offices.	Approximately 600 residential dwellings, as well as a factory, restaurant and shops.	Approximately 1800 residential apartments, 97,000 sqm offices and 12,000 sqm retail.
Density/area: proposed development is more than 200+ residential dwellings and/or 4 hectares in size.	10.2 ha	20 ha	5.8 ha
Developer: the development is privately led/funded.	Ashwells Ltd. (site purchased by Brookgate Ltd. after global recession).	Amvest	Sekisui House Australia (planning permission obtained by CUB)
Existing infrastructure: at least 50% of land (excluding transport and water networks) contains existing buildings.	See Figure 2	See Figure 2	See Figure 2
Planning permission: indicative masterplan has obtained planning permission and the development is under construction.	Site purchased: 2004 Planning approved: 2008. As of April 2019, still under construction.	Site purchased: 2005 Planning approved: 2010 As of April 2019, still under construction.	Planning approved: 2007 Site purchased by Frasers: 2007 As of April 2019, still under construction.
Research participants: range of decision-makers and stakeholders can be identified and contacted.	13 interviews	10 interviews	15 interviews

Adapted from Baker, 'The Adaptation and Demolition of Existing Buildings', see note 4.

Table 2. Stakeholder categories, number of interviews and focus group participants.

	Number of interviews (interviewees)				Number of participants	
Stakeholder category	CB1, Cambridge, UK	Strijp-R, Eindhoven, Netherlands	Central Park, Sydney, Australia	Expert interviews	Focus Group 1	Focus Group 2
Academic	–	–	–	2	2	1
Amenity/voluntary group (e.g. heritage society)	–	–	–	6	–	–
Community member	3	–	1	–	–	–
Construction company	–	1	–	–	–	–
Consultant	5	3	5	11	2	3
Designer	1	4	4 (8)[a]	3[b]	2	1
Developer	1	–	2	4[b]	–	1
Investor	–	–	–	–	1	–
Policy maker	1	–	1	2	–	–
Planner	2	1	2	2	–	1
Regulator	–	–	–	3	–	–
Total	13	10	15 (19)[a]	33 (34)[b]	7	7

Adapted from Baker, 'The Adaptation and Demolition of Existing Buildings', see note 4.
[a]Number in brackets indicates the number of interviewees as some interviews contained more than one person.
[b]Total number of expert interviews was 33 but one interview included two interviewees (a developer and a designer).

knowledge base behind those sites … the engineering that went on within the buildings, the process that went on … as well as the knowledge of the process'.

In the case studies and therefore in practice, the historical values tended to focus on this role that buildings had in the former production processes rather than simply their age. In the heritage report for the CB1 development it states: 'the station, mill and silo are rare survivors of the industrial heritage of Cambridge'.[46] For Strijp-R in the Netherlands, the building report highlights that '[the] main historical significance of Strijp-R is … in the mass production of television tubes for the period from 1952 to 1977'.[47]

It is therefore difficult to separate historical and social values as it is often the industrial history and activities that took place that led to a sense of identity. This was also clear from the interviews with experts, one highlighting an example of coal mines: 'in mining communities … you don't have to dig very far and you find that people value their surroundings very highly'. In the case study interviews, this concept of identity was particularly prevalent in Strijp-R. The process manager offered 'identity' as a benefit of retention, whilst the landscape architect described the most successful part of the development as 'the genius loci, the spirit of the place … you can still feel it was a former industrial site'. This sense of identity extended beyond the curtilage of the case study site, since Philips, the former owner, was renowned throughout the city. One interviewee explained: 'the inventing of products, which was mainly the designers of Philips … was [Eindhoven's] identity'.

The sense of identity provided by an industrial site is therefore likely to vary depending on the industrial company's influence on the surrounding area, as well as when the factories ceased production. Both CB1 and Central Park had halted production for some time (2001 and 2005 respectively) and although important industrial companies to the immediate local area, they did not have the same degree of influence over the entirety of the cities where they are located compared to Strijp-R.

Consideration of heritage in retention decisions

Heritage was the main driver behind the decision to retain existing buildings in all three of the case study investigations. This consideration appears to have been due primarily to heritage policy on both CB1 and Central Park. On Strijp-R buildings were not protected by heritage policy, but were still retained due to their social value and their contribution to place-making.

In a UK context, the expert interviewees felt that national listings offered a high degree of protection for individual buildings, with the one saying that 'the demolition of a listed building is very difficult to get approved', and another describing national listings as 'quite a strong tool' for influencing retention decisions. The CB1 case study was the only site examined which contained nationally listed property, including the railway station building. Several of the case study interviewees said that its national listed status meant it had never been considered for demolition. However, national listings do not guarantee protection. A nationally listed former police office on the same site was demolished to provide space for a new taxi-rank, justified as a fundamental piece of infrastructure. Demolition in this case was therefore considered to be a public benefit, which is required by UK planning policy to justify the harm or loss of a nationally listed building.[48]

Buildings and structures can also be listed at a local level. These listings are assigned by local authorities (LAs) and their significance is perceived to be lower than national listings: 'If we are getting down to the black and white of it, if something is important on a national level, it will be listed … so local listings really, it does what it says on the tin, it is a local recognition of importance' as put by one interviewee. Outside the context of a masterplan, the UK expert interviewees agreed that local listings are therefore not that effective in influencing decisions to retain individual buildings. One public planner described their influence as 'pretty weak', whilst another said that 'if a building is locally listed, then it's not really that difficult to get rid of'. However, in the context of a larger urban development rather than individual buildings, some interviewees felt that local listings have a higher degree of influence on retention and demolition decisions, and can help to safeguard at least some of the buildings. One conservation officer considered local listings to be at least a starting point for conversations between developers and local authorities and felt that without any listings it is much harder for local authorities to require retention.

On the CB1 site, seven locally listed buildings were outlined in the Station Area Development Framework (SADF), which formed part of the local plan setting out guidelines for development.[49] Three of these buildings were proposed for retention in the final planning application. Members of the design team indicated that changes from the aspirations of the SADF were necessary as the SADF had not been commercially tested. Despite the loss of some of the locally listed buildings, there was one example where it appears that the local listing did offer protection and influenced the decision for retention. In the initial masterplan design proposed by the developers, 125 Hills Road (a former goods yard office) was to be demolished, as well as its neighbouring buildings, and replaced with new build student accommodation. The local authority was being advised by a Design and Conservation Panel, who said 'we would like to see an option prepared which shows the retention of 125 Hills Road before we are convinced that the masterplan requires the demolition of this [Building of Local Interest]'.[50] In the final design, 125 Hills Road was retained and adapted to be used as a restaurant (Figure 3). This revised decision, as well as the retention of some of the other locally listed buildings, suggests that the local listings did have a degree of influence within the design of the masterplan. It is unlikely that planning permission would have been granted if the application had proposed to demolish all the locally listed buildings. As the area also contained a conservation area, a large area of land protected by planning policy, extra weight may have been given to some of the heritage items.

Within Central Park in Sydney, the buildings that were retained also held a local heritage listed status. These were initially identified in the Sydney Local Environment Plan (LEP) and additional listings were proposed during the development of a Conservation Management Plan (CMP).[51] In the final design, the majority of the buildings listed in the LEP were retained. However, some of the additional items deemed significant in the CMP were demolished. Although the demolition was opposed by the City of Sydney, as Australia has a federal planning system with three tiers of government and the site had been granted State Significance, the State of New South Wales, rather than the City of Sydney, was responsible for granting planning permission.[52]

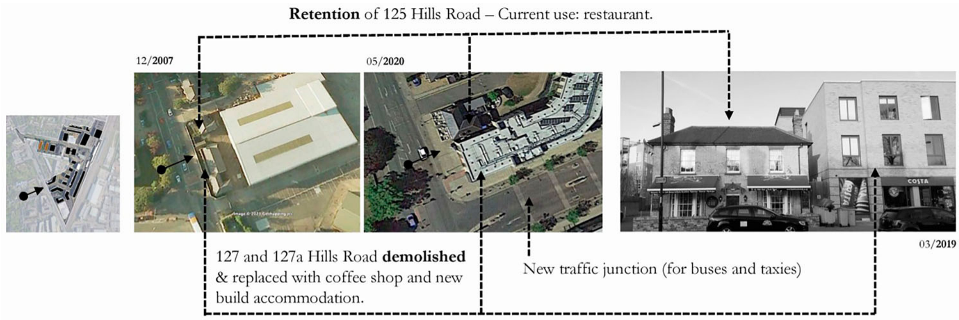

Figure 3. Retention of 125 Hills Road, CB1 development, Cambridge. Adapted from Baker, 'The Adaptation and Demolition of Existing Buildings', see note 4. Map data (shapes of buildings added by author): Google 2021/ Getmapping. Photograph (right) taken by author.

Heritage is not only defined by policy and listings. Existing buildings can add character to a large-scale development and contribute to place-making, thus creating a point of differentiation from generic new build developments: 'having historic buildings gives a sense of character … and a bit of distinction which makes [a development] separate from everything else' as one expert interviewee explained. The idea of demolishing all the existing buildings on a masterplan site was described as 'old-fashioned' by one property consultant. Several interviewees felt that the character and/or place-making provided through building retention can also add economic value to a development, even if this value is difficult to quantify due to its subjective nature.

Four assets were retained in the Strijp-R development despite not being listed (example provided in Figure 4). During interviews for this case study, the demolition of all existing buildings was also described as 'old-fashioned' and the buildings' retention was thought to 'give character, a sense of place-making [and] diversity to the development'. The masterplan architect's website explains 'although there are no listed buildings in the area, the history of the place proved so rich that Amvest wanted to derive Strijp-R's new identity from it'.[53]

The contribution to character and place-making through building retention was also recognised by interviewees on CB1 and Central Park. The developer of Central Park stated 'the site would not be anywhere near as great a site without Kensington Street, Abercrombie Hotel, Old Clare and the Brewery Yard', all of which were retained buildings (examples provided in Figure 4). Members of the CB1 design team similarly felt that the retained buildings added diversity and character to the development. However, as the majority of buildings retained on both these sites were also designated (either locally or nationally), it is difficult to establish whether the true driver behind their retention was policy, character/place-making or both.

In addition to the planning structure and heritage legislation, it is important to note that the case study investigations showed that retention decisions are also governed by other factors including (but not limited to) housing/commercial demands and the people involved. As the exploration of these complexities goes beyond the scope of this paper, further detail can be found in Baker,[54] and only a brief overview is provided here and in Table 3. In the context of housing/commercial demands, Strijp-R is located on the edge of the city, while CB1 and Central Park are situated next to key transport interchanges. On Strijp-R the demand was for low density family housing and on CB1 and Central Park higher densities were sought. In terms of building retention and demolition decisions, there was therefore more demand in the latter two for demolition of buildings with small floor areas and building heights. In terms of people, one of the factors uncovered in both the Strijp-R and Central Park case studies was the influence of individual people over the retention decisions. These were Piet Hein Eek, a famous Dutch furniture designer who invested in some of the existing buildings on Strijp-R, and Dr Stanley Quek, the CEO of the development company responsible for Central Park's modified masterplan. One interviewee described Dr Quek as 'a very insightful and astute developer' with a vision of retaining Kensington Street. Without their roles, the final developments could have had different retention outcomes.

Understanding whole life energy and carbon impacts

To assess the carbon impacts of retention options compared to demolition and new build, both embodied and operational emissions need to be considered. During the expert interviews and focus groups, several people suggested that retention should be considered favourable when evaluating energy and carbon impacts due to the savings in material. One participant stated 'it is better if you can reuse the buildings as opposed to demolition and complete rebuild because you are then using up new materials and new resources which in its very nature are short-term and finite', whilst another felt strongly that when considering energy and carbon impacts 'it should be a slam dunk in favour of refurbishment'. However, in some cases the retained building may not always have a lower whole life cycle impact compared to new build due to the difficulty of meeting the required operational efficiency.

The potential to improve operational energy efficiency of an existing building is determined to a great extent by a building's form, and the amount of intervention required will also be dependent on the proposed function. The level of intervention in turn affects the costs of retention and adaptation. Additional difficulties in upgrading an existing building's thermal performance can be caused by heritage constraints, which can be 'relatively

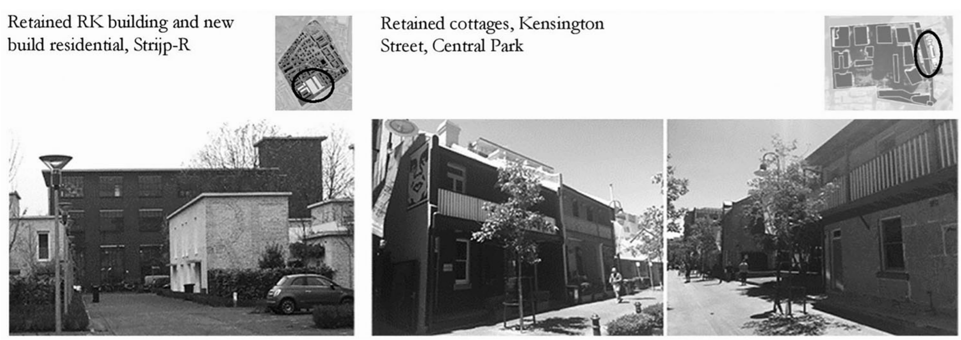

Figure 4. Retained RK building and new build residential on Strijp-R (left); Retained cottages on Kensington Street, Central Park (right). Adapted from Baker, 'The Adaptation and Demolition of Existing Buildings', see note 4. Map data (shapes of buildings added by author): Google 2021. Photographs taken by author.

Table 3. Factors governing demolition and retention decisions on case studies.

	CB1	Strijp-R	Central Park
Housing/ commercial demands	High density due to location next to key transport gateway.	Low density family housing as located on outskirts of city.	High density due to location in centre of city and next to key transport interchange.
Consent authority	Local authority (Cambridge City Council).	Local authority (Eindhoven municipality)	State/regional authority (State of NSW planning minister)
LA development plans	Station Area Development Framework 2004 & Cambridge Local Plan 2006.	No local plan in place when the site was purchased by developers	Sydney Local Environment Plan 2005 & Conservation Management Plan 2005.
Heritage designations	Contained nationally and locally listed buildings, as well as a conservation area.	Contained no designated buildings.	Contained locally listed buildings.
Role of individuals	No key influential figure identified from case study investigation.	Piet Hein Eek, Dutch furniture designer identified as influential figure for building retention.	Dr Stanley Quek, former CEO of development company identified as influential for building retention and design quality.

More detail provided in Baker, 'The Adaptation and Demolition of Existing Buildings', see note 4.

strict … if you are actually removing fabric but not so much if you are adding things' as one interviewee explained. However, another described the perception of heritage listings being a barrier to energy improvements as 'erroneous'.

Consideration of embodied impacts in retention decisions

The focus group participants were generally in agreement that the drivers behind retention and demolition decisions were not likely to be whole life energy and carbon impacts, but instead issues such as the building's fitness-for-purpose, target markets, heritage listings and the desire to create a density uplift. All of these considerations were identified in the case study investigations.

Focus group participants and expert interviewees also felt that more often than not the focus of whole life energy and carbon impacts is on operational impacts, with a lack of policy deemed to be the main reason for the absence of embodied impacts in decisions. One explained that for embodied impacts to 'be a valid argument … in terms of seeking retention … it would depend on a firm policy being developed that had a clear reference to how the embodied energy could be offset'.

It was recognised in the focus groups that there are some bodies which are beginning to look into embodied carbon but 'it is very hit and miss' and that it is not currently required in planning policy 'unless you have a particularly inspired LA'. One of the reasons interviewees and focus group participants felt that embodied impacts are not part of policy yet is due to problems with its quantification and the methodology, including the choice of different life-cycle stages and data uncertainty. Despite efforts in the academic literature to standardise methods, one focus group participant said 'I am extremely sceptical about any government regulation in this area until we have had a lot more research on methodology stuff … we are ten years away from that at least, but it is coming, it is coming'.

In the case study investigations, the degree to which factors related to embodied impacts were considered or referred to was extremely limited. In the context of energy, the focus tended to be on operational impacts. Where embodied impacts were mentioned, it was usually associated with the end-of-life phase, through the recycling of demolition material. On Strijp-R, interviewees discussed how bricks from the existing buildings were reused in the construction of the road network and on Central Park the developer stated 'when we demolished the buildings, I think we ended up with 95% of the materials that were recycled in one-way shape or form'. This focus on recycling materials is possibly influenced by tax incentives. These were also discussed in the focus groups and one participant felt there was an influence in the UK due to the cost implications: 'most construction companies now will try and guarantee an almost 100% recycle rate of the existing building because of the landfill taxes. It is now biting enough to make it viable'.

Beyond policy requirements, there were some suggestions that a driver towards reducing the whole life energy and carbon (if considered at all) was reducing life-cycle costs. During the focus groups, an environmental consultant felt 'the conversation is about the economics of it, how much of a saving is there using demolition rather than refurb'. Although some focus group participants felt there was an obvious cost saving from reducing materials and consequently embodied impacts, one interviewee felt: 'people get it is inherently more sustainable to reuse existing buildings than it is to demolish it, but you don't get any financial credit for it'. Economic arguments for demolition and new build include being able to build back bigger, and a perceived desirability/demand for new buildings, particularly if there is not heritage value attached to the existing structure.

Whole life energy and carbon may also be considered in retention decisions as part of voluntary certification schemes such as sustainability assessments including BREEAM, LEED and Green Star. Expert interviewees felt that certifications gave buildings 'green credentials' which could help increase income through marketing or help to obtain planning permission. Achieving high scores on these sustainability assessments was described by one architect as 'a massive issue and one contractors take very seriously … [because] one has to adopt the benchmarks in industry'. This marketing value of sustainability assessments was also identified in the case study interviews. In the CB1 case study, the developer discussed BREEAM excellent ratings of the new build as an indication of quality, whilst the sustainability consultant for Central Park explained that sustainability assessments 'had really taken off and been influential … it will attract a higher level of tenant and a higher level of rent'. However, the calculation of embodied impacts currently only forms a small part of these assessments.

Can embodied carbon learn from heritage thinking?

Two key arguments for the retention and refurbishment of buildings over their demolition and rebuild are (a) the retention of heritage value, and (b) the lower embodied greenhouse gas emissions ('embodied carbon') produced by retaining buildings.[55] Research has demonstrated the validity of both, with heritage value having positive social and economic impacts, and retaining and retrofitting buildings often shown to have lower environmental impacts. The three case studies indicate however that in practice, heritage is by far the most common reason for retaining buildings. In contrast, embodied carbon is seldom influential in retention/demolition decisions, with the main environmental arguments being focused on operational impacts.

The reasons for the difference in the strength of the two arguments is in some ways complex, but in others quite straightforward. The argument for retaining heritage has long been supported by global, national and local policy. As long ago as 1931, the Athens Charter for the Restoration of Historic Monuments was presented. Since then, there have been multiple supporting policies and initiatives, as well as a development in the heritage discourse to include social values.[56] Heritage policy enforcement is further supported by national heritage bodies within each country and local council positions such as conservation officers. The impact of this political support, both national and local, for retaining heritage buildings has been clear in the case studies, despite being located in different countries.

In contrast, none of the decisions to retain, or demolish, buildings in the three case studies were determined by embodied carbon considerations. While the effects of human activities on the environment have also been of concern for many years, within the built environment these have focused on the direct effects of energy use.[57] The major European regulations came from the 2002 Energy Performance of Buildings Directive (EPBD) which for years has focused national building regulations entirely on operational energy from heating, cooling and lighting buildings, and has ignored the energy and carbon impacts from construction, repair and replacement, and demolition of buildings.[58] Only now, in 2021, is the embodied carbon impact of buildings starting to be considered in some countries. It has been included as a requirement for calculation for new buildings within the Netherlands for the last few years, but is not yet part of the regulations in either the UK or Australia. Therefore, the presentation of policy presents as a barrier to demolition of buildings with 'heritage value', in a way that does not yet exist for buildings with 'embodied carbon value'.

There is an additional point in terms of policy that was clear within the case studies. In a few cases, buildings were demolished despite their heritage listing, with arguments being made of the public good of an alternative. This potential flexibility is likely to be important for any regulatory requirements to be accepted by the industry.

Another factor highlighted by the research, which has also been explored by previous studies, is the social value that heritage buildings are considered to hold by some developers and clients. This was particularly evident in Strijp-R. This can translate into a market uplift, and therefore offers an economic incentive for developers. In parallel to the barrier to demolition that heritage policy provides (which has limitations in enforcement), this perceived market uplift provides a driver towards the retention of heritage buildings.

Currently similar market uplifts are being seen in the sale of energy efficient buildings, as identified through the Energy Performance Certificate (EPC) scheme in the UK for example. This rates buildings on their energy efficiency, and research has shown that as consumers are positive about both lower energy bills and environmental values, higher ratings can translate into higher prices. In other words, for a developer there is an economic value to build low operational carbon buildings. Similarly, sustainability assessments such as BREEAM can act as what Carmona defines as a promotional instrument, leading to higher yields and a means of marketing a building and/or site.[59] However, embodied impacts are not included in the EPC scheme, and have very limited weight in sustainability assessments. Therefore, again, there is currently no clear market driver for a low embodied carbon building.

Conclusion

The social and economic value offered by retention, and the barrier against demolition offered by local and national policy, has resulted in the acceptance of heritage as both an economic and social positive and consequently its consideration in retention and demolition decisions is becoming the norm. In order for whole life (embodied as well as operational) energy and carbon impacts to be as readily accepted, it is clear therefore that the calculation of embodied impacts needs to be included in regulation, and that demonstration of the reduction of whole life impacts should be a requirement before buildings are demolished. The positive role that retaining buildings can play in reducing our impact on the climate must also be stressed to all stakeholders. This research demonstrates that retention of buildings, be they heritage or not, have social, economic, and environmental values which all interact to varying degrees depending on time and place; the challenge is ensuring each is acknowledged and considered in decision making.

Limitations and further work

This paper discusses an analysis of three case studies located in three different developed nations. The intricacies of decision making will of course vary on a case-by-case basis as several factors including the economic conditions, planning structure, people involved, and the processes will all affect development decisions.[60] Thus, the findings from these case studies are unlikely to be applicable to every example of urban development projects. However, the results reveal an interesting differentiation in how environmental impacts and heritage impacts are considered in these case studies. This study could be extended further to test the applicability of these findings in other contexts, including scales of development, types of developer and location. Finally, it perhaps goes without saying that the argument to consider embodied impacts, alongside operational, in decision making should not be constrained to demolition versus retention decisions but should be extended to all decisions assessing different design options in the built environment.

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