The adaptation and demolition of existing buildings on masterplan sites

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Declaration

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

Abstract

Thesis title: The adaptation and demolition of existing buildings on masterplan sites

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This thesis extends current adaptation theory by considering the practical realities of adaptation and demolition decisions at the masterplan scale. As existing adaptation theory mainly focuses on individual buildings or the city level, it is not sufficient for explaining decisions on large brownfield sites being redeveloped through the implementation of a masterplan.

A qualitative inductive approach was used to generate new knowledge about the topic. Initially, data was gathered from interviews and focus groups with built environment professionals. In-depth case study investigations of masterplan developments containing former industrial areas were then undertaken. The locations were Cambridge, UK; Eindhoven, Netherlands; and Sydney, Australia. Examining decisions in these different contexts unpacked the realities of how and why adaptation decisions on masterplan sites are made in practice.

For individual buildings, existing literature argues that the physical attributes of a building are the major factor in decisions to adapt or demolish, due to their impact on construction costs. At the masterplan scale, these factors are still applicable. However, the primary data analysis shows there is a different interpretation of economic viability as costs can be offset elsewhere within large developments, and that there are a number of additional issues considered at the masterplan scale. These include the relative scale of buildings and considerations of vehicle and pedestrian flow through the site.

There are two benefits of building retention which are commonly cited in the academic literature: conservation of heritage and savings in materials, and therefore savings in embodied energy and greenhouse gas emissions. In practice, the role of heritage was found to be frequently considered at an individual building level and in some instances is thought out at a larger physical scale, notably as part of place-making within a masterplan. However, embodied impacts were found to be rarely considered in adaptation decisions at either the individual building or masterplan scales. This difference, it is suggested, may be due to the fact

that heritage has been included within planning policy for many years, while embodied impacts are only just starting to be included.

The three case studies uncovered factors that govern decisions on large urban developments. People involved in, or affected by, masterplan developments including planning authorities, local communities and individuals were found to have a significant influence over the decision-making process, which is also contingent on the structure of the planning system and economic conditions at the time decisions are made. Due to the long time-span of masterplan developments, these decisions may also change at a later date in the development process.

The theoretical underpinnings of urban development including equilibrium, structural, event-sequence and agency models, are applied to the research findings to offer a potential theoretical framing applicable to the masterplan scale. Through the multiple lenses provided by composite models, the variations in the factors governing decisions are explained. These include the influence of hierarchies within the planning system, the ability of developers to negotiate with local authorities over planning policy requirements and the transfer of risk to individuals willing to take it. Through the exploration of these complexities which are exacerbated by the physical and chronological scale of the masterplan, current adaptation theory is extended and practical recommendations made.

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Published papers, conference papers and reports

Baker, H. and Moncaster, A. (2018). 'Adaptation and Demolition in a Masterplan Context'. In: Wilkinson, S., Remøy, H. (eds.) *Building Urban Resilience through Change of Use*. Wiley-Blackwell, pp. 57–81.

Baker, H. and Moncaster, A. (2018). 'Embodied carbon and the decision to demolish or adapt.' *Presented at the ZEMCH 2018 International Conference*, Melbourne, Australia, p. 19.

Baker, H. and Moncaster, A. (2017). 'Demolition and adaptation at the CB1 development, Cambridge.' *Presented at the European Real Estate Society Annual Conference*, Delft, the Netherlands, p. 18.

Baker, H., Moncaster, A. and Al-Tabbaa, A. (2017). 'Decision-making for the demolition or adaptation of buildings.' *Proceedings of the Institution of Civil Engineers - Forensic Engineering*, p. 13.

Baker, H. and Moncaster, A. (2017) 'The Role of Stakeholders in Masterplan Regeneration Decisions', *World Sustainable Built Environment Conference*, 5-7 June 2017, Hong Kong. p.10

Baker, H. (2016) *'Masterplan regeneration on brownfield sites – The decision to demolish or adapt existing buildings'*, Report for Capital and Counties Ltd. (Capco), London, UK. p.79

Awards and global collaborations

Invited to be part of a design panel including experts from industry and academia for the development of a Demolition and Adaptation Database (DaDD) being developed at Clemson University, USA (2016 – present).

Undertook two academic secondments, one with Assistant Professor Hilde Remøy at Delft's University of Technology (TU Delft) in the Netherlands (2017) and the other with Assistant Professor Sara Wilkinson at the University Technology Sydney (UTS) in Australia (2018).

First prize (£300) in the Management & Social Sciences category at the Association of British Turkish Academics (ABTA) researcher awards (2017).

Awarded the Doctoral Prize Fellowship in Future Cities (£2000), sponsored by Capital and Counties Ltd. (a London based developer) and the University of Cambridge's Department of Land Economy (2016).

Organised and conducted workshops with the Arup Education Trust (AET) in Johannesburg, South Africa and the Interdisciplinary Design and Built Environment (IDBE) Master's programme, Cambridge, UK (2016).

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List of abbreviations

ABTA	Association of British Turkish Academics
AET	Arup Education Trust
AHD	Authorised Heritage Discourse
AHP	Analytical Hierarchy Process
AM	Adaptive Management
ANP	Analytic Network Process
BLI	Building of Local Interest
BPRA	Building Premises Renovation Allowance
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
BS	British Standard
CABE	Commission for Architecture and the Built Environment
CAC	Conservation Area Consent
CAQDAS	Computer Assisted Qualitative Data Analysis Software
CDT	Centre for Doctoral Training
CEO	Chief Executive Officer
CIC	Construction Industry Council
CIOB	The Chartered Institute of Building
CMP	Conservation Management Plan
CSFs	Critical Success Factors
CUB	Carlton and United Breweries
CUBES	Cambridge University Built Environment Sustainability Group
DaDD	Demolition and Adaptation Database
DCLG	Department for Communities & Local Government
EP&A	Environmental Planning and Assessment
EPBD	European Performance of Buildings Directive
EPC	Energy Performance Certificates
EPSRC	Engineering and Physical Sciences Research Council
ESD	Environmentally sustainable development
FCB	Feiden Clegg Bradley
FIBE CDT	Future Infrastructure and Built Environment Centre for Doctoral Training
GFC	Global Financial Crisis
ICE	Inventory of Carbon and Energy
ICOMOS	International Council on Monuments and Sites

IDBE	Interdisciplinary Design and Built Environment
IEA EBC	The International Energy Agency Energy in Buildings Communities Programme
IHBC	Institute of Historic Building Conservation
IPCC	International Panel for Climate Change
LA	Local Authority
LCA	Life-cycle assessment
LEED	Leadership in Energy and Environmental Design
LEP	Local Environment Plan
M&E	Mechanical and electrical
MHCLG	Ministry of Housing Communities & Local Government
MRes	Masters in Research
NatHERS	Nationwide House Energy Rating Scheme
NPPF	National Planning Policy Framework
NSW	New South Wales
PPG	Planning Policy Guidance
ref.CS.CB1	Reference to case study (CB1) interview.
ref.CS.CP	Reference to case study (Central Park) interview.
ref.CS.SR	Reference to case study (Strijp-R) interview.
ref.FG	Reference to focus group participant
ref.PI.	Reference to 'professional interview'
RIBA	Royal Institute of British Architects
RICS	Royal Institute of Chartered Surveyors
RSS	Regional Spatial Strategy
RTPI	Royal Town Planning Institute
SADF	Station Area Development Framework
SLEP	Sydney Local Environment Plan
SPD	Statutory Planning Document
SSD	State Significant Development
SSI	State Significant Infrastructure
TICCIH	The International Committee for the Conservation of the Industrial Heritage
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Education, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UTS	University Technology Sydney
ZEMCH	Zero Energy Mass Custom House

To my Grandparents

Although no longer with us, I hope I am still making you proud.

CHAPTER 1:

Building adaptation and demolition on masterplan sites

There are currently over eighteen thousand previously developed sites with the potential for redevelopment in England, in total these could accommodate up to one million homes (CPRE, 2019). Since many of these sites contain existing buildings, as Bullen and Love (2010, p.215) state: "*an issue that will face many building owners, designers, property developers and planners will be to adapt or demolish existing buildings to meet changing economic and social needs*". In some instances, developers will prefer to start from a blank canvas and demolish all of the existing structures, services, design and layouts (Plimmer et al., 2008; Wilkinson, 2011). However, this approach has been criticised as it only considers the economic aspirations of the developers. Conejos et al. (2011, p.8) suggest that the "*premature destruction of built assets for economic (often profit-seeking) motives with minimal regard for social and environmental outcomes is a contemporary characteristic of the developed world*". Others point out that the decision to adapt or demolish existing buildings needs to consider the impacts on the environment, on the surrounding economy, and on the local communities (Love and Bullen, 2009; Wilkinson et al., 2014).

This thesis extends current adaptation theory by considering the practical realities of adaptation and demolition decisions at the masterplan scale. As existing adaptation theory mainly focuses on individual buildings or the city level, it is not sufficient for explaining decisions on large brownfield sites being redeveloped through the implementation of a masterplan. As identified by the Commission for Architecture and the Built Environment (CABE, 2011): "*[a spatial masterplan] sets out proposals for buildings, spaces, movement strategy and land use in three dimensions and match these proposals to a delivery strategy*".

This chapter sets the scene for this research and begins by examining why there is a push to develop previously developed land in urban centres. Definitions of building adaptation and demolition are provided, followed by an outline of barriers to, and then the benefits of, building retention and adaptation. The added complexity of decisions at the masterplan level are examined, as well as an overview of the decision-making process. The chapter concludes by providing a breakdown of the thesis structure.

1.1 Housing shortages, brownfield sites and urban regeneration

New housing developments are required in urban areas due to increasing populations and trends towards living in the city, which increases demands for housing and commercial space (Watson, 2009). This shift in population is applicable worldwide as the United Nations (UN) predict 68 per cent of the world's population will live in urban areas by 2050. This is a 13 per cent increase from 2018 (United Nations, 2018). As a result, the UN's 'World Urbanization Prospects' report states that many countries will face challenges meeting the demands for housing. For this reason, there is a continued push towards utilising previously developed land, commonly referred to as brownfield sites (Dixon et al., 2008). In the UK, this is evident through the Government's Housing and Planning Act 2016, which proposed the relaxation of planning rules on brownfield sites to encourage redevelopment due to housing shortages (HM Government, 2016).

Brownfield sites vary in scale from individual buildings to large plots of land with multiple buildings. Categories put forward by Dixon et al. (2008) include previously developed land which is now vacant, vacant buildings, derelict land and buildings, land or buildings currently in use and allocated by a planning authority for development, and land or buildings currently in use with redevelopment potential. Previously undeveloped land is referred to as greenfield sites. The redevelopment of brownfield sites is often favoured over the development of greenfield sites as they tend to be located in areas with existing infrastructure and their redevelopment reduces urban sprawl (Dixon et al., 2008.).

In the USA, the redevelopment of brownfield sites is usually linked to contamination, whereas in Europe, the term urban regeneration is often used to describe the redevelopment of larger brownfield sites to reflect their reuse for other purposes, and the sites are not necessarily contaminated (Fonseca and Ramos, 2019). Regeneration is an "*ambiguous term*" (Roberts, 2008, p.24) which began to be used regularly since the 1990s. Previous terms include reconstruction in the 1950s, revitalisation, renewal, and then redevelopment in the subsequent decades (ibid.). Regeneration is considered to have a longer term and more strategic purpose. The 1990s also saw a more integrated approach to redevelopment including economic, environmental, social and cultural improvements (Colantonio and Dixon, 2009). For the purposes of this thesis, urban regeneration is defined as a physical intervention which has physical but also economic, social and environmental outcomes for an area located in a city.

The concept of regeneration is more applicable to larger areas of land rather than individual buildings, with Fonseca and Ramos (2019, p.240) stating "*more that refurbishing or renovating buildings…urban regeneration is seen as being part of the broader planning process…[and] masterplans have been the main vehicle used for addressing urban regeneration polices*". These areas are often abandoned, including former industrial sites, with the availability of industrial vacancy being accelerated due to economic restructuring and deindustrialisation, whilst also being located in 'prime locations' which are desirable for redevelopment (Belláková, 2016; Petković-Grozdanovića et al., 2016). This thesis therefore focuses on three case studies/former industrial sites being regenerated through the implementation of a masterplan by private developers.

1.2 Defining building adaptation and demolition

Demolition is the end of a building's and/or its component's life caused by manmade destruction (Thomsen et al., 2011; Thomsen and Flier, 2009). Building adaptation is defined by Douglas (2006, p.1) as "*any work to a building over and above maintenance to change its capacity, function or performance (i.e. any intervention to adjust, reuse or upgrade a building to suit new conditions or requirements)*".

The decision to adapt or demolish existing buildings is often a response to a building being under-used or out of date, otherwise referred to as obsolete (Hanafi et al., 2018). Obsolescence is caused by a variety of factors associated with a building's physical condition, economic circumstances, function, location and environmental conditions (Thomsen and Flier, 2011). For example, a functionally obsolete building no longer meets the functional requirements of the user and is not considered fit-for-purpose. At a masterplan scale, often industrial sites in urban areas become functionally and economically obsolete as the industrial processes are no longer required due to advancing technology or the processes have been moved to a location where production is cheaper (Chan et al., 2015; Wilson, 2010). Ideally, the vacancy of property at either the individual or masterplan scale, should be avoided due to negative economic impacts for the owner, as well as social impacts including social uncertainty, vandalism and illegal occupancy (Remøy and Van der Voordt, 2006). Intervention strategies to avoid this obsolescence include building adaptation or demolition with a replacement new build (Wilkinson et al., 2014).

When adaptation takes place, the original use of the building can change or remain the same depending on the original property type. Change of use adaptation, also referred to as 'adaptive reuse' involves a change in the function of a building as the original use is no longer economically or socially viable. When the use remains the same, referred to as 'within use' adaptation, as the name suggests, the function of the building remains the same. If the building was used as an office or residential housing, it will continue to be used as an office or housing but the building may be upgraded, for example energy efficiency standards are improved (Wilkinson, 2011).

Different types of adaptation are also affiliated with different levels of intervention. A framework indicating these levels of intervention which are dependent on the risk of obsolescence is presented by Douglas (2006) and is shown in Figure 1-1. Interventions include preservation, conservation, refurbishment, rehabilitation, renovation, remodelling, restoration and demolition. Retrofit is a term which is often used synonymously with refurbishment, which has led to calls for a distinction to be made. For example, through a series of interviews with stakeholders in commercial property, Dixon (2017, p.41) found that retrofit is frequently used to describe a building which is refitted with "*relatively 'light touch' energy efficiency measures*". Refurbishment requires a "*much 'deeper' level of refit*" which includes changes to the building's internal and external fabric. Therefore, there are an array of terms which can be considered as building adaptation. However, the different terms are generally used to describe different levels of change to the building's fabric (Wilkinson et al., 2014).

Different interventions are also closely aligned with the layers of a building. These layers include location, structure, skin, services, space plan and 'stuff'. A model depicting these layers was originally developed by Duffy and Henney (1989), which was later updated by Brand (1994) and has since been regularly cited by several academic papers focusing on building adaptation (Borst, 2014; Douglas, 2006; Gosling et al., 2013; Kelly et al., 2011; Lacovidou and Purnell, 2016; Schmidt III et al., 2010; Wilkinson, 2011). This model is reinterpreted in Figure 1-2, which depicts the layers of the building alongside the different timescales of adaptation which were previously identified by Schmidt III et al. (2010). One example of these varying timescales is that of building services compared to the skin of the building, otherwise known as the façade. The building services, which have a shorter timescale of intervention (7-15 years), are likely to change more regularly than the façade of the building (20 years), and will also be dependent on the property type and use. Meanwhile, the façade of the building has a shorter life span than the structure and can be changed to maintain a building's aesthetics and/or improve energy efficiency (Plevoets and Van Cleempoel, 2011). Depending on the type of obsolescence and the building layer, there are several options for adaptation. These include demolish, strip out and maintain the building shell, maintain the building in a vacant state, part demolish and adapt, part extend (vertically or horizontally), let all or part, and sell the building (Wilkinson, 2011).

Adaptation is therefore a broad term with a variety of meanings and interpretations. For the purposes of this thesis, adaptation is considered to be when an existing building is retained and some form of intervention beyond general maintenance takes place to provide a new function or update/improve a building's existing function. Therefore, this can include 'change of use' or 'within use' adaptation, and all levels of intervention outlined by Douglas (2006), from preservation to restoration. It is recognised that higher levels of intervention will require the demolition of some of the building layers, such as the internal space plan or services. When this thesis discusses the demolition of an existing building, this is considered to be when all of the building layers (excluding location) are fully destroyed.

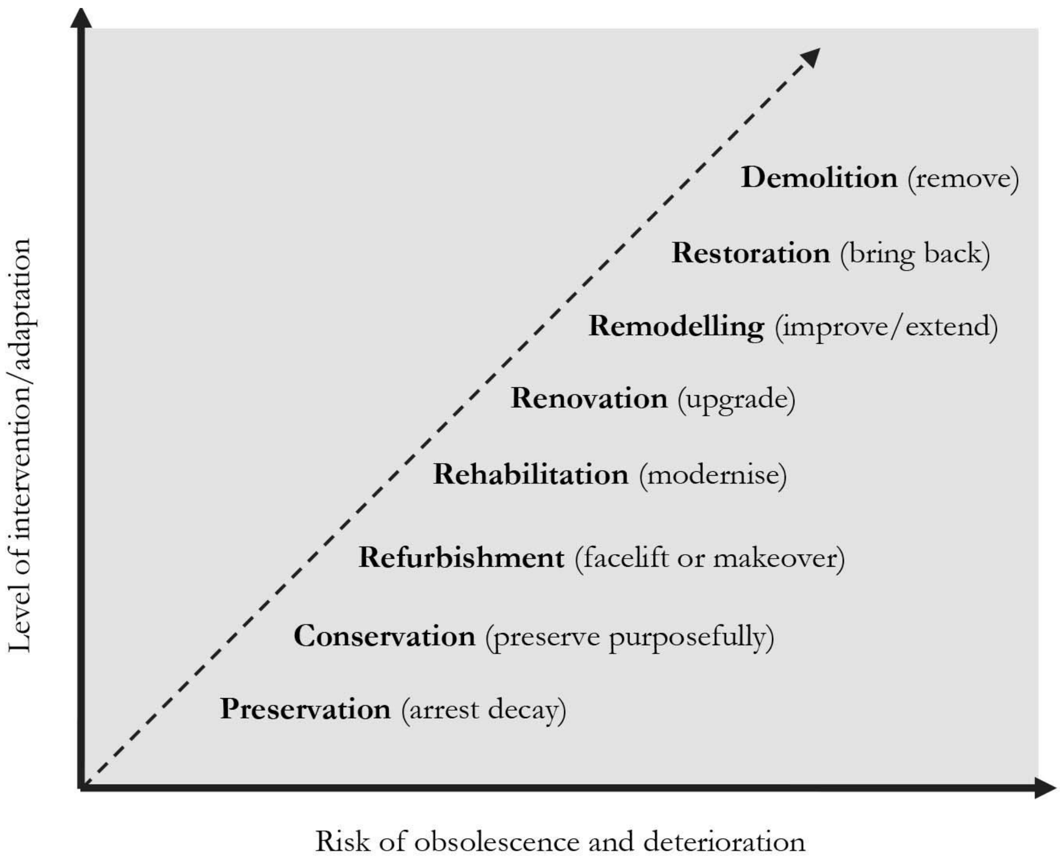

Figure 1-1: 'Level of intervention/adaptation' and 'risk of obsolescence and deterioration'.
Adapted from: Douglas, J. (2006, p.3) *Building Adaptation*, Second Edition, 2 edition. ed. Elsevier, Oxford, UK.

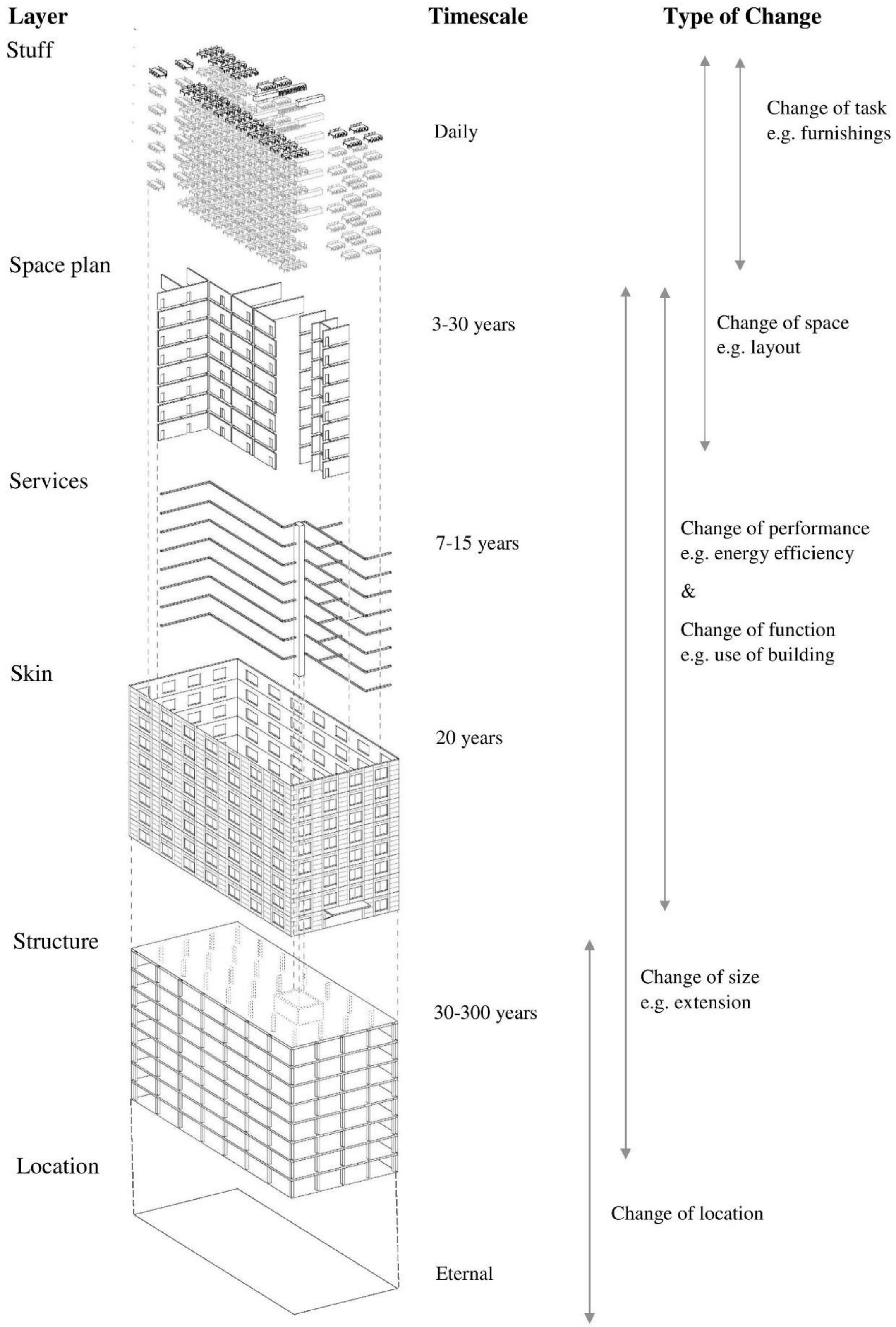

Figure 1-2: An individual building's layers and the associated timescale of adaptation.
Image produced by author, published in: Baker, H. and Moncaster, A. (2018, p.60). 'Adaptation and Demolition in a Masterplan Context'. In: Wilkinson, S., Remøy, H. (eds.) *Building Urban Resilience through Change of Use*. Wiley-Blackwell, pp. 57–81.
Original data sources: Brand, S. (1994). *How Buildings Learn: What Happens After They're Built*. Penguin Publishing Group & Schmidt III, R., Eguchi, T., Austin, S. and Gibb, A. (2010). 'What is the meaning of adaptability in the building industry?' *Presented at the CIB 16th International Conference on Open and Sustainable Building*, Bilbao, Spain, p. 10.

1.3 Barriers to and benefits of building adaptation

A number of barriers to and benefits of adapting buildings, which therefore encourage demolition and rebuild or building adaptation, are commonly claimed. Using the abstracts, introductions and a search for the words: 'benefit', 'advantage', 'disadvantage' and 'barrier', the disadvantages and advantages of building adaptation expressed within forty academic papers has been documented (see Appendix 1). Identified barriers to building adaptation include: building regulations (including heritage restrictions), low energy efficiency standards, new buildings having the potential to increase density and demolition being cheaper/more economically viable. Benefits include conserving heritage, savings in material and therefore embodied energy, the provision of housing in prime locations, cost savings and wider economic benefits.

There is an inconsistency across studies as to whether adaptation or demolition and rebuild is cheaper. As expressed by Yung and Chan (2012, p.353) "*there is still some debate on whether the costs of reusing the buildings are in fact lower than the costs of demolition and reconstruction*". This is due to cost being determined by a variety of factors related to the physical attributes of an individual building. Several studies refer to poor building condition, lack of conformity with building regulations and a lack of functional quality, which all increase the cost of the adaptation strategy relative to the new build alternative (Ball, 2002; Bullen and Love, 2010; Itard and Klunder, 2007; Plevoets and Van Cleempoel, 2011; Remøy and Van der Voordt, 2006; Thomsen and Flier, 2009; Watson, 2009; Wilkinson et al., 2014; Yung and Chan, 2012). However, if a building is in good condition and has good adaptation potential, other studies highlight that construction times are shorter and fewer materials are required which makes the retention project cheaper than demolition and new build (Ball, 2002; Bullen and Love, 2011; Crawford et al., 2014; Plimmer et al., 2008; Power, 2008; Wilkinson, 2011). The physical attributes of individual buildings, as well as economic viability are explored in detail in Chapter 2.

From the benefits, the two most commonly referred to were the conservation of heritage and savings in materials. In terms of heritage conservation, the retention of built heritage can provide a competitive edge to cities especially under the forces of globalisation (Beckhoven and Kempen, 2003). For example, the widespread demolition and replacement of 1960s/70s housing in the UK, has been described as ripping the heart out of some communities (Douglas, 2006), and the construction of monotonous new build developments is frequently criticised due to their single tenure and standard housing types (CABE, 2003) which deny a sense of place and urban identity (Bürklin and Peterek, 2017; Carmona et al., 2012; Metzger et al., 2014; Oktay, 2002). Demolition which leads to the loss of heritage is also commonly associated with community opposition. Power (2008 p.4489) discusses how "*[demolition] provokes community opposition* *among the very people who are supposed to benefit*". Both retaining heritage and reducing community opposition are considered as benefits of building adaptation and the London Assembly (2015) suggest that the demolition of existing homes should always be the last resort.

The reduction of materials is considered advantageous as the embodied energy and greenhouse gas emissions associated with the lifespan of materials are also reduced. Embodied energy and greenhouse gas emissions occur throughout the life of a building. Life-cycle stages include the production of materials, transportation of materials to site, construction on site, replacement and maintenance of materials, and their final demolition and disposal (BSI, 2011a, 2011b). However, studies note that existing buildings may not be as energy efficient as new build and therefore produce more greenhouse gas emissions during the day-to-day running of a building. This is sometimes used as a justification by developers for demolition, as seen by energy efficiency being a barrier to adaptation (Ball, 2002; Gaspar and Santos, 2015; Thomsen and Flier, 2009). To enable an accurate assessment of environmental impact, both the embodied and operational emissions should be considered in adaptation and demolition decisions (Power, 2008). Whole life energy and carbon impacts are important to consider as one of the most critical issues facing the world today is global warming, which has resulted in international efforts to reduce greenhouse gas emissions (IPCC, 2014). Both heritage and whole life energy and carbon are considered in more detail in Chapter 3.

1.4 Decisions at the masterplan level

The majority of previous adaptation and demolition research focuses on individual buildings, rather than larger areas of land containing multiple buildings and being developed as part of a masterplan. Past research includes decision-making toolkits assessing the adaptation potential or suggested intervention for existing buildings which form part of a portfolio of assets (Geraedts and Van der Voordt, 2007; Langston and Smith, 2012). An analysis of these toolkits was conducted by the author for her Master's thesis which preceded this PhD, and was subsequently published in a peer-reviewed journal (Baker, et al. 2017). Using real-life examples of adaptation and demolition decisions, a disparity was found between what the toolkits suggested and the actual decisions made. One of the fundamental reasons for these discrepancies was that the toolkits examined were designed to focus on the adaptability of individual office buildings. The use of the toolkits outside their intended context, on development projects different in both property type and scale, suggests that they cannot be easily transferred to other situations, such as different building uses or on masterplan sites, as other factors need to be considered.

Other research considers the decision to adapt or demolish on a much larger scale by considering the dwelling stock within a city (Crawford et al., 2014; Deakin et al., 2012; Sandberg et al., 2017; Stephan et al., 2013). However, these tend to focus on mass retrofits and energy and carbon impacts by creating scenario models (Power, 2008), which is not adequate for understanding how and why decisions are taken about individual buildings within the context of a masterplan development.

For the purposes of this thesis, the masterplan scale is considered to be situated in-between the whole city and individual building scales. There are a small number of reports from the 'grey literature' that have been identified which focus on adaptation and demolition decisions on social housing estates. The masterplan scale is applicable here as an estates' redevelopment goes beyond the individual building level and has wider economic benefits but is not applicable to an entire city. However, there are limitations in the applicability of estate regeneration to this thesis as they are often public rather than privately-led projects and do not contain former industrial sites. There are also limitations with the literature. These include a report by Crawford et al. (2014) from University College London, which resulted in a policy briefing by Bell et al., (2014). Crawford et al's (2014) findings are based on a review of secondary data from a range of different fields including engineers, energy modellers, planners and public health specialists. Their focus is swayed towards the decision to refurbish buildings to improve environmental performances, rather than comparing the factors that lead to adaptation versus demolition. A report by the London Assembly (2015, p.4) states "*one of the most divisive questions is whether to demolish or refurbish the existing homes*". Examples of decisions made about housing estates are provided within the text but not analysed in detail. Additionally, this report does not include a review of academic literature and the methodology is not clearly outlined. Nevertheless, due to their relevance to the scale of the masterplan, findings from these reports are referred to in the following chapters.

The increased complexity of decision-making at the masterplan level is suggested by the Building Research Establishment's Environmental Assessment Method (BREEAM) for Communities toolkit (BRE, 2012). This sustainability assessment uses multiple criteria to score a large-scale development for social, economic and environmental impacts. One of the criteria within the 'resources and energy' category is 'existing building and infrastructure'. However, there are only two credits out of 118 available for this category (figure 1-3). The number of issues that are analysed indicates that decision-making at the masterplan level is part of a highly complex system, where a variety of factors are considered and balanced alongside one another (Baker and Moncaster, 2018a).

Overall, there is currently limited research focusing on the decision to adapt or demolish existing buildings on larger brownfield sites which are being redeveloped as part of a masterplan design by private developers, as previous studies have focused on the individual building or city scales. The few reports found in this area focus on social housing estates where the buildings on the site are likely to have been built in the same style and at similar times, and been redeveloped as pubic projects. This reflects a significant gap in the literature focusing on adaptation and demolition decisions.

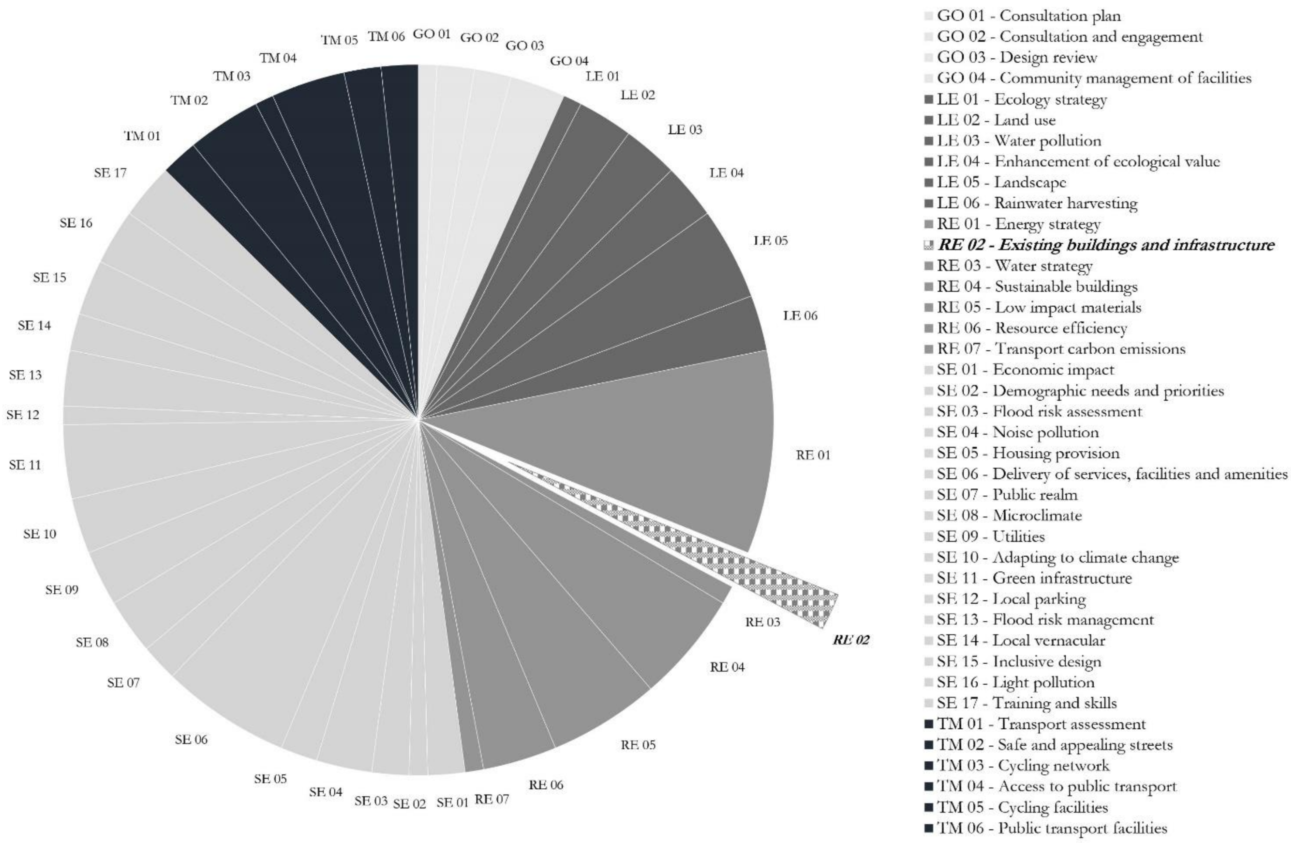

Figure 1-3: BREEAM Communities 2012 assessment. The complexity of decision-making at the masterplan level and issues that need to be considered.
(GO = Governance; SE = Social and economic wellbeing; RE = Resources and energy; LE = Land use and ecology; TM = Transport and movement).
Image produced by author, published in: Baker, H. and Moncaster, A. (2018, p.63). 'Adaptation and Demolition in a Masterplan Context'. In: Wilkinson, S., Remøy, H. (eds.) *Building Urban Resilience through Change of Use*. Wiley-Blackwell, pp. 57–81.
Original data source: BRE. (2012). *BREEAM Communities - Technical Manual* (No. SD202- 1. 1:2012). BRE, Watford, UK.

1.5 Decision-making process for individual buildings and masterplan sites

At an individual building level, Wilkinson (2011, p.223) states "*building adaptation and the associated decision-making process is a complex issue with multiple factors to consider*". Similar notions of complexity are expressed by Bullen (2012, p.37) who states "*the decision-making process associated with the reusing or disposing of built assets was found to be extremely complicated for building owners and operators*".

The adaptation or demolition of a building is an asset management decision (RICS, 2019). There are several documents in the 'grey literature' which indicate that the decision-making process for a development project constitutes of a series of stages. These are said to be useful for a range of stakeholders including project managers and clients to provide reference points. Examples include: the Royal Institute of British

Architects' (RIBA, 2013) Plan of Work, The Chartered Institute of Building (CIOB, 2014) Code of Practice for Project Management for Construction and Development, the Construction Industry Council's (CIC, 2007) Scope of Services (major projects), and the Royal Institution of Chartered Surveyors (RICS, 2009) Practice Standards for Development Management. These frameworks are shown in Figure 1-4.

The terminology used within these frameworks differs from one another as they serve slightly different purposes. For example, the RIBA (2013) plan of work is aimed at the architectural profession and is used as both an architectural project and design management tool. The stages include: strategic definition, preparation and brief, concept design, developed design, technical design, construction, handover and close out, and in use. The RICS (2009) practice standards for development management are targeted towards project management surveyors and only includes the development management stages, which RICS define as "*the emergence of the initial development concept to the commencement of the tendering process for the construction of the works*" (p.2). They acknowledge this does not cover construction and completion which are included in the other frameworks mentioned. For an individual building, the point at which the decision is made to adapt or demolish is generally before construction commences, this research will consider if this differs at the masterplan scale, thus when the decision is made to adapt of demolish existing buildings within the site.

A limitation of presenting the decision-making process as a series of stages is that is appears to be a linear process, whereas in reality, even at the individual building level it has been described as a "*diverse and dynamic*" process (Bullen, 2012, p.35). This is likely to be exacerbated at the masterplan scale due to increased complexity. As described in the BREEAM communities' assessment: "*masterplanning is an iterative process characterised by developing plans, consulting stakeholders and revising plans*" (BRE, 2003, p.3). It is possible there will be overlaps between the different stages presented in Figure 1-4 and the process may go 'back and forth' as the project progresses. Thus, the frameworks presented should only act as guidelines and be open to flexibility.

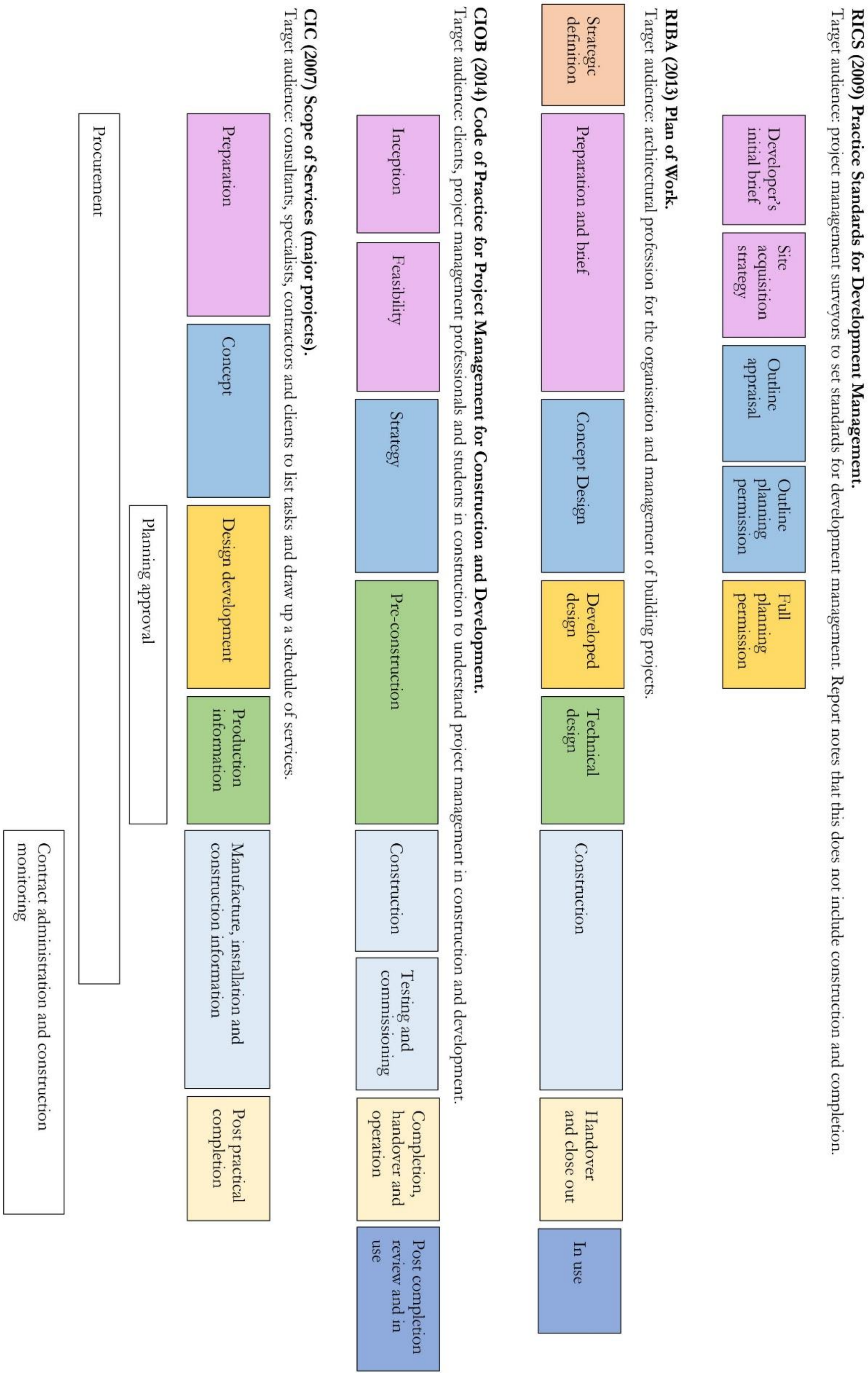

Figure 1-4: Frameworks of design and development management processes.
Data Sources: CIC (2007) *The CIC Scope of Services Handbook* (No. Stock Code 61444). RIBA, London, UK.
CIOB (2014) *Code of Practice for Project Management for Construction and Development*, 5th ed. Wiley-Blackwell, Bracknell, UK.
RIBA (2013) *RIBA Plan of Work 2013 - Overview* (No. ISBN 978 1 85946 519 6). Royal Institute of British Architects, London, UK.
RICS (2009) *RICS Practice Standards, UK. Development management.* (No. ISBN 981 1 84219 500 0). Royal Institution of Chartered Surveyors, Coventry, UK.

1.6 Research aims, questions and thesis structure

The overarching aim of this thesis is to explore and understand what is considered during the decision to adapt or demolish existing buildings on masterplan sites containing former industrial areas, and why this is so. This research contributes to the academic literature by exploring adaptation and demolition in a new context, large brownfield areas rather than the individual building level or city scale. As well as this, the focus on former industrial areas is topical as industrial processes continue to move out of cities and people continue to move into urban areas.

To address this aim, the first research question asks:

1) What is considered in the decision to adapt or demolish existing buildings on masterplan sites?

Since both the retention of heritage, and savings in whole life energy and carbon, are commonly cited in the literature as benefits of building adaptation (section 1.3), the research also asks:

2) Are heritage values and whole life energy and carbon considerations taken into account in practice when decisions are made to adapt or demolish existing buildings on masterplan sites?

As a subsidiary question to these first two questions, the thesis considers:

3) Are there underlying reasons governing the consideration of different factors, including heritage and whole life energy and carbon, when deciding to adapt or demolish existing buildings on masterplan sites?

Additionally, as there is little pre-existing literature on the topic, Saunders (2015, p.149) suggests that "*it may be more appropriate to work inductively…reflecting upon what theoretical themes the data are suggesting*". Therefore, the fourth research question asks:

4) What theoretical framing can be used to explain these findings and develop previous adaptation and demolition theory?

This thesis consists of nine chapters which construct a narrative in order to answer these four questions. Figure 1-5 outlines these chapters alongside a brief explanation of their purpose.

The academic literature on decision-making criteria applicable to adaptation and demolition is reviewed in Chapter 2. Chapter 3 is structured in two halves and includes a review of heritage retention, followed by a review of savings in whole life energy and carbon in the context of adaptation versus reuse decisions.

These are regularly referred to as benefits of retention, yet in the context of adaptation and demolition decisions, their theoretical underpinnings are rarely discussed in detail. This detailed review aims to shed additional light on whether and why these two issues might be considered in practice.

The research design and methods are outlined in Chapter 4. This is followed by three analysis chapters. Building characteristics and additional considerations required at the masterplan scale are discussed in Chapter 5. Chapter 6 considers in what circumstances the two arguments regularly given in favour of adaptation in the academic literature are considered in practice. The third analysis chapter, Chapter 7, considers the reason different factors govern decisions in different contexts. Chapter 8 explains the findings using the theoretical underpinnings of urban development. The thesis concludes in Chapter 9 by providing answers to each of the research questions and a series of recommendations for stakeholders, including policy-makers, planning officers and developers. This is followed by a discussion of the research's limitations and suggestions for further work.

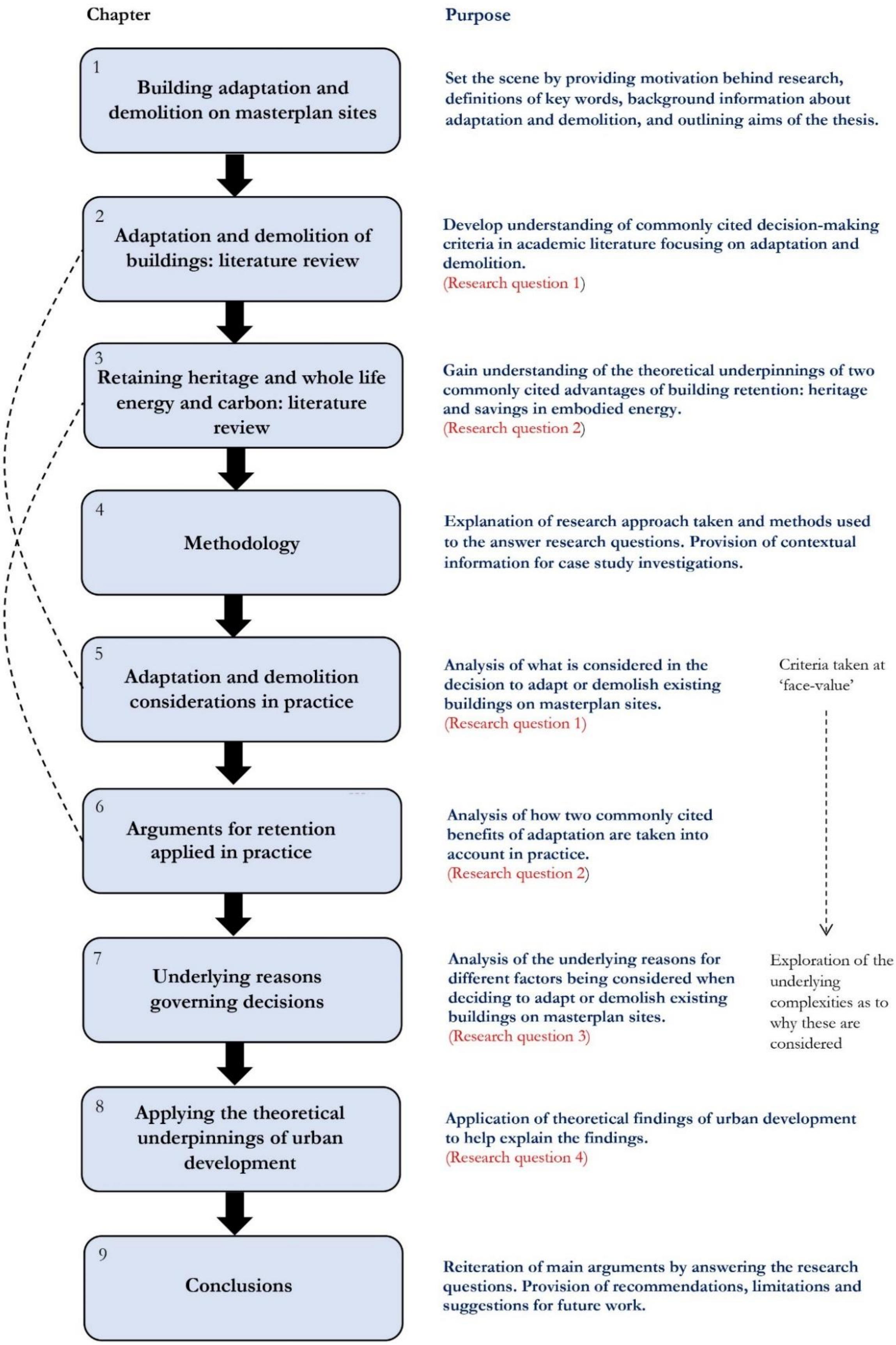

Figure 1-5: Thesis structure.

CHAPTER 2:

Adaptation and demolition considerations: literature review

At an individual building level, the decision-making criteria which affect the decision to adapt or demolish an existing building have been examined in detail by previous academic studies. Both qualitative and quantitative methods have been used. Prevailing qualitative methods involve literature reviews, document analyses and interviews (Bullen and Love, 2011; Chen et al., 2015; LianPing et al., 2014; Mısırlısoy and Günçe, 2016). Quantitative assessments include the assessment of building or demolition permits to identify common features between buildings which have previously been adapted or demolished (Weber et al., 2006; Wilkinson, 2011). Quantitative assessments help to provide a numerical evidence base, particularly for the physical characteristics of a building (Wilkinson, 2011). Justifications for qualitative methods include the ability to consider the context, such as policy issues and socio-cultural aspects, which are difficult to assess quantitatively due to their subjectivity (Mısırlısoy and Günçe, 2016).

This chapter discusses these decision-making criteria. These include criteria related to an individual building's physical attributes which often affect the construction costs and therefore economic viability. Other criteria consider factors beyond the individual building level including location, land use planning and social factors. This is followed by a discussion about how important criteria are relative to one another, which has been determined through various weighting mechanisms. The chapter concludes by discussing the main findings and outlining what is considered in adaptation and demolition decisions by previous academic studies.

2.1 Individual buildings' physical attributes

The physical attributes of an individual building affect the technical complexity and feasibility of adaptation, and therefore cost of a project. These criteria include a building's condition, structure, layout and dimensions, previous/future function, and applicable building regulations. These are criteria which are commonly cited in the academic literature and can also be broken down into more specific factors related to these themes, as depicted by Table 2-1. The countries of the study and the existing property type are also indicated. From the studies included, developed nations are well represented. However, there is a skew in focus towards residential and commercial properties rather than industrial. When applicable, the property type is discussed further in the following text which examines the consideration of these factors in the decision to adapt or demolish existing buildings.

Table 2-1: Building's physical attributes – commonly cited decision-making criteria.

Physical attribute	Sub-category	References	Countries of study	Existing property type: Residential	Commercial	Industrial
Building condition	**Damp**	Brennan and Tomback (2013); Geraedts and Van der Voordt (2007); Harun (2011); Lin and Low (2012); Plevoets and Van Cleempoel (2011)	Netherlands, Malaysia, UK & Singapore	x	x	
	Contamination of materials	Brennan and Tomback (2013); Bullen and Love (2011) Wilkinson (2011)	Australia & UK		x	
Building function	**Acoustics**	Brennan and Tomback (2013); Geraedts and Van der Voordt (2007); Plevoets and Van Cleempoel (2011)	Netherlands & UK	x	x	
	Comfortability	Geraedts and Van der Voordt (2007); Kutut et al. (2014); Langston (2013); Lin and Low (2012); Palmer et al. (2003); Plevoets and Van Cleempoel (2011)	Australia, Lithuania, Netherlands, Singapore & UK	x	x	
	Fitness-for-purpose & finding a use	Borst (2014); Bullen (2007); Geraedts and Van der Voordt (2007); Lin and Low (2012); Palmer et al. (2003); Plimmer et al. (2008); Thomsen and Flier (2009); Watson (2009); Wilkinson (2011).	Australia, Netherlands, Singapore & UK	x	x	
	Quality of interior spaces	Langston and Smith (2012); Thomsen and Flier (2009)	Australia & Netherlands	x	x	
	Security	Bullen and Love (2011); Geraedts and Van der Voordt (2007); Heath (2001); Langston (2013)	Australia, Canada, Netherlands & UK	x	x	
	Specialist spaces & up-to-date technology	Bullen and Love (2011); Clark (2001)	Australia & Europe		x	x
Building regulations	**Fire regulations**	Davison et al. (2006); Drury and McPherson (2015); Geraedts and Van der Voordt (2007); Heath (2001); Lin and Low (2012); Natividade-Jesus et al. (2013); Plevoets and Van Cleempoel (2011); Wilkinson (2011).	Australia, Canada, Netherlands, Portugal, Singapore & UK	x	x	
Building services	**Condition of services**	Brennan and Tomback (2013); Bullen and Love (2011)	Australia & UK	x	x	
	Service provision	Geraedts and Van der Voordt (2007); Lin and Low (2012)	Netherlands & Singapore	x	x	
Building structure	**Date of construction and methods**	Clark (2001); Geraedts and Van der Voordt (2007); Lin and Low (2012); Plimmer et al. (2008); Weber et al. (2006); Wilkinson (2011)	Australia, Europe, Singapore & USA	x	x	x
	Durability	Lin and Low (2012); London Assembly (2015)	Singapore & UK	x		
	Load-bearing capacity	Brennan and Tomback (2013); Plevoets and Van Cleempoel (2011); Wilkinson (2011)	Australia & UK		x	
	Material	Harun (2011); Plimmer et al. (2008)	Malaysia & UK	x		
	Stability	Bullen and Love (2011); Geraedts and Van der Voordt (2007); Kim et al. (2010); London Assembly (2015); Wilkinson (2011)	Australia Netherlands, Republic of Korea & UK	x	x	

Table continues…

Layout and dimensions	**Building depth**	Clark (2001); Davison et al. (2006); Geraedts and Van der Voordt (2007); Heath (2001); Lin and Low (2012)	Canada, Europe & Singapore	x	x	x
	Building height	Been et al. (2016); Bullen and Love (2011); Heath (2001); Lin and Low (2012); Wilkinson (2011)	Australia, Canada, UK & USA	x	x	
	Disabled access	Brennan and Tomback (2013); Bullen and Love (2011); Davison et al. (2006); Geraedts and Van der Voordt (2007); Heath (2001)	Australia, Canada, Netherlands & UK	x		
	Floor area	Heath (2001); Plimmer et al. (2008); Weber et al. (2006); Wilkinson (2011)	Australia, Canada, UK & USA	x	x	
	Floor-to-ceiling heights	Brennan and Tomback (2013); Davison et al. (2006); Geraedts and Van der Voordt (2007); Wilkinson (2011)	Australia, Netherlands & UK	x	x	
	Possibility of extension	Brennan and Tomback (2013); Geraedts and Van der Voordt (2007); Wilkinson (2011)	Australia, Netherlands & UK		x	
	Space layout/flexibility	Borst (2014); Bullen and Love (2011); Clark (2001); Heath (2001); Langston and Smith (2012); Lin and Low (2012); Plimmer et al. (2008); Wilkinson (2011)	Australia, Canada, Europe & Singapore	x	x	x

2.1.1 Individual buildings' condition

Poor building condition is a common driver towards building demolition, due to the increased costs of the retention strategies compared to demolition and new build (Ball, 2002; Clark, 2001; Dutta and Husain, 2009; Kutut et al., 2014; Langston and Smith, 2012; Power, 2008; Van der Flier and Thomsen, 2006; Watson, 2009; Wilkinson, 2011; Yung and Chan, 2012). As put by Wilkinson (2011,p.41) "*the building's physical condition has a critical impact on viability*". Therefore, if a building is in good condition, it can be a driver towards adaptation. For example, a study of 450 former industrial buildings showed that a higher percentage of buildings that were reused compared to those that remained vacant were in good condition (Ball, 2002). However, in the same study, there were also vacant industrial buildings that were in good condition and not reused, indicating that other factors are also taken account in adaptation and demolition decisions.

Several studies discuss poor condition being a driver towards demolition, however few actually define what poor condition is and the assessment is reliant on the judgment of the assessor. For example, in the Transformation Meter, a toolkit examining the adaptation potential of former office buildings for conversion to residential, the assessor has to answer yes or no to whether or not the "*building [is] poorly maintained/looks in poor condition*" (Geraedts and Van der Voordt, 2007, p.10). IconCUR, a different toolkit also focusing on former office buildings, asks the toolkit's users to provide a score from one to five (low-high) of the building's design standard, maintained service level, and regulatory compliance for the structure, exterior envelope, interior finishes/fit out, engineering services, and external works (Langston and Smith, 2012). In these instances, the toolkit user, will use their expertise to make an assessment as to what constitutes as 'poor condition' or what scores for the different elements are applicable. Although the interpretation of what 'poor condition' is dependent on the assessor, the cost of overcoming the problems identified is generally what is considered in adaptation and demolition decisions. If the capital expenditure for retention is higher than the demolition and new build alternative, existing studies argue it will commonly act as a driver towards demolition (Ball, 2002; Picco et al., 2012).

There are a number of factors that affect the condition of an individual building. Defects can affect the different building layers (Chapter 1) with structural problems being more significant than surface ones (Watson, 2009). Common issues identified in structural surveys include damp, poor workmanship and vandalism (IStructE, 2008). Problems can also be specific to different construction types. For example, masonry buildings may be vulnerable to bulging walls from overloading, damaged lintels, and weathered bricks and mortar, whilst concrete frame buildings may have spalling concrete (concrete falling away and exposing the reinforcement bars) and cracks in beams and columns. In timber buildings, common problems include wet rot, timber floor deflection, splits and knots. Additionally, the contamination of materials is frequently referred to in the context of building condition (Brennan and Tomback, 2013; Bullen and Love, 2011; Wilkinson, 2011). Asbestos presents a challenge as there are often complications removing it without compromising the rest of the building's structure (Wilkinson, 2011).

The risk of uncovering problems with the condition of an existing building, which were not identified during initial inspections are commonly referred to and is applicable to all property types (Bullen and Love, 2010; LianPing et al., 2014; Picco et al., 2012; Remøy and Van der Voordt, 2006; Tan et al., 2018; Watson, 2009; Wilkinson, 2011; Yung and Chan, 2012). These are often called 'latent defects' and are the reason why refurbishment projects are frequently perceived as more risky than new build. If additional problems are identified after the initial condition and feasibility investigations, the construction costs are likely to increase beyond the original predictions. Additionally, existing buildings do not always correspond with building records, or there may be a lack of drawings, which creates difficulties when undertaking the initial building appraisal (Remøy and Van der Voordt, 2006; Sheth, 2011).

The perception of risk is determined by people's previous experience adapting existing buildings. This was demonstrated in Plimmer et al's (2008) survey where respondents who worked on new build only, perceived high construction costs as significantly more of a barrier than those who only worked on refurbishment projects. Hence why previous studies argue that this risk is better managed by people with experience working with existing buildings (Bell et al., 2014; Ireland and Koerth, 2012; IStructE, 2010).

2.1.2 Individual buildings' structure

The structure of an existing building, its layout and dimensions are also considered in adaptation decisions and will often vary depending on the former use of a building. Chapter 1 discussed how the structure of a building has a longer lifespan than the other layers such as the skin, services and space plan. If the building's structure can be reused, existing studies indicate that there are likely to be cost savings in comparison to demolition and new build (Laefer and Manke, 2008; Wilkinson, 2011). There are a number of factors related to the structure which influence its adaptation potential. These include floor spans/structural grids, construction materials and floor-to-ceiling heights (Clark, 2001; Geraedts and Van der Voordt, 2007; Heath, 2001; Lin and Low, 2012; Plimmer et al., 2008; Wilkinson, 2011).

Columnar structures in both former commercial and industrial buildings have been identified as favourable to load-bearing walls as they are better enablers to adaptability due to the flexibility of the internal space (Clark, 2001; Wilkinson, 2011). The degree of this flexibility is determined by the size of the structural grid. In the Transformation Meter, if the size of the structural grid (distance between columns) in the former office building is less than 3.6m, Remøy and Van der Voordt (2006) note that the flexibility becomes constrained. However, not all studies have found frame structures to be drivers towards adaptation. Following a review of demolition permits in Chicago, frame structures were established to be more prone to demolition due to lower demolition costs compared to load-bearing masonry buildings (Weber et al., 2006). Reasons for the different findings might be due to the different foci of the studies. Weber et al. (2006) focused on existing residential buildings, whilst Wilkinson (2011) assessed vacant office buildings and Clark (2001) researched industrial premises. Additionally, Weber et al. (2006) does not define whether these frames were concrete, timber or steel, which is likely to influence the results.

The construction material is another factor considered in adaptation and demolition decisions. Wilkinson, (2011) discusses how concrete frames are more difficult to cut into than steel, which can increase the complexity and cost of the project. Other studies indicate that thick concrete floor plates can be a constraint as they make it more complicated and expensive to install services such as plumbing. However, the benefit of these is that they have a high load-bearing capacity (Plevoets and Van Cleempoel, 2011).

A combination of large floor spans, high ceilings and strong load bearing capacity of industrial buildings can act as drivers towards adaptation as they increase the flexibility of internal spaces (Chan et al., 2015; Tan et al., 2018; Wilson, 2010). However, other studies indicate that if the span of the former industrial building is too large, which creates deep floor plans, conversion will then become more difficult due to the lack of natural lighting that can reach the middle of the building. In these situations, additional interventions such as light wells or an atrium might be needed, which adds to the construction costs (Petković-Grozdanovića et al., 2016). The impact of deep floor plans is also linked to other requirements which are set out by building regulations. For example, deep floor plans affect the location and distance to structural cores. The means of escape from a building are dependent on these, and is therefore considered when assessing a building's conformity to fire regulations (Kee, 2014; LianPing et al., 2014).

The former use of a building can be highly functionally specific, this is particularly applicable to former industrial buildings For instance, Giuliani et al's (2018) found grain silos to have an 'unfavourable morphology' due to their structural configuration, whilst Tan et al. (2018) notes that the façades of industrial buildings will not always have windows which will make conversion to functions such as residential difficult due to lighting regulations. If substantive changes are required for a building to meet current regulations, which can be caused by deep floor plans or structural configurations specific to a former use, buildings might not be upgraded due to higher costs and longer construction times. In these instances it is likely demolition will be favoured if only assessing the building's physical attributes (Iacovidou and Purnell, 2016).

Low floor-to-ceiling heights is another factor commonly cited as being a driver towards demolition for different property types (Brennan and Tomback, 2013; Geraedts and Van der Voordt, 2007; Wilkinson, 2011). This is linked to the service requirements of a building which need to be updated to ensure that it is fit-for-purpose (Watson, 2009). Even if a building is in good condition, the services may be outdated and intervention will be required (Hanafi et al., 2018). To implement modern day services, suspended ceilings are often required to hide ductwork, wiring and pipes (Blagojević and Tufegdžić, 2016; LianPing et al., 2014). In a study focusing on the refurbishment of healthcare facilities, one interviewee was quoted saying:

> "*with existing buildings it is difficult to achieve 4800mm floor-to-floor height, including 1200mm in false ceiling for ancillary services (as per modern regulations), thus the preferred option is new construction.*" (Sheth, 2011, p.156)

However, there are instances where the services can be located on the outside of a building to overcome the constraint of low floor-to-ceiling heights. This was the case for Fort Dunlop in Birmingham, UK, which was a former tyre factory converted to offices (Baker, 2015; Baker et al., 2017). However, this type of intervention can be costly.

2.1.3 Individual buildings' proposed function

The structure, services, layout and dimensions of an existing building are all considered in adaptation and demolition decisions due to their influence on the proposed function of the building and whether or not it will be fit-for-purpose (Borst, 2014; Bullen, 2007; Geraedts and Van der Voordt, 2007; Palmer et al., 2003; Plimmer et al., 2008; Thomsen and Flier, 2009; Watson, 2009; Wilkinson, 2011). As conveyed by Wilkinson et al. (2014, p.130) "*the building can be seen as a frame, or bookshelf, and possible functions or activities are seen as books*". If a function cannot be found for an existing building, it acts as a driver towards demolition. Hanafi et al. (2018, p.266) states: "*a primary reason for the disposal of a building is because it does not meet the immediate needs of owners and their occupiers*".

Some functions may be more difficult to accommodate than others depending on the needs of the users. For instance, hotels have been described as more complex than residential units as 'back of house' activities and additional services may be required (LianPing et al., 2014). Different target groups will also have different aspirations for a building's use. A survey of 343 professionals from a range of backgrounds including house builders, architects and housing associations showed that one of the top three criteria in favour of demolition is the desire for modern, open-plan layouts, which are often (but not always) favoured by larger companies (Plimmer et al., 2008). Whereas, a study completed by the Heritage Lottery Fund (2013, p.7) assessing the distribution of different types of businesses in listed[1] and non-listed buildings in the UK found that listed buildings are more likely to be occupied by independent non-branded businesses, start-up companies and creative industries as the buildings gives them "*a sense of distinctiveness, authenticity, and diversity*". Therefore, existing studies have shown a building's proposed function is dependent on the building's structure, layout and dimensions, and services, as well as the future occupier's needs.

2.2 Economic viability for individual buildings and larger urban developments

Construction costs, profit margins, land values, sales income, brand value, operational and maintenance costs (table 2-2) are all considered when making adaptation and demolition decisions as they affect the economic viability of a building project (Crawford et al., 2014; Plimmer et al., 2008). Several studies emphasise that the economics are often the driving force behind decisions and refer to corporate objectives (Bullen, 2007; Dutta and Husain, 2009; Kim et al., 2010; Langston, 2011; Van der Flier and Thomsen, 2006; Wilkinson, 2011; Yung and Chan, 2012). Hanafi et al. (2018, p.266) state that "*the language of developers is economics*", and in another study where stakeholders were interviewed about adaptation and demolition decisions, the authors found that:

> "*Fundamentally, the decision to reuse or demolish built assets were driven by economic considerations (i.e. development costs, project costs, investment returns and market) and a desire for short-term profits.*" (Bullen and Love, 2011, p.38)

Tax implications can be a driver to adaptation but also a barrier (Chen et al., 2015; Tan et al., 2018). An example of a driver was identified in Baker et al's (2017) study where the incentive behind converting a

[1] Listings, also known as designations, refers to when buildings are protected from change by planning policy.

vacant office building to a hotel was the Building Premises Renovation Allowance (BPRA). This provided the building owners with a 100 per cent tax allowance on the costs incurred during the adaptation process (HM Revenue & Customs, 2014), thus was a driver towards adaptation. A barrier to retention, in the UK, is VAT as this is often charged at 20 per cent for in-use adaptation, whereas new homes are not subject to this[2] (Plimmer et al., 2008). Consequently, the London Assembly's (2015, p.9) report on housing and estate refurbishment calls for a deduction in this VAT disparity arguing for a *"more level playing field between refurbishment and demolition as regeneration alternatives*". The Listed Property Owner's Club (2018) have launched a national petition to reduce VAT on listed buildings to five per cent for repairs and approved alterations. Although these are taxes relevant to the UK, and tax incentives will differ between countries, it indicates that tax implications can either act as a driver or barrier to adaptation depending on the policy.

Profit margins and sales income are affected by a building's floor area. At an individual building level, if an existing building has lower floor areas than the proposed replacement new build, the predicted revenue is likely to be lower (LianPing et al., 2014; Pavlovskis et al., 2017). The amount of space a building occupies within a plot of land is referred to as the building to plot ratio. The higher the building to plot ratio, the higher the density of that development and potentially higher profits (Wilkinson, 2011). However, other studies note this needs to be balanced against the desirability of the site which is determined by the building having enough space for external open space, natural lighting, ventilation and parking (Bell et al., 2014; London Assembly, 2015; Petković-Grozdanovića et al., 2016).

The total floor area of a building is also affected by its height which generally determines the number of floors. Often the higher the building, the more floors there are and consequently larger total floor areas. One framework which focuses on historic housing districts, thus the larger scale applicable to masterplan developments, evaluates whether a development will be profitable by assessing the amenity values, associated with heritage and building heights (Been et al., 2016). The framework suggests that if existing buildings are tall, demolition and rebuild is not profitable as the floor area/density is already in place. If the area consists of low-rise buildings with poor amenity value, the whole area should be redeveloped as one project (rather than piecemeal development) to ensure it is profitable. Additionally, in the context of social housing estates, both Power (2008) and the London Assembly (2015) suggest that if land values are high but the land is not well utilised, developers often use this as an argument to demolish existing buildings and

[2] A VAT refund can be applied for on building materials and services if building a new home, converting a property into a home, building a non-profit communal residence e.g. a hospice, or building a property for a charity (HM Government, 2019a).

develop them at a higher density, indicating that land values affect the proposed density and therefore adaptation and demolition decisions.

Table 2-2: Factors affecting economic viability – commonly cited decision-making criteria.

Economic viability factor	Sub-category	References	Countries of study	Existing property types: Residential	Commercial	Industrial
Capital costs	**Construction costs**	Ball (2002); Lin and Low (2012); London Assembly (2015); Palmer et al. (2003); Plimmer et al. (2008); Wilkinson (2011); Yung and Chan (2012)	Australia, Hong Kong, Singapore & UK	x	x	x
	Funding opportunities	Geraedts and Van der Voordt (2007); Heath (2001); Kutut et al. (2014); London Assembly (2015)	Canada, Lithuania, Netherlands & UK	x	x	
	Land value	Plimmer et al. (2008); Thomsen and Flier (2009)	Netherlands & UK	x		
	Tax incentives/disincentives	Bullen (2007); Heath (2001); Plimmer et al. (2008); Yung and Chan (2012)	Australia, Canada. Hong Kong & UK	x	x	
Wider economic impacts/factors	**Development trends in area**	Bullen (2007); Geraedts and Van der Voordt, (2007); Heath (2001); Langston (2013); Plimmer et al. (2008); Thomsen and Flier (2009)	Australia, Canada, Netherlands & UK	x	x	
	Reputation/competitiveness of area	Geraedts and Van der Voordt (2007); London Assembly (2015); Plimmer et al. (2008); Wilkinson (2011)	Australia, Netherlands & UK	x	x	
	Wider economic benefits	Kutut et al. (2014); Yung and Chan (2012)	Lithuania & Hong Kong			
Operational & maintenance costs	**Maintenance costs**	Bullen and Love (2011); Lin and Low (2012); London Assembly (2015)	Australia, Singapore & UK	x	x	
	Operational costs	Bullen and Love (2010); Langston (2013); Lin and Low (2012)	Australia & Singapore	x	x	
Revenue & income	**Profit and returns**	Bullen and Love (2011); Langston (2013); Lin and Low (2012); Plimmer et al. (2008); Wilkinson (2011)	Australia, Singapore & UK	x	x	
	Rental values	Lin and Low (2012); Thomsen and Flier (2009); Wilkinson (2011)	Australia, Netherlands & Singapore	x	x	
	Target market	Geraedts and Van der Voordt (2007); Heath, (2001); Van der Flier and Thomsen (2006)	Canada, Netherlands & UK	x	x	

2.3 Factors beyond the individual building level

The adaptation potential of a building is not only dependent on the building itself, but also external factors beyond the individual building (Rockow et al., 2018; Thomsen and Flier, 2011). These include locational, land use planning and social factors.

2.3.1 Locational factors

The location of an individual building is considered in adaptation decisions due to the impact decision-making criteria related to a geographic area can have on the real estate market (Wilson, 2010). Although a building could be deconstructed and moved from one location to another, this is rare (Kelly et al., 2011). Accessibility to services and facilities, parking, as well as transportation networks were the most commonly cited as locational factors affecting decisions to invest in adaptation (Ball, 2002; Borst, 2014; Bullen, 2007; Dutta and Husain, 2009; Geraedts and Van der Voordt, 2007; Heath, 2001; Kutut et al., 2014; Langston, 2013; Wilkinson, 2011; Yildirim, 2012; Yung and Chan, 2012). Other locational factors include the quality of the environment, safety and security, and use of neighbouring buildings (Heath, 2001).

There are examples where buildings have been adapted despite having unfavourable locational characteristics. Ball (2002, p.100) found that canal-side premises are sometimes in difficult locations in terms of access to services but they have a "*distinct attractiveness*". In these instances, he found that the accessibility of the site in "*crude distance terms*" had little or no direct influence over adaptation decisions. This emphasises that locational factors cannot just be thought about as distance to amenities, as subjective aspects such as attractiveness are also influential in the adaptation and demolition decisions.

Studies referred to which consider locational characteristics tend to focus on the decision to invest in adaptation rather than comparing adaptation and demolition options. It is likely that these locational factors will also affect the general desire to make an investment in an area, thus will also impact the decision to demolish a building and replace with new build. If neither option is desirable, the building may just remain vacant. At an individual building level, these locational characteristics are more difficult to change, as they are outside the control of the decision-makers (Thomsen and Flier, 2011; Van der Flier and Thomsen, 2006). It is likely this is why they have such a strong influence on investment decisions, which is shown by locational criteria having a higher weighting for consideration than individual building criteria in decision-making toolkits, such as the Transformation Meter (Geraedts and Van der Voordt, 2007).

2.3.2 Land use planning

The location of a building is linked to what planning policies are relevant which can affect adaptation and demolition decisions (Ball, 2002; Burby et al., 2006; Galvan, 2006; Gann and Barlow, 1996; Heath, 2001;

Kee, 2014; Kersting, 2006; Plimmer et al., 2008; Shipley et al., 2006; Snyder, 2005; Wilkinson, 2011). As stated by Tallon (2013, p.4) "*at a basic level, policy is a course of action adopted and pursued by government; it is an approach, method, practice and code of conduct*".

In the UK, planning policy is designed to be implemented by local authorities and communities in adherence to national planning policy. Due to the Town and Country Planning Act 1947, which nationalised development rights, land owners lost the right to develop their land without obtaining the relevant planning permission from local councils (Historic England, 2019a). Planning permission is now often required for many development projects and proposals should be in accordance with local policy which often includes a land use plan setting out the parameters for development, including the height of buildings and uses.

There are also policies specific to existing buildings within planning legislation. In the UK, this is the Planning (Listed and Conservation Areas) Act 1990. If a building is protected by a heritage listing, further planning permission will need to be sought for intervention to take place or to demolish it, thus is a common reason that buildings are retained (Wilkinson, 2011). Planning policies differ between countries due to political, legal and administrative traditions (Gurran et al., 2014). For this reason, a detailed explanation of the relevant planning policies for the case study sites examined in this research is provided later in the thesis.

There can also be policy which encourages the adaptation of individual buildings by relaxing planning restrictions. In Baker et al's (2017) analysis of previous toolkits, a driver towards the retention of a vacant office building which was converted to residential units was a policy called the General Permitted Development Order 2013. This allowed the underused office building to be converted to residential dwellings without the need for full planning permission, which reduced the timescale required for planning approval (HM Government, 2015). Thus, government support and planning policies influence development possibilities and what is allowed and/or encouraged in terms of adaptation or demolition (Remøy and Van der Voordt, 2006).

The time at which planning permission is obtained can also vary and is dependent on the nature of the planning application. Several frameworks of the development management process were discussed in Chapter 1. In RICS (2009) Practice Standards for Development Management, there is both outline planning permission and full planning permission. In the UK, for outline planning, the initial application sets out the parameters for development rather than a detailed plan and fewer details are provided as these are agreed with reserved maters at a later stage and is the equivalent to full planning permission. These matters include the appearance, means of access, landscaping, and layout of individual buildings within a masterplan (Planning Portal, 2019). For an individual building within a masterplan development reserved matters may be applied for once construction elsewhere on the site has already begun. Whereas, for an individual building in isolation, the initial planning application is likely to be the detailed design as the project is of a smaller scale.

2.3.3 Social implications

Adaptation and demolition decisions also have social implications at both the individual building and masterplan scales. These include the well-being of a community that is affected by these decisions (Crawford et al., 2014). Hence, Bell et al. (2014, p.1) recommend that "*social factors and well-being indicators should be incorporated into decision-making*". These well-being factors include the health of occupants living in social housing. At the individual building level, they argue that refurbishment is required to overcome issues brought about by poor air quality and energy standards. Beyond the individual building level, they also discuss issues with the broader social and behavioural environment including overcrowding, sleep deprivation and issues linked to the locational surroundings including infrastructure deprivation, neighbourhood safety and social cohesion.

At the larger masterplan scale, to overcome negative social impacts of urban regeneration, public participation in decision-making is considered to be key in the reports focusing on social housing estates (Bell et al., 2014; Crawford et al., 2014; London Assembly, 2015). One of the main messages put forward by the London Assembly (2015) is that there needs to be clarity with the public about what the main drivers behind estate regeneration are. The report recognises that there will always be winners and losers, and that there needs to be an understanding by the public that new housing, requiring the demolition of existing buildings, is needed for growth. An issue they highlighted with this is: "*the trade-offs associated with demolishing council homes to build a greater quantity of more expensive homes are seen by some as realism, and others as social cleansing*" (London Assembly, 2015, p.4). This is reiterated by Van der Flier and Thomsen (2006) who suggest there may be secret agendas including the disposal of unwanted tenants in the redevelopment of Dutch social housing estates. Often the social decline in an area is used to justify large-scale regeneration through demolition and rebuild: "*an extremely rundown area seems a lot easier to demolish than to renovate*", which may require existing tenants to move (Power, 2008, p.4489). As the focus of this PhD is on former industrial sites, issues specific to social housing estates, such as the re-location of residents are unlikely to be as relevant. However, social impacts do form a key part of urban regeneration and are still important to consider as masterplan developments may have social impacts within and beyond the curtilage of the site.

2.4 Weighting decision-making criteria

Decision-making criteria are unlikely to be considered equally in the decision to adapt or demolish existing buildings at both an individual building level and for buildings within a larger masterplan development. As Crawford et al. (2014, p.6) said: "*decisions to demolish or refurbish buildings are rarely clear cut, and will invariably involve trade-offs between different objectives and values*". There are several academic studies that have assessed the importance of decision-making criteria for individual buildings relative to one another by assigning them with weightings, examples are provided in Table 2-3. These studies use different methods to weight criteria in terms of their importance. These include pairwise comparison techniques, including the Analytical Hierarchy Process (AHP), which is when two criteria are compared against one another (Kim et al., 2010; Kutut et al., 2014; Wang and Zeng, 2010), and Likert Scales, when scores on a scale such as one to five, corresponding with 'not important' to 'very important', are assigned to a criterion (Conejos et al., 2014; Hanafi et al., 2018; Tan et al., 2018). Both these methods require a factor of importance to be assigned to a criterion and the results indicate the importance of one criterion relative to another.

The physical characteristics of an individual building, such as the degree of structural defects and damage, were ranked high in importance relative to other criteria in several of the studies (Hanafi et al., 2018; Kim et al., 2010; Kutut et al., 2014; Lin and Low, 2012), suggesting that they have a high degree of consideration in adaptation and demolition decisions. However, in one study, the condition was ranked lowest in comparison to other factors including market demand, building regulations, land lease control, location, transportation and accessibility (Tan et al., 2018). This acts as an indication that the determination of importance is not universal across the different studies.

Several studies ranked economic factors higher relative to others (Hanafi et al., 2018; Kutut et al., 2014; Lin and Low, 2012), whilst other studies prioritised social and cultural aspects, such as heritage (Dutta and Husain, 2009; Wang and Zeng, 2010). Those studies prioritising cultural and social aspects focused on cultural heritage properties. In contrast, Lin and Low (2012) focused on public housing and ranked economic viability highly and heritage was not considered in this investigation, which suggests that the different studies prioritise criteria differently depending on the type of building under investigation. However, there were also studies focusing on cultural heritage, where economics did rank highly (Hanafi et al., 2018; Kutut et al., 2014), indicating that economic viability is not irrelevant for cultural heritage buildings.

In a multi-criteria analysis, as is the case for adaptation and demolition decisions, different stakeholders are likely to have different perspectives (Natividade-Jesus et al., 2013). This ambiguity between people's preferences is considered in Kim et al's. (2010) study, where a beta distribution (a type of bell curve) is applied to the weightings to reflect the variation in preferences. Other studies used methods to determine the correlation of weightings between respondents, where percentages or standard deviations were used to determine the degree of consensus (Conejos et al., 2014; Hanafi et al., 2018; Kutut et al., 2014; Tan et al., 2018).

As well as between stakeholders, there can also be a lack of consensus within a stakeholder group. This was demonstrated in a study focusing on the adaptability of new build structures which surveyed practicing architects (Conejos et al., 2014). The consensus of the rankings assigned to criteria as to their importance in the decision-making process varied from 37.4 per cent to 80.75 per cent, where the percentage reflects the percentage of participants that assigned the same ranking to a criterion. The criteria with the highest degree of consensus were the maintainability of the building, material durability, orientation, and solar access. Those with the lowest consensus between rankings included service ducts and corridors, energy rating, and ecological footprint and conservation. Although this focus is on new buildings, the suggestion that there may be a lack of consensus within the same profession is also applicable to the adaptation of existing buildings (Bullen and Love, 2010).

The same criterion can be considered as an advantage or disadvantage for adaptive reuse depending on the person making the judgement. One study asked interviewees to interpret aspects of decision-making criteria as a benefit or a barrier towards adaptation (Bullen, 2007). The results indicate that some people interpreted a criterion as negative, whilst others considered the same one to be positive. For instance, approximately 40 per cent of respondents considered the "*planning approval process*" (p.27) to be a benefit and 60 per cent as a barrier for the adaptive reuse of commercial buildings; whilst 35 per cent perceived '*increasing urban density*' as a benefit and 65 per cent as a negative. Depending on the people making an assessment, different criteria will be determined as important relative to others but also the same criterion can be considered as a positive or negative influence. As the decision involves a range of stakeholders including architects, developers, engineers, heritage consultants, investors, planners and planning consultants, property consultants, surveyors and users (Bullen and Love, 2011; Wilkinson, 2011), current studies are limited in their weightings as opinions have not been sought from all of these stakeholder groups. Furthermore, a degree of subjectivity is inevitable as people will have their own opinions based on their experiences, personal preferences and role in the decision-making process (Plimmer et al., 2008).

A range of opinions is also applicable to masterplan regeneration in general. When discussing the perceived benefits of redeveloping industrial sites with industrial heritage experts and the general public, Loures (2015) found that reducing urban sprawl, encouraging recreation and connectivity were valued by the experts, whilst the benefits put forward by the public included the creation of green space and jobs. Additionally the London Assembly's (2015, p.10) report quotes a representative from a housing association saying "*the process will be long and complex involving many different participants*", emphasising that multiple people, with different opinions are involved in decisions.

Table 2-3: Examples of academic studies weighting decision-making criteria.
Unless stated otherwise, focus of studies is on cultural heritage properties.

Authors and paper title	Method to identify criteria	Method to weight criteria[3]	Top 3 ranked criteria	Country of study
Conejos et al. (2014) Designing for better building adaptability: a comparison of adaptSTAR and ARP models. Note: focuses on new build.	Based on expert interviews.	Five-point Likert Scale survey (n=25) with practising architects.	**Overall categories: physical, economic, functional.** **Specific criteria: structural integrity and foundations, material durability and workmanship, maintainability.**	Australia
Dutta and Husain (2009) An application of multicriteria decision making to built heritage. The case of Calcutta.	Interviews with officials responsible for heritage planning.	Barron's Rank-Order Centroid method.	**Historical value, architectural value, sociocultural value.**	India
Hanafi et al. (2018) Essential entities towards developing an adaptive reuse model for organization management in conservation of heritage buildings in Malaysia.	Literature review.	Five-point Likert Scale survey (n=129) with contractors and consultants.	**Physical, social, economic.**	Malaysia
Kim et al. (2010) An experience curve-based decision support model for prioritizing restoration needs of cultural heritage.	Selected by central government officials and 'experts' in restoring heritage.	Stochastic Analytical Hierarchy Process (AHP) and Delphi technique.	**Degree of damage, importance of cultural heritage, management policy.**	Korea
Kutut et al. (2014) Assessment of priority alternatives for preservation of historic buildings using model based on ARAS and AHP methods.	Based on opinions expressed by representatives of the public.	AHP.	**Investment required for restoration of cultural property, value of the building in terms of heritage, state of the building.**	Lithuania
Lin and Low (2012) Influential criteria for building adaptation potential from the perspective of decision makers.	Literature review and interviews.	Seven-point Likert Scale survey.	**Maintenance cost saving in long-term, building age, degree of structural and surface defects.**	Hong Kong
Tan et al. (2018) Critical Success Factors (CSFs) for the adaptive reuse of industrial buildings in Hong Kong.	Literature review.	Five-point Likert Scale survey (n=62).	**Market demand, building ordinance/regulations, land lease control.**	Hong Kong
Wang and Zeng (2010) A multi-objective decision-making process for reuse selection of historic buildings.	n/a	AHP, Fuzzy Delphi Method and Analytic Network Process (ANP) through expert interviews.	**Architecture, continuity, culture.**	Taiwan

[3] Likert scale survey: survey respondents rate importance of factors using a scale e.g. 1-5 equates to not important – very important.
Barron Rank-Order: formula to identify single weight (centroid) from combination of weights (Dutta and Husain, 2009).
Analytic Hierarchy Process (AHP): technique for hierarchy structuring multiple criteria. Uses pairwise comparison techniques to interpret ratio of preference between two criteria (Wang and Zeng, 2010).
Delphi technique: consists of three stages: 1) identifying important issues by asking experts; 2) provides opportunity to reconsider assessment after circulating others opinions; 3) experts propose potential attributes (Kim et al., 2010).
Analytic Network Process (ANP): AHP is starting point and then ANP provides a more generalised model and considered independencies e.g. connections between different levels of criteria (Wang and Zeng, 2010).

2.5 Discussion

A variety of criteria affect the decision to adapt or demolish existing buildings. This chapter discussed factors related to an individual building's physical attributes and economic viability, as well as factors beyond the individual building level including location, land use planning, social implications. These were identified from both quantitative and qualitative studies. Consequently, the decision-making criteria are considered to be a combination of objective and subjective factors. Those that are measurable and therefore objective, were often identified in the quantitative studies (Weber et al., 2006; Wilkinson, 2011), whilst those linked with policy and social-cultural aspects and therefore subjective, were commonly identified in the qualitative studies (Bullen and Love, 2011; Chen et al., 2015; LianPing et al., 2014; Mısırlısoy and Günçe, 2016). This alone begins to indicate the complexity of the decision-making process and that multiple factors are considered, even at an individual building level.

At an individual building level, the construction costs of an adaptation project were examined including how these are affected by a building's physical attributes. If the cost of adaptation is more expensive than demolition and new build it is often a driver towards demolition (Ball, 2002; Picco et al., 2012). Factors that have the potential to increase construction costs include poor building condition and low floor-to-ceiling heights which can create difficulties installing building services and are often dependent on the former function. Unfavourable structural morphologies are common in industrial buildings, which can limit change of use adaptation potential. All of these factors therefore affect whether or not a building is deemed fit-for-purpose. Previous studies suggest larger corporate companies tend to prefer large open plan spaces, whilst start-up companies and creative industries are often located in heritage buildings without these flexible floor plans (Heritage Lottery Fund, 2013; Plimmer et al., 2008).

Economic viability appears to be a fundamental part of adaptation and demolition decision-making at both the individual building and masterplan scales. This chapter highlighted how this is based on a number of factors including construction costs, tax incentives, potential revenue and income, and land values (Crawford et al., 2014; Plimmer et al., 2008). Density is affected by a building's height and whether or not a building occupies the land efficiently. Previous studies have shown that if developers can increase density, this can act as a driver towards demolition and replacement, particularly when land values are high (Been et al., 2016). However, this also needs to be balanced against other aspects that affect the desirability of an area, including the amount of surrounding green space and the effect of overshadowing on the building (Petković-Grozdanovića et al., 2016).

External factors beyond an individual building are also considered in the decision to adapt existing buildings (Rockow et al., 2018; Thomsen and Flier, 2011). Factors such as the distance to amenities and aesthetics of an area are considered by many studies to determine whether or not to invest in the adaptation of an existing building (Ball, 2002; Borst, 2014; Bullen, 2007; Dutta and Husain, 2009; Geraedts and Van der Voordt, 2007; Heath, 2001; Kutut et al., 2014; Langston, 2013; Wilkinson, 2011; Yildirim, 2012; Yung and Chan, 2012). However, it should be noted that these criteria are applicable to investment in general and will also affect the decision to demolish and replace a building. At an individual building level, these external factors are often more difficult to change as they are outside of the control of the decision-makers (Thomsen and Flier, 2011; Van der Flier and Thomsen, 2006).

Planning policy and land use plans often establish what is and is not allowed on a development site and are applicable to both individual buildings and larger masterplan schemes. Depending on these permits, they can either be a driver or barrier to adaptation. Reports focusing on social housing estates (Crawford et al., 2014; London Assembly, 2015) also identified a number of social implications that need to be considered, such as the health and well-being of the occupants, as well as public participation activities, suggesting that developments of a larger scale are likely to have more impact on the surrounding community.

Decision-making criteria are unlikely to be considered equally. The last section of this chapter examined previous studies which attempted to weight decision-making criteria in terms of their importance for individual buildings (Hanafi et al., 2018; Kim et al., 2010; Kutut et al., 2014; Tan et al., 2018; Wang and Zeng, 2010). Although these can act as a useful indication as to what is regularly considered, the studies are limited (particularly for comparison with one another) as they begin with different criteria and have different outcomes of the importance of one criterion relative to others. This discrepancy between the findings was attributed to the focus of the study e.g. residential housing or cultural heritage sites, and variations in preferences between the people judging their importance, as there is a plurality of viewpoints in the decision-making process.

CHAPTER 3:

Retaining heritage and whole life energy and carbon: literature review

Conservation of heritage and savings in materials and therefore reductions in embodied energy and greenhouse gas emissions, are two regularly cited benefits of building adaptation (Appendix 1). However, despite being regularly referred to, the two concepts and their theoretical underpinnings are rarely discussed in detail in academic papers assessing adaptation and demolition decisions. Generic statements are often made without exploring the complexities of the concepts, including the differing perceptions of heritage values and the uncertainties associated with embodied energy calculations. This chapter explores these two benefits in depth by discussing key findings from the review of academic papers specifically focused on heritage and whole life energy and carbon. This allows the relevant theories to be better understood. Each benefit and its underlying concepts are examined, followed by a discussion highlighting similarities and differences between the two.

3.1 Retaining heritage

Factors related to heritage are one of the main drivers to retain existing buildings, on their own or alongside others as part of larger developments containing multiple buildings, as they can provide character and status to an area (Iacovidou and Purnell, 2016). This section explores the concept of heritage by discussing "*two key contemporary underpinnings for the analysis of conservation practice*" (Pendlebury, 2013, p.710). These underpinnings include understanding heritage and conservation as a values-based activity and understanding the heritage discourse and how its interpretation has changed over time. Different heritage values are discussed, followed by an examination of studies that have attempted to weight these and then others focusing on the changing heritage discourse. As economic factors are considered to be highly influential in the decision-making process, the concept of heritage price premiums of individual buildings and then the concept of heritage-led regeneration, which is more applicable to the masterplan scale, are explored.

3.1.1 Values-based approach for industrial heritage

It is common to interpret conservation as a 'values-based' activity, meaning it is a term which has multiple values attached to it (Pendlebury, 2013). According to the Nizhny Tagil Charter which was adopted by The International Committee for the Conservation of the Industrial Heritage (TICCIH):

> "*Industrial heritage consists of the remains of industrial culture … the historical period of principal interest extends forward from the beginning of the Industrial Revolution in the second half of the eighteenth century up to and including the present day, whilst also examining its earlier pre-industrial and proto-industrial roots*" (TICCIH, 2003, p.1).

Architectural, economic, historic, social and technological values, alongside the aesthetics and a sense of identity/memory are commonly referred to in studies focusing on industrial heritage, as shown in Table 3-1.

Former industrial sites, as well as the individual buildings within them, are considered to be important milestones in human history (Belláková, 2016) and technological and scientific values are regularly considered (Giuliani et al., 2018; Ifko, 2016; Liu et al., 2018). This is due to the knowledge base and historical technological developments that occurred in industrial areas (Patiwael et al., 2018).

Studies also argue that the redevelopment of former industrial buildings and/or sites are an integral part of many cities' identity and should reflect the 'genius loci'/spirit of a place and provide a sense of connection for the community, as new build can be replicated anywhere (Belláková, 2016; Loures, 2008). Although arguments have been put forward suggesting that social values are growing in importance due to the globalising world (Copic et al., 2014; Hall, 1999; Winter, 2014), other studies have found that this social dimension of heritage is often neglected (Ifko, 2016).

The majority of values identified for industrial heritage are also applicable to other types of heritage buildings. However, one value which stands out as missing from academic papers discussing industrial heritage is 'spiritual value'. It is likely spiritual value is missing from these studies as industrial sites rarely link to religion. Spiritual value is better related to places of worship, such as churches. This difference helps to demonstrate that heritage values will differ between the different property types and there is not a 'one-fits-all' explanation.

Heritage values often have positive connotations, however there are examples where these are negative. Wilkinson (2011, p.52) refers to difficulties reusing "*mental asylums*" and some prisons as they are associated with negative emotions. In industrial terms, Giuliani et al. (2018) links stakeholders' memory of grain silos in Italy to the Fascist regime, and Ifko (2016) discuss the negative perceptions of former industrial areas due to job losses and economic downturns. Others argue that industrial heritage celebrates the lower classes and that other types of heritage, such as stately homes, are "*always an affair of higher classes*" (Pozo and González, 2012, p.446). Therefore, when assessing industrial heritage, it should be recognised that the values prescribed are often prone to subjective judgements and varying perceptions. Hence, Pendlebury's (2013) critique of viewing heritage as a value-based approach as there are other external forces that shape them. For instance, how and why do people perceive these values in the way that they do?

Table 3-1: Industrial heritage values identified from the academic literature.
Definitions adapted from the Oxford English Dictionary & Drury, P. and McPherson, A. (2015). *Conservation Principles, Policies and Guidance.* Historic England, London, UK.

Industrial heritage value	Description	References	Countries of study
Aesthetics	Value depicting the appreciation of beauty.	Copic et al. (2014); Giuliani et al. (2018); Liu et al. (2018); Loures (2008); Xie (2015)	China, Germany, Italy, Portugal & multiple*
Architectural	Value recognising the art or practice of designing and/or constructing buildings.	Florentina-Cristina et al. (2014); Romeo et al., (2015)	Italy, Romania
Cultural	Value relating to the ideas, customs, and/or social behaviour of a society or community.	Cercleux et al. (2012); Florentina-Cristina et al. (2014); Ifko (2016); Landorf (2009); Liu et al. (2018); Loures (2008); Patiwael et al. (2018); Pendlebury (2013); Romeo et al. (2015); Winter, (2014)	China, Europe**, Italy, Romania. Slovenia, UK, USA & multiple*
Economic	Value recognising the potential creation of wealth or trade.	Copic et al. (2014); Ifko (2016); Landorf (2009); Mason (2008); Pozo and González (2012); Winter (2014); Xie (2015)	Europe**, Germany, Portugal, Slovenia, Spain, UK & USA
Historical	Value reflecting past people, events and aspects of life which can be connected to a building/place in the present day.	Belláková (2016); Copic et al. (2014); Falser (2001); Florentina-Cristina et al. (2014); Giuliani et al. (2018); Leary and Sholes (2000); Liu et al. (2018); Loures (2008); Pendlebury (2013); Winter (2014); Xie (2015)	China, Europe**, Germany, Italy, Portugal, Romania. Slovakia, UK, USA & multiple*
Identity & memory	Value which creates a sense of being or helps to establish who someone is through a connection to the past.	Ballesteros and Ramírez (2007); Belláková (2016); Cercleux et al. (2012); Copic et al. (2014); Florentina-Cristina et al. (2014); Loures (2008); Pozo and González (2012); Winter (2014); Xie (2015)	Germany, Europe**, Portugal, Romania, Slovakia, Spain, USA & multiple*
Social & Communal	Values connected with the collective/shared use or meaning of a space.	Copic et al. (2014); Ifko (2016); Landorf (2009); Liu et al. (2018); Mason (2008); Patiwael et al. (2018); Winter (2014)	China, Europe**, Germany, Slovenia, UK & USA
Technological/ Scientific	Values relating to the developments of technology or science associated with a building/place.	Giuliani et al. (2018); Ifko (2016); Liu et al. (2018)	China, Italy, Slovenia

* Loures (2008): Australia, Brazil, China, Denmark, Egypt, England, France, Germany, Greece, Holland, Hungary, Israel, Italy, Korea, Mexico, Norway, Poland, Portugal, Slovenia & Spain, Switzerland.

** Winter (2014) covers 'Europe and USA' without listing European countries.

3.1.2 Weighting industrial heritage values

Due to the subjective nature of heritage values, they are perceived to have differing levels of importance relative to one another, which often means trade-offs are inevitable (Vadimovna, 2013). Similar to the weighting of general decision-making criteria for adaptation and demolition (Section 2.4), academics have tried to quantify the importance of different heritage values for existing industrial buildings. Liu et al. (2018) and Gang et al. (2014) survey experts connected to the heritage field and have used methods such as the analytical hierarchy process to compare their relative significance.

Artistic and historic values had the highest weighting of importance in comparison to the other values in both studies. These are values often perceived as tangible (can be seen/touched) and are the same values regularly identified within academic papers focusing on adaptation and demolition. In Liu et al's (2018) study, the other heritage values (from highest to lowest weight) were: technological, social, and economic. In Gang et al's (2014) these were (from highest to lowest) scientific, environmental, emotional/cultural, and real estate. In Liu et al.'s (2018, p.218) study they state that the survey was completed by people "*who engage in architectural history, architectural conservation, and architectural design*". Therefore, these results may be subject to a degree of bias towards historical values and aesthetics, which is why economic value received the lowest weighting.

Liu et al. (2018, p.212) argue that their use of Demster-Shafer theory[4] allows them to synthesise uncertain information and subjective judgement by combining/fusing evidence from different sources. Although they argue "*there are no sharp evidential conflicts on the value of industrial heritage*", this justification should be questioned as only 'experts' from a small sample (twenty-two people) were surveyed to assign their weightings. It is highly likely there would be a higher diversity of opinion when other stakeholders are involved, which is a more realistic reflection of the decision-making process.

Heritage is a heterogeneous term and is context specific (Pendlebury, 2013), meaning the assigned weighting is likely to change between locations both within and between countries and by the stakeholders interpreting them. This is reflected in Ballesteros and Ramírez's (2007, p.678) use of the term "*identity polyphony*" to emphasise that people will prescribe different identities to a heritage site. This demonstrates that the findings from studies quantifying the importance of value-judgements should be used with caution as they are unlikely to be universally applicable.

[4] Dempster-Shafer theory is used to combine evidence from different sources, in this case, expert judgements.

3.1.3 Changing perceptions and heritage discourses

The second underpinning of conservation practice is the changing perceptions and interpretations of heritage (Pendlebury, 2013). The act of protecting buildings from change or demolition due to heritage values attached to their past is not new. Vitruvius' manual 'De Archicitectura', written over two-thousand years ago declared an architect should have a "*wide knowledge of history*" to ensure that they understand the symbolic context of a building (Winter, 2014, p.446). More recently, in the mid-to-late nineteenth century, art critics, such as Viollet-le-Duc and John Ruskin, are described as "*the 'founding-fathers' of the modern conservation movement*" (ibid. p.558). Their attitudes were influenced by the industrial revolution and rapid replacement of buildings. This resulted in a "*nostalgia for what was being lost*" and was intertwined with a sense of nationalism, which led to the "*simple message to save what can be saved before it's too late*" (Ashworth, 2011, p.5-6). Based on these preservationist principles, the Authorised Heritage Discourse (AHD), which aims to protect buildings with heritage values was established.

However, academics such as Ballesteros and Ramírez (2007), argue that since the mid-20th century, the AHD and understanding of heritage has been re-evaluated and new perceptions developed. Three separate interpretations are proposed by Ashworth (2011): preservation, conservation and 'heritage planning', and discussed in several academic papers (Ashworth, 2011; Ballesteros and Ramírez, 2007; Fredholm et al., 2018; Janssen et al., 2017; Parkinson et al., 2016; Patiwael et al., 2018; Pozo and González, 2012; Vadimovna, 2013; Yadollahi, 2017). The changing discourse is reflected in Figure 3-1.

There has been a development in thinking of how heritage is viewed from a positivist perspective, whereby the heritage value is judged by experts and deemed to be scientific, to an attitude which recognises the plurality of viewpoints, including that of the community and how these are often socially constructed depending on people's past experience in relation to the asset(s) (Ballesteros and Ramírez, 2007; Janssen et al., 2017; Yadollahi, 2017). Jones (2017, p.23) states "*early-mid twentieth century international Charters privileged historic, scientific and aesthetic values*". These include the Athens Charter 1931[5] and the Venice Charter 1964[6]. They proceed to argue that the Burra Charter[7], first adopted in 1979, was a key document in bringing about a shift where social and communal values began to be considered and that there are a "*few recent exceptions were social and communal values, have played a key role in designation, over and above*

[5] The Athens Charter for the Restoration of Historic Monuments. Adopted at the First International Congress of Architects and Technicians of Historic Monuments, Athens, 1931.
[6] The Venice Charter for the Conservation and Restoration of Monuments and Sites. Adopted at the Second International Congress of Architects and Technicians of Historic Monuments, Venice, 1964.
[7] The Burra Charter - The Australia International Council on Monument and Sites (ICOMOS) Charter for the Conservation of Places of Cultural Significance was first adopted in 1979. Updated periodically "*reflect developing understanding of the theory and practice of cultural heritage management*" (Australia ICOMOS, 2019).

historic or architectural merit" (p.24). Since then, the Councils of Europe's (2005) Faro Convention on the Value of Cultural Heritage for Society is provided as an example of the emerging heritage discourse (Schofield, 2014), whilst Blagojević and Tufegdžić (2016, p.148) highlight how The Venice Charter now encompasses these social values:

> *"Modern contemporary philosophy and practice of protection have been specifically influenced by the introduction of the concept of historic place, which indicates the importance of intangible heritage (spiritual, cultural, ethnographic etc.)"*

Consequently, there are changes as to what values are considered in the interpretation of heritage but also who determines these.

The preservation discourse often perceives heritage as a barrier to redevelopment due to the protective nature of policy against changes to a building's fabric. In the conservation discourse, adaption is considered as a stimulus to development and within the 'heritage planning' discourse, it is seen to determine the direction of development (Janssen et al., 2017). This suggests the redevelopment of heritage buildings within the conservation and 'heritage planning' discourses have the ability to act as a catalyst for further redevelopment in an area. Within the 'heritage planning' discourse, the economic value that can be created is more readily accepted, as the existing buildings are often transformed or enhanced rather than just restored (Ashworth, 2011; Janssen et al., 2017; Pozo and González, 2012).

A development in the heritage discourse particularly applicable to the masterplan scale, is that rather than viewing heritage as a single object, such as a building, the 'conservation discourse' recognises a move towards ensemble value, meaning the surroundings of an object (Ashworth, 2011; Janssen et al., 2017). In terms of industrial heritage, this is often referred to as the industrial landscape or even "*landscapes of nostalgia*", where site-scale industrial processes that used to occur within an area are recognised (Copic et al., 2014, p.44). The transition from single object to ensemble, takes a step further within the 'heritage planning' discourse, where the narrative which sits behind the physical construction is also considered. Without this narrative and story related to an asset or assets, the physical object is described as an "*empty stage*" with no meaning (Leary and Sholes, 2000, p.66).

Although there has been an evolution in thinking about heritage, this is not universal (Jones, 2017; Schofield, 2014). There is often a blurring of the boundaries amidst the discourses and different stakeholder's interpretation will sit somewhere between these. Some people will have a positivist attitude and base their judgement on expert opinion and view heritage as something which needs to be preserved. Others will take the 'heritage planning' viewpoint and accept a higher degree of intervention is sometimes necessary. In these cases, Plevoets and Cleempoel (2019) argue that the theory of adaptive reuse needs to consider both, a suitable function for the building typology, and creating an aesthetic relationship between the old and new.

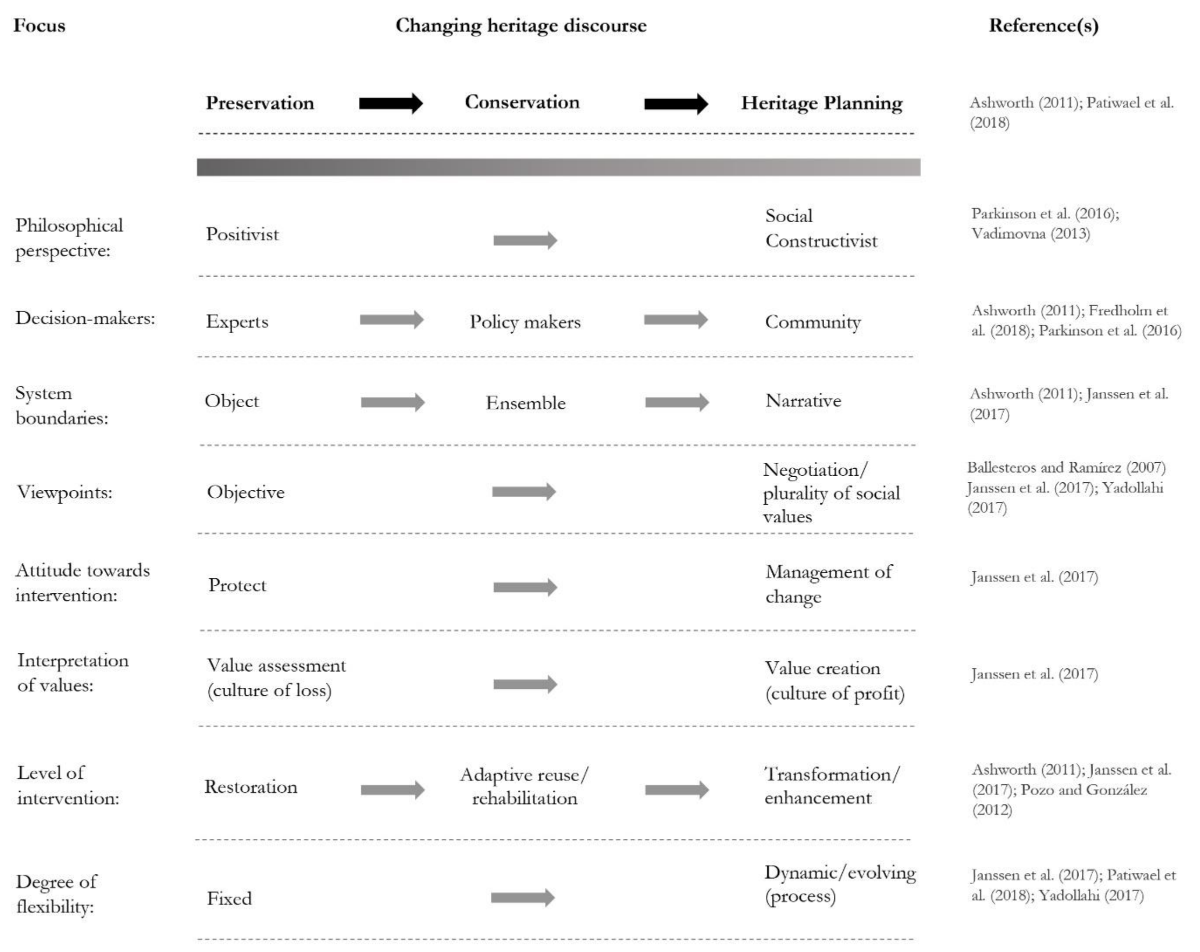

Figure 3-1: Developing heritage discourse.
Diagram produced by author.

3.1.4 Economic value provided by heritage retention

The redevelopment of brownfield sites is often market dominated. Conservationists therefore should not only consider traditional heritage values, such as aesthetics, historical and architectural values but also economic arguments (Mason, 2008; Ruijgrok, 2006). For example, Bullen and Love (2010) discuss how the traditional features of heritage buildings are often promoted for marketing purposes and to attract potential tenants. Within the academic literature, there are concepts related to the creation of economic value at both the individual and masterplan scales. At the individual building level, these are price premiums for a building, whilst at the masterplan level, the concept of heritage-led regeneration considers the added value to a larger area and crosses over with the concept of urban regeneration discussed in Chapter 1.

3.1.4.1 Individual buildings: heritage price premiums

There have been attempts in the academic literature to assess whether heritage designations for buildings and wider areas of land increases the economic value of individual buildings. Although these apply their analysis to different countries including the Netherlands (Lazrak et al., 2013; Ruijgrok, 2006; Van Duijn et al., 2016), UK (Ahlfeldt et al., 2012), and USA (Been et al., 2016; Noonan and Krupka, 2011), their focus is on the residential housing stock. Despite not focusing on industrial heritage, the studies still serve an important indication of the impact of heritage in general, thus have been included in this review. The methodologies of all the studies are similar as hedonic regression modelling[8] is used to quantify the effect of different variables, including those related to heritage and their effect on property prices.

Both Lazrak et al. (2013) and Ahlfeldt et al. (2012) found that if a residential building was designated (protected by policy) there was an increase in property values, thus a price premium. In Lazrak et al's (2013) study, the premium calculated was approximately a 30 per cent increase for buildings which were designated compared to those that were not, and a 28 per cent increase for buildings located in a conservation area (a larger area of land protected by planning policy), compared to those outside. Although, premiums were still identified in Ahlfeldt et al's (2012) study, these were just under ten per cent for buildings located in conservation areas. Additionally, within Ahlfeldt et al's study, they contend that there was not a "*statistically significant designation effect*" (p.6) between the areas being non-designated and becoming designated. This implies there was already a price premium in these areas before the designation was put in place and that the added monetary value to individual buildings is due to characteristics of the areas, such as the general appeal and aesthetic value of the buildings, rather than the designation itself.

In contrast to these two studies, Noonan and Krupka (2011) found that designated areas had a negative impact on property prices due to the constraints these cause to property owners in terms of what intervention is allowed. However, they did find that there was still a premium for historic properties due to the aesthetic, architectural and historic values attached to them. These premiums can act as a driver towards retention.

A limitation of all of these studies is that the price comparison is to the existing building stock (without heritage values attached) rather than new build. It must be recognised that new build is often desirable.

[8] Hedonic regression modelling considers the impact of changing housing and location characteristics/variables on observable transaction prices (Ahlfeldt et al., 2012).

This is particularly applicable to masterplan sites as the decisions about adaptation are generally compared to the value of the replacement new build rather than the existing stock.

A further limitation is that the whole notion of assigning economic values to heritage is questioned by some academics. Pozo and González (2012) argue that assigning monetary value to heritage may ignore the intangible aspects such as the sense of identity. This tension between cultural factors and realising economic value through heritage retention will influence adaptation and demolition decisions.

3.1.4.2 Masterplan scale: heritage-led regeneration

Studies focusing on heritage price premiums are only applicable to individual buildings, yet the value added by heritage can also be considered at the larger masterplan scale. Chapter 1 defined the concept of urban regeneration as a physical form of intervention leading to the revival or reuse of an area for new purposes within a city, resulting in economic, social and environmental changes, noting that regeneration was applicable to the masterplan scale. One specific type of regeneration has been coined 'heritage-led regeneration'. The concept revolves around the retention of heritage items which act as a catalyst for redevelopment in the surroundings (Alsalloum and Brown, 2010; BPF et al., 2017; Elseragy and Elnokaly, 2018; Mosler, 2019; Pendlebury and Porfyriou, 2017).

A common topic of discussion within the context of heritage-led regeneration is a tension between the need for economic growth and conservation (Ashworth and Tunbridge, 2017; BPF et al., 2017; Elseragy and Elnokaly, 2018; Mosler, 2019). For instance, within a report entitled 'Heritage Works – a toolkit for best practice in heritage regeneration' (BPF et al., 2017, p.24), it states "*sustainable development is about positive growth and change for the better. In terms of our heritage…this means taking opportunities to achieve this growth while also conserving and enhancing the historic environment*". The report refers to "*comprehensive regeneration schemes which have swept away heritage assets in the name of efficiency, cost, viability and meeting occupier requirements*" (ibid. p.6), and argues that these regeneration schemes do not take into account the benefits of heritage retention highlighted earlier in this thesis, including the sense of place heritage provides and the additional investment in embodied energy when replacing a building.

This tension between development and conservation will be dependent on the context. For example, Pendlebury and Porfyriou (2017, p.429) describe European countries and China as polar opposites, with the rate of change in Europe being fairly slow due to heritage protection in planning policy, whilst the rate of change in China as an "*astonishingly rapid process, with the risk of heritage erasure*" due to rapid economic and demographic growth. As well as the provision of housing or other real estate, there may also be conflict or competition between heritage and other urban typologies within larger regeneration developments, such as circulation and accessibility (Ashworth and Tunbridge, 2017), due to, as worded by Mosler (2019, p.4) "*the hierarchy of place organisation*".

There is clearly an overlap between the notion of heritage-led regeneration and the 'heritage-planning' discourse. As discussed in the previous section, the preservation discourse sees the retention of heritage as a barrier to growth, whilst 'heritage planning' considers it a catalyst and opportunity for transformation or enhancement. Ashworth and Tunbridge (2017), citing Smith and Ebejer (2012), refer to these contrasting approaches as the 'museumification' of the city centres and city revival strategies.

Regeneration projects are likely to include a combination of building retention and replacement new build. To ensure that character of an area is not lost, Alsalloum and Brown, (2010, p.15) suggest a series of questions to judge the appropriateness of the new buildings within heritage-led regeneration projects. For instance: "*Are they creating harmony with the existing structures, in terms of materialism, colours, height and style? How do these structures enhance the authentic historical context?*"

Alongside heritage acting as a catalyst for growth and having the potential to create both economic and social value within a development, BPF et al. (2017, p.9) argue that in heritage-led regeneration schemes "*individual buildings can be less important than the overall ambience of the areas. In other words, the whole public realm can be greater than the sum of the parts*", emphasising the importance of thinking beyond the individual building level and considering the whole area in masterplan developments. Thus, considering heritage as an ensemble or even narrative, reiterating the cross-over between the 'heritage-planning' discourse and the concept of heritage-led regeneration.

3.2 Whole life energy and carbon

Savings in materials were the other regularly cited benefit of adaptation due to the savings in the greenhouse gas emissions, including carbon emissions, associated with the life-cycle of materials, otherwise known as embodied emissions. Internationally, there is scientific consensus that carbon emissions need to be reduced to prevent anthropogenic global warming (Cook et al., 2013). If not mitigated, the changing climate is highly likely to result in an increase in extreme events, such as flooding, droughts and cyclones (IPCC, 2014). In 2016, the Paris Agreement became effective. This is a global initiative with the aim of preventing the global temperature this century rising above two degrees from pre-industrial levels. Following this, the International Panel for Climate Change (IPCC) highlighted that limiting this increase to 1.5°C, will help to avoid a number of climate change impacts. For instance, the report states "*Future climate-related risks depend on the rate, peak and duration of warming. In the aggregate, they are larger if global warming exceeds 1.5°C*" (IPCC, 2018). The IPCC also recognises that the building sector has an important role to play in reducing carbon emissions as buildings are responsible for over 40 per cent of global energy consumption and one third of global greenhouse gas emissions (IPCC, 2014; UNEP, 2009).

This section begins by providing definitions for embodied and operational impacts and how these should be assessed through life-cycle assessments (LCA). Existing academic studies comparing the environmental impact of demolition and new build as opposed to building retention are examined. This is followed by a discussion about variations in operational energy standards and methodological uncertainties and inconsistencies in LCAs.

3.2.1 Embodied and operational impacts

Reducing individual buildings' embodied or reducing individual buildings' operational impacts are two mitigation measures identified by the IPCC for the building sector to reduce their carbon emissions contribution (IPCC, 2014). Embodied energy is sequestered in building materials throughout the life-cycle of a building including production, on-site construction, and the final demolition and disposal (BSI, 2011a, 2011b). Operational energy is the energy consumed through the day to day running of a building and maintaining the internal environment, for example space heating and cooling (Dixit et al., 2010). The total life-cycle energy of a building includes both embodied and operational energy. As the majority of this energy comes from fossil fuels, it significantly contributes to annual carbon emissions (Dixit, 2017).

LCAs can be used to assess a range of environmental impacts including global warming potential, ozone depletion, photochemical smog formation, acidification, and eutrophication (Owens, 1996). This thesis focuses on global warming potential caused by carbon emissions and energy consumption as this is what previous academic papers discussing adaptation and demolition tended to focus on.

Internationally, there have been efforts to harmonise LCA methods through international standards including ISO 21929-1 (ISO, 2011), ISO 21931-1 (ISO, 2010) and European Standards, which have been implemented as British Standards, including EN 15643-2 (BSI, 2011a) and EN 15978 (BSI, 2011b). The European TC350 technical committee, who wrote a collection of standards on 'Sustainability of Construction Works' produced a framework which identifies every aspect of energy use over and beyond a building's lifespan (see Figure 3-2). Initial embodied impacts include raw material supply, transport to the factory, manufacturing, transport to the construction site, and the construction/installation process. Recurrent embodied impacts include use, maintenance, repair, replacement and refurbishment. End of life embodied impacts encompass deconstruction, transport to end of life, waste processing and disposal. Operational impacts include energy use but also water use (Commission of the European Communities, 2014; Rasmussen et al., 2018). If an LCA includes all stages from the raw material supply to the disposal of the building, this is known as a 'cradle to grave' system boundary (Rasmussen et al., 2018). It is also possible to reuse, recover or recycle materials, which is referred to as 'benefits and loads beyond the system boundary', in these cases the boundary definition is 'cradle to cradle'.

Policy and academic papers have previously focused on improving the energy efficiency of buildings (Birgisdottir et al., 2017). Power (2008) highlights that papers arguing for the demolition of existing buildings based on operational energy standards, do not take into account embodied impacts and Szalay (2007) discuss the European Commission's Energy Performance Directive and that this only encompasses operational emissions. However, in the future, as operational energy consumption decreases due to these efforts to reduce it, the proportion of embodied energy will increase over the life-cycle (Clegg, 2012; Ibn-Mohammed et al., 2013). Consequently, embodied impacts will have more influence on the total carbon emissions released over a building's life-cycle. This is one of the reasons why there is increasing interest in the topic[9]. Ibn-Mohammed et al. (2013, p.240) suggest embodied emissions are likely to become key metrics to be addressed when considering the whole-life sustainability of a building, and concludes "*its inclusion in the decision-making process is therefore of the utmost importance*".

LCAs are also applicable beyond the individual building level. Recent papers comment on the moving trend towards conducting LCAs at the neighbourhood or masterplan scale as the benefits of assessing buildings in a 'cluster' are beginning to be recognised (Lotteau et al., 2015; Walker et al., 2018). Saheb et al. (2018, p.142) argue that "*working at a community scale, rather than on the more typical individual building scale, offers a mitigation path towards the deep carbonisation required to meet the Paris Climate Agreement target*". This larger scale enables the introduction of large scale energy systems which can reduce the operational carbon emissions consumed by individual buildings (Bucking, 2018; Lotteau et al., 2015). At the masterplan/neighbourhood scale, the system boundaries move beyond the building and can include roads, pavements, parking and green spaces. They can also include networks, for example: electricity, waste water, gas and district heating, and mobility e.g. cars, trains and buses (Lotteau et al., 2015; Stephan et al., 2013). However, as with individual buildings, the inclusion of embodied emissions is often missing when assessing net-zero energy neighbourhoods and the focus is on improving energy efficiency (Saheb et al., 2018; Walker et al., 2018).

[9] After an analysis of published literature in embodied carbon, Pomponi and Moncaster (2016) demonstrate that academic interest in the topic is steadily growing.

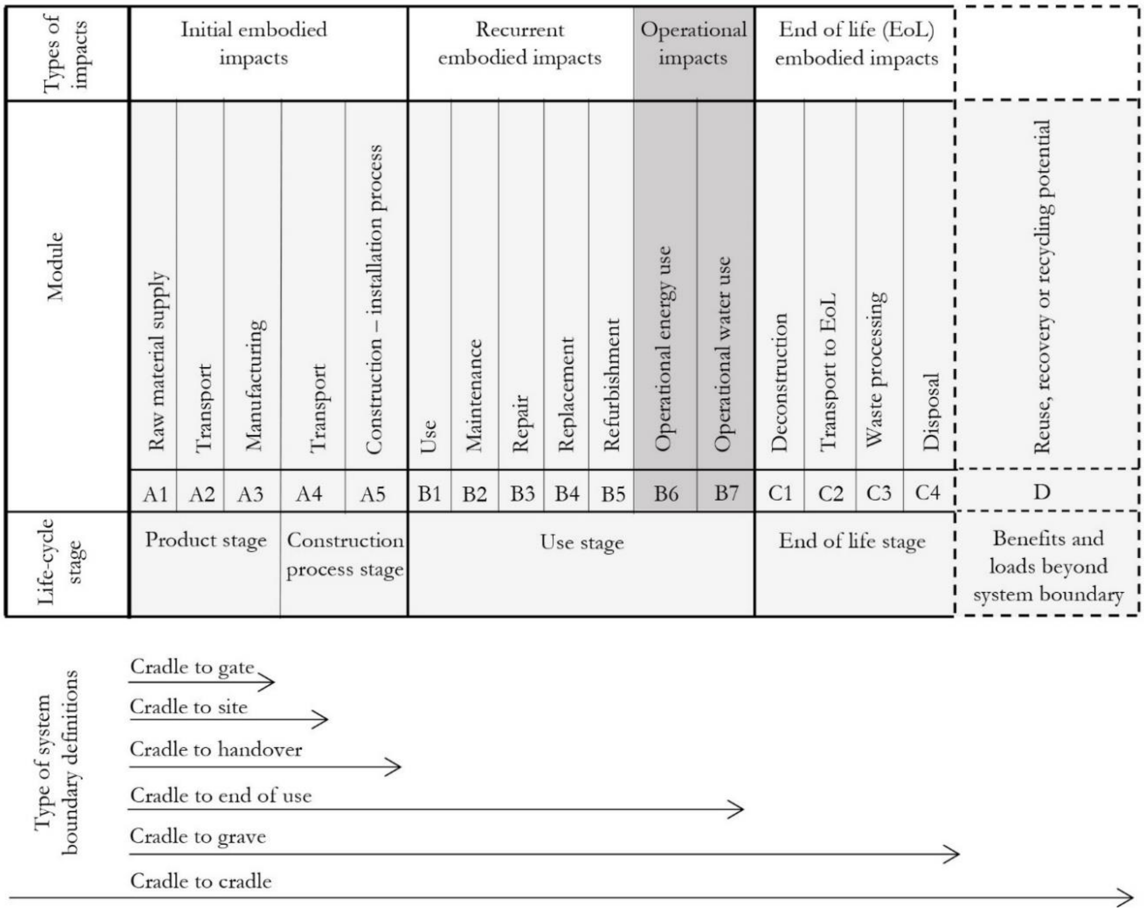

Figure 3-2: Life-cycle stages and system boundary definitions for whole life energy and carbon life-cycle assessments. Adapted from: BSI. (2011a). *BS EN 15643-2:2011 - Sustainability of construction works. Assessment of buildings. Framework for the assessment of environmental performance.* British Standards Institution, UK & Rasmussen, F.N. et al. (2018). 'Analysing methodological choices in calculations of embodied energy and GHG emissions from buildings.' *Energy and Buildings,* 158: pp. 1487–1498.

3.2.2 Adaptation versus demolition and new build life-cycle assessments

Savings in materials, thus embodied impacts are regularly referred to as a benefit of building retention (Ball, 2002; Bullen and Love, 2010; Clegg, 2012; Conejos et al., 2011; Gaspar and Santos, 2015; Itard and Klunder, 2007; Lin and Low, 2012a; Remøy and Van der Voordt, 2006; Van der Flier and Thomsen, 2006; Watson, 2009; Wilkinson et al., 2014; Yung and Chan, 2012), whilst higher energy efficiency standards and therefore lower operational impacts of new buildings in comparison to adaptation is regularly referred to as a barrier to retention and therefore favours demolition and new build (Ball, 2002; Gaspar and Santos, 2015; Thomsen and Flier, 2009). Thomsen and Flier (2009, p.657) stated:

> "*…for materials and waste, the environmental impact of life-cycle extension is definitely less than demolition and new construction. On the other hand, the energy performance of new construction seems to be superior*".

LCAs therefore need to be considered when assessing the whole life energy and carbon impacts of adaptation versus demolition for individual buildings, as the embodied and operational impacts both need to be evaluated in parallel to one another. If an existing building can reach the same operational energy standards as a new building, it is likely the life-cycle impact will be lower for the adaptation option as considerably fewer materials will be required during the construction phase (Crawford et al., 2014; Power, 2008). For this reason, one architectural practice, Feilden Clegg Bradley (FCB) Studios, stated:

> *"The old attitude of 'demolish and re-build' is inappropriate as the building stock is a neglected resource. The value of an existing building's embodied carbon is now incorporated by FCB into an environmental appraisal when considering the merits of demolition versus renovation"* (Clegg, 2012, p.368).

However, in existing studies comparing refurbishment options to demolition and new build, there is currently a lack of consensus as to which has lower energy and carbon impacts over the life-cycle (Schwartz et al., 2018). In the context of the existing housing stock, Power (2008, p.4487) states "*the evidence on whether demolition would reduce the amount of greenhouse gases we emit into the atmosphere is unclear and disputed*". Several papers comparing the environmental impact of adaptation to demolition and new build, found adaptation to have a lower environmental impact (Alba-Rodríguez et al., 2017; Gaspar and Santos, 2015b; Itard and Klunder, 2007; The Empty Homes Agency, 2008; Wastiels et al., 2016; Weiler et al., 2017), whilst others found that new buildings had a lower impact in comparison to retention options (Berg and Fuglseth, 2018; Hawkins and Mumovic, 2014; Rønning et al., 2009). This lack of consensus is likely to be caused by different design choices but also methodological choices in the LCA assessment. Different design and construction strategies, such as the use of timber or natural materials, can optimise the operational energy use and reduce embodied impacts (Malmqvist et al., 2018). Methodological choices also have a significant impact on the assessments. Moncaster et al. (2018, p.397) 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*". Discrepancies related to design and methodological choices (identified by the author) are shown in Table 3-2 and are discussed in more detail in the following sub-sections.

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Table 3-2: Existing studies comparing life-cycle assessments for adaptation and demolition decisions.

Column reference:	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
		Methodology																						System boundaries																									Critiques of academic literature			Results
		Scenario definition					Modelling approach			Number of scenarios		Background data source					Units of analysis							Building layers						Indication of LCA stages		Life cycle stages included																				
Study	Country of buildings in study	Existing property type	Existing building age	Life cycle (yrs)	Single building	Multiple buildings	Process	Input-Output	Hybrid	Multiple new build scenarios	Multiple refurbishment scenarios (exc. do nothing)	EcoInvent	ICE	EnviroImpact	National database	Other	$KgCO_2e$	tCO_2e	kWh	MJ	gha	Other	Normalised to m^2	Infrastructure	Structure	Skin	Services	Space plan	Stuff	References national or international framework	Qualitative description	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	Calculations inc. existing embodied emissions	Calculations includes decarbonisation	Like-for like replacement of existing building	Lowest environmental impact scenario. R = Refurbishment, N = New Build
Alba-Rodrígue z et al. (2017)	Spain	Resi.	1950s	25	x				x	x		x				x					x		x		x	x	x				x	x	x	x	x	x						x	x	x	x	x					x	R
Berg and Fuglseth (2018)	Norway	Resi.	1920s/ 30s	60	x		x				x	x					x						x		x	x	?				x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x				x	N
Gaspar and Santos (2015)	Portugal	Resi.	1970s	50	x		x						x		x				x				x		x	x		x			x	x	x	x								x				x	x		x		x	R
Hawkins and Mumovic, (2014)	UK	Uni	1950s	60	x		x				x			x				x					x		x	x		x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	N
		Uni.	1960s		x		x				x			x				x					x		x	x		x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	N
Itard and Klunder (2007)	Netherlands	Resi.	1950s	50		x	x				x				x					x			x		x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					R
			1960s			x	x				x				x					x			x		x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					R
Rønning et al. (2009)	Norway	Bank	1970s	60	x		x											x							x	x	x	x			x	x	x	x				x				x									x	N
The Empty Homes Agency (2008)	UK	Resi.	1890s	50	x		x			x	x		x				x						x		x	x	x	x			x	x	x	x								x										R
Wastiels et al. (2016)	Belgium	Resi.	n/a	60	x		x				x	x			x	x						x			x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					R
Weiler et al. (2017)	Germany	Resi.	1970s	50	x		x				x				x		x						x		x	x		x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	R

References

Alba-Rodríguez, M.D., et al. (2017). 'Building rehabilitation versus demolition and new construction: Economic and environmental assessment'. *Environmental Impact Assessment Review*, 66(September): pp. 115–126.

Berg, F. and Fuglseth, M. (2018). 'Life cycle assessment and historic buildings: energy-efficiency refurbishment versus new construction in Norway.' *Journal of Architectural Conservation*, 24(2): pp. 152–167.

Gaspar, P.L and Santos, A.L. (2015). 'Embodied energy on refurbishment vs. demolition: A southern Europe case study.' *Energy and Buildings*, 87(January): pp. 386–394.

Hawkins, D. and Mumovic, D. (2014). 'Use of an integrated simulation application to assess life cycle carbon impacts of university building redevelopment.' *Presented at the Building Simulation and Optimization*, London, UK, p. 8.

Itard, L. and Klunder, G. (2007). 'Comparing environmental impacts of renovated housing stock with new construction.' *Building Research & Information*, 35(3): pp. 252–267.

Rønning, A. et al. (2009) 'Refurbishment or Replacement of Buildings – What is Best for the Climate?' Presented at the Joint actions on Climate Change, Aalborg, Denmark, p.11

The Empty Homes Agency. (2008). *New Tricks with Old Bricks: how reusing old buildings can cut carbon emissions*. London, UK.

Wastiels, L., et al.. (2016). 'Demolition versus Deep Renovation of Residential Buildings: Case study with environmental and financial evaluation of different construction scenarios.' *Presented at the SBE16 - Sustainable Built Environment Conf*erence, Zurich, Switzerland.

Weiler, V., et al. (2017). 'Life cycle assessment of buildings and city quarters comparing demolition and reconstruction with refurbishment.' *Energy and Buildings*, 134(January): pp. 319–328.

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3.2.3 Variations in operational energy consumption

The operational impacts of an individual building are determined by its energy efficiency and therefore design. As shown in Chapter 1, different types of adaptation are affiliated with different levels of intervention and changes to thermal performance. In the context of the UK residential sector, existing studies argue that demolition is often unnecessary and environmental targets can be reached through refurbishment options, as it is possible for existing buildings to reach the same operational energy standards as new build (Morelli et al., 2014; Palmer et al., 2003; Power, 2008). However, Dubois and Allacker (2015) critique existing studies for only focusing on 'deep retrofit' strategies, which they define as a 60 per cent or more reduction in operational energy.

The retention options in the studies outlined in Table 3-2 use a range of terminology which corresponds to different types of intervention. These include rehabilitation, refurbishment (advanced and medium), transformation[10], consolidation[11], maintenance, and renovation. An indication that these studies only focus on more intrusive interventions is the lack of the word 'retrofit'. As discussed in Chapter 1, retrofit is considered to be a lighter touch than refurbishment by Dixon (2017). This variation in terminology and lack of definition highlights the difficulties in clustering studies together as this detail is lost. Therefore, it is unsurprising that there are different results comparing the impact of adaptation and demolition decisions as the chosen operational energy standards are inconsistent. This will also be impacted by the former and proposed use of the buildings in question, as they will have significantly different usage demands to one another. For instance, a former industrial building which operated 24hours a day is likely to use considerable less operational energy if change of use adaption to residential dwellings occurs.

A reason that residential refurbishment scenarios do not always reach the same operational energy standards as new build is due to the amount of intervention required and the costs of this (Itard and Klunder, 2007; Wastiels et al., 2016). In the context of heritage buildings, there may also be constraints on what intervention is allowed to take place. To overcome this, some studies such as Oregi et al's (2017) sensitivity analysis of 775 refurbishment scenarios, assumed that no restrictions were imposed. This assumption questions how realistic some of the scenarios posed in the academic literature are. In reality, as acknowledged by Olsson et al. (2016, p.30), "*cultural heritage values make some building envelope measures impossible*". In these instances, the required intervention to bring the building up to the same operational

[10] Transformations – "*improvements or interventions in a housing block or complex that go beyond an individual house*". e.g. joining houses together (Itard and Klunder, 2007. p.253).

[11] Consolidations – "*improvements of the building shell (such as insulation without any change in the floor plan of the house or housing block*" (Itard and Klunder, 2007. p.253).

standards as new is likely to be more complex, which increases the cost of the retention option compared to demolition and rebuild (Itard and Klunder, 2007).

At a city or even national level, the carbon emissions produced by operational energy consumption is likely to decrease in the future as there is a move towards renewable energy sources (Crawford et al., 2014). This is referred to as the decarbonisation of the electricity grid (Alderson et al., 2012; Kannan and Strachan, 2009). To evaluate the impact of including the decarbonisation of the grid on adaptation and demolition decisions for individual buildings, a study which resulted in a peer-reviewed conference paper was completed by the author (Baker and Moncaster, 2018b). The study used secondary data and adjusted the emissions factors (carbon produced by the energy consumption) based on the UK Government's goal to reduce carbon emissions by 34 per cent by 2020 and 80 per cent by 2050 compared to 1990 levels (HM Government, 2008). Although the purpose of the study was only to demonstrate a concept (not provide accurate numeric figures), it demonstrated that by taking into account the decarbonisation of the grid, the relative impact of the new build scenario compared to the 'medium refurbishment' switched. Therefore, a current limitation of papers comparing adaptation and demolition options is that decarbonisation of the electricity grid is excluded. If included in assessments, refurbishment scenarios are likely to be favoured as the proportion of embodied emissions will be higher.

3.2.4 Methodological uncertainties and inconsistencies

There are international efforts aiming to overcome the current methodological uncertainties and inconsistencies when calculating whole life energy and carbon. For example, The International Energy Agency Energy in Buildings Communities Programme (IEA EBC) Annex 57 programme took place from 2011-2016 and consisted of authors from fifteen countries, researching current limitations in embodied assessment methods and ways that embodied impacts can be reduced (Birgisdottir et al., 2017).

Methodological uncertainties and inconsistencies are caused by different data sources, modelling approaches and temporal and/or physical system boundaries (Rasmussen et al., 2018). Existing studies argue that these need to be overcome for embodied emissions to be fully embedded into policy or regulations (Birgisdottir et al., 2017; Rasmussen et al., 2018; Schmidt, 2018). Other causes for inconsistences within LCAs include operational energy predictions and assuming like-for-like replacements.

3.2.4.1 Modelling approaches and data sources

There are two main modelling approaches used for embodied impacts. British Standards, including EN 15643-2 (BSI, 2011a) and EN 15978 (BSI, 2011b) use a process-based approach to quantify embodied emissions. This approach traces the environmental impacts of all materials, components and processes which form the buildings. Input-output models assess the total economic or environmental inputs to and outputs of a specific industry or sub-sector (Crawford, 2011). Process-based is more common at the building level and input-output at the national/global level, although this can vary between countries due to data availability (Birgisdottir et al., 2017). The data sources for process-based models include databases such as EcoInvent and the Inventory of Carbon and Energy (ICE). These databases quantify the emissions for different materials, which are used for calculations using the process-based approach.

Studies focusing on LCAs for adaptation and demolition use different data sources. This makes comparison difficult as there can be a significant range in the distribution of embodied carbon coefficients. A review of coefficients by Moncaster et al. (2018) established that the carbon coefficients values[12] for concrete varied from 0.06-0.22kgCO_2e/kg$_{MAT}$, masonry ranged from 0.17-0.26kgCO_2e/kg$_{MAT}$, and steel from 1.80-2.21kgCO_2e/kg$_{MAT}$. These values correspond with 73 per cent, 35 per cent and 19 per cent differences within the same material category, emphasising that the choice of data source and material co-efficient have significant impacts on the final values quantified.

3.2.4.2 Temporal and physical system boundaries

There are also inconsistencies between which life-cycle stages are included in studies assessing the life-cycle impacts of a building. Conclusions from Annex 57 recommend that the minimum information required for a building should be 'cradle to handover' (Birgisdottir et al., 2017). The importance of including all life-cycle stages is emphasised by Moncaster and Symons (2013) who argued a focus on all life-cycle emissions rather than just the product stage can increase the embodied carbon by a factor of two. However, despite the recognised importance of including all life-cycle stages, through assessing a combination of systematic literature reviews, Pomponi and Moncaster (2018) found that the product and end-of life stages for embodied impacts were included in LCAs significantly fewer times than the construction process stage and use stage. This inconsistency in temporal system boundaries makes the comparison of assessments difficult.

In the context of existing buildings, another inconsistency identified between studies is whether or not emissions associated with the past construction are included in the assessment. Gaspar and Santos (2015) evaluate a family dwelling in Portugal for its embodied carbon. Their analysis includes the quantification of material in the existing structure, as well as the new material required for the refurbishment option and a new build replacement. Other studies, such as Erlandsson and Levin (2005), state that these are historical emissions and not relevant today, thus are 'sunk costs'. The inclusion of these historical emissions can also cause additional complications due to the accessibility to accurate data for historical materials (Bin and

[12] kgCO_2e/kg$_{MAT}$ = kilograms of carbon dioxide emission equivalents per kilogram of materials. Carbon dioxide emission equivalents used to describe greenhouse gas emissions using a common unit.

Parker, 2012). Overall, the majority of papers comparing adaptation and demolition options, do not include or mention the existing emissions (Alba-Rodríguez et al., 2017; Berg and Fuglseth, 2018; Hawkins and Mumovic, 2014; Itard and Klunder, 2007; Rønning et al., 2009; The Empty Homes Agency, 2008; Wastiels et al., 2016; Weiler et al., 2017). This indicates that the inclusion of these is not necessary.

In many papers it is difficult to assess what methods have been used including which life-cycle stages have been assessed as they are often inadequately described (Birgisdottir et al., 2017; Moncaster et al., 2018). This became apparent during the author's own comparison of papers discussing adaptation and demolition scenarios which was shown in Table 3-2. Several studies described life-cycles qualitatively (Alba-Rodríguez et al., 2017; Berg and Fuglseth, 2018; Gaspar and Santos, 2015; Itard and Klunder, 2007; Rønning et al., 2009; The Empty Homes Agency, 2008; Wastiels et al., 2016; Weiler et al., 2017). However, the detail provided varied with some papers describing the analysis as cradle to gate (Rønning et al., 2009) or cradle to grave (Wastiels et al., 2016; Weiler et al., 2017), whilst others described the stages e.g. 'production of materials'. Only one of the studies explicitly referred to the life-cycle stages outlined by the European TC350 technical committee (Hawkins and Mumovic, 2014). Therefore, identifying life-cycle stages and other the methods proved to be difficult, which supports arguments made by previous academics that there does need to be an improvement in traceability (Rasmussen et al., 2018).

System boundaries are also applicable to the physical system as well as the temporal, thus going beyond the individual building level. Stephan et al's (2013) study of 107 houses within a suburban neighbourhood showed that infrastructure aspects such as roads and power lines, equated to 16.9 per cent of the primary energy[13] over a one-hundred-year lifespan. They concluded that it is critical these requirements are considered in building LCA studies. None of the studies identified comparing adaptation and demolition decisions considered the surrounding infrastructure which is potentially a limitation.

3.2.4.3 Operational energy consumption predictions

Uncertainty is also applicable to calculations of operational energy consumption. A cause of major uncertainty predicting building performance is attributed to the diversity of occupants and their actions (O'Brien et al., 2017). In some instances, there are unintended consequences of energy improvements and occupants use more energy than is predicted, as a decrease in costs may unintentionally lead to an increase in energy beyond the predicted level. This is referred to as the rebound effect: "*in broad terms, the 'rebound effect' quantifies the proportion by which the consumption of energy services increases as a result of energy efficiency upgrade, and usually in relation to the proportionate increase in energy efficiency*" (Galvin, 2014, p.516).

[13] Primary energy is energy at the "*source level before conversion as opposed to the end-use energy at consumer*" (Rasmussen et al., 2018, p.1490).

The opposite of this, where occupants consume less heating energy than the calculated rating, is referred to as the 'prebound effect'. This is applicable before retrofit when people are more economical in energy efficient buildings (Sunikka-Blank and Galvin, 2012). At a masterplan level, these uncertainties increase further as large sites and cities are even more complex and there are multiple buildings in which occupancy rates need to be predicted (Lotteau et al., 2015; Sandberg et al., 2017; Zhivov et al., 2014). These uncertainties of operational energy consumption should be acknowledged as the assumptions made in the energy consumption models can significantly impact the overall output of LCAs and relative impact of retention versus demolition and vice versa.

3.2.4.4 Like-for-like replacements

The review of papers comparing adaptation and demolition options by the author identified that the majority of the LCA studies assume a like-for-like replacement (Alba-Rodríguez et al., 2017; Berg and Fuglseth, 2018; Hawkins and Mumovic, 2014; Itard and Klunder, 2007; Rønning et al., 2009; Weiler et al., 2017). This is considered to be unrealistic in practice as existing buildings are often demolished and replaced with bigger buildings to increase density (section 2.2). Although the use of carbon emissions per metre squared (CO_2e/m^2) is useful for comparison purposes for material choices and when replacing a building with one of the same floor area, this use of units needs to be treated with caution when comparing adaptation to demolition and new build.

To demonstrate the limitation of using like-for-like replacements, the author used secondary data to assess how changing floor areas effected the life-cycle emissions in Baker and Moncaster (2018b). This data included the carbon emissions for both a new build and refurbishment option, as well as the floor areas of these buildings. The values for CO_2e/m^2 were calculated and used to determine when the total emissions for the new build exceeded that of the refurbishment scenario, as the floor area of the new build was increased, and the floor area of the retention option was kept constant (figure 3-3). Using data from Weiler et al.'s (2017) study, the existing building's useable floor area was 1635m^2 with 1.70million kgCO^{2}e produced for the medium refurbishment and 1.66milliosn kgCO^{2}e produced for the new build over a 50-year lifespan. If the new build's floor area was to increase to 1766m^2 (and the refurbishment's remains at 1635m^2), only an eight per cent increase, the total emissions from the new build begin to exceed that of the refurbishment. This simple calculation demonstrates that if the existing building is replaced by a larger building, the total amount of emissions will increase which will be hidden by reporting only the relative emissions per square metre.

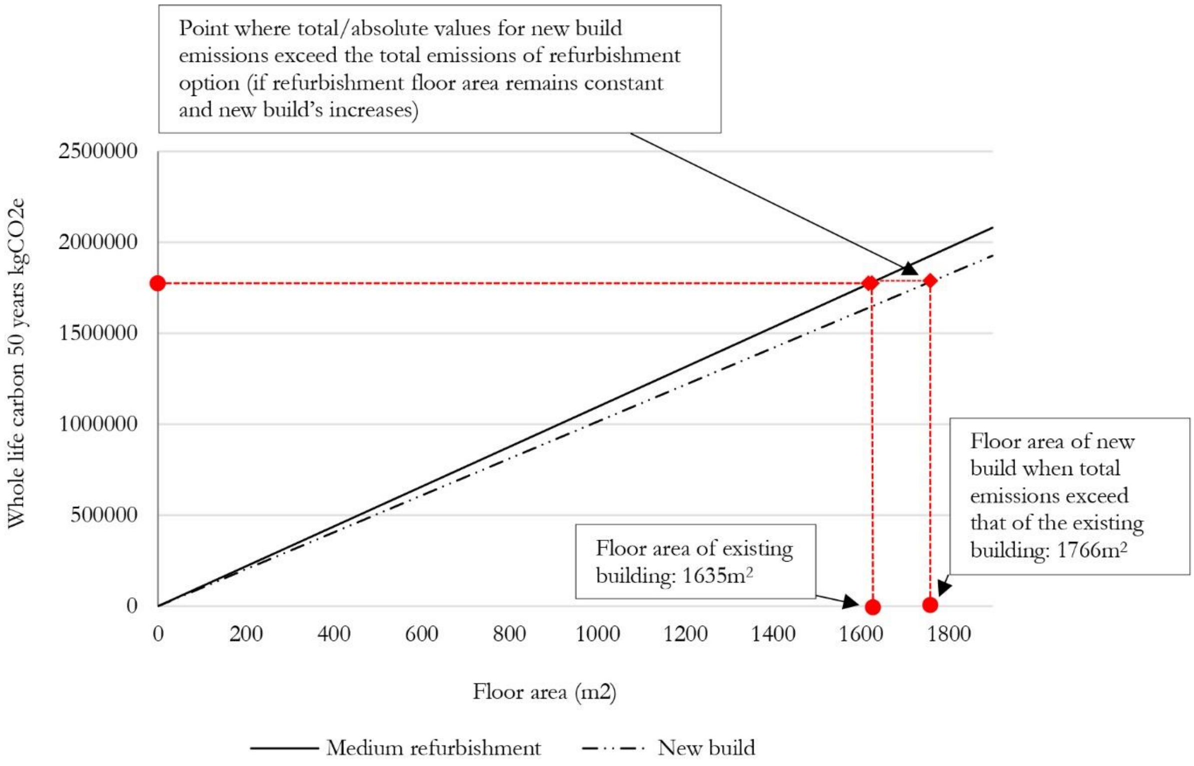

Figure 3-3: Impact of changing floor areas on whole life energy and carbon impacts.
Image produced by author. Published in: Baker, H. & Moncaster, A. (2018, p.15) Embodied Carbon and the Decision to Demolish or Adapt, *Zero Energy Mass Custom House (ZEMCH) Annual Conference*, 29 January – 1 February 2018, Melbourne, Australia.
Original data source: Weiler, V., Harter, H. and Eicker, U. (2017). 'Life cycle assessment of buildings and city quarters comparing demolition and reconstruction with refurbishment.' Energy and Buildings, 134(January): pp. 319–328.

3.3 Discussion

Retaining heritage and savings in materials and therefore reductions in embodied energy and greenhouse gas emissions, are both identified as benefits of building retention in existing studies focusing on adaptation and demolition decisions. However, these studies do not explore the theoretical underpinnings behind these claims. This chapter has discussed these concepts in detail in order develop an in-depth understanding of both heritage and whole life energy and carbon impacts, which includes embodied energy. Although, these were discussed separately, the discussion has shown that it is difficult to think about these factors, as well as those discussed in Chapter 2, in isolation from one another. For example, if an existing building is perceived to have heritage value, there may be constraints on what intervention is allowed to improve its energy efficiency, which is also affected by a building's physical attributes, demonstrating that adaptation and demolition decisions include a range of decision-making criteria that have to be balanced against one another (Crawford et al., 2014; Natividade-Jesus et al., 2013).

Heritage was discussed in the first part of this chapter. Heritage is a value-laden term, meaning multiple values are attached to it (Pendlebury, 2013). For industrial heritage, both individual buildings and larger sites containing multiple buildings, these include (but are not limited to) architectural, historical, technological and social values. The chapter discussed how there have been attempts to weight heritage values against one another in terms of their importance (Gang et al., 2014; Liu et al., 2018). A critique of these studies by the author emphasised that the judgement of values is subjective and will vary depending on who is making the assessment.

Changing theoretical perspectives of heritage from the preservation discourse to 'heritage planning' discourse were then discussed. This evolution in theory includes a growing acceptance of social values and thinking of heritage beyond the individual building level, by considering the ensemble value and even narrative behind a building or site. This is particularly relevant to industrial areas as the industrial process often goes beyond an individual building level (Copic et al., 2014).

The heritage section concluded by discussing the potential of heritage retention to add economic value at both the individual building level and at the larger scale of the masterplan. At the individual building level existing studies have found that historic residential buildings often have a price premium in comparison to non-historic residential buildings (Ahlfeldt et al., 2012; Lazrak et al., 2013; Noonan and Krupka, 2011). However, a limitation of these is that the prices of these existing buildings were not compared to new dwellings. At the masterplan level, the concept of heritage-led regeneration is relevant, whereby the retention of heritage items act as a catalyst for redevelopment in the surroundings. There is an acknowledgement of the tension that can exist between economic growth and conservation and that this is often dependent on the context and rate of change/population growth. As with the heritage planning discourse, the concept of heritage-led regeneration is applicable beyond the individual building level and considers the wider economic impacts, which is relevant to consider when discussing the redevelopment of larger brownfield sites.

Whole life energy and carbon impacts were discussed in the second part of this chapter. Savings in materials are regularly considered to be a driver towards the retention of buildings due to reduced embodied impacts. New buildings are often considered to be more energy efficient, which reduces operational impacts and can act as an argument for demolition and new build. However, these studies do not always consider embodied impacts (Power, 2008). In order to form a correct conclusion both embodied and operational impacts need to be addressed through a life-cycle assessment (LCA). Through the review of existing papers assessing the whole life energy and carbon of adaptation versus demolition decisions (table 3-2), the chapter suggested that a combination of different operational energy standards and methodological choices have led to the lack of consensus as to which option has a lower environmental impact.

Operational energy standards vary due to the design of individual buildings and their intended use (Malmqvist et al., 2018). However, as the carbon emissions produced through consumption are likely to reduce in the future due to a continued move towards renewable energy (Crawford et al., 2014), existing studies argue embodied impacts will contribute a larger proportion of the total life-cycle emissions (Rasmussen et al., 2018), which is likely to favour retention options as fewer materials tend to be used.

The uncertainty and inconsistency in methods has a significant impact on the LCA calculations at both the individual building and masterplan scales (Moncaster et al., 2018; Rasmussen et al., 2018). This currently makes the comparison of LCA studies focusing on adaptation and demolition decisions limited as it is difficult to determine whether it is the design choices or the methods used which are leading to different outcomes of whole life energy and carbon impacts.

There are at least two parallels that can be drawn between the review of heritage and energy. These are the inconsistencies in assessments and applicability of these factors beyond the individual building level. The section on heritage discussed how there are changing perceptions of heritage which is reflected in the changing heritage discourse. Additionally, the heritage values attached to a building or area, and their degree of importance, are dependent on the person making the judgement. For energy and carbon, the methodological choices differ between assessments and are dependent on the assessor. These inconsistencies emphasise the influence of people's judgement.

Thinking beyond the individual building level is particularly applicable to masterplan developments and the focus of this thesis. The chapter showed that heritage can be considered at the individual building level, but also that the ensemble or narrative behind the site can be assessed (Ashworth, 2011; Janssen et al., 2017). As for whole life energy and carbon, at the masterplan scale, buildings can be clustered together and utilise site-wide energy systems which can help to reduce operational impacts (Lotteau et al., 2015; Walker et al., 2018). However, the majority of papers included in the LCA review comparing adaptation and demolition options focused on individual buildings in isolation. When multiple buildings and infrastructure items are considered as part of larger development, the uncertainty currently associated with these calculations is likely to be exacerbated, thus there is an added complexity when addressing whole life energy and carbon at the masterplan scale.

There is also a key difference between the two benefits discussed. Heritage tends to focus on social impacts and it is considered as important to ensure cities continue to have a sense of identity in a globalising world (Copic et al., 2014; Hall, 1999; Winter, 2014). Embodied and operational impacts consider greenhouse gas emissions and are linked to environmental impacts as there are international efforts to prevent global warming (IPCC, 2014). Nonetheless, both benefits link to economic factors. The price premium associated with heritage and notions underpinning the concept of heritage-led regeneration can act as a driver towards retention. In terms of energy, it is often possible to adapt a building to the same energy efficiency standards as new build but the level of intervention will be determined by the building's physical attributes and therefore construction costs.

CHAPTER 4:

Methodology

The overarching aim of this thesis is to explore and understand the factors that are considered when the decision is made to adapt or demolish existing buildings on masterplan sites containing former industrial areas, and why this is so. As outlined in Chapter 1, the research questions ask:

1) What is considered in the decision to adapt or demolish existing buildings on masterplan sites?
2) Are heritage values and whole life energy and carbon considerations taken into account in practice when decisions are made to adapt or demolish existing buildings on masterplan sites?
3) Are there underlying reasons governing the consideration of different factors, including heritage and whole life energy and carbon, when deciding to adapt or demolish existing buildings on masterplan sites?
4) What theoretical framing can be used to explain these findings and develop previous adaptation and demolition theory?

'What' and 'Are' questions both invite the exploration of a central phenomenon, which is relevant to qualitative research (Creswell and Creswell, 2018; Silverman, 2013). Thus, the first three questions invite both descriptive and exploratory answers. The last question helps to frame and therefore provide a better explanation for the conclusions drawn.

This chapter begins by explaining the author's philosophical worldview and how this has informed the research design. Research methods are discussed including an explanation of data collection and data analysis techniques. The chapter concludes by outlining how the three case study sites were selected and provides a description of each one.

4.1 Pragmatist worldview and qualitative research approach

A research approach is determined by the author's philosophical worldview, research design and research methods (Creswell and Creswell, 2018). Four philosophical worldviews are put forward by Creswell and

Creswell (2018). These include post-positivism, constructivism, advocacy/participatory and pragmatism. Brief definitions of these are provided in Table 4-1.

This thesis takes a pragmatic worldview, which is centred on understanding real-word problems (Creswell and Creswell, 2018; Robson and McCartan, 2016). As expressed by Saunders (2015, 143) "*it strives to reconcile both objectivism and subjectivism, facts and values, accurate and rigorous knowledge and different contextualised experiences*". The literature review (Chapters 2 and 3) demonstrated that adaptation and demolition decisions involve both objective and subjective judgements. The physical attributes of a building, such as floor-to-ceiling heights, are often measurable and therefore objective, whilst other factors, such as the social impacts and perception of heritage, are commonly perceived as subjective. Hence, the decision of adaptation and demolition is well-suited to the pragmatist worldview which aims to understand both objective and subjective facts and values.

Pragmatists seek to learn from past experiences and from present actions to understand complex systems. Ehrenfeld and Hoffman (2013, p.112) state:

> "*That's where pragmatism really hits its stride. The world you look at physically may be the same world I look at, but we may see very different worlds. We each bring something to the equation of understanding what's around us.*"

The comparison of studies weighting decision-making criteria and heritage values in Chapters 2 and 3, indicated that people have different opinions about what is important to consider, hence the need to recognise that people will view the problem of adaptation and demolition in different ways.

Pragmatism is commonly linked to mixed-methods research, which is often described as a combination of quantitative and qualitative approaches (Johnson et al., 2007). However, pragmatists do not have to use both. Saunders (2015, p.144) discuss how "*they use the method or methods that enable credible, well-founded, reliable and relevant data to be collected that advance the research*" (Saunders, 2015, p.144). Therefore, methods can be qualitative, quantitative or both. Pragmatists use all approaches necessary to address the research questions and the chosen methods are dependent on what the researchers wants to achieve (Baert, 2005; Creswell and Creswell, 2018; Denzin and Lincoln, 2018; Morgan, 2014). This thesis uses only qualitative methods as research and existing literature about the decision of adaptation and demolition at the masterplan scale is limited and the overarching aim is one of understanding and exploration, which lends itself to qualitative methods (Saunders, 2015).

As adaptation and demolition at the masterplan scale is a new topic, it is appropriate to take an inductive approach to generate data and reflect on the theoretical themes that the data suggests (Saunders, 2015). This means the researcher builds up patterns, categories and themes from the 'bottom-up'. Often there is not a theory 'a priori' to the research being undertaken and the understanding of the phenomenon emerges as the research progresses (Creswell and Creswell, 2018). Baert (2005, p.154) explains how "*the ultimate aim is not to defend or refine a particular system but to use academic conversation to enhance our imaginative faculties*".

Table 4-1: Philosophical worldviews.
Adapted from: Creswell, J.W. and Creswell, J.D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 5th ed. SAGE Publications Inc., Los Angeles, London, New Delhi, Singapore, Washington DC, Melbourne.

Knowledge claim	Epistemological/knowledge assumptions
Post-positivism	Determination; reductionism; empirical observation and measurement; theory verification.
Constructivism	Understanding; multiple participant meanings; social and historical construction; theory generation.
Advocacy/Participatory	Political; empowerment issue orientated; collaborative; change-orientated.
Pragmatism	Consequences of actions; problem-centred; pluralistic; real-world practice orientated.

4.2 Research design

A research design is defined as *"[a] logical plan involving strategic decisions with the aim of maximising the validity of findings"* (Toit and Mouton, 2013, p.126). The design of this research was sequential, meaning one phase of data collection and analysis was followed by another (Bovaird and Kupzyk, 2010). This type of design allowed the author to explore particular aspects related to the qualitative data in more detail as findings emerged from the study. The one phase could build upon the findings of the stage before it. The sequential approach permits flexibility in the design which is well suited to real-world studies and also characteristic of inductive theorising (Gibbs, 2008; Robson and McCartan, 2016).

The research consisted of four phases (figure 4-1). These are now summarised to provide an overview of the research design. The first phase was the literature review. This in itself took a sequential approach. The decision to focus on adaptation and demolition at the masterplan scale emerged from the testing of existing decision-making toolkits in the author's Master's thesis, as the focus is on individual buildings or a city scale in previous adaptation and demolition studies. The review of academic literature focusing on adaptation and demolition was then developed to gain a broader understanding of the topic and provided the foundations for the rest of the work (Oliver, 2012). During this review, two key benefits of adaptation emerged as they were referred to by multiple studies. Hence, additional literature reviews took place examining the theoretical underpinnings of both heritage and whole life energy and carbon.

The second phase of the research included preparatory and exploratory studies, focus groups and interviews with professionals in the built environment. The aim of this phase was to understand and explore the key concepts related to adaptation and demolition from a range of disciplines and provide the author with a core level of understanding before the case study investigations took place.

Contextualisation is seen as the 'core logic' behind case studies (Proverbs and Gameson, 2009; Robson and McCartan, 2016; Toit and Mouton, 2013). Case study research was undertaken in the third phase to explore decisions within a real-life context, at the masterplan scale, and to address why different factors may be considered in varying circumstances. The use of case study research on project specific sites is supported by Toit and Mouton (2013). They set out a series of design considerations for research in the built environment and suggest the appropriate type of research design (see Table 4-2).

The three case studies are all masterplans under construction in areas previous used for industrial purposes. They are located in three different countries: the UK, the Netherlands and Australia. Descriptions of how the case studies were selected and an overview of each site is provided at the end of this chapter (section 4.4). Multiple methods were used as sources of evidence (Schwandt and Gates, 2018; Yin, 2009). These included site-visits, a review of documentation, and interviews.

The author then reflected on the analysis of the data from all of the preceding stages to answer the first three research questions. She then identified what theoretical framing could be used to explain the findings and how this could be used to develop building adaptation theory which is currently focused on the individual building level.

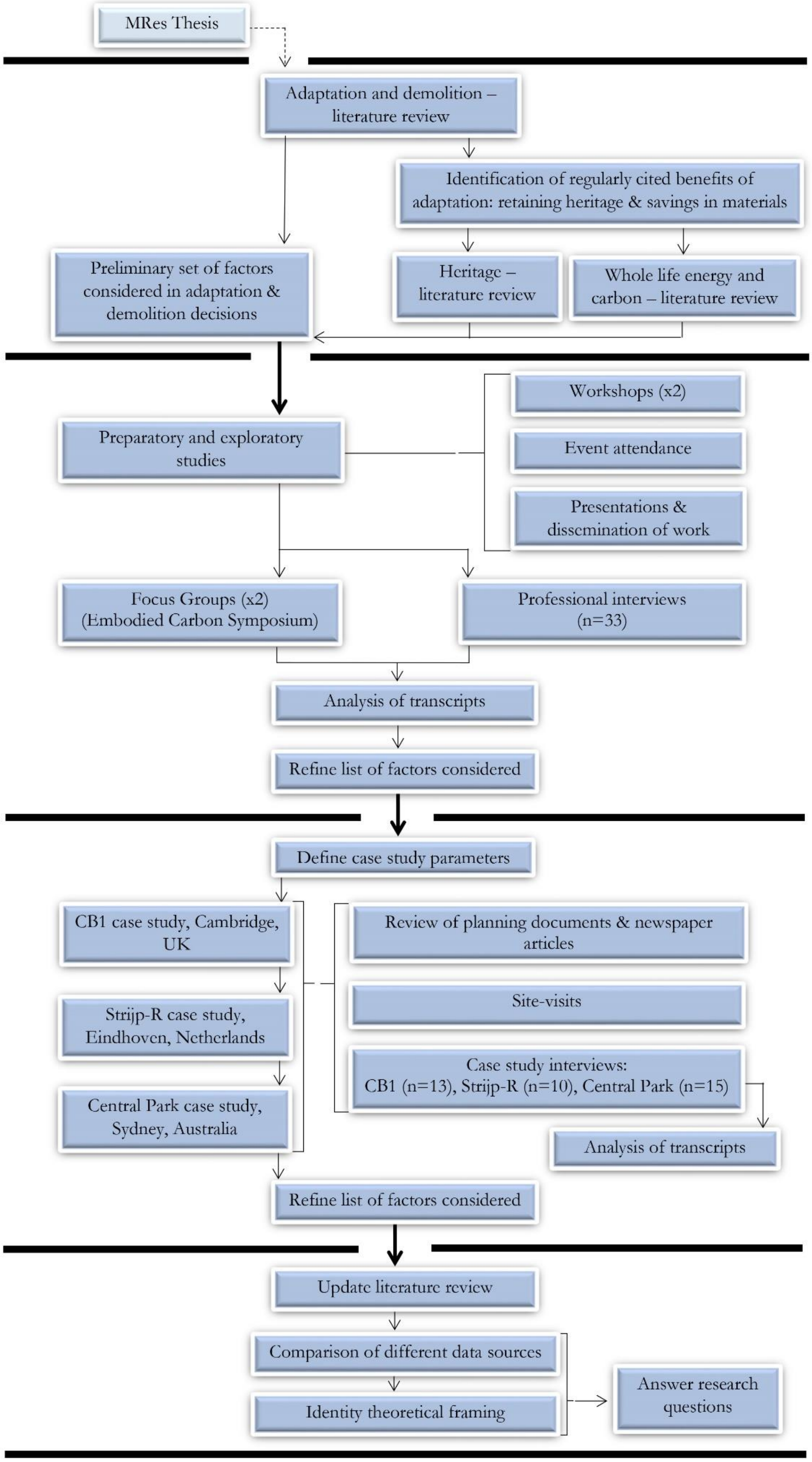

Figure 4-1: Research design.

Table 4-2: A typology of design for research in the built environment.
Adapted from: Du Toit, J.L. and Mouton, J. (2013, p.132). 'A typology of designs for social research in the built environment.' *International Journal of Social Research Methodology*, 16(2): pp. 125–139.

Design considerations						Research Design
Research context & research aim	**Research purpose**	**Methodological paradigm**	**Methodological approach**	**Source of data**	**Core logic**	
Basic (towards applied) contexts Theoretical aims	Interpretative Exploratory Descriptive	Interpretive social science (towards pragmatic)	Qualitative	Primary (towards hybrid)	Contextualisation	**Case studies**

4.3 Research methods

Research methods include the mechanisms used for data collection, analysis and interpretation (Creswell and Creswell, 2018). This section begins by discussing preparatory and exploratory studies, then outlines the different forms of data collection used for this research. The analysis of interview and focus group data is then discussed, followed by an explanation of how the findings were interpreted and contribute to theory.

4.3.1 Preparatory and exploratory studies

Preparatory and exploratory studies include the author's Master's thesis, organisation of two workshops focusing on adaptation and demolition on masterplan sites, the attendance at events relevant to the research, and receiving feedback from presentations.

The benefits of pilot studies are discussed by Silverman (2013). For instance, they allow the researcher to practice interview technique and determine if there will be substantive or interesting data related to the research topic. The research conducted for the author's Master's thesis included eighteen interviews, with people involved in the development projects, used to test adaptation and demolition toolkits (Baker, 2015). These gave the author practice interviewing.

The author was invited to organise two separate workshops based on the research topic. The first workshop was for the Arup Education Trust (AET) in Johannesburg, South Africa. The AET sponsors undergraduate students from historically disadvantaged backgrounds on courses related to the built environment. The second workshop was organised for the Interdisciplinary Design and Built Environment (IDBE) Master's programme in Cambridge, UK. This Master's programme is part-time and designed for professionals in the built environment. The aim of the workshops was two-fold. They served as a learning exercise for the participants but also helped to determine if the research topic led to substantive and interesting data, hence why they constitute as pilot studies.

During the workshops the classes were separated into different stakeholder groups (approximately 5-6 people per group). Each group was asked what decision-making criteria were important to their stakeholder and to write their answers onto post-it notes. To provide the class with context to the decision, they were provided with a handout with a brief description of a masterplan development and images of buildings on the site. The participants were asked to order the criteria in terms of importance and then present to the class (see figure 4-2).

In the first workshop the stakeholder groups were developers, the design team, end-users and town planners. These were chosen to represent an array of disciplines in the decision-making process. However, feedback from the workshop indicated that there are limitations grouping stakeholders such as architects and engineers in the same group (the design team), as they are likely to have different perspectives on what needs to be considered. For this reason, in the second workshop, the design team was split into architects and engineers, however the engineering group felt that there were even more sub-categories such as mechanical and electrical (M&E) and structural engineers. Additionally, during the workshops some groups felt it was difficult to rank criteria in terms of their importance, with a particular issue being that they did not have a sufficient understanding of the context.

As the findings from the workshops were not from people representing their own profession, they have not been included in the analysis chapters. Nonetheless, they helped to outline what factors might be considered in the decision-making process, the difficulties of grouping stakeholders, and importance of contextual factors. Therefore, they were still useful in developing the author's understanding of the topic and determining the research approach for the following phases.

The author also developed her understanding of the topic by attending events considered to be relevant and by the dissemination of research through a variety of presentations. The attendance at events allowed the author to identify potential interviewees, whilst feedback from the presentations provided direction for the research project. These events and presentations are outlined in Table 4-3, alongside what impact they had on the research design.

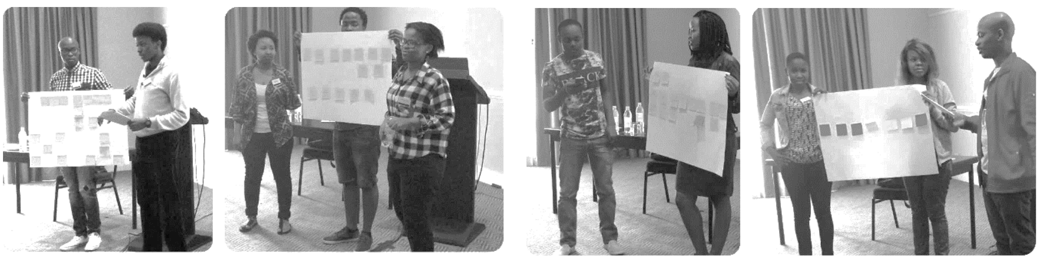

Figure 4-2: Arup Education Trust (AET) students presenting their criteria and results from workshop to the rest of the class. Photographer: Susan Snaddon.

Table 4-3: Preparatory and exploratory studies: workshops, event attendance and presentations by author.

Preparatory/exploratory study	Date	Impact on research design
Workshops (organised by author)		
Arup Education Trust	28/11/2015	Developed background knowledge on decision-making criteria. Identified limitations of grouping stakeholders together and the importance of considering contextual factors when determining the importance of decision-making criteria.
Interdisciplinary Design and Built Environment	10/12/2015	
Event attendance		
The Listed Property Owners Club – The Listed Property Show	20/02/2016	Identification of potential interviewees.
The Royal Town Planning Institute (RTPI) – Development in the Rural Historic Environment	16/03/2016	Background information and identification of potential interviewees.
The Chartered Institute of Building – How to Make Buildings Work for You – Heritage, Renovation, Innovation and Sustainability	17/03/2016	Background information and identification of potential interviewees.
The Academy of Urbanism 2016 – The Future of Urbanism	09/06/2016 – 10/06/2016	Provided author with a broader understanding of issues related to urbanism.
Bristol Young Urbanists - Finzels Reach site visit	11/07/2017	Background information from masterplan site visit and identification of potential interviewees.
Presentations by author		
Building Research Establishment (BRE)	16/01/2016	Potential future collaboration and interviewees identified. Provided author with broader understanding of BRE's sustainability assessments and relevance to building retention and masterplan developments.
Buro Happold Offices	17/01/2016	Background knowledge. Discussion how research linked to Buro Happold's projects.
Centre for Sustainable Development, University of Cambridge	16/02/2016	Feedback received from professors and other PhD students about future direction of research.
Cambridge Architectural Research Ltd.	01/06/2016	Discussion with audience (including architects, practitioners, policy-makers and academics) about potential case study sites and avenues of exploration.
Future Cities Conference, University of Cambridge	29/06/2016	Identification of potential interviewees.
FIBE CDT Annual Conference	17/10/2016	Identification of potential interviewees. Feedback received from FIBE CDT industry partners and academics.
Interdisciplinary Design and Built Environment	06/12/2016	Presentation to professionals in the built environment. Potential interviewees identified.
Cambridge University Science Festival	25/03/2017	Formed links with other academics within University.
Cambridge Architectural Research 30th Anniversary	27/04/2017	Feedback received through discussion with other authors and practitioners.
Corporate Arcadia, TU Delft, Netherlands	12/12/2017	Focus on embodied carbon. Presented alongside other talks. Cross-overs between topics identified.

4.3.2 Data collection

This section outlines how the data was collected for the interviews with professionals in the built environment, focus groups, as well as those required for the case studies including planning documents and media articles, site visits and additional case study interviews.

4.3.2.1 Professional interviews

The purpose of interviews is to produce new knowledge and gain an exploratory overview of a phenomenon by obtaining new insights and fresh perspectives (Collins, 2010; Gubrium and Holstein, 2001; Kvale, 2008). As conveyed by Brinkmann (2018, p.580) interviews are "*conversations conducted for a purpose*". Interviews took place with professionals in the built environment in the second phase of research in order to obtain an in-depth understanding of different viewpoints to adaptation and demolition at both the individual building level and masterplan scale. These are referred to from this point on as 'professional interviews'.

4.3.2.1.1 Participant selection

Participants were chosen through purposive sampling methods, as they were selected based on known characteristics and parameters (Given, 2008; Silverman, 2013). It is common to use purposive sampling in flexible research designs and the parameters are set to enable the researcher to satisfy their needs for the project: "*the idea behind qualitative research is to purposefully select participants or sites that will best understand the problem and question*" (Creswell and Creswell, 2018, p.185). The needs here being gathering a plurality of viewpoints on adaptation and demolition decisions.

Types of purposive sampling techniques include 'convenience sampling' and 'opportunistic and snowball sampling' (Kemper et al., 2003). Convenience sampling is when groups or individuals are chosen due to being conveniently available and willing to participate in the study (Collins, 2010). This is one of the most commonly used purposive techniques (Kemper et al., 2003). For this research, potential participants were identified through the industry partners[14] for the author's PhD programme (FIBE CDT), links through the author's former consultancy work, supervisor contacts, and attendance at conferences and events. Once an interview had taken place, the interviewee was asked if they recommended further people to be interviewed. This led to a 'snowballing effect', as additional participants were identified (Given, 2008).

A common critique of convenience and opportunistic sampling is that it is not representative of the population (Collins, 2010; Kemper et al., 2003). However, as the purpose behind the interviews was to explore and understand different viewpoints towards adaptation and demolition, a representative sample

[14] The author is part of a Centre for Doctoral Training (CDT) which has industry partners including major consultancies, contractors and asset providers. Their role is to engage with training and research activities within the CDT.

was not considered necessary or even possible as viewpoints were unknown before the interviews took place.

Stakeholders were defined using lists provided in previous academic studies focusing on adaptation and demolition decisions and/or brownfield redevelopment (Bullen and Love, 2010; Doak and Karadimitriou, 2008; Plimmer et al., 2008; Wilkinson, 2011). The stakeholders identified include amenity groups, community members, construction companies, consultants, designers, developers, investors, policy makers, planners, regulators, service providers and users.

The stakeholder list is set out in Table 4-4 alongside related terms and the number of people interviewed in each category. As the preparatory workshops demonstrated that there are limitations grouping stakeholders together, a list of interviews including additional information about the interviewees, alongside the interview date and length is provided in Appendix 2.

In total, there were 31 professional interviews with the stakeholders outlined. Two additional interviews with academics specialising in embodied energy also took place whilst the author was on academic secondment in the Netherlands and Australia. These provided an overview of embodied energy's consideration in these countries. In sequential research designs, the number of participants is not predetermined (Bovaird and Kupzyk, 2010). Instead, the author proceeded onto the case study investigations when no new issues emerged from the interviews, otherwise known as reaching qualitative saturation (Creswell and Creswell, 2018).

There are likely to be other stakeholders which are not identified. This is suggested by Doak and Karadimitriou's (2008, p.71) use of the word 'simplified' in their caption for a figure depicting stakeholder networks: "*The (simplified!) network of actors around brownfield regeneration*". However, those outlined are considered to be the main stakeholder groups and those excluded are likely to have significantly less influence over the decision than those defined (Wilkinson, 2011).

Community members and building users were not interviewed as there was no building or area to contextualise the viewpoints and the stakeholder group was considered too broad. Although, construction companies and service providers were identified as stakeholders for brownfield regeneration by Doak and Karadimitriou's (2008, p.71), due to the lack of inclusion of these stakeholder categories in lists from studies focusing on adaptation and demolition decisions (Bullen and Love, 2010; Plimmer et al., 2008; Wilkinson, 2011), they are not considered so influential for this topic. As discussed by Wilkinson (2011, p.25) "*stakeholders make decisions at different stages in the process and each has different degrees of influence*". There were also no interviews with investors. This thesis is not exploring whether or not people invest in an area but what happens to a building when the building or site has already been purchased. Despite these missing categories, the interviews still provide multiple viewpoints from people with different roles and experiences, which allowed the author to gain a deeper understanding of the research problem.

The parameters set for inclusion in this research, beyond the participant fitting within one of the stakeholder groups, was that they must have a chartered status. If a chartered status was not applicable, five or more years of experience in the identified role was required. The participant also needed to have experience working with existing buildings, ideally at a masterplan level. This ensured that the participant had a sufficient level of background knowledge to contribute to the research.

Table 4-4: List of stakeholder categories and number of professional interviews.
Data sources to identify stakeholders: Bullen, P.A. and Love, P.E.D. (2010). 'The rhetoric of adaptive reuse or reality of demolition: Views from the field.' *Cities*, 27(4): pp. 215–224; Doak, J. and Karadimitriou, N. (2008). 'Chapter 4: Actor Networks: The Brownfield Merry-Go-Round.' In: Dixon et al. (eds.) *Sustainable Brownfield Regeneration*. Wiley-Blackwell, pp. 67–88; Plimmer, F. et al.. (2008). *Knock it down or do it up? Sustainable housebuilding: New build and refurbishment in the Sustainable Communities Plan*. BRE Press, Watford, UK.; Wilkinson, S. (2011). *The Relationship between Building Adaptation and Property Attributes*. PhD. Deakin University, Australia.

Stakeholder category	Related terms	Number of interviewees
Academic (embodied energy only)	-	2
Amenity group	Heritage society	6
Community member	Resident, lobbyist	-
Construction company	Contractor, project manager	-
Consultant	Advisor, engineering consultant (fire, structural, mechanical, electrical), environmental consultant, heritage consultant, planning, quantity surveyors, agent/value, community consultant	11 + 1 email response.
Designer	Architect, urban designer, engineer	4
Developer	Development company, land owner, real estate owner	4
Investor	Insurance companies, banks	-
Policy makers	Government agency; Local Authorities; public agency; government official; approver	2
Planner	Public planner, conservation officer	2
Regulator	Watchdog; statutory consultees e.g. heritage; building surveyors	3
Service provider	Utility company	-
User	Occupier, retailers, building manager	-
	Total number of professional interviewees	**34***

*Total number of interviews was 33 as one interview included two interviewees (a developer and a designer).

4.3.2.1.2 Interview preparation and conduction

Potential participants were contacted via an email which provided an overview of the project and a request for their participation. If someone agreed to take part in the research, they were provided with an information sheet and consent form before the interview took place. Copies of these, alongside the ethical approval[15] to undertake this research, are provided in Appendix 3. The information sheet outlined the purposes of the research and how the data from the interview would be used. The consent form included a request to voice record the conversation. The participant was asked to confirm consent via email. Following consent being granted, a time and date convenient to the participant was organised for the interview to take place. Fifteen of the interviews took place in person, which is preferred as it allows the author to build a better rapport with the interviewee through their 'embodied presence' (Brinkmann, 2018). However, due to time constraints and a lack of financial resources for travel, the remaining eighteen interviews took place over the telephone. The average length of interview was 49 minutes, ranging from 20 minutes to 90 minutes.

There are different types of interview including informal conversation, general interview guide approach, and closed-fixed/structured interviews response (Haigh, 2009). The interview type used for this research was the general interview guide approach, also referred to as semi-structured interviews. Although semi-structured interviews are harder to compare than structured interviews, which have a fixed set of questions, the flexibility and exploratory nature suited the inductive research approach (Proverbs and Gameson, 2009).

The interview guide for these professional interviews is displayed in Figure 4-3 and consists of four stages. At the beginning of the interview (stage 1), the author introduced herself, explaining that she was a PhD student looking at the decision of adaptation and demolition, whilst emphasising that she was particularly interested in masterplan developments. The author thanked the participant for taking part and clarified whether or not they still agreed to the conversation being recorded. The author tried to use this initial introduction to build a rapport with the participant to encourage them to talk openly and freely during the rest of the conversation (Robson, 2011). This was achieved by talking enthusiastically about the topic and highlighting how the participant's viewpoint would be beneficial. The author explained that there was a list of questions but that these were just a guide and other questions may be asked based on what the participant said.

[15] As people were involved in the research, ethics approval was required by the Department of Engineering, University of Cambridge.

The questions in the interview guide were designed to be open and invite descriptive answers as advised by Denzin and Lincoln (2018). The initial questions (stage 2) invited the interviewee to discuss their job and role in adaptation and demolition decisions, followed by a discussion about the process that they go through when undertaking tasks relevant to their stakeholder role. For example, building surveyors were asked to discuss how they determined the technical feasibility of adaptation, whereas heritage consultants were asked about the process they go through to produce heritage impacts statements. Depending on the conversational flow and what content was covered in these initial stages, other essential themes/core questions in the interview guide may have been asked (stage 3). These included: benefits and drawbacks of retention, problems with the decision-making process and potential improvements to the process.

As the interviews were semi-structured, this allowed the author to ask additional follow-up or probing questions to utilise their exploratory and flexible nature (Bryman and Bell, 2011; Proverbs and Gameson, 2009). For example, asking the participant what was meant by something they said or asking them to talk about a particular issue in more detail. Often these follow-up questions were used by the interviewer to show interest in what was said and to continue developing a rapport and encourage conversational flow. As the interviewee was speaking, the interviewer would make a note of a topic/prompt for a follow-up question and go back to it as a convenient time. The interviewer tried to ensure that they were not leading in any of their questions and in some cases delayed asking about particular topics e.g. embodied energy, to see if it came up naturally in conversation. In addition to this, before the interview took place, background research on the participant was undertaken. Therefore, if particular topics were not mentioned by an interviewee, for example specific projects they had been/were involved in, they were asked directly about them e.g. "*please could you tell me more about adaptation and demolition decisions on [name of project] that I saw you have been involved in*?". Examples of these prepared questions and follow-up questions are provided in Appendix 4. At the end of the interview (stage 4), the participant was asked if they had any suggestions for masterplan case study investigations or other people to talk to. After checking if they wanted to add anything else which had not been covered, the interviewer thanked them for their time and asked if they would like to keep updated about the project.

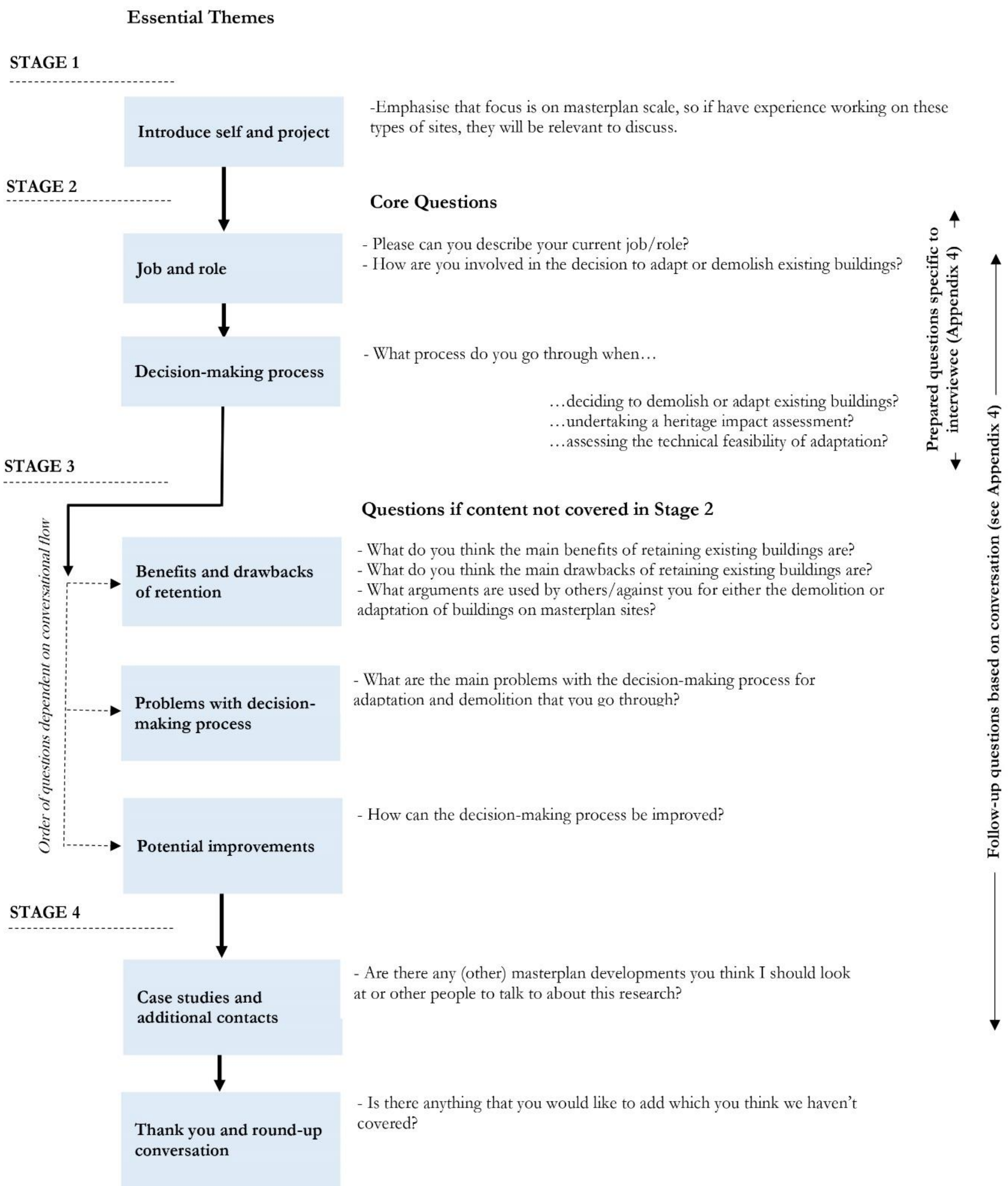

Figure 4-3: Interview guide for 'professional interviews'.

4.3.2.2 Focus groups

Focus groups are group discussions focused on a particular issue and help to create a wide variety of views about the same problem (Bryman and Bell, 2011). During the initial professional interviews, embodied energy was rarely discussed in detail by participants, yet was a regularly discussed benefit of building adaptation in the academic literature. Therefore, when the opportunity arose in the 1st year of the PhD to lead two focus group discussions as part of an Embodied Energy Symposium, the opportunity was taken.

The symposium was hosted at Newnham College, Cambridge, UK on the 11th April 2016. It was organised by The Cambridge University Environment Sustainability Group (CUBES). The day included talks by CUBES members and two rounds of six simultaneous focus group discussions, of which the attendees chose which one to attend based on the question. The question set by the author was: "*How can embodied carbon be incorporated in the decision to demolish or retain existing buildings?*". The aim of the focus groups was to help answer the second research question and assess whether embodied carbon is taken into account in practice when deciding to adapt or demolish existing buildings, and if not, what can be done to ensure that it is.

The focus group participants were previous contacts of CUBES members and included academics and professionals in the built environment. They were selected due to their involvement and expertise in embodied energy. Table 4-5 outlines the different stakeholder categories and the number of participants representing these within each focus group discussion (additional information is provided in Appendix 5). A limitation of the focus groups for this thesis, is that due to the background of people involved, their experience on masterplan sites was limited and the discussion tended to focus upon individual buildings in isolation and not in the context of larger urban developments. However, the viewpoints were still applicable and build upon the foundation set by the literature review as they show general attitudes towards the incorporation of embodied carbon into decision making.

Each discussion lasted thirty minutes and had seven participants. Initially everyone was asked their viewpoint 'one-by-one' and then the topic was opened up for discussion. Following twenty minutes of conversation, the participants were asked to outline what they thought the key points were. The discussion was recorded. As with the interviews, the participants were aware of this and asked to sign a consent form beforehand. As focus group discussions require a free-flowing conversation but should avoid irrelevant discussion (Bryman and Bell, 2011), the author took the role of facilitator which helped to overcome problems with dominant characters and redirected conversation if need be.

Table 4-5: Stakeholder categories and number of focus group participants.

Stakeholder category	**Number of participants**	
	Focus Group 1	**Focus Group 2**
Academic	2	1
Consultant	2	3
Designer	2	1
Developer	0	1
Investor	1	0
Planner	0	1
Total	**7**	**7**

4.3.2.3 Case study documents and observation

Case study investigations are context specific, therefore it was important for the author to obtain contextual information about the sites before any interviews took place (Creswell and Creswell, 2018). This was achieved through the review of publicly available planning documents, newspaper articles and site visits.

All of the case study sites (descriptions are provided at the end of the chapter) were masterplan developments which had received planning permission, therefore there were documents online for the masterplan's application. In addition to planning documents, newspaper articles were useful for providing further information about the site and its history. A database called Factiva was used to search for articles relating to each cases study site. Factiva is a Global News Database, where many of the sources are no longer available on the free web. The author obtained access via the University of Cambridge internet login. Both the planning documents and newspaper articles were a rich source of information and useful to obtain basic and/or factual information about the case in hand (Proverbs and Gameson, 2009). A list of documents and articles is provided in the case study references at the end of this thesis.

Site visits act as a causal data gathering exercise which allows a researcher to obtain a better understanding of the context under investigation (Yin, 2009). The author was able to visit all three case study sites[16]. These visits took place after some background research had taken place. A site visit has been classified as a time that the author visited the site with the purpose of taking photographs and exploring the area. This is being noted as the author also had the opportunity to regularly pass through two of the case study sites. For the Cambridge site, this occurred multiple times as the author lives in close proximity to the development. In Australia, despite only being in Sydney for four weeks, the author regularly walked through the site on the commute during her academic secondment. This was beneficial on both sites as the author was able to observe the site at different times of day. In the Netherlands, the site was over an hour away from the author's host university. However, the majority of interviews took place in Eindhoven (where the site is located) which gave the author an opportunity to visit.

4.3.2.4 Case study interviews

Interviews are considered to be one of the most important sources of information in case study research (Proverbs and Gameson, 2009; Yin, 2003). Although the majority of interviews were with professionals in

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[16] Site visit dates:
CB1 – 30/11/2016, 18/01/2017, 29/03/2017, 22/05/2017.
Strijp-R – 02/11/2012, 03/11/2017, 15/11/2017, 16/11/2017, 08/11/2017.
Central Park – 06/02/2017, 11/02/2018, 24/02/2018, 27/02/2018, 02/03/2018.

the built environment, to distinguish this set of interviews from the 'professional interviews', from this point on they are referred to as 'case study interviews'.

4.3.2.4.1 Participant selection

Once the cases had been selected, the review of documentation and newspaper articles was used to create a list of people involved with and affected by adaptation and demolition decisions during the design of the masterplan. The author sought to find contact details and proceeded to invite participants for interview through email. For some of the participants, there was a snowballing effect, whereby an interviewee suggested someone else to talk to.

In total thirty-eight case study interviews were conducted. Table 4-6 provides a summary. A detailed breakdown of these interviews including the date, length, and additional information about the interviewees is provided in Appendix 6. Stakeholder groups were the same as those for the professional interviews (section 4.3.2.1) and included consultants, developers, designers, planners, and policy-makers. Local residents were also interviewed on two of the sites, as the case studies now provided a context. In addition, on Strijp-R, due to 'snowballing', the opportunity arose to interview the contractor for some of the existing buildings.

Table 4-6: Number of interviews and response rate for each case study site.

Stakeholder category	Number of interviews (interviewees)		
	CB1, Cambridge, UK	**Strijp-R, Eindhoven, Netherlands**	**Central Park, Sydney, Australia**
Academic	-	1	-
Community member	3	-	1
Construction company	-	1	-
Consultant	5	3	5
Designer	1	4	4 (8)
Developer	1	-	2
Policy makers	1	-	1
Planner	2 + 1 email response	1	2
Total	**13**	**10**	**15*(19)**

*Number totals to 15 for Central Park interviews, however there were 19 interviewees.

4.3.2.4.2 Interview preparation and conduction

The case study interviews took a similar format to the professional interviews in that they were semi-structured and an interview guide was prepared beforehand. The interviewees were also provided with an information sheet and consent form. The average length of the interviews was 74 minutes, ranging from 30 minutes to 135 minutes. In comparison to the professional interviews, the majority of the case study interviews took place in person. This was considered necessary due to the extra depth required for the investigation.

The interview questions focused on adaptation and demolition decisions specific to the case study site. However, broader questions related to the masterplan development were also included to obtain a better understanding of the context and viewpoints towards the development as a whole. As with the professional interviews, the interview guide (figure 4-4) included essential themes and core questions to be covered. The interviewer first introduced herself and the project (stage 1) and then asked the interviewee to describe their role within the case study project and what processes they went through when either deciding to adapt of demolish existing buildings on the site or undergoing assessments which affect these decisions (stage 2). An aerial map/plan of the development was taken to the interview to allow the interviewee to refer to this. Depending on the content discussed in this initial stage, further questions were prepared including additional detail about the decision-making process, benefits and drawbacks of retention, successes with the masterplan development and problems with the decision-making process and potential improvements (stage 3). The interviews had the same semi-structured nature as the professional interviews which allowed for follow-up and probing questions during the conversation, which helped to keep conversation flowing and show interest. Questions specific to the interviewee were also prepared before the interview took place. A list of these subsequent questions is provided in Appendix 7. The interview concluded by asking if there were any other people that should be contacted and thanking the interviewee for their time (stage 4).

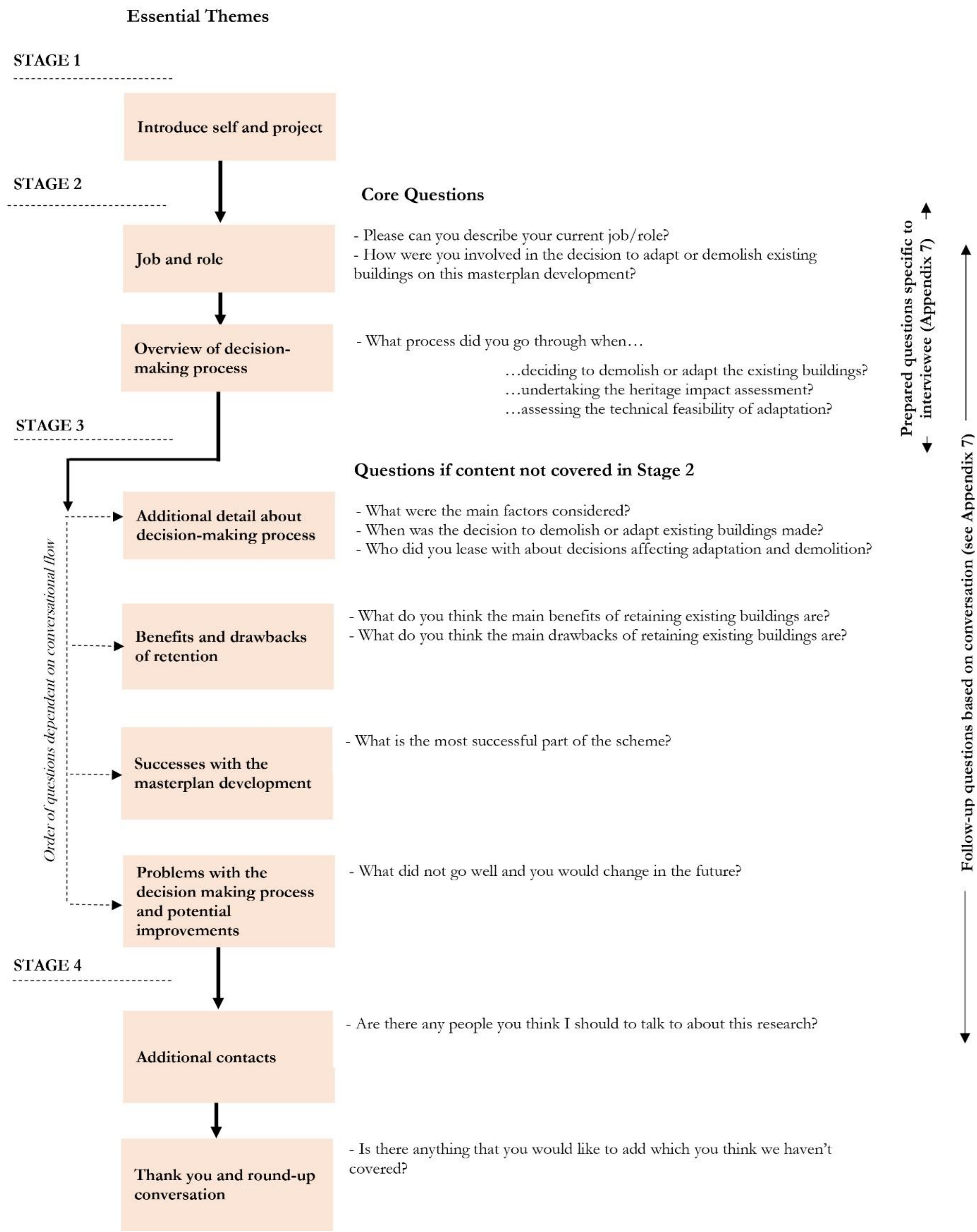

Figure 4-4: Interview guide for 'case study interviews'.

4.3.2.5 Dealing with the individual building and masterplan scales

The main contribution of this PhD is the exploration of adaptation and demolition decisions on the masterplan scale rather than the individual building level, therefore the focus, in terms of either the individual building or masterplan scale, should be defined for the different data collection methods. This focus varied depending on the point in time the data collection took place and its purpose (table 4-7).

The aim of the professional interviews was to provide an exploratory overview of adaptation and demolition decisions and build upon the current adaptation and demolition literature by obtaining different viewpoints. Although participants ideally had experience working at the masterplan level and interviewees were informed that this was the focus of the PhD, this was not always the case due to their stakeholder role. For example, building surveyors tended to focus on their experiences at the individual building level, whereas developers of large urban development projects were better placed to talk about the masterplan scale.

The embodied energy focus groups aimed to obtain a general overview of attitudes towards incorporating embodied energy into the decision making process. As previously mentioned, due to focus group being part of a wider event and the experience of the participants, they tended to focus on the individual building level. However, they were still useful for building upon the foundation provided by the literature and providing a plurality of viewpoints about the consideration of whole life energy and carbon.

All three of the case studies are large urban development's being regenerated through the implementation of a masterplan by private developers. Interviewees discussed issues with both the individual buildings and the larger masterplan scale. Again, depending on their role, this did impact what was focused upon more, however all interviewees were asked to reflect upon issues at the masterplan scale.

Due to the different foci of the research methods, within the analysis chapters, differences from decisions made about buildings on their own compared to decisions about buildings being made within the context of a masterplan development are highlighted throughout.

Table 4-7: Data collection method and focus, in terms of individual building or masterplan scale.

Data collection method	Focus (individual building level, masterplan, both)	Justification/explanation
Professional interviews (Section 4.3.2.1)	Both – individual building level and masterplan scale	Aim to gather a general understanding of building demolition and adaptation. Some stakeholders such as building surveyors, focused on the individual building level, others such as developers of large urban developments discussed the masterplan scale.
Embodied energy focus Groups (Section 4.3.2.2)	Individual building level	Focus group formed part of a wider event. Majority of conversation focused on individual building level.
Case study documents and interviews (Sections 4.3.2.3 & 4.3.2.4)	Masterplan	Individual buildings were discussed within the context of the masterplan case study sites.

4.3.3 Data analysis

Interview analysis is the segmenting and taking apart of data and putting it back together. This can be achieved via coding which is "*the process of organising the data by bracketing chunks (or text or image segments) and writing a word representing the category*" (Creswell and Creswell, 2018, p.193). These codes can be used to develop thematic ideas (Gibbs, 2008).

Recorded interviews (professional, focus groups and case studies) were transcribed verbatim. If notes had been taken from the interview instead, as permission had not been granted to record, they were word-processed as soon as conveniently possible to ensure valuable information was not forgotten. Haigh (2009, p.118) describes how transcription is "*time consuming and sometimes tedious, [but it] provides the author with an opportunity to re-familiarise himself or herself with the data that has been collected*". Although Haigh (2009) states that it typically takes three to four hours to convert the spoken word into a verbatim transcript, it took the author at least seven to eight hours to transcribe a one hour interview. To assist in the transcription process, the author slowed the voice recording to half speed.

Analytic induction was the type of coding used to analyse the qualitative data. Schwandt and Gates (2018, p.349) define this as "*looking for common features and major dimensions of variation among instances of the phenomenon developing an explanation accounting for these features and dimensions, and seeking disconfirming evidence (i.e. negative cases) to test and refine explanations and observation*s". For this research, these codes/features were a list of decision-making criteria and influencing factors for the decision to adapt or demolish existing buildings. For example, if an interviewee discussed how building condition was a driver towards demolition, this passage of text was tagged/coded as 'building condition'. These were later grouped into overarching themes. Table 4-8 provides examples of passages of text and how they were coded. In some cases, the initial code was quite detailed and could be mapped back onto a criterion established in the literature review when the codes were refined. In other cases a new criterion was formed. In many cases, as shown by the last passage of text the table, the same extract of text could be categorised by more than one criteria. Once the transcripts were coded, at least two more iterations took place to refine the codes by eliminating duplicates and identifying any information that may have been overlooked in the initial coding (Morgan, 1996).

Three types of coding are suggested by Creswell and Creswell (2018). These include the use of pre-determined codes, developing codes based only on emerging information from the interview, or using a combination of pre-determined and emerging codes. This study used a combination. An initial list was established during the literature review. These codes/criteria were built upon from the analysis of the professional interviews and the case study interviews as new factors emerged. A full list of the final codes and their source is provided in Appendix 8. The focus group conversations were analysed in a similar way to the interviews, except all of the codes emerged from the conversation and none were pre-defined and therefore uses a different set of codes to the interviews.

Computer Assisted Qualitative Data Analysis Software (CAQDAS) assisted with the coding. For this study HyperResearch was used. CAQDAS allowed the author to efficiently code compared to manually using a pen and paper. She was also able to view all the different passages of text about a single decision-making criterion in one document which helped with the analysis, as different viewpoints discussing the same factor/theme could easily be viewed. The software also allowed the author to assess the frequency that a code was used e.g. number of interviewees mentioning a criterion. Within the analysis chapters of this thesis (Chapters 5-7) the frequency is not referred to as a number, instead dominant themes are discussed. The reason for this is that the interviews were semi-structured and the frequency was not considered necessarily significant. However, the dominance of a topic across conversations still acts as an indication of the factors relevance on adaptation and demolition decisions (Morgan, 1996). These dominant discussion points have been used to structure each of the analysis chapters. The frequency distributions reflecting the overall themes discussed within each chapter are provided at the start.

To validate the findings from the professional interviews, it was useful to have multiple perspectives by interviewing a range of stakeholders. For the case studies, multiple sources of evidence were used to triangulate information (Dainty, 2009). Official planning documents provided factual information and were useful to authenticate statements made during the interviews. Furthermore, references to newspaper articles are used in the analysis chapters to elaborate on some key points that emerged. Additional validation of the findings has taken place through 'peer-debriefing' (Creswell and Creswell, 2018) as parts of this research have been published in an academic journal, book and conference papers and feedback from academic peers was received during the review process (Baker and Moncaster, 2018b, 2018a, 2017a, 2017b). Interviewees were also sent the quotations used and asked if there were any objections or if they had been misunderstood.

Table 4-8: Examples of coding procedure for interviews.

		Final codes		
Example text	**Initial code**	**Sub-criteria**	**Main criteria**	**Overall theme**
To preserve the brickwork and everything else we had to go through and make good all of the, I guess, eroded areas around the chimney. (ref.CS-CP-11)	Masonry – replacement bricks required	Non-structural damage	Building condition	Buildings' physical attributes
There was wet rot and to the point that there was deformation in the timber joists of up to 60 odd mm. (ref.CS-CB1-5)	Timber - Rot	Deteriorating materials	"-"	"-"
The concrete is really poor ... we have to saw out the floor and its complex. (ref.CS-SR-3)	Concrete – Deterioration	"-"	"-"	"-"
Some buildings eventually or some sites, as it were, overtime come to lose the purpose for which they were intended. And if their function has changed, then I think it's almost easier to argue for changing to their actual structure as well. (ref.CS-CB1-10)	Fitness-for-purpose	Fitness for purpose	Building function	"-"
One of the design silos would have been doing some initial feasibility works, what can you do? How can you use it? Clearly, it is not big enough to be an office building. (ref.CS-CB1-8)	Fitness-for-purpose	"-"	"-"	"-"
There are a lot of national chain stores...there were going to be no independent shops. (ref.CS-CB1-13)	Independent vs chain stores	-	Land use	Masterplan design principles
I seem to recall to put 2 million sq feet on the site, mixed use which again was important from an Urban Task Force Perspective. (ref.CS-CB1-8)	Mixed-used developments	-	"-"	"-"
Predominantly residential. So I think we analysed typically swings between 30, 70; 70, 30. What would it do? And then if you shifted the mix around, the worst case in a sense is high res. because it needs the most solar performance. (ref.CS-CP-7a)	Land-use	-	Land use	Masterplan design principles
	Building Height	-	Massing and Scale of existing buildings	"-"
	Solar performance	-	Solar access	Environmental

4.3.4 Interpretation and contribution to theory

The focus of the first three analysis chapters (Chapters 5-7) reflect the first three research questions. Within these, the topics discussed are the dominant themes that emerged from the interviews relevant to these questions, which are highlighted in the frequency distributions at the beginning of each chapter. Chapter 8 then provides a theoretical framing which can be used to explain the findings and build upon current adaptation theory. To do this, the author takes into account queries put forward by Haigh (2009, p.119):

"1) *Did the interviewees agree or contradict one another?*

2) Did the interview data contradict any of the research ideas or what was discovered in the literature review?

3) Did the interviews uncover anything which was not identified in the literature?"

These questions are also addressed in each analysis chapter by referring to the different data sources: literature review, professional interviews, focus groups and case study documents and case study interviews, and whether they agree or contradict with one another.

Quotations are used throughout the text to reflect opinions on the dominant discussion points. Using HyperResearch, the author viewed all quotations about a particular code/factor on one page. She then selected quotations which best contributed to the narrative and were either representative of the majority of viewpoints put forward or they offered a contradictory opinion. If a direct quote is used or a participant is paraphrased this is referenced using a unique reference number[17] that has been allocated to that data source. These are shown in the appendices outlining the interviews and focus groups participants (Appendices 1, 3 and 4).

The aim of qualitative research is not necessarily to create new theories but to understand the problem and generate new knowledge as their subjects see it, hence why a theoretical framework has not been tested (Creswell and Creswell, 2018; Runeson and Skitmore, 2009). In this case the problem is adaptation and demolition decisions on masterplan sites. As stated by Flyvbjerg (2006, p.241) "*the case study method in general can certainly contribute to the cumulative development of knowledge*", which this thesis strives to achieve.

[17] The beginning of each reference number indicates the data source: ref.PI – professional interviews, ref.FG1 – focus group 1, ref.FG2 – focus group 2, ref.CS,CB1 – CB1 case study, ref.CS.SR – Strijp-R case study, and ref.CS.CP – Central Park case study.

4.4 Case study selection and descriptions

Case study investigations are being used to contextualise the decision of adaptation and demolition on masterplan sites. This section describes how these were chosen and provides a description of each of the three sites selected.

4.4.1 Case study parameters

The cases are all spatially bound (Proverbs and Gameson, 2009) masterplan developments with the boundary being the curtilage (border) of the planning application for the illustrative masterplan. Different types of case study are set out by Yin (2009) including critical, extreme/unique, representative/typical, revelatory and longitudinal. This thesis uses typical case studies, meaning they are not necessarily considered to be exemplars of heritage-led regeneration. An example of an exemplar is considered to be Kings Cross, London, UK, as it is referred to by England's national heritage authority, Historic England, as a precedent for conservation (Historic England, 2013). Additionally, the case studies are cross-sectional, rather than longitudinal as they are analysed at a particular point in time (Proverbs and Gameson, 2009).

The selected case studies are called CB1, Strijp-R and Central Park. These are located in Cambridge, UK; Eindhoven, Netherlands; and Sydney, Australia. The author always had an intention to undertake case study investigations in different locations (either nationally or internationally), providing the opportunity arose to do so. This was to enable the decision of adaptation and demolition on masterplan sites to be reviewed in different contexts. During the author's Master's thesis, due to the relevance of their work, she established contact with both Dr Hilde Remøy at Delft's University of Technology (TU Delft) in the Netherlands and with Dr Sara Wilkinson at the University Technology Sydney (UTS) in Australia. Following this initial contact, the author was later invited to write a chapter for their book entitled "*Building Urban Resilience through Change of Use*" (Baker and Moncaster, 2018a). Due to this ongoing collaboration, the author organised to undertake an academic secondment at both institutions and utilised the time there to undertake a case study investigation. By conducting case studies in different countries and therefore contexts, which included different planning policies, the author was able to explore whether there were underlying reasons governing the consideration of different factors when deciding to demolish or adapt existing buildings. Although this could also have been achieved by examining case studies within different parts of the UK, the author embraced the opportunity to work alongside experts in the field of building adaptation and demolition and utilised the time spent whilst on secondment to conduct the case studies.

The case study sites were selected using purposive sampling techniques. The parameters are set out below and justifications are provided alongside a description of how each case study fits within these in Table 4-9 at the end of this chapter:

1) Former function: significant proportion of the development site contains former industrial land/buildings.
2) Proposed function: the final use of buildings on site must be mixed-use and therefore include more than one property type.
3) Density: proposed development is more than 200+ residential dwellings and/or 4 hectares in size.
4) Developer: the development is privately led/funded.
5) Existing infrastructure: at least 50 per cent of land (excluding transport and water networks) contains existing buildings.
6) Planning permission: indicative masterplan has obtained planning permission and the development is under construction.
7) Research participants: range of decision-makers and stakeholders can be identified and contacted.

The case studies were chosen using a combination of convenience and opportunistic sampling. The Cambridge case study was selected as the author had become aware of the development as she lived in close proximity to the area. Once, the academic secondments were organised, the secondment hosts suggested a list of potential case study sites. The author determined which of these fitted best within the case study parameters. The following sub-sections provide a brief overview of each site.

4.4.2 CB1, Cambridge, UK

The CB1 development (figures 4-5 and 4-6) surrounds and includes Cambridge's main railway station which was constructed in 1845. In 1896, Foster's mill was built near the station and the area surrounding it served as a goods yard. The industrial site was then sold onto other flour milling companies including Spillers Ltd. and then Rank Hovis in 2000. The site ceased use in 2001. Paul Thwaites, the founder and director of Ashwells (Bloomberg, 2017) purchased the first building in the area in August 2001 and continued to buy land as it became available (Estates Gazette, 2003). The purchase of the Rank Hovis site was the last of 19 acquisitions in 2004 (Planning, 2004). Aspirations to develop the area were set out in Cambridge City Council's (2004) Station Area Development Framework (SADF), as there were many vacant industrial buildings and warehouses and their objective was for the area's redevelopment to form a gateway to Cambridge around the railway station. Other uses in the area at that time included occupied and vacant office buildings, a doctor's surgery and retail including a bicycle shop and 'do it yourself' store. Parts of the ground in the industrial area were contaminated.

In January 2006, Ashwells submitted a planning application to redevelop the station area but it was refused (Ashwell CB1 Ltd., 2006). Twenty-six reasons were provided for the refusal including negative traffic congestion and failure to show enhancement to the station buildings which were listed, thus protected by planning policy (Dyer, 2008a). Following the refused application, the plan was revised and a new application was submitted in 2008 and approved by Cambridge City's Planning Committee, comprising of elected council members. The masterplan design was for a mix of uses including student accommodation, residential dwellings, commercial buildings and a hotel.

The approved application set out the parameters for the site through an outline planning permission (discussed in Section 2.3.2). This allowed fewer details to be provided about the proposal at this stage, with additional details being agreed through reserved matters provided they were in accordance with the original approval. However, full planning was required for some of the smaller plots of land within the development as there was too much discrepancy with the initial masterplan.

Approval for the demolition of existing buildings was granted at the outline application stage. However, when this permission was granted, the planning officer's report[18] stated that for buildings within the Conservation Area (an area of land protected by planning policy), which occupied the majority of the site, demolition was still subject to Conservation Area Consent (CAC):

> "*Conservation Area Consent (CAC) will be required for the demolition of any buildings within the Conservation Area and listed building consent will be required for the demolition of any part of the listed Station Buildings.*" (Dyer, 2008a, p.70)

Following the masterplan's outline planning approval, Ashwell's went into administration during the 2007-2008 global financial crisis. A new firm, Brookgate Ltd, which includes former directors of Ashwells emerged and are the current (as of 2019) developers implementing the masterplan (Havergal, 2009). A ceremony was held in April 2011 to officially mark the start of construction (Cambridge News, 2011).

4.4.3 Strijp-R, Eindhoven, Netherlands

Strijp-R (figures 4-7 and 4-8) was one of three industrial sites that Philips, the electronics company, constructed in the Strijp district of Eindhoven between the 1920s and 50s. Strijp-R was constructed after the Second World War for the production of television tubes. In the 1950s additional warehouses and factories were constructed on the site due to the popularity of the television and many of the buildings were connected using walkways to facilitate the site-wide production process. By the 1970s there was no

[18] A planning officer is a public sector planning practitioner. Their responsibilities include (but are not limited to): offering pre-application advice, liaising with other stakeholders, providing advice to the public, and preparing reports and making recommendations for planning committees (planning councillors decide whether or not an application should be approved).

further space for expansion to continue, which was one of the main reasons for production ceasing in the area (van der Hoeve, 2006).

In 1991, Philips began a major restructuring effort to save themselves from bankruptcy (Bevolo, 2015). This included the divestment of business units and leasing of under-used factories, such as Strijp-R (Meurs et al., 2007). The restructuring culminated in the late 90s when they moved their headquarters from Eindhoven to Amsterdam (Bevolo, 2015).

The site was purchased by Amvest, the developer for the masterplan, in 2005. At the time of purchase, some of the ground was contaminated and the existing buildings included offices, production facilities, storage rooms and laboratories, some of which had been empty for some time (Hezemans, 2005). Unlike the CB1 development, there was not a detailed analysis of the area by the municipality, which is the equivalent of the local authority in England, before the masterplan was developed. The process manager[19], a consultant to the developers, suggested this was because the site had not been identified as an area for redevelopment before its sale was advertised, and the process happened quickly. As a result, the municipality did not have a local plan or any design parameters when the site was sold to Amvest (ref.CS-SR-5).

The original intention on Strijp-R was for the majority of existing buildings to be demolished (ref.CS-SR-1, ref.CS-SR-5, ref.CS-SR-8) and demolition commenced in 2009 whilst the masterplan was still being finalised (De Leeuw, 2009a). During the formulation of the core principles and masterplan design, Piet Hein Eek, a famous Dutch furniture designer, visited the area as he was wishing to re-locate and purchased one of the buildings to convert to a furniture factory (De Leeuw, 2009b). This, as well as two other buildings purchased by Piet, who subsequently set up his own architectural practices, led to changes to the masterplan whilst the application was being developed.

In 2010, the final masterplan design was approved by Eindhoven's municipality. Rather than a building permit, as Strijp-R was a much larger site containing multiple buildings, a 'Bestemmingsplan', which translates to 'Destination Plan'/zoning plan was submitted by the developers and their design team and then approved by Eindhoven's municipality and their advisors. For more detailed follow-up designs, a design panel reviewed the proposals to ensure they were in accordance with criteria set out in the approved plan. Construction of new buildings began in 2010, the same year as the approval of the masterplan (Gemeente Eindhoven, 2010a). However, as the former use of the site had been industrial, the planning restrictions allowed for

[19] A process manager is a consultant working for the developers responsible for co-ordinating the development process and engaging with other consultants and the public.

some processes, such as Piet Hein Eek's factory, to continue on site before this approval (Gemeente Eindhoven, 2010b). Once complete the area will include residential dwellings, as well as the factory, restaurant and shops.

4.4.4 Central Park, Sydney, Australia

The Central Park development (figures 4-9 and 4-10) is located on a former brewery site. This was initially established as the Kent Brewery in 1835. However, a fire in 1853 destroyed the brewery and it was rebuilt. Following this, the site expanded and was owned by Tooth & Co, and in 1983 was sold to Carlton and United Breweries (CUB). It continued to function as a brewery until 2005 when it permanently closed (City of Sydney, 2006; NSW Department of Planning, 2007).

The closure was known before this and a company called Australand purchased the option to buy the site and began developing a masterplan. As Australand and their consultants were unable to resolve design issues with the City of Sydney, the local planning authority, both parties agreed to launch a design competition in 2004. The parameters and design guidelines for the competition were written by the City of Sydney (ref.CS-CP-12). Six schemes were short-listed and ranked based on a range of considerations including feedback from the community, land use, public open space and networks, tower forms, winter sunshine, traffic, heritage, community facilities and environmentally sustainable development (ESD). A preferred scheme was selected rather than a winner by the City who felt the design still needed to be refined through conversations with the city's planners.

After the competition, between July 2004 and March 2005, a Conservation Management Plan (CMP) was prepared by Australand in consultation with the City of Sydney, the New South Wales (NSW) Heritage Council and the NSW Heritage Office. These detailed heritage investigations identified additional heritage buildings with greater significance than identified in the competition brief and recommended that they should be protected by local planning policy.

In 2005, CUB rescinded the sale of the site and CUB (rather than Australand) developed the masterplan through the use of consultants. Planning permission was obtained in 2007 from the State of New South Wales (NSW) department for planning, rather than City of Sydney. This was due to the site being declared State Significance under Part 3A of the Environmental Planning and Assessment Act 1979 – "*Part 3A projects are developments that, in the opinion of the Planning Minister, are of State or regional environmental planning significance*" (EDO, 2013). The City of Sydney was a consultee rather than a decision-maker and they objected to the scheme that was submitted. The approved design was for a mixed-use development including residential dwellings, offices, retail and public spaces (Bindon, 2006).

Following the planning approval, the site was purchased by Frasers Centrepoint Ltd, who formed part of Frasers Property Australia. In 2009, they submitted a modified masterplan application to NSW Department of Planning and this was approved. As with the original application, this was approved by the State rather than the City. Modifications included an increase in density and alterations to the transportation network. In 2011, Sekisui House Australia formed a joint venture with Frasers Property Australia and construction began.

4.4.5 Planning structure and policy in England (UK), Netherlands and Australia

At the time of the planning applications for the case study masterplans, the UK and Netherlands were both in the European Union. Additionally, the UK and Australia share close cultural ties due to former colonisation. Consequently, all three countries have similarities in their political, legal and administrative traditions (Gurran et al., 2014), yet there are still differences in the planning structure, which should be acknowledged.

All three case study developments were privately led-developments, meaning that the land was owned and developed by private developers but due to the planning systems in each country, planning permission had to be granted by public authorities in order to undertake any physical development. In both England and the Netherlands, planning policy is designed to be implemented/applied by local government and communities, in adherence to national planning policy. This is due to them both being unitary states. For the CB1 case study, Cambridge City Council were the consent authority and the planning application had to be in accordance with their local planning policies, which at the time was the Station Area Development Framework (SADF) and the primary national planning legislation was the Town and Country Planning Act 1990. The primary planning legislation in the Netherlands at the national level is The Spatial Planning Act 1965 (Wet op de Ruimtelijke Ordening), and the consent authority for Strijp-R was Eindhoven's municipality (Gemeente Eindhoven) who were responsible for the approval of Strijp-R's zoning/destination plan (Bestemmingsplan Strijp-R).

In Australia, there is a federal system which means that the planning system is not co-ordinated by the national government and the constitutional authority is with the States (Ruming and Gurran, 2014). There are six states and two territories with their own planning laws and rules. The Central Park case study is in the State of New South Wales (NSW). In NSW there are several pathways for planning approval which depend on the size and scale of the development, including local, regional and State significant developments (NSW Government, 2019a). As highlighted in the previous section, the Central Park case study was declared State significant under Part 3A of the Environmental and Assessment Act 1979, which allowed the Minister of Planning for NSW to be the consent authority, whilst the City of Sydney, who objected to many aspects of the development were a consultee.

More detail on the planning structure for each country and the history of changes to this structure are provided in Appendix 9.

Table 4-9: Case study parameters, justifications for choice and identification of how case studies fit within these.

Parameter	Justification	Applicability of case studies: CB1	Strijp-R	Central Park
Former function: significant proportion of the development site contains former industrial land/buildings	Former industrial sites are often located in 'prime locations' which are desirable for redevelopment (Belláková, 2016; Petković-Grozdanovića et al., 2016). Previous studies focusing on masterplan sites focus on social housing (Crawford et al., 2014; London Assembly, 2015). Therefore, the focus on industrial areas which are likely to be redevelopment opportunities generates new insights into the research topic.	Railway station, and the 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	Urban regeneration projects often contain a mix of uses and the final use of buildings affects adaptation decisions.	Approximately 300 residential dwellings and 1250 student bed spaces and over 53,000sqm offices.	Approximately 600 residential dwellings, as well as a factory, restaurant and shops.	Approximately 1800 residential apartments, 97,000sqm offices and 12,000sqm retail.
Area/Density: proposed development is more than 200+ residential dwellings and/or 4 hectares in size.	A definition provided by the Department for Communities and Local Government defines largescale major developments as those which have 200 or more residential dwellings (or over 4 hectares if dwelling counts are unknown) (DCLG, 2007).	10.2ha.	20ha	5.8ha
Developer: the development is privately led/funded.	Required to address critique that private developers often prefer to start from a blank canvas (Plimmer et al., 2008; Wilkinson, 2011).	Ashwells Ltd. (site purchased by Brookgate Ltd. after global recession).	Amvest.	Sekisui House Australia (planning permission obtained by CUB)
Existing infrastructure: at least 50per cent of land (excluding transport and water networks) contains existing buildings.	Research is exploring the decision to adapt or demolish existing buildings. Case studies consisting of high quantities of vacant land were not applicable to the investigation. In addition, this coverage must contain more than one building as the study is examining decisions beyond the individual building level.	See Figure 4-6.	See Figure 4-8	See Figure 4-10
Planning permission: indicative masterplan has obtained planning permission and the development is under construction.	If going through the planning process for the masterplan, it is likely there would have been issues with confidentiality. Once planning is received and the development is on site, the majority of applicable literature is in the public domain. If the development was complete, the relevant stakeholders would have been more difficult to identify.	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.	The interviews are a fundamental method embedded within the case study investigation. Therefore, checks need to be made in the initial stages to ensure that people involved in the process can be contacted and are willing to participate in the research (Proverbs and Gameson, 2009).	13 interviews	10 interviews	15interviews

CB1,
Cambridge,
UK

Figure 4-5: Location of CB1, Cambridge, UK.
Aerial image source: Google Earth

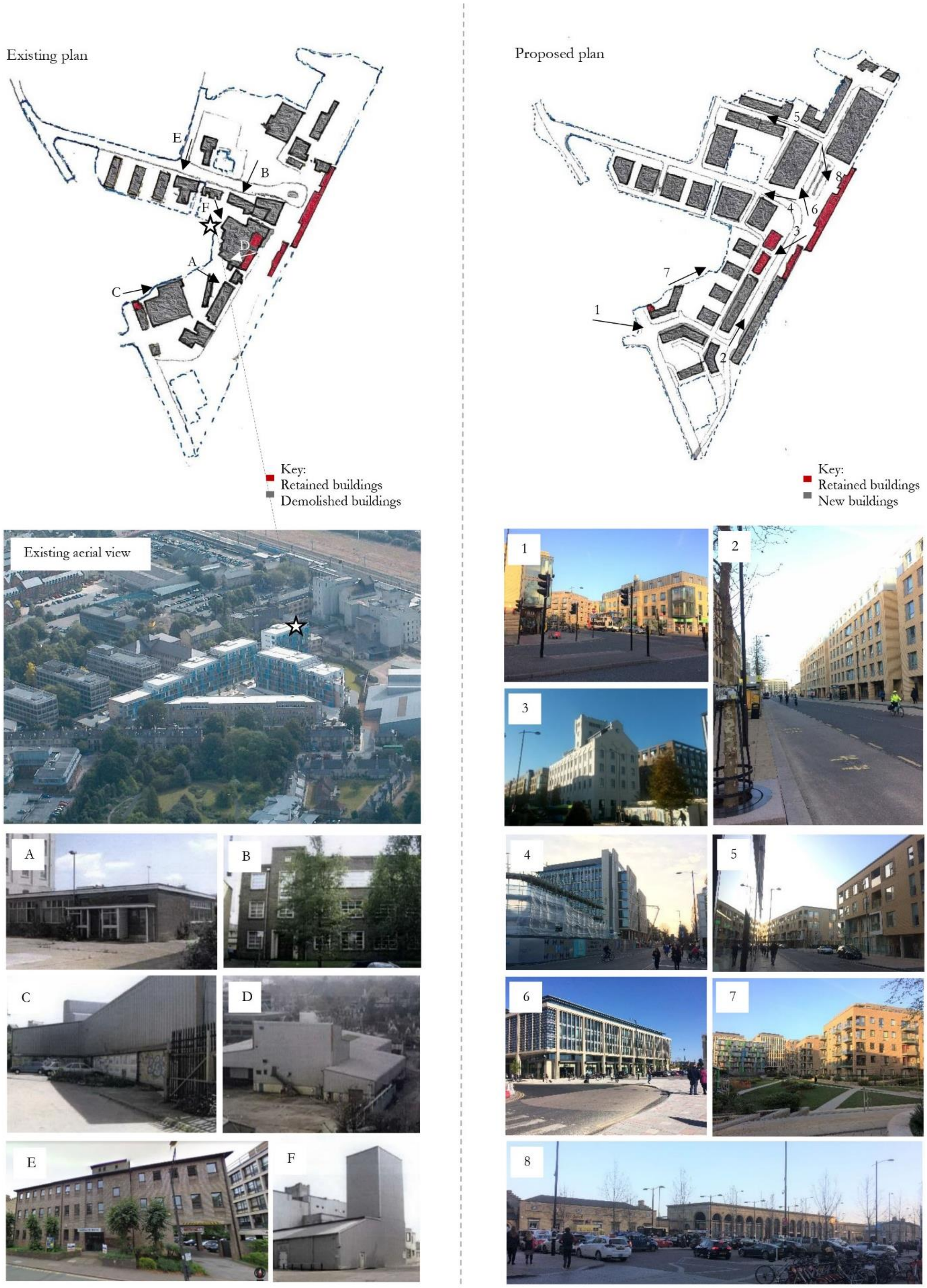

Figure 4-6: Before and after photographs of CB1 case study site.
'After photographs' by author.
Sketches by author using images and information from Ashwell CB1 Ltd. (2006). *Planning. Application Summary. (Planning application reference: 06/0008/OUT).* Cambridge City Council, Cambridge, UK.
Other image sources: QUBE. (2005) *Supporting statement for the demolition of buildings on: The former Rank Hovis site, Station Road, Cambridge.* (Planning application reference: 09_0031_CAC). Cambridge, UK.

Strijp-R
Eindhoven,
Netherlands

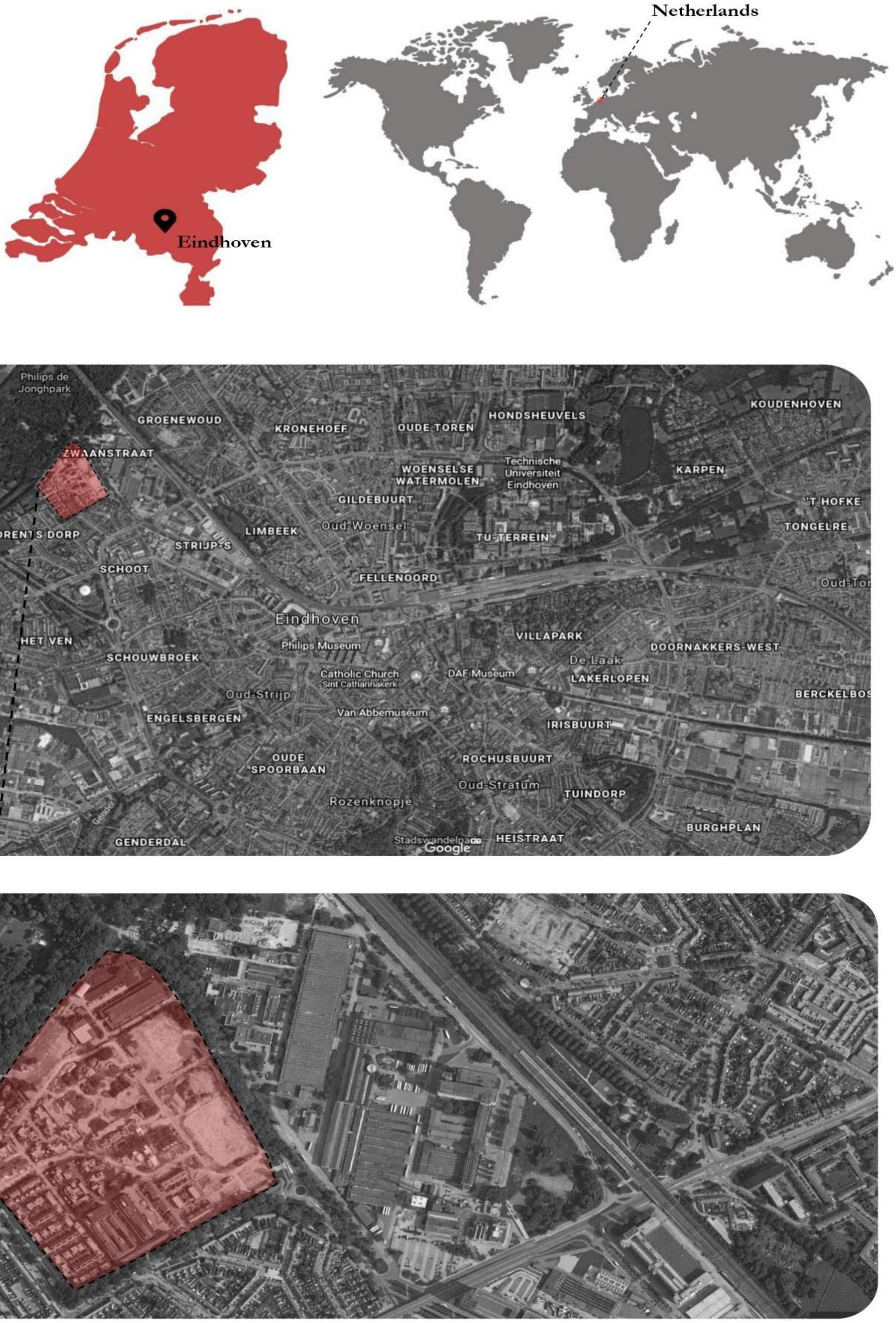

Figure 4-7: Location of Strijp-R, Eindhoven, Netherlands.
Aerial image source: Google Earth

Figure 4-8: Before and after photographs of Strijp-R case study site.
'After photographs' by author.
Sketches by author using images and information from Gemeente Eindhoven. (2010b). *Ontwerp Strijp-R (Design Strijp-R) (No. Document: 4286782/1/StrijpR)*. Eindhoven, the Netherlands.
Other image sources: van der Hoeve, J.A. (2006) *Bouwhistorische verkenning van de fabrieksgebouwen. Strijp-R, Eindhoven (Building historical exploration of the factory buildings, Strijp-R, Eindhoven)* (No. 06–11360167). Bureau voor bouwhistorisch (office for building history) produced for Amvest, Utrecht, Netherlands.

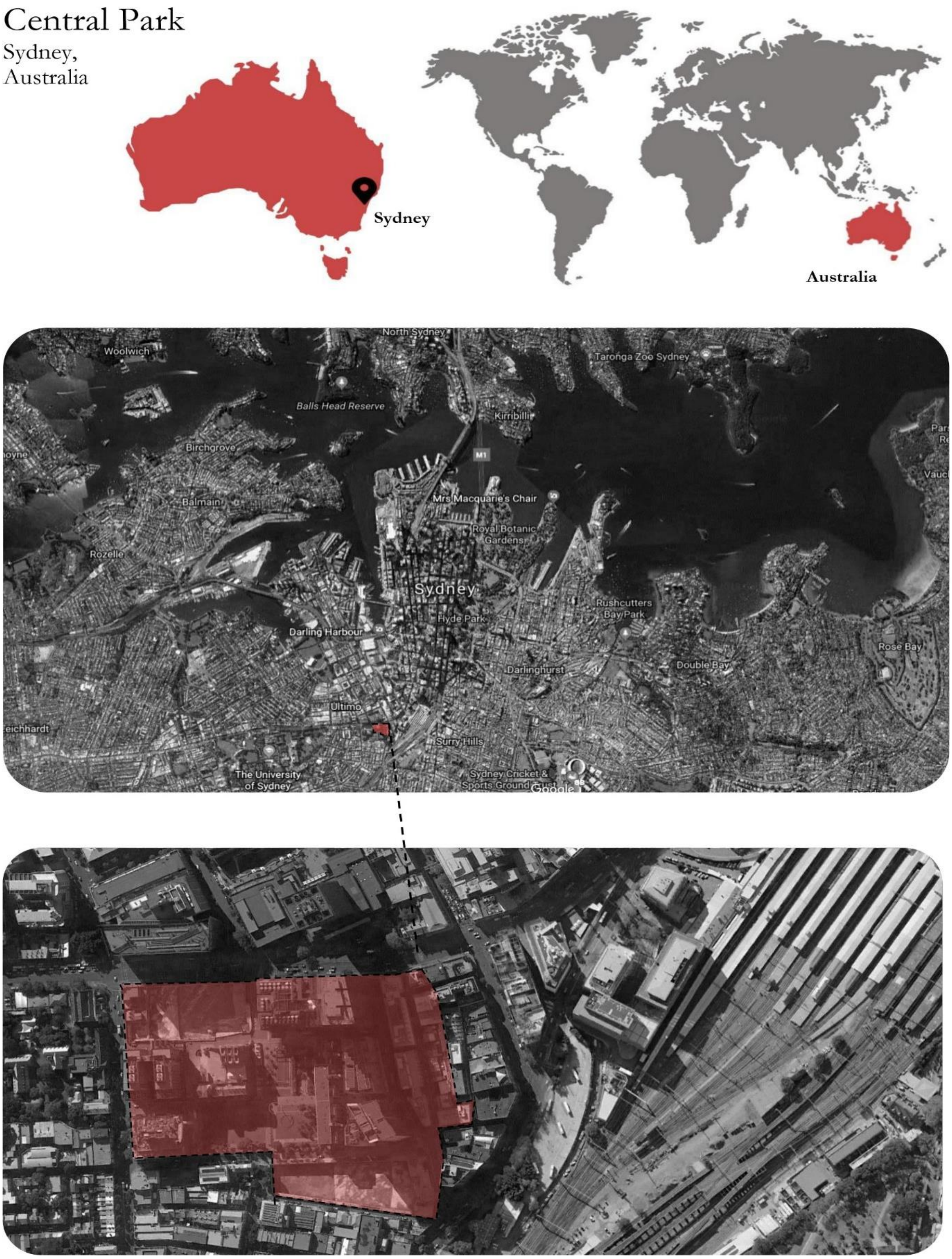

Figure 4-9: Location of Central Park, Sydney, Australia.
Aerial image source: Google Earth

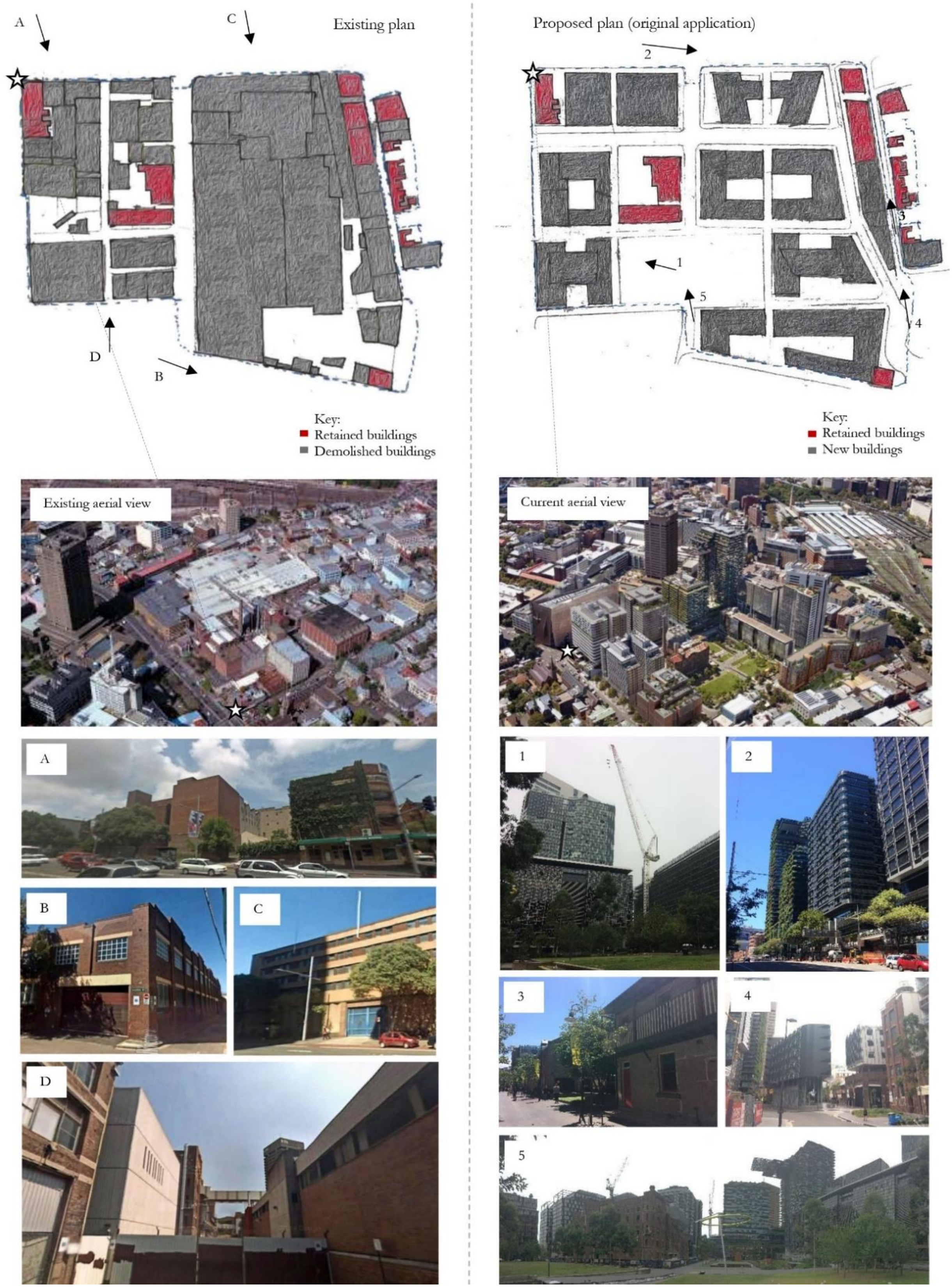

Figure 4-10: Before and after photographs of Central Park case study site.
'After photographs' (excluding aerial photograph) by author.
Sketches by author using images and information from NSW Department of Planning. (2007). *Major Project Assessment. Carlton United Brewery Site. Director-General's Environmental Assessment Report. Section 75I of the Environmental Planning and Assessment Act 1979* (No. MP 06_0171). NSW Government. Department of Planning, New South Wales, Australia.
Other image sources: Google Street View; NSW Department of Planning (2007) (see above); Tzannes, A. (2016). *Designing Central Park*, Chippendale. Architectural Bulletin, pp. 18–21.

CHAPTER 5:

Adaptation and demolition considerations in practice

A variety of factors are considered by developers and their design teams when deciding whether to adapt or demolish existing buildings. This chapter considers these at both the individual building and masterplan scales. Both are relevant as the decision of adaptation or demolition is about an individual building, yet the focus of this PhD aims to look at how this decision is affected by the building being part of a larger urban development being implemented through a masterplan rather than about a building on its own.

The factors discussed are those which were regularly referred to across the professional and case study interviews. This was used as an indication of importance. The relevant frequency distributions are shown below in Figures 5-1 to 5-4. The dominant discussion points are highlighted and have been used to structure the chapter. For individual buildings, the technical feasibility of adaptation, is applicable, as was found in the literature review. The first section focuses on individual buildings' function and form, in particular ensuring that a building is fit for purpose by finding a use and how this is often dictated by the building's structure and layout including floor-to-ceiling heights, load bearing capacity, stability, floor area and space flexibility. The chapter then considers building condition as this was regularly referred to as a driver to demolition if there are issues including contamination, deterioration of materials, damp, as well as non-structural damage.

Section 5.3 considers the massing and scale of existing buildings, as well as density which is influenced by the economic conditions and the target market. Section 5.4 then considers how economic viability differs at the masterplan scale compared to individual building level, with dominant points of discussion across the interviews including construction costs, profit and returns and commercial risk. The penultimate section focuses on the provision of space for vehicles and pedestrians within a masterplan. The frequencies show that although an individual building's physical attributes are relevant, conversations, particularly those about the case studies, were dominated by these principles relating to the masterplan scale. The chapter concludes with a discussion to help answer the first research question: '*What is considered in the decision to adapt or demolish existing buildings on masterplan sites?*'.

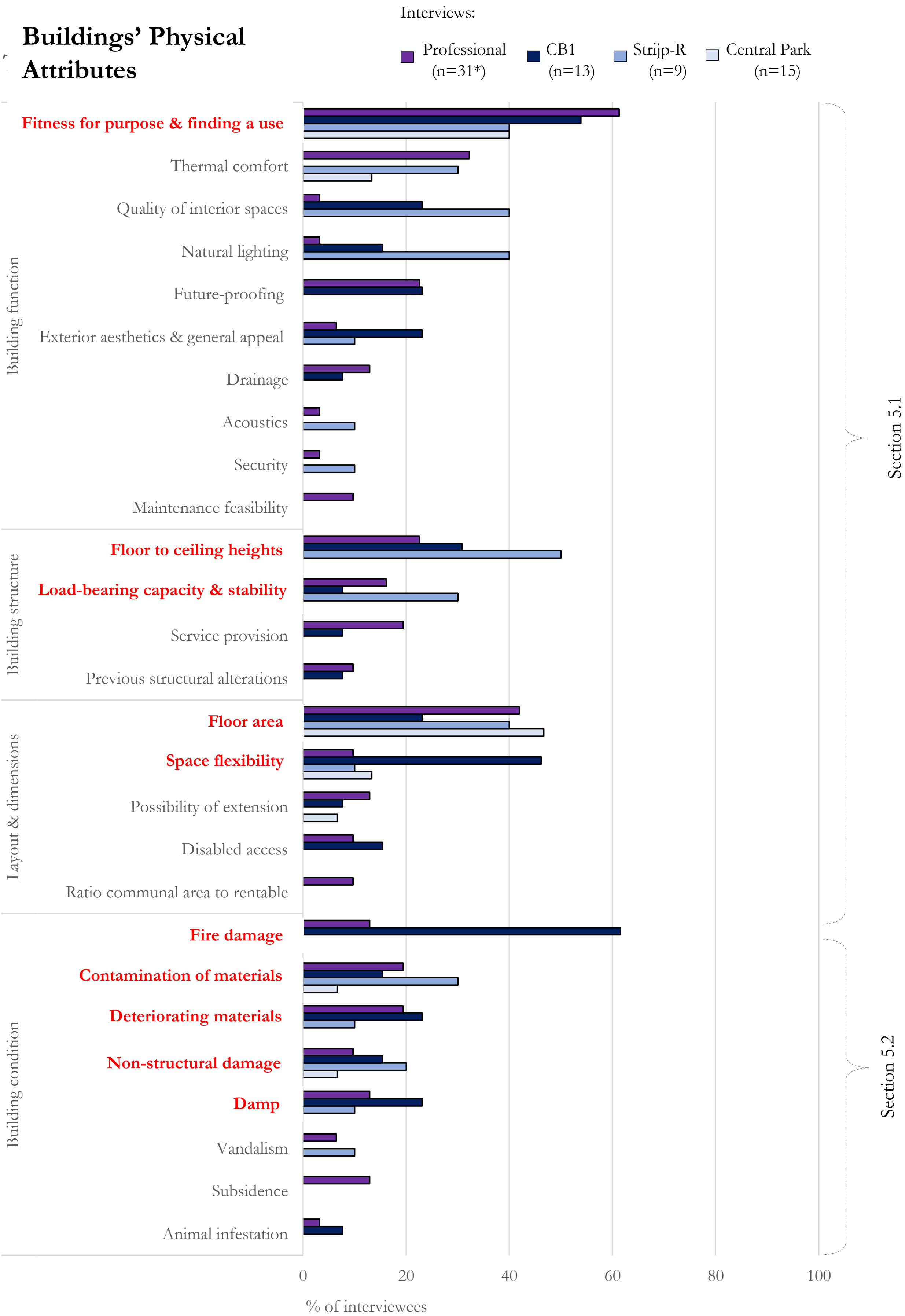

Figure 5-1: Theme – Buildings' Physical Attributes. Frequency distribution of codes mentioned across interviews.
*excludes interviews with academics specialising in embodied energy.

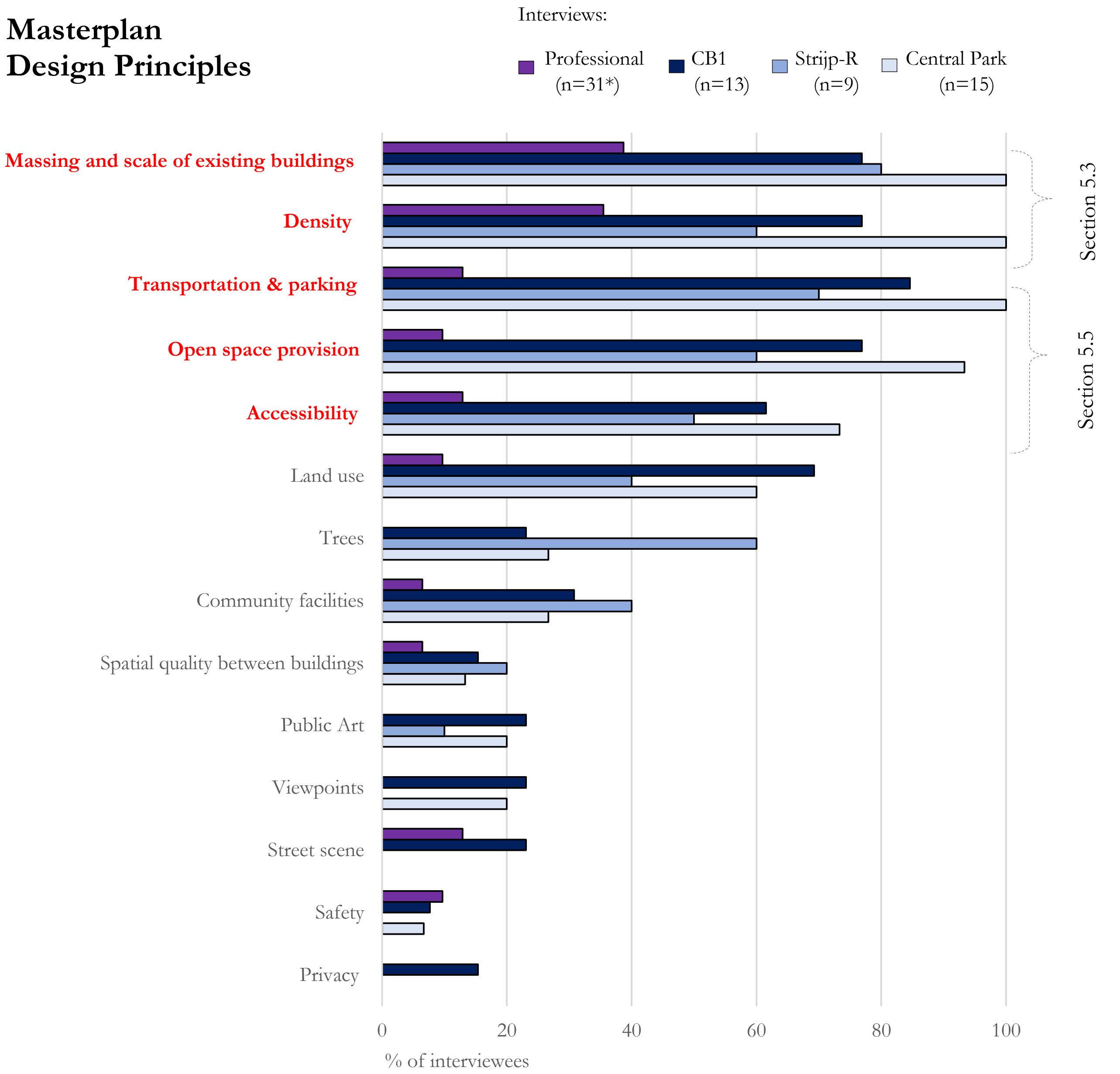

Figure 5-2: Theme – Masterplan Design Principles. Frequency distribution of codes mentioned across interviews.

Economic Conditions

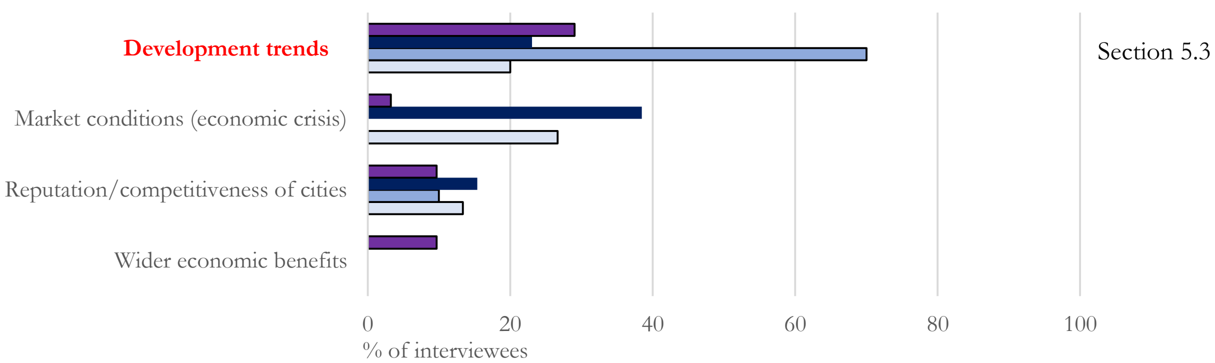

Figure 5-3: Theme – Economic Conditions. Frequency distribution of codes mentioned across interviews.
*excludes interviews with academics specialising in embodied energy.

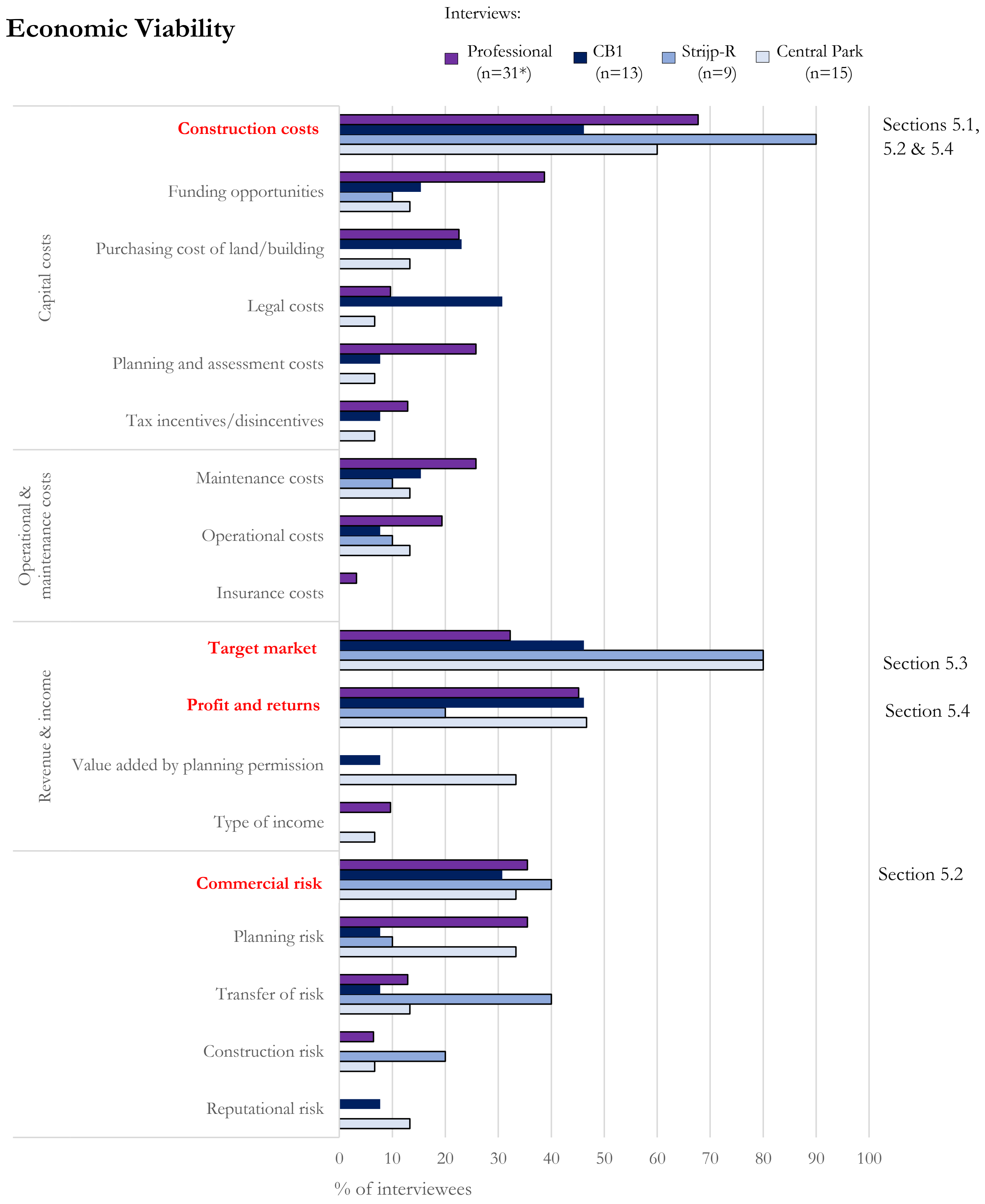

Figure 5-4: Theme – Economic Viability and Conditions. Frequency distribution of codes mentioned across interviews.
*excludes interviews with academics specialising in embodied energy.

5.1 Individual buildings' function and form

The apparent fitness-for-purpose of individual buildings, on their own or as part of a masterplan, was the most common reason provided by interviewees to determine whether a building should be adapted or demolished. The future function of a building is often dependent on its structure and layout. Factors related to the structure include floor-to-ceiling heights, load-bearing capacity and stability, and factors relating to layout include open-plan spaces.

A use needs to be found for an existing building, otherwise as conveyed by a representative from a national heritage organisation, there is no purpose in regenerating them (ref.PI-21). A building surveyor reiterated this point, expressing that for a building to survive, a "*meaningful use*" needs to be established (ref.PI-6). This is required to overcome obsolescence and bring revenue and income back into the site (ref.PI-4).

Sometimes finding a new use for a building is overly constrained by its structure. For example, one heritage society representative discussed how an existing building's structure is a considerable limitation if…

> "*… [it] has beams or supports that you can't move. How do you use that limited floor space?...not only is the floor space small but it is an odd shape.*" (ref.PI-8)

The interviewees also discussed how building occupiers, such as retailers, often want standardised floor plates, and large corporate companies are more likely to accommodate new buildings with large open spaces, rather that dealing with the "*nooks and crannies*" in existing buildings (ref.PI-21). Additionally, some functions such as car parks, require a specific layout in order to work effectively. As one developer explained…

> "…we *didn't use any of the existing columns because the column grid didn't work for car parking. So, we have got 760 car parking spaces in there, if we had tried to live with the column grid, we probably would have only had 450." (*ref.PI-26*)*

Another professional interviewee, who was a property consultant, discussed one of their client's aspirations to construct a new biological laboratory on a brownfield site. Due to the specific nature of this function, he described how the current buildings which were small and built in the 1960s/70s could not accommodate this and were consequently demolished (ref.PI-4).

The accommodation for disabled access is also taken into account. This is sometimes difficult to achieve due to the structure of a building and it is unlikely clients, especially corporate, will want a building without this access (ref.PI-16).

These professional opinions suggest that buildings are often demolished if the future function cannot be accommodated for by the existing structure. This was summed up by a building surveyor who said:

> "*It depends on the use of the building, it depends on what the building is going to be in terms of its end-use, and how far it can cope with that.*" (ref.PI-7)

Examples of buildings being demolished due to the proposed future functions were identified on the case study sites. In the CB1 (Cambridge, UK) case study, the developer described how people would be 'blown away' by the interior of the new office buildings due to the large expanse of floor uninterrupted by columns (ref.CS-CB1-1). He explained that the existing buildings would have been 'pokey' and therefore undesirable. The planning consultant also discussed how these new buildings were appealing as large corporate clients want collaborative workspaces:

> "*The Amazons of this world and the Microsofts of this world want large floor plates where they can collaborate…which don't exist in Cambridge.*" (ref.CS-CB1-9)

Both Microsoft and Amazon Research are now located in new buildings within the development. These attitudes towards the functional capabilities of new buildings agree with those set out in the professional interviews in that aspirations for large open spaces and flexibility act as a driver towards demolition.

In the Central Park (Sydney, Australia) case study, the original planning proponent's consultant felt the potential uses of the existing buildings was limited: "*we considered the reuse possibilities…and frankly there were not that many*" (ref.CS-CP-8). A contrasting viewpoint was put forward by a representative of the City of Sydney planning department:

> "*Our position at the city was that a lot of the buildings were suitable for adaptation…yes…there would be difficulty in adaptation but that wouldn't be sufficient to allow those buildings to be demolished.*" (ref.CS-CP-12a)

This difference in opinion comes back to the costs of adaptation relative to demolition and new build and the potential yield. The complexities of finding a new use were thought to lead to increased construction costs by the proponents.

Low floor-to-ceiling heights were the most commonly referred to factor related to the structure of existing buildings and were often provided as a reason for demolition due to the complexity of installing services. An energy consultant described this constraint as a "*difficult one to overcome*" (ref.PI-11), whilst a developer said:

“there are lots of old 60s and 70s office buildings that just don’t work for technology these days, it’s mostly to do with floor-to-ceiling heights because by the time you have got all your air-conditioning kit and services…you have almost got nothing left.” (ref.PI-26)

Required services are dependent on the final use of a building. One architect provided an example of a former high-rise office building and stated that there had been several feasibility studies as “*one of the problems of the building was the height of the floor-to-ceiling was too low to have a service zone*” (ref.PI-24). They continued to say that this may have been less of an issue as the building was being adapted to residential use which has different service requirements to offices. Conversely, if an existing building has high floor-to-ceiling heights, professional interviewees described this as a desirable feature which can be a driver towards adaptation (ref.PI-3, ref.PI-10, ref.PI-26, and ref.PI-31a).

In practice, low floor-to-ceiling heights were the main reason provided by the developer for the demolition of three 1960s concrete office buildings on the CB1 site, known as the Deities (figure 5-5). If refurbished, the buildings’ services needed to be replaced to meet energy efficiency standards, which required suspended ceilings and raised floors. This would have reduced the floor-to-ceiling height further which the developer felt would have made the spaces too low to be attractive to corporate clients (ref.CS-CB1-1).

On the contrary, on Strijp-R (Eindhoven, the Netherlands), the high floor-to-ceiling heights of the retained RK building, which was used as a ceramic workshop (figure 5-6), were described as an attractive feature due to the amount of natural daylight that they allowed into the internal spaces (ref.CS-SR-1, ref.CS-SR-9). The masterplan architect explained how this is a quality that you rarely get on new build projects and was a key reason for adaptation (ref.CS-SR-6).

Load-bearing capacity is another factor related to the structure of existing buildings. As described by one building surveyor…

“…*if you have a mill building which was designed for enormous loadings already, then you probably don't have a problem saying that it is going to work and change it to domestic use. If you're doing it the other way round, you got a domestic building which is going to be a museum or public building, then clearly you have got more of a problem.*” (ref.PI-7)

This suggests the future use of a building is dependent on the previous function which can determine the structure’s load-bearing capacity. If a structure is very robust, it might lead to retention as it is less costly to retain it than demolish. One developer explained how a former postal sorting office in Birmingham, UK, was retained as “*it was such a ridiculously robust structure…this was built at the time of IRA letter bombs and* *the like".* This was important as the brief for its original construction was that it was: *"adaptable but also would stand a consequence of a bomb going off"* (ref.PI-26). However, on the case study sites there were no examples of buildings being retained as it was cheaper than demolition. It is highly likely this is due to the insignificance of cost savings relative to the rest of the masterplan[20].

The discussion so far has suggested that a lack of open floor space and robustness, as well as low floor-to-ceiling heights are considered to be drivers towards demolition. However, the professional interviewees also referred to instances where buildings were retained despite having these features. One property consultant discussed how some commercial clients "*turn their back, saying 'no have exposed ceilings - it's more a funky fit out'*" (ref.PI-3). Another interviewee described how businesses such as cafés, restaurants and independent shops, do not require new buildings, as their equipment is quite small and can be accommodated for by the existing structure (ref.PI-21). This was reiterated by a building surveyor who stated: "*groovy start-ups want to go into groovy little buildings*" (ref.PI-7). These viewpoints suggest that existing buildings are often suited to smaller businesses. Thus, adaptation and demolition decisions are heavily influenced by who the end-user will be and their aspirations.

This was also seen in practice on the case study sites. The buildings which have been adapted on CB1 are now used a pub, restaurant and residential apartments, as well as the station building which continues to operate as the main railway station for Cambridge. On Strijp-R, the existing buildings are used as bespoke residential dwellings where the clients have had an input into the design features (ref.CS-SR-1, ref.CS-SR-7), a furniture factory, offices for start-up companies, and a café. Retained cottages on Kensington Street, Central Park are now used as retail units, cafés and restaurants (figure 5-7). The planning consultant described their retention as:

> "*The boldest part because…redeveloping a site located like that you are always going to sell apartments and things like that, retail has been tougher.*" (ref.CS-CP-13)

This suggests that the demolition of the existing cottages and replacement with new build apartments might have created more income on the site. However, the main driver behind the retention of these buildings was their contribution to and policies related to heritage (discussed further in the next chapter), rather the technical feasibility of adaptation and increasing densities. Therefore, in practice despite existing buildings

[20] Approximate masterplan project costs:
CB1 - £725million (Wainwright, 2017)
Central Park - £1.1billion (converted from 2billion Australian dollars) (Frasers Property, 2013)
Strijp-R – n/a – publicly available data on project costs not available.

having undesirable structural morphologies and requiring complex interventions, which increases construction costs, some are still retained due to other factors such as heritage.

To enable the retention of existing buildings when their structure and layout is not ideal for the proposed function, decision-makers are required to have an open mind as to how the space can be used. One interviewee compared having a fixed idea about how a building will be used to a 'fat man' trying to fit into a suit of the wrong size:

> *"[it is] like squeezing a fat old man into a skinny suit, just because that's what you want to wear doesn't mean it's going to fit."* (anonymous)

In these circumstances the function might be creatively re-imagined to fit the form of the existing building.

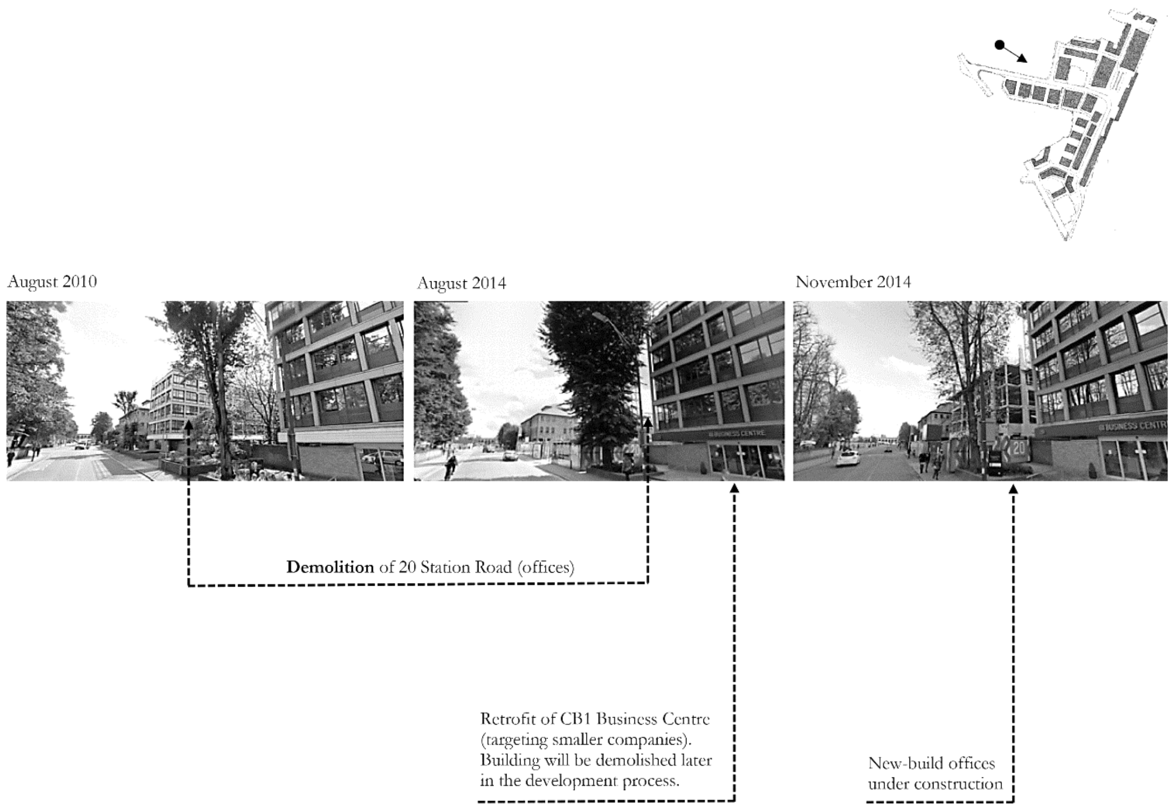

Figure 5-5: Demolition of one of 'the deities' on the CB1 case study due to low floor-to-ceiling heights.
Image source: Google Street View.

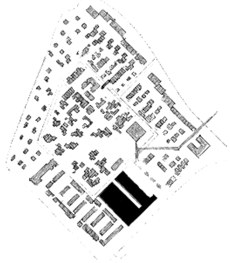

Figure 5-6: High floor-to-ceiling heights inside retained RK building, Strijp-R.
Photographs by author.

Figure 5-7: Retained buildings on Kensington Street, Central Park. Now used as cafes, restaurants and retail units.
Photographs by author.

5.2 Individual buildings' condition

A second key issue determining whether an individual building, either on its own or as part of a masterplan, is retained or demolished is its condition. Often if a building is in poor condition, it is a driver towards its demolition due to the added costs of retention. Several aspects related to the condition of existing buildings were referred to during the professional interviews, including general deterioration, material contamination, fire damage and subsidence. For example, one interviewee discussed how the general deterioration of a building can lead to issues including damp and rot, particularly at the end of timber roof and floor beams (ref.PI-17). Other interviewees described how material contamination, which often includes asbestos, might be present in various components of a building such as the cladding, pipework and structural elements (ref.PI-1, ref.PI-16). Fire damage was described as a "*major argument*" used by developers as they contend the intervention required due to the damage compromises the heritage value (ref.PI-5). Additionally, in terms of subsidence, one building surveyor described how this can create cracks in the existing building and elaborated by saying: "*the type of crack that you can put your hand in...is the type of crack that you start to worry about*" (ref.PI-6). This reflects a comment by a structural engineer that it is structural issues rather than non-structural which are more difficult and therefore costly to overcome:

> "*So, it's the main structure, is usually the bit. You can deal with the cosmetics. If there are cracks and issues, you can deal with those, but really the shell. The core of the building, is it sound?*" (ref.PI-19)

There are a range of issues that affect the condition of an existing building. Depending on the extremity of these, the construction costs will vary: "*it's a cost issue…a viability issue*" as conveyed by one planner, whilst another interviewee said: "*if you've got a building in very poor condition, it's going to cost a lot to bring it back into use to make it usable*" (ref.PI-14). These added construction costs due to poor condition are drivers towards demolition.

On the case study sites, interviewees justified the demolition of some existing buildings due to their condition. Buildings located on the Northern Sidings of the CB1 site (figure 5-8) were said to be in "*very poor quality*" (Cambridge City Council, 2004). As they were perceived to have no heritage significance in the heritage assessment, the decision to demolish them was described as straightforward by the developer (ref.CS-CB1-1).

On Strijp-R, buildings or parts of buildings were demolished due to aspects relating to their condition. An architect at Piet Hein Eek's practice explained how a 'third arm' of the RK building (figure 5-9), was demolished due to the high level of contamination (compared to the two remaining blocks) which had been caused from former industrial processes. She commented…

> "…*if the building is in poor condition or too contaminated it should be demolished, but if it is still in good condition then why break it down? The costs, the efforts and the result should be weighed up.*" (ref.CS-SR-1)

Therefore, in practice the poor condition of existing buildings, particularly if they have no heritage value, is clearly a driver towards demolition.

Building condition surveys are undertaken to identify the problems with the condition of an existing building. Despite these being undertaken, building retention was described as "*inherently risky because you can at any time uncover something nasty embedded in your buildings which you haven't anticipated*" (ref.PI-11). Due to this, one heritage consultant described the costings of retention projects as "*just a finger in the air estimate* (ref.PI-18). This financial uncertainty is due to problems with the condition being uncovered after the initial surveys are undertaken. At the masterplan scale, a developer also described how the investigations tend to be visual rather than intrusive and you would not have a detailed understanding about the condition until later in the process, often after the decision to adapt or demolish has been made (ref.PI-29).

To reduce this risk the use of professionals with experience surveying existing buildings was recommended by interviewees. One heritage consultant described how "*you hire the best professionals you can, to go and make the best possible visual inspection that they can, and work from it*" (ref.PI-18). She discussed how organisations such as the Institute of Historic Building Conservation's (IHBC's) list of recognised professionals[21] helps to maintain quality advice.

So far, this section has shown that poor building condition is a driver towards demolition at both the individual building level and masterplan scales. However, there were buildings retained on the case study masterplan sites despite being so. For example, the structural engineer for the retained station building on CB1 discussed how there had been several complications with the building including pigeon infestation, soil contamination, damp, wet rot, deformation of timber joists and deteriorating brickwork leading to the loss of structural integrity (ref.CS-CB1-5). The mill building (figure 5-10), on the same site, was also retained but the developer explained it had poor quality brickwork and required a new structural core and floor slabs due to the deterioration of the concrete (ref.CS-CB1-1).

[21] The Historic Environment Service Provider Recognition is a promotional service for businesses working in conservation that meet the service standards expected by the IHBC (2019).

On Strijp-R, the two retained arms of the RK building had contamination, albeit less than the demolished third arm, and minor cracks in the brickwork, alongside other technical constraints such as limited load-bearing capacity in the roof slab. To overcome contamination from oil spills, the RAG building required major interventions. An architect at Piet Hein Eek's practice described how the contractors "*had to cut out some really really heavy concrete foundations…to make new floors*" (ref.CS-SR-1). In addition, the RAG building's façade had been vandalised with graffiti which required cleaning, and the masonry was repointed (figure 5-11).

On Central Park, issues with the foundations of a former administrative building converted to a hotel were uncovered when the floorboards were pulled up and they discovered that the piers were sitting on sand. The developer explained how the contractors had to "*pull the floor out, dig piers, redo the piers, redo the floors, redo the columns*" (ref.CS-CP-11). The architect for the Kensington Street precinct also described how the buildings in that area were in "*totally terrible condition*". He went on to say that…

> "*…if you take the blunt view on the return per square metre, it probably doesn't stack up… [but] it was a huge selling tool for the apartments"* (ref.CS-CP-9).

This indicates that other aspects of economic viability are considered in the decision. The retention of the buildings was described as a selling tool as they added character to the area and consequently value to the site, thus the driver towards their retention were factors related to heritage which outweighed the additional costs brought about by the poor condition of the buildings.

Figure 5-8: Demolished buildings on the 'Northern Sidings', CB1. Demolished due to poor quality.
Image source: Google Street View, CB1.

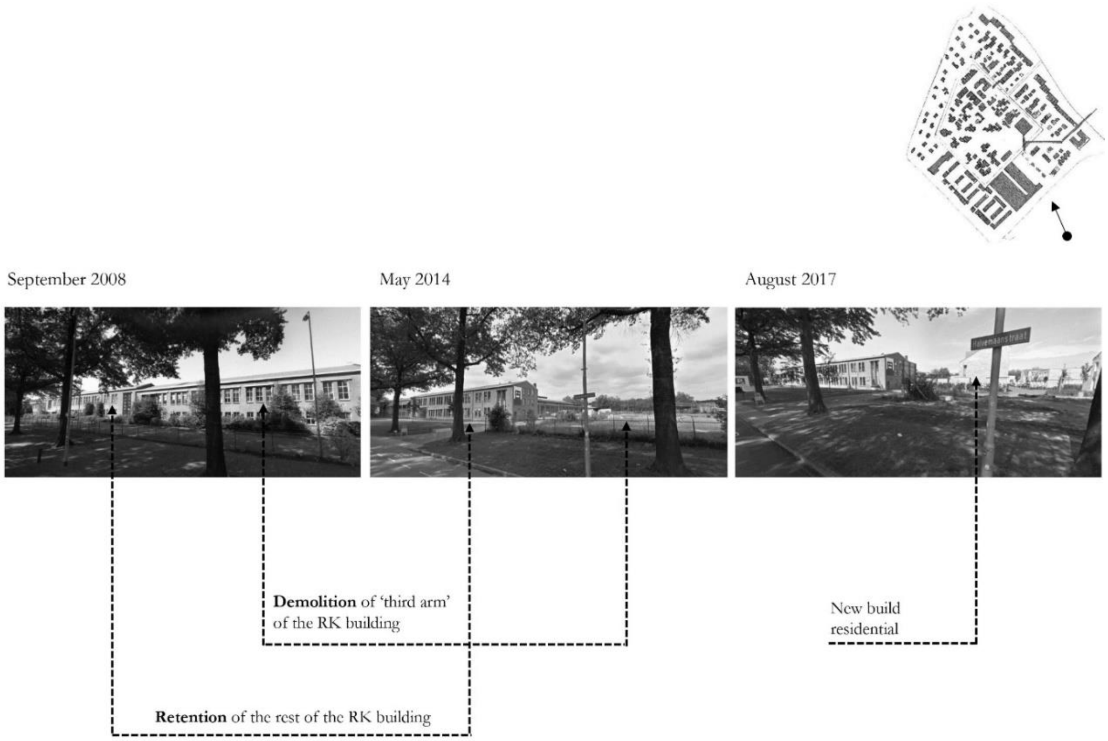

Figure 5-9: Demolition of RK building's 'third arm' due to high contamination levels, Strijp-R.
Image source: Google Street View.

Figure 5-10: Retained mill building, CB1.
Photograph by author.

Figure 5-11: Retained RAG building, Strijp-R.
Image source: Left – Eek en Deekers (2019) *RAG*. Available at: https://pietheineek.nl/en/product/rag-wonen-in-een-uniek-pand (Accessed: 3 January 2019).
Right – photograph by author.

5.3 Massing and density for individual buildings and within masterplans

The massing of proposed new buildings and the scale of existing ones is a key consideration as to whether existing buildings are adapted or demolished at both the individual building level and masterplan scale. Developers often want to increase the massing on site to create a 'density uplift' which will create more income through increased floor areas. This attitude was expressed by one public planner who felt that the main argument for the demolition of existing buildings used by developers is that they need to increase density to make the development viable:

> "*They would say that retaining the existing buildings is not viable because we won't get the number of units that we need to be able to develop the site further.*" (ref.PI-23)

However, a different interviewee highlighted that developers sometimes benefit from retaining existing buildings as they would not receive planning permission to demolish and build back bigger:

> "*I'm working on a project at the moment where it was certainly to the commercial advantage of the developer to retain and extend the existing building because he has permission for much greater floor area than if he demolished and put a new building on the site.*" (ref.PI-11)

The reasoning behind the decision comes back to maximising density in both of these examples. On the one hand, it indicates that existing buildings are demolished when the developer has the opportunity to build back bigger. On the other, if there are planning constraints, it might be beneficial for the developer to retain the existing building as this is the maximum density they will achieve.

Increasing density was also a dominant point of discussion during both the CB1 and Central Park interviews and therefore at the masterplan scale. On the CB1 site, the small scale of the Victorian buildings of Wilton Terrace (32-38 Station Road) in comparison to its surroundings was used by the planning applicants as one of the main rationales for its demolition (figure 5-12). As Wilton Terrace was located opposite a proposed six storey hotel which already had planning permission, it was argued that a three-storey terrace would have looked 'out of place' in the context of the masterplan (ref.CS-CB1-1). Additionally, the masterplan architect explained how this area around the station "*should be seen as a commercial hub and then as you go north and south away from the station itself then the building fabric is smaller*" (ref.PI-8). In the planning officer's report, which recommended that the masterplan application was approved by the planning councillors, these arguments for the demolition were supported and it was stated that the replacement building for Wilton Terrace had a "*pivotal role*" in the scheme and that "*the loss of 32-38 Station Road is justified by the need to increase the density of the development across the site*" (Dyer, 2008a). Although the argument was that the existing building looked out of place, the driver behind its demolition is clearly the density uplift.

Increasing density was also a key driver to the demolition of existing buildings on Central Park, where the community consultant expressed: "*clearly you couldn't get the density of the site if you retained absolutely everything*" (ref.CS-CP-5). When describing the benefits of replacement new builds, the original masterplan architect said *"[the reason] to replace any of the heritage buildings really would have been increased floor area. I mean that is fundamentally it*" (ref.CS-CP-12b). The city planner linked increasing density to increasing income when he said "*in the end it came down to yield I suppose versus the capacity to find a good use for those buildings if they were to be retained*" (ref.CS-CP-12a). Therefore, as with the CB1 site, increasing density was considered to be a fundamental driver for demolishing existing buildings. It should be noted that although the modified masterplan submitted by Frasers (figure 5-13) increased the density on site further, this did not require any additional demolition.

On both these sites, increasing density was justified on the grounds that the sites were located next to key transport hubs[22]. For CB1, the area was described as a future 'Transport Gateway' by the Local Authority's local planning policy – the Station Area Development Framework (Cambridge City Council, 2004). For Central Park, the planning proponent's consultant contended that the site was "*adjacent to Australia's biggest railway and if you couldn't get some density here, you have got no hope*" (ref.CS-CP-8). This is also reflected in

[22] Annual number of passengers using train stations next to CB1 and Central Park developments:
Cambridge station (2017-2018) – 11.5million people (Office of Rail and Road, 2019)
Central station (2018) – 85.4million people (Hounsell, 2019).

a quotation in the local media, where the Chief Executive Officer (CEO) of Frasers (the developers) stated: "*the city has to grow but there are not many places for it to grow*" (Creagh, 2008). Clearly, the aspiration to increase density throughout both masterplan developments which led to demolition, was justified based on the developments being located next to key transport interchanges.

In contrast, the design team on Strijp-R wanted to have smaller scale new buildings relative to the existing to provide family housing rather than larger new builds with apartments and/or studios, due to the limited family housing stock in Eindhoven (Gemeente Eindhoven, 2010a). They also wanted the area to have a different character to the neighbouring Strijp-S "*which had lots of monumental buildings, very high buildings*" (figure 5-14) (ref.CS-SR-8). For this reason, the RAF building (figure 5-15a), a seven storey former office block described as the Strijp-R's "*most striking building*[23]" (van der Hoeve, 2006, p.169), was considered out of character with the proposed development as it was too tall and was consequently demolished. In addition, the RO building (figure 5-15b), which had a 100m façade, was demolished, as the design team felt it did not fit with the scale of the development (ref.CS-SR-5), indicating that the horizontal scale (the footprint on the ground) is also an important factor. Therefore, in practice existing buildings are not always demolished to build back bigger. However, on Strijp-R, the decision was still driven by economic factors as the demolition occurred due to the 'target market' and meeting housing demands in the area.

Existing buildings might also be retained on a masterplan as it makes it easier to obtain planning permission to increase the density elsewhere on site. This was particularly evident on the CB1 site where the masterplan architects felt that the mill and silo "*help define a scale of the neighbouring buildings*" (ref.CS-CB1-8). Within the planning application, the height of the mill and silo are also referenced and said to determine the height of the surrounding new build (Dyer, 2008a). This use of existing buildings to build others up to the same height was critiqued by David Jones (2013), the author of 'Hideous Cambridge - a city mutilated' who felt the mill *"should have been demolished, because that was an eyesore, but I suspect they kept it because it was a justification for building other buildings up to the same height*" (Higginbotham, 2013). As was mentioned in the professional interviews, an individual building may be retained as permission will not be granted to build back bigger. The CB1 case study indicates that existing buildings may be retained within a masterplan development to help obtain planning permission to increase the height of buildings elsewhere on the site.

However, the scale of existing and new buildings was not the same for all the buildings located in the three case studies, as there was a combination of old and new buildings with different masses relative to one another within the masterplan design. As explained by CB1's heritage consultant, masterplan developments

[23] Original text: "*meest opvallende gebouw*".

can have a "*juxtaposition of scales… [where] you do get quite small buildings next to quite tall ones*" (ref.CS-CB1-6). He proceeded to discuss the retention of a two storey building (125 Hills Road) next to a three-storey new building. A much more extreme mixing of scales was visible on Central Park. This balance of massing was described as a challenge by the planning consultant (CS-CP-13). An example is illustrated in Figure 5-16, which shows a four-storey pub on the corner of the development which has been retained with a new twelve storey mixed-use building cantilevering over the top. Although the masterplan architects acknowledged the pub was dwarfed by the existing building, they believed it added a point of reference for the development and its history (ref.CS-CP-7a). Others questioned the success of this design strategy with the original planning proponent's consultant stating that the pub looked "*out of place*" (ref.CS-CP-8). The extremity of contrasting scales between new and old buildings on Central Park relative to CB1 is likely to be due to Sydney having a significantly larger population[24] than Cambridge, thus there are demands for a much larger density uplift.

A juxtaposition of scales was also seen on Strijp-R. However, the existing buildings, such as the RK building, are bigger than the new buildings (figure 5-17). The heritage consultant explained that "*you have a variety of scale, in which you have the industrial scale, large scale and the small*" (ref.CS-SR-8). As discussed earlier, the smaller scale of the new build is due to the demand for smaller family housing in the area.

The juxtaposition of scale between existing and new buildings on all three case study sites demonstrates that this can be accommodated for within a masterplan's design. This questions the argument that buildings are demolished because they are 'out of place'. Instead, the real reason appears to be maximising density and/or meeting housing demands in the area.

[24] Approximate populations (3sf) of cities where case studies are located: Cambridge (2017) - 125,000 people (Office for National Statistics, 2018). Eindhoven (2017) - 228,000 people (Statistics Netherlands, 2019). Sydney (2018) - 5.48million people (Population Australia, 2019).

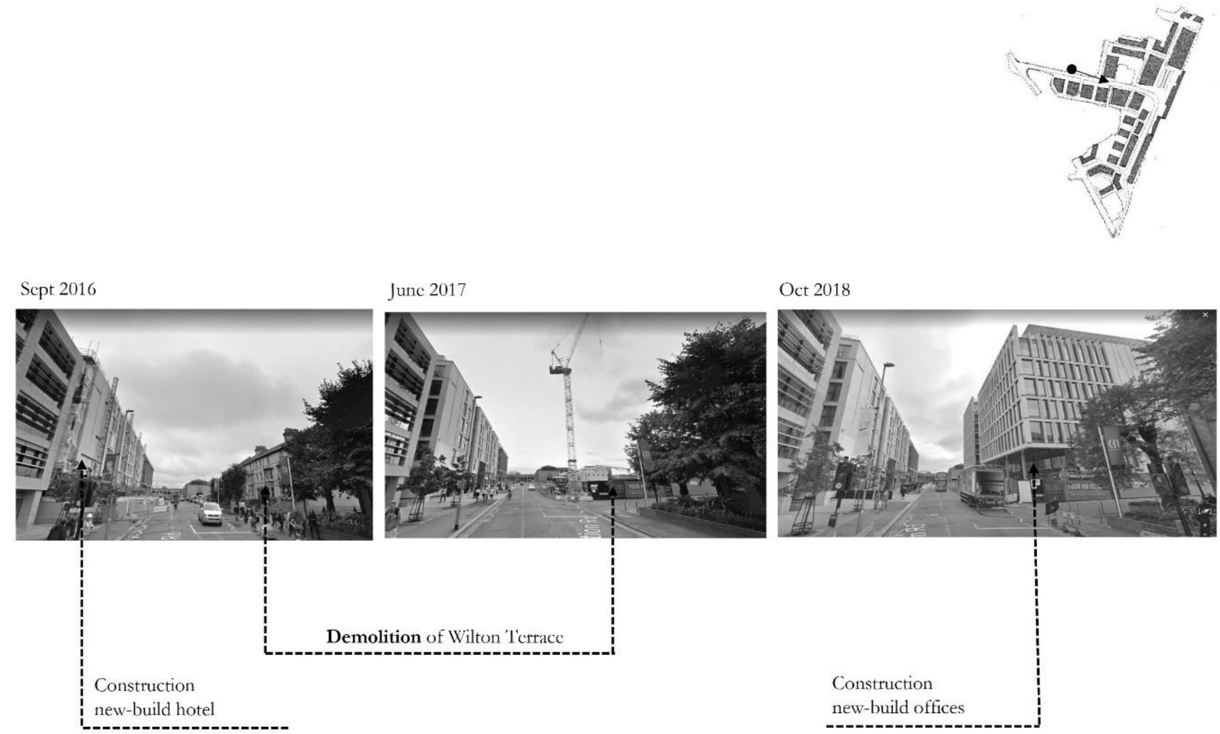

Figure 5-12: New build hotel and Wilton Terrace, CB1. Wilton Terrace demolished due to scale compared to surroundings and to increase density.
Image source: Google Street View.

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Available at: https://www.centralparksydney.com/explore/masterplan

Figure 5-13: Modified masterplan for Central Park. Changes included an increase in density.

Figure 5-14: Larger scale buildings on Strijp-S, development site neighbouring Strijp-R.
Photographs by author.

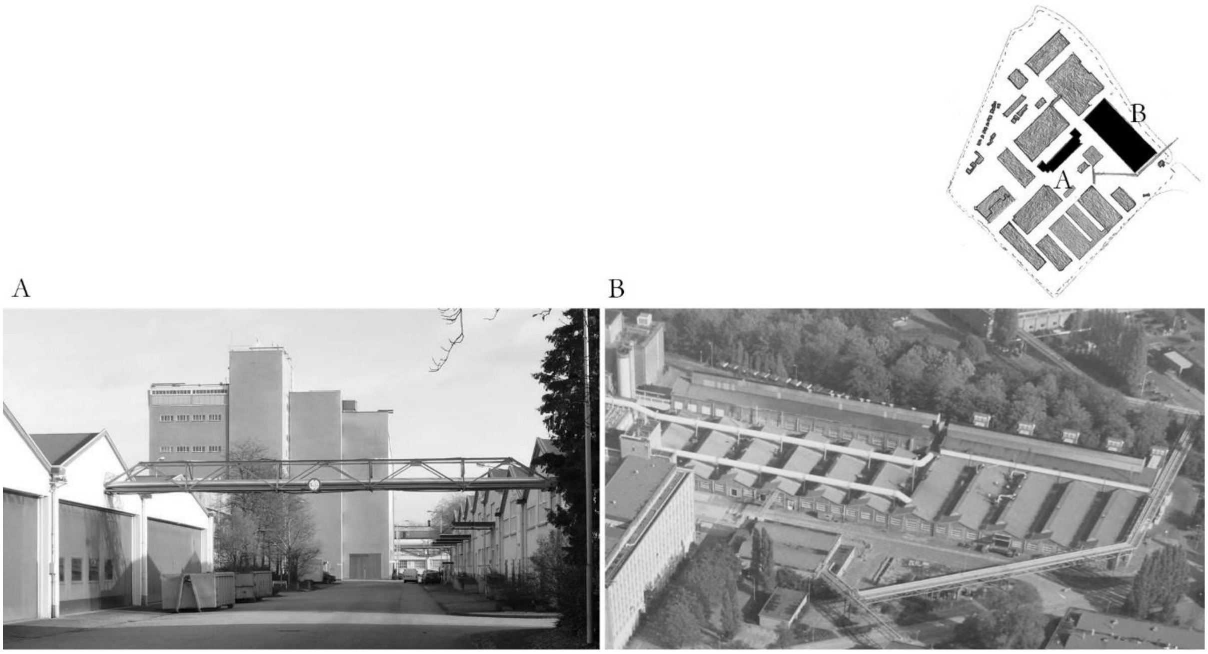

Figure 5-15: RAF (a) and RO (b) buildings on Strijp-R. Demolished due to large massing in comparison to surrounding development.
Image source: van der Hoeve, J.A. (2006). *Bouwhistorische verkenning van de fabrieksgebouwen. Strijp-R, Eindhoven (Building historical exploration of the factory buildings, Strijp-R, Eindhoven)* (No. 06–11360167). Bureau voor bouwhistorisch (office for building history) produced for Amvest, Utrecht, Netherlands.

Figure 5-16: Juxtaposition of scales on Central Park. Retained pub with new building cantilevering over the top.
Photograph by author.

Figure 5-17: Juxtaposition of scales on Strijp-R. Retained industrial building alongside smaller scale new build residential housing.
Photograph by author.

5.4 Economic viability at the individual building and masterplan scales

All of the factors discussed so far relate back to the economic viability of retention versus demolition and new build. A building's form and the condition affect the capital costs of the project, whilst the desire to increase density affects the revenue and income.

At an individual building level, interviewees acknowledged that "*everything is repairable… [but] that's not to say that it is economically viable to repair*" (ref.PI-7). Often if a building is more expensive to retain than to demolish and replace it with something new, the demolition option will be favoured. For example, when one interviewee was discussing what clients look for when assessing the feasibility of re-use, he said "*Oh golly, in the end if the client will be interested in retention, what will it cost him? What the building will be worth afterwards?*" (ref.PI-11).

In some instances a project may have funding to assist with the retention. One developer described the retention of a former industrial factory as "*economically, it was very difficult to find a viable use*" (ref.PI-26). However, he said the driver towards retention was heritage and funding was received from a public body to assist in the retention. In another interview a public planner said "*if there is funding available to cover capital costs, then that can obviously help*" (ref.PI-23).

In other cases, the developer and/or building owner, might be a charitable institution and economics are not the key driver behind the decision. This was apparent during an interview with a historian at a charitable organisation, the Landmark Trust, specialising in the adaptation of existing buildings when she said:

> "*Very often things aren't susceptible to residential conversion…we do not look for any return on investment in a formal developer's kind of the way, so from our point of view, if something is worth saving, it's almost worth saving at any cost.*" (ref.PI-12)

On masterplan sites, the economic viability can be considered differently compared to individual buildings. The larger scale can provide developers with the opportunity to increase the density of new buildings and recover the cost elsewhere on site. As one property consultant suggested:

> "*When you look at the benefit of knocking that building down and replacing it in the scheme of the masterplan, it's miniscule…any space that we could have grabbed by knocking it down, we could catch up with elsewhere.*" (ref.PI-3)

In addition, a different property consultant described how the demolition of existing buildings ruins the attractiveness of an area:

> "*The developer has to suck it up a little bit really, because there's no point in saying we should knock the whole lot down and start again if it kills the attraction of the development in the first place.*" (ref.PI-13)

A third consultant described a masterplan development where an industrial mill was retained despite using space inefficiently. Although he recognised that the decision looking at the building individually was 'not commercial', he felt that in the context of the masterplan, the retention helped to create place and character (ref.PI-4). Therefore, the consensus between these property consultants' viewpoints suggest that economic viability is considered differently at the masterplan scale as the retention of existing buildings provide a positive contribution to the attractiveness of a development and in some cases the costs of retention can be recovered by increasing densities elsewhere on site.

This difference in interpreting economic viability and the positive contribution of existing buildings at the masterplan scale helps to explain why buildings which were in poor condition or had unfavourable structural morphologies were retained on all three case study sites. For example, the architect who conducted feasibility studies for retaining the walkway (figure 5-18) on Strijp-R described how the concrete was in really poor condition and that retention was "*really expensive but interesting if you make it the centre point of a little larger development*" (ref.CS-SR-3). Furthermore, on the Central Park development the developer explained how there is often "*some underlying reason to [retain a building] that's beyond straight excel spreadsheet mathematics*", and referred to the economic benefits of retention within a masterplan development (CS-CP-11). However, it is rarely possible or desirable to keep all of the existing buildings within a masterplan. Hence why one conservation officer stated the decision is *"a sort of toss-up… [with] the loss of a building to enable the investment in another building"* (ref.PI-15).

A different interpretation of economic viability at the masterplan level is also evident due to the lack of buildings being retained on the case studies due to it being cheaper to adapt the building rather than demolish and rebuild. As previously discussed, in comparison to the individual building level, it is highly likely the cost savings of retention would have been insignificant compared to the costs of the overall masterplan and other masterplan considerations including increasing densities dominated decisions.

Figure 5-18: Retained walkway, Strijp-R.
Photograph by author.

5.5 Making space for vehicles and pedestrians within a masterplan

Existing buildings on masterplan sites are often demolished where otherwise they would not be due to the need for transportation systems and pedestrian access. This is a reason for demolition which is particularly applicable to masterplan sites rather than individual buildings. One conservation officer discussed an example of this. He felt that the justifications provided for demolition…

> *"…very clearly set out the case for demolishing a listed building because it provides access to the wider site, and that, I think sets out the scale of the arguments that you need. It was a huge site and perhaps therefore was in some ways easier to justify."* (ref.PI-20)

The interviewee clearly suggests that the demolition of the building may have been easier to justify than at an individual building level due to the size of the site, thus is applicable to masterplans rather than individual buildings on their own.

The influence of establishing transportation systems on the decision to demolish was also evident on the CB1 site, where the construction of a new taxi-rank and drop-off point were used as justifications for the demolition of the police station and Sleeperz Hotel, both of which were considered to be heritage assets (figure 5-19). The decision was described as "*practical*" by the heritage consultant, as the area needed to accommodate the movement of cars, taxis, buses, cyclists and pedestrians (ref.CS-CB1-6). The introduction of a new junction for buses also led to the demolition of two existing buildings, 127 and 127a Hills Road (figure 5-20), which the conservation officer accepted "*as essential for the transport interchange*" (Dyer, 2008b, p.25). Making way for transportation systems was therefore a fundamental justification provided for the demolition of existing buildings, which were required due to the scale of the masterplan and need to provide the necessary infrastructure.

On both the CB1 and Central Park developments, a public open space was designed in front of and to enhance a retained building. In order to accomplish this, other buildings deemed less significant in terms of heritage were demolished. On CB1 this open space was a forecourt to the railway station and on Central Park, it was a park by the brewery building (figure 5-21). The key design concept of the CB1 square was to "*create a focus around the station building*", as described by the masterplan architect (ref.CS-CB1-8). Similar reasoning was given by Central Park's masterplan architect who said "*the whole idea was that the park would celebrate the building*" (ref.CS-CP-7a).

Pedestrian activity was also enhanced on Central Park through the demolition of buildings on either end of Kensington Street. These were demolished to create points of entry to 'Spice Alley' which is a small intimate area with food stalls just behind Kensington Street (figure 5-22). The developer stated that "*the vibrancy of the space… justifies what we have done*" (ref.CS-CP-10). Hence, on both CB1 and Central Park, existing buildings perceived to have some heritage value were demolished to make space for open spaces and other pedestrian activities. As with transportation systems, these are design features and infrastructure provisions required as part of the masterplan development and are factors rarely considered in adaptation and demolition decisions at the individual building level.

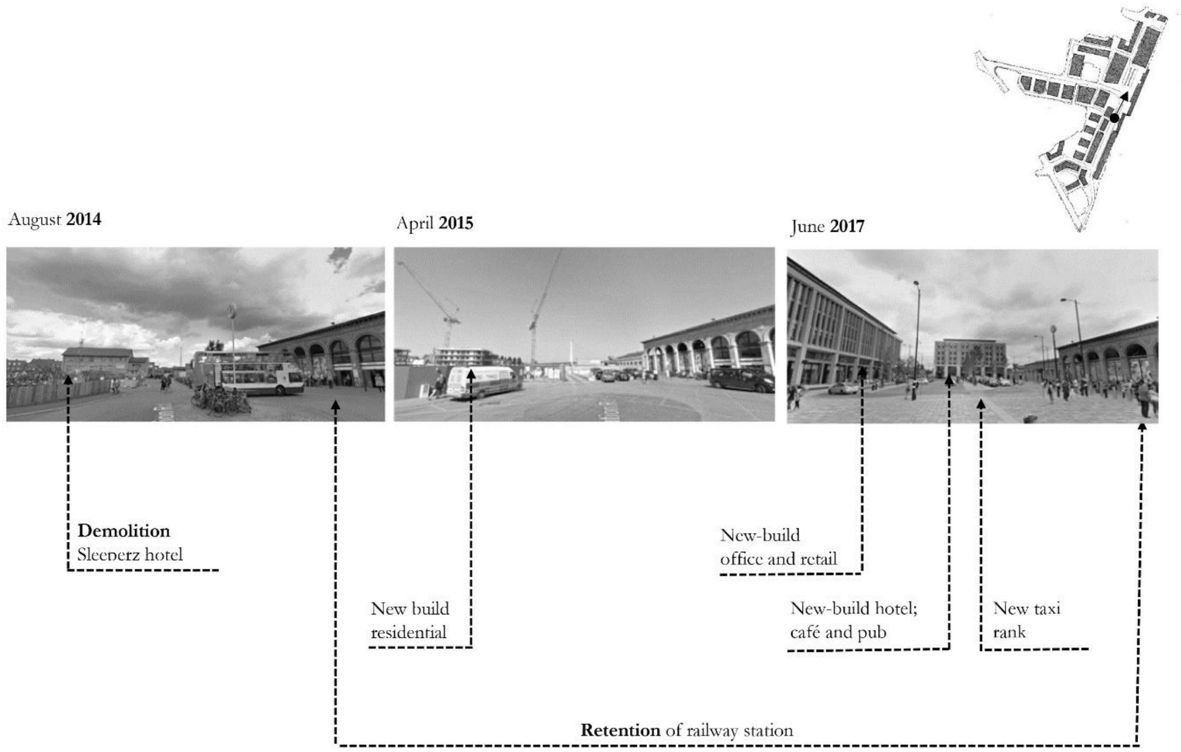

Figure 5-19: Demolition of Sleeperz hotel to make space for taxi-rank and station forecourt, CB1.
Image source: Google Street View.

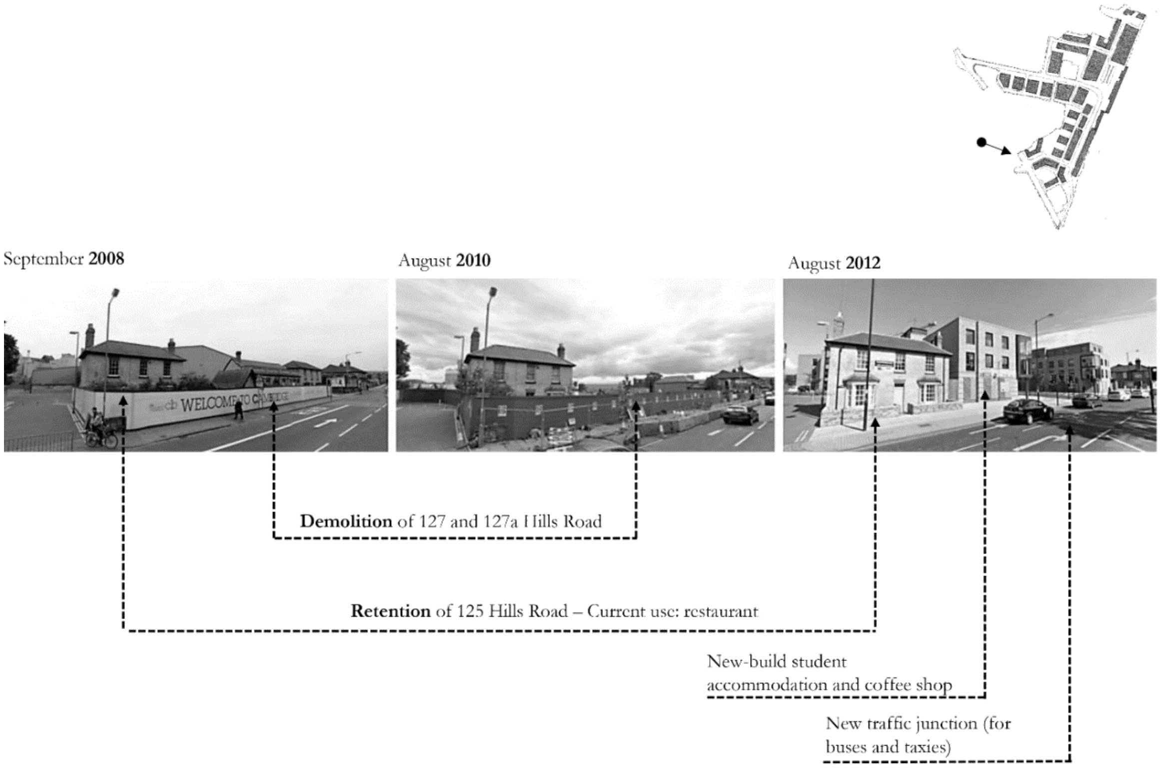

Figure 5-20: Demolition of 127 and 127a Hills Road to make space for traffic junction, CB1.
Image source: Google Street View.

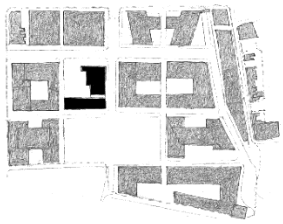

Figure 5-21: Open space in front of retained brewery building, Central Park.
Photographs by author.

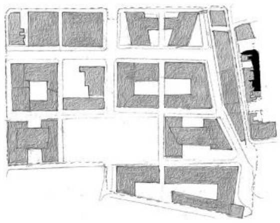

Figure 5-22: Spice Alley, Central Park. Cafés and pop-up food stalls located behind retained Kensington Street cottages.
Photographs by author.

5.6 Discussion

Several previous academic studies have shown the consideration of the physical attributes of a building on the decision to demolish or adapt at an individual building level, as well as identifying influential locational factors often outside the control of the decision maker, such as distances to amenities. This chapter has shown that for buildings within the context of a masterplan, the physical attributes of the individual buildings are still applicable. However, there is both a changing interpretation of economic viability and additional factors included in the masterplan's design which affect decisions.

The majority of decision-making criteria related to the physical attributes of individual buildings were identified in all three data sources – the literature review, professional interviews and case study interviews, emphasising their relevance at both the individual and masterplan scales.

There was general agreement across the professional and case study interviewees that issues with a building's form, in particular whether or not the existing form could be used with minimal intervention to suit updated or new functions, can lead to demolition, especially if a building has no heritage value. Common reasons provided for demolition included low floor-to-ceiling heights in the existing structure which makes installing new services difficult and the desire for large open plan floor plates. Other drivers towards demolition include poor building condition, as well as the financial uncertainty due to problems with a building being uncovered once construction is underway, referred to as latent defects in the academic literature (Wilkinson et al., 2014). Furthermore, in the context of a masterplan, interviewees suggested that detailed condition surveys are often undertaken after the decision to retain a building has already been made, which relied upon a visual inspection.

The physical attributes of a building can also favour adaptation options. If floor-to-ceiling heights are high, which is common in former industrial buildings, this can be considered as an attractive feature, whilst high load-bearing capacities might result in expensive demolition costs in comparison to retaining the structure. Although the same physical attributes are considered in adaptation decisions, the former function of a building will cause these to differ. For example, former industrial buildings are more likely to have higher load-bearing capacities and floor-to-ceiling heights than residential dwellings, whilst both former offices and industrial buildings are more likely to have larger open floor areas. Thus, the future use is likely to be determined by the previous function.

However, in both the professional and case study interviews, it was suggested that buildings might be retained despite high construction costs if they are considered as heritage items by the developer or through planning policy (policy related to heritage is discussed in the next chapter). In these circumstances, the function is chosen to fit the form, which is often favourable to smaller businesses. This agrees with findings in the literature review focused on the individual building level, that large corporate companies are likely to favour demolition and new build as they want large open plan offices, whereas heritage buildings are more likely to accommodate start-up companies (Heritage Lottery Fund, 2013; Plimmer et al., 2008).

Massing and masterplan density are clearly influential over the decision to adapt or demolish existing buildings at both individual building and masterplan scales. All three data sources indicated that there is often a desire to build back bigger to create a density uplift (Been et al. 2016). One issue that was not considered in the literature review on this topic, was the target market and that bigger is not always better, as the density is determined by housing and commercial demands in an area. On Strijp-R, larger buildings were demolished and replaced by smaller new buildings. The key difference between the case study sites is that CB1 and Central Park are in prime city centre locations next to key transport interchanges and the developers used this as an argument for higher densities. Strijp-R is located on the edge of Eindhoven and the target market for the development was families requiring houses rather than apartments or studios.

Furthermore, planning restrictions are influential over what densities are allowed on sites which can sometimes lead to the retention of existing buildings. At an individual building level, the analysis discussed how an existing building may provide the maximum density that can be obtained due to planning constraints. At the masterplan scale, existing buildings might be retained to help obtain planning permission to build the surrounding new buildings up to the same height, as was seen on the CB1 development. Although leading to the retention of buildings, maximising density is still the key driver behind these decisions.

One justification provided by developers for demolition on the case study sites, which was not identified in the literature review, was that an existing building was out of place with its surroundings and/or the proposed new buildings. However, on all the masterplan developments, there was a juxtaposition of scales between existing and new buildings. The extremity of this juxtaposition varied across the sites. On Central Park, the new buildings are significantly larger than the existing in comparison to the difference in scales seen on CB1. This is due to the larger population of Sydney, compared to Cambridge, which led to higher densities. On Strijp-R, the existing buildings are larger than the new smaller housing due to the demand for this type of new dwelling. It is therefore clear that a masterplan can accommodate for a range of scales and that the reason for demolishing an existing building because it is 'out of place' should be questioned. It is much more likely the driver behind these decisions was economics. On CB1 and Central Park this was to increase densities and on Strijp-R meet the market demands for smaller dwellings.

Economic viability at the masterplan level can be determined differently to the individual building level. At the individual building level, viability is significantly influenced by the construction costs. If these costs are high relative to the new build option, it is commonly used as a justification for demolition, particularly if the building has no heritage value. However, professional interviewees suggested that economic viability at the masterplan scale is interpreted differently as the scale of the masterplan allows the cost of retention to be recovered by the rest of the development, hence there are examples of buildings being retained in the context of a masterplan which are unlikely to have been retained at an individual building level as it would not have been economically viable or desirable to do so.

Additionally, although the same physical attributes identified by previous academic studies led to the demolition of buildings, on the case study sites there were no examples of buildings being retained as it was cheaper to retain, rather than demolish and replace. The chapter argued that the driving force behind retention on these masterplan sites was heritage rather than cost savings as the scale of the masterplan made these savings insignificant. Furthermore, as masterplan developers have invested in the area beyond an individual building, they have an increased interest in adding economic value though place-making to the wider area (this is discussed further in the next chapter).

The masterplan scale also creates extra considerations that are rarely influential at the individual building level. This includes making space for vehicle and pedestrian flows within the masterplan design, which can lead to the demolition of existing buildings, even if they are perceived as heritage items. At the individual building level, locational factors influencing decisions that were identified in the literature included the distance to open space. Previous academic studies described these as external factors which are outside the control of the decision-makers (Thomsen and Flier, 2011; Van der Flier and Thomsen, 2006). However, within large urban developments, these are part of the design and decision making process and can be interpreted differently. Limitations associated with locational factors at the individual building level can be overcome as the scale of the masterplan has the capability to provide this improved infrastructure and is often required as part of the physical intervention of urban regeneration projects. This was referred to in the 'heritage-led regeneration' literature as "*the hierarchy of place organisation*" (Mosler, 2019, p.4) as there is competition between heritage and other urban typologies (Ashworth and Tunbridge, 2017). This may also be why masterplan design principles dominated case study conversations in comparison to considerations at the individual building level, with one topic noticeably absent being building regulations. It is likely this level of detail will be established later in the process, after the initial masterplan planning application.

Evidently, at the masterplan scale, there is an added layer of complexity as design principles for the development of a whole area dominate decisions. As the CB1 masterplan architect expressed, when designing a masterplan, the focus is much more holistic:

> "*You are not designing buildings…you are designing the number and size of a number of jelly moulds and you are placing them on site. You are not filling them with jelly, all you are doing is creating the physical constraints in which architecturally you can respond.*" (ref.CS-CB1-8)

CHAPTER 6:

Arguments for retention applied in practice

The two arguments which were frequently put forward in the academic literature for the adaptation rather than demolition of buildings are considered in this chapter. These were retaining heritage and savings in materials, which are relevant to a building's whole life energy and carbon impacts. This chapter considers these two benefits and their consideration in adaptation and demolition decisions from the perspectives of the professional interviewees and focus groups, alongside the case study realities. This is followed by a discussion which helps to answer the second research question: *"Are heritage values and whole life energy and carbon considerations taken into account in practice when decisions are made to adapt or demolish existing buildings on masterplan sites?"*.

6.1 Retaining heritage

The conservation of heritage is a key driver towards the retention of existing buildings demonstrated by it being the fundamental reason for adaptation of all the buildings that were retained on the case study sites. This section explores the term 'heritage' in detail to gain an in-depth understanding as to why it, or concepts related to it, are so regularly referred to as a reason for building adaptation at both the individual and masterplan scales.

Figures 6-1 and 6-2 provide a frequency distribution of the dominant points of discussion within themes connected to heritage. The values that interviewees attached to existing buildings are examined, followed by discussions about whether or not heritage was considered beyond the individual building level, as group or ensemble values. Significance and designations for individual buildings are then discussed, followed by an examination of conservation area designations, which are applicable to larger areas of land. The last sub-section focuses on character and place-making which were regularly referred to as benefits of building retention and are particularly relevant to the masterplan scale.

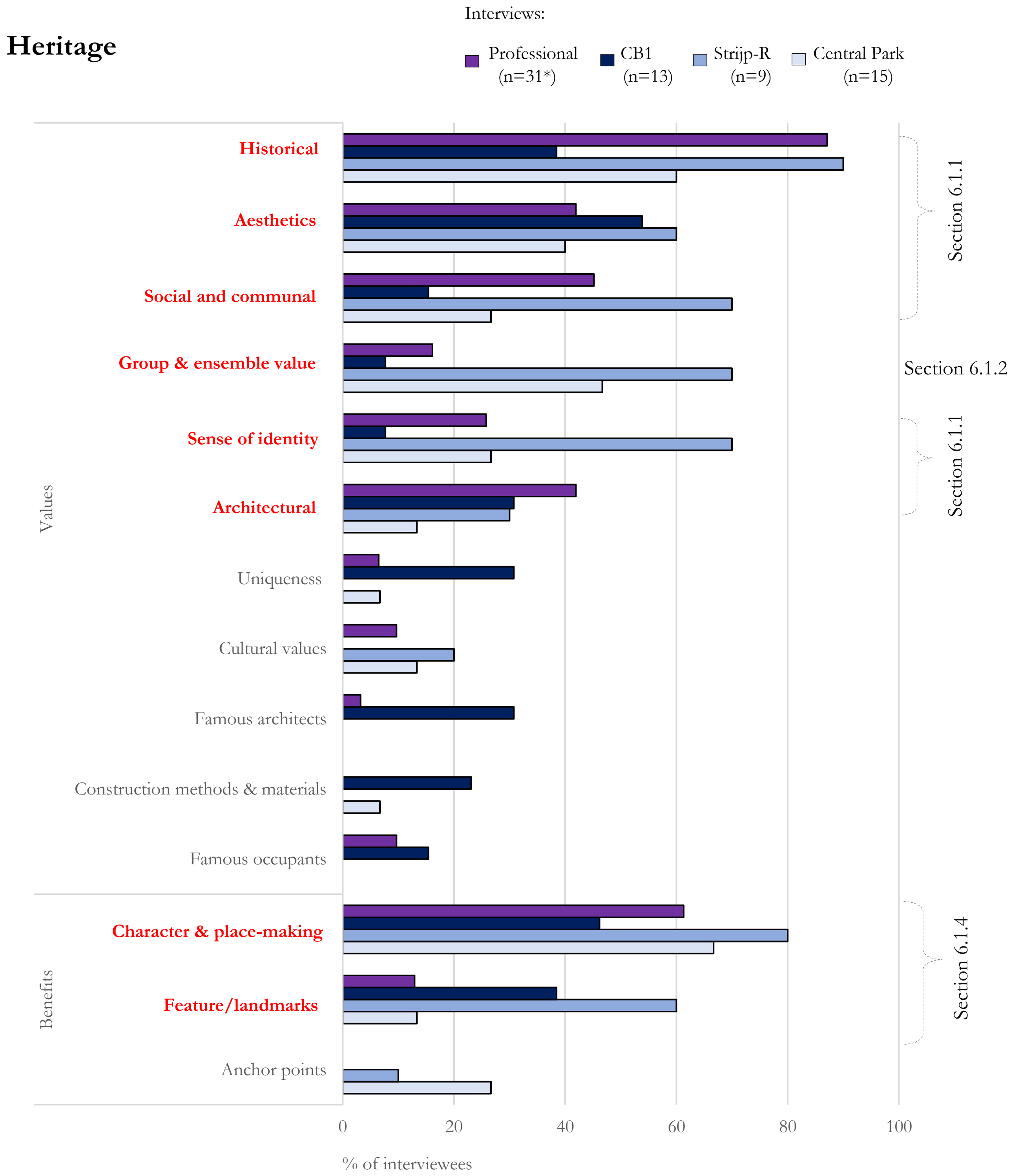

Figure 6-1: Theme – Heritage. Frequency distribution of codes mentioned across interviews.
*excludes interviews with academics specialising in embodied energy.

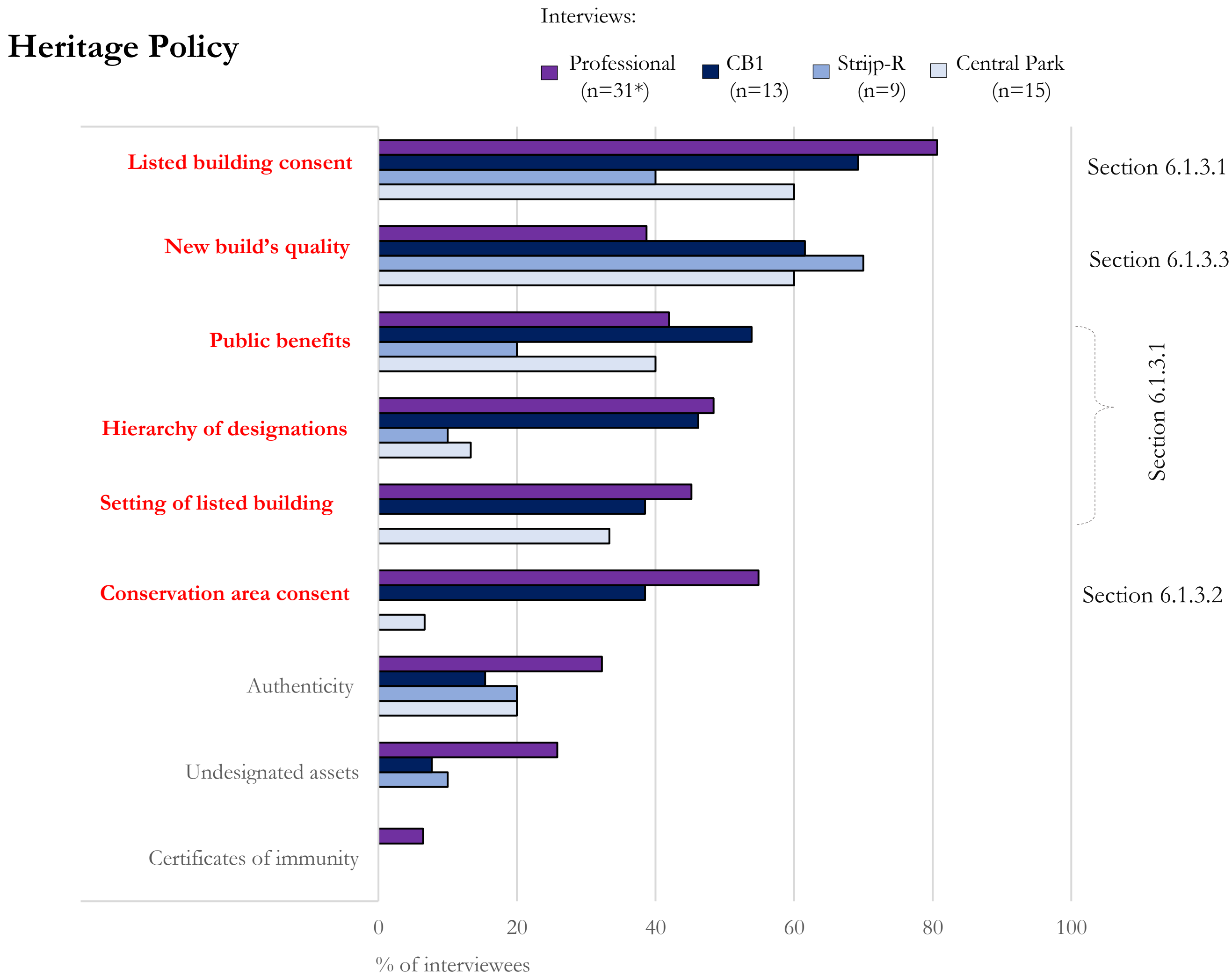

Figure 6-2: Theme – Heritage Policy (within Planning Structure and Requirements). Frequency distribution of codes mentioned across interviews.
*excludes interviews with academics specialising in embodied energy.

6.1.1 Industrial heritage values

A range of values are used to understand the heritage associated with different property types including architectural, historical and social values. The values most regularly referred to in the professional interviews were those related to the historical development of an individual building or site, with one heritage consultant saying that this is the factor considered first when trying to assess heritage:

> *"The first stage of anything is to understand historical development because you know associations with people, the way places have developed over time, settings and context, all of these things contribute to understanding what makes a place significant."* (ref.PI-18)

Industrial buildings are considered to be a part of history due to the technical and scientific developments of their former use/production procedures. An expert in industrial heritage described this as "*the 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*" (ref.PI-2). It is likely this is why there were similar attitudes towards the historical values of industrial buildings on the case study sites despite the built heritage of Australia[25] being significantly newer than the two European countries. The historical values tended to be concerned with the production processes, rather than the age. This is applicable to individual buildings and larger areas of land, which is discussed further in the next section.

The aesthetic qualities of heritage are attributed to the way a building or place looks and its beauty. At an individual building level, the aesthetic qualities for industrial buildings were accredited to the high-floor-to-ceiling heights and large volume spaces. One building surveyor suggested that aesthetics is often considered in residential properties as "*people do quite like living in a nice-looking area, in a nice-looking house*" (ref.PI-7). Others implied that this desirability to live in aesthetically pleasing areas could add value to the property: "*if you look at the private real estate market, it is the heritage buildings which are the most expensive…they are desirable places to live…because they are so aesthetically pleasing*" (ref.PI-8). However, in some cases, buildings were described as "*ugly*" (ref.CS-SR-6) or "*unlovely" (*ref.PI-20*),* yet interviewees suggested they were still retained as they are important: "*not much for the architecture but for the history*" (ref.PI-24). Despite these viewpoints, one heritage society representative felt that aesthetics, particularly for 20th century architecture, often has a greater degree of consideration: "*unless it is something very obviously beautiful and a landmark…they are not necessarily understood yet*" (ref.PI-8).

On the case study sites, industrial buildings with historical values but not necessarily architectural were retained. On the CB1 site one local resident declared that they had "*never been that enamoured by the mill…but nevertheless it was a landmark for local people*" (ref.CS-CB1-2). In the heritage report it states "*the station, mill and silo are rare survivors of the industrial heritage of Cambridge*" (QUBE, 2008, p.15).

On Strijp-R, the retained industrial buildings were also not considered architecturally significant but the history of the site which related to development of the TV was outlined as an important change in society (ref.CS-SR-9). As conveyed in the building report: "*[the] main historical significance of Strijp R is therefore in the mass production of television tubes for the period from 1952 to 1977*"[26] (van der Hoeve, 2006, p.27). In contrast, the architecture on the neighbouring Strijp-S, also a former industrial site, was described as monumental and architecturally significant. When it was built (1916-1923) the aim was to represent the corporate image of Philips. According to the heritage consultant, as Strijp-R was constructed after WWII,

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[25] Aboriginal and Torres Strait Islander heritage is also an important part of Australian heritage and precedes the built heritage which has been referred to.

[26] Original text: "*De belangrijkste historische betekenis van Strijp R ligt dan ook in de massaproductie van beeldbuizen voor TV's gedurende de periode circa 1952 tot 1977*".

"[Philips] became more pragmatic because by then that role [of corporate image] had been taken over by advertising…they just wanted to have flexible, cheap production units" (ref.CS-SR-8). Although retained buildings on both CB1 and Strijp-R were not considered aesthetically or architecturally pleasing in a traditional sense, they told the history of the site and were thus considered as historical features.

Nonetheless, despite their industrial history, other buildings were demolished on the case study sites as they were considered to be unattractive. Their removal was said to enhance the aesthetics of the other buildings within the masterplan development. For example, on the CB1 site, the demolition of existing industrial buildings was justified on the following grounds:

> "*All of the buildings were constructed with the efficient operation of the mill in mind rather than aesthetic considerations and consequently many of the structures [were] extremely unattractive… the removal of these buildings [would] improve the appearance of the Conservation Area.*" (QUBE, 2005, p.9)

The majority of references made to the architectural value of existing buildings related to aesthetics. However, architectural values also consider historic and/or unique construction methods. Case study interviewees referred to Great Eastern House (figure 6-3) on the CB1 site which was an early example of pre-cast concrete (ref.CS-CB1-6), whilst a large concrete building (the Barley building) referred to on Central Park, which was said to have "*early reinforced concrete mushroom columns*" (ref.CS-CP-7a), was described as a "*pioneering use of pre-cast concrete*" by the City of Sydney (2006, p.8) and "*ugly as… [with] extraordinary internal construction details*" by the heritage consultant (ref.CS-CP-2). Although these construction methods were commented on and perceived as important reflections of previous construction methods, the buildings were still demolished due to their lack of aesthetic quality, suggesting that aesthetics is more widely accepted and appreciated. Although the construction of a building might be of interest to some, the importance will not necessarily be understood by a layperson. This emphasises the plurality of viewpoints that exist when interpreting heritage.

Individual features of buildings were also deemed to be important on the case studies yet demolished. For example, the ventilation shafts (figure 6-4a) on the RO building on Strijp-R (ref.CS-SR-9) were commented upon positively in the heritage assessments (van der Hoeve, 2006). However, they were demolished due to high adaptation costs. Although part of the RF building was retained, the loss of large garage doors (figure 6-4b) received media attention and efforts to save them (De Leeuw, 2009a). Due to the size of the masterplan and the number of buildings that were assessed, it is likely that individual features of buildings will not have the same degree of importance if that building was being assessed in isolation, outside the context of the masterplan.

Social and communal values were other values identified during the professional interviews. Although not yet universally considered, interviewees suggested that they are becoming increasingly recognised:

> *"What is becoming increasingly important in the last couple of years, is communal value, there is even an element of buildings that might not have a lot of historical or aesthetic aspects but have gained an importance to a group of people."* (ref.PI-18)

If a place has social or communal value, the heritage is not only about the physical object but also the memories of people: "*places are not a collection of things, they are a collection of memories and that kind of stuff, familiarisation*", as conveyed by one heritage consultant (ref.PI-27).

It is of course frequently difficult to separate social from historical values on industrial sites as it is the industrial history and activities that took place which often led to the sense of identity. This message was expressed in the professional interviews where the specialist in industrial heritage felt it was important to keep examples of the coal industry to know what happened and it was "*socially important because so many people worked there"* (ref.PI-2). She described the subject as "*emotive*", whilst another interviewee felt that "*in mining communities…you don't have to dig very far and you find that people value their surroundings very highly*" (ref.PI-17). These viewpoints indicate that people's memories and sense of attachment to an area are perceived as important on industrial sites.

In practice, the term 'identity' was often used in connection to the heritage. The urban designer for Eindhoven (Strijp-R's city) believed that *"[the] inventing of products, which was mainly the designers of Philips…was [Eindhoven's] identity*" (ref.CS-SR-10). The sense of identity extended beyond the curtilage of the masterplan as Philips was renowned throughout the city, which was considered to be a 'company town' (ref.CS-SR-4, ref.CS-SR-10). Philips was also well-known for looking after his workers and provided community facilities including a football stadium and science museum (figure 6-5) (ref.CS-SR-5). Although Philips have now moved their headquarters to Amsterdam (van der Hoeve, 2006), the legacy remains which is demonstrated through the annual Glow Festival which celebrates the invention of the lightbulb by Philips, and the Philips museum located in the city centre which tells the history of the company.

The role the buildings on Strijp-R therefore played as part of the memories of former Philips workers was described as the most important reason to retain buildings by the masterplan architect (ref.CS-SR-6). This was also evident in the interview with Strijp-R's process manager. When asked about the benefits of retention, her answer was "*identity*" (ref.CS-SR-5). Additionally, the landscape architect referred to "*the genius loci, the spirit of the place…you can still feel it was a former industrial site*" as the most successful aspect of the development (ref.CS-SR-2). This sense of identity and importance of the industrial past to the local community is also evident through the publication of a book by Eindhoven community members called 'Out of Sight[27]' (De Stichting R-In Beeld, 2012). This is described as "*a book with memories of 60 years of TV picture tubes and the people who made the picture tube legendary*[28]" (BeeldBuisBoek, 2012). As the sense of identity extended across the city, it is likely this is why it was conveyed so strongly.

On Central Park, a book called "*Chippendale: Beneath the Factory Wall*" (Fitzgerald, 1990) describes the history of Chippendale (the area containing Central Park) and the industrial processes on the site. Interestingly, the title of the book is similar to the one produced on Strijp-R, as both industrial areas were closed off from the public. However, in contrast to the sense of identity so apparent on the Strijp-R case study, the sense of identity provided by the brewery, was not so apparent during the interviews. The heritage consultant felt that there was a disconnection between the neighbouring communities and the site as all the workers left when the brewery closed in 2005. The heritage consultant explained that "*there was more of a clean slate which has enabled the developers to re-establish the new identity*" (ref.CS-CP-2). Although there were some connections made between the mill on CB1 being one of the only industrial areas in Cambridge, the message of identity also did not come across to the same extent as on Strijp-R. It is likely this is because the industrial companies (CUB and Rank Hovis) did not have as great an influence over the cities of Sydney and Cambridge as they were cities with many more employers and not considered as 'company towns'. This suggests that social values, particularly the sense of identity, are likely to vary depending on the industrial company's influence on the surrounding area and city, as well as when the factories ceased production.

[27] Original text: "*Buiten beeld geraakt*".
[28] Original text: "*Een boek met herinneringen aan 60 jaar TV beeldbuizen en de mensen die de beeldbuis legendarisch maakten*".

Figure 6-3: Demolished Great Eastern House, CB1. Considered to be an early example of pre-cast concrete.
Image source: Google Street View.

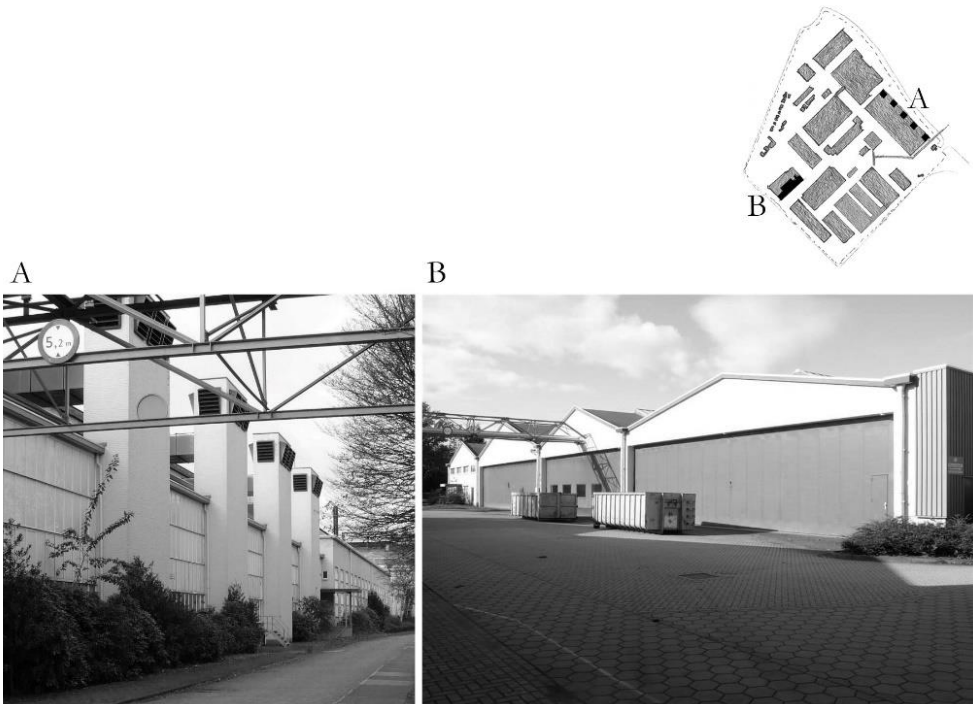

Figure 6-4: Individual building features considered as heritage items but demolished on Strijp-R due to technical feasibility.
A – Ventilation shafts of RO building. B - Garage doors of RF building
Image source: van der Hoeve, J.A. (2006). *Bouwhistorische verkenning van de fabrieksgebouwen. Strijp-R, Eindhoven (Building historical exploration of the factory buildings, Strijp-R, Eindhoven)* (No. 06–11360167). Bureau voor bouwhistorisch (office for building history) produced for Amvest, Utrecht, Netherlands.

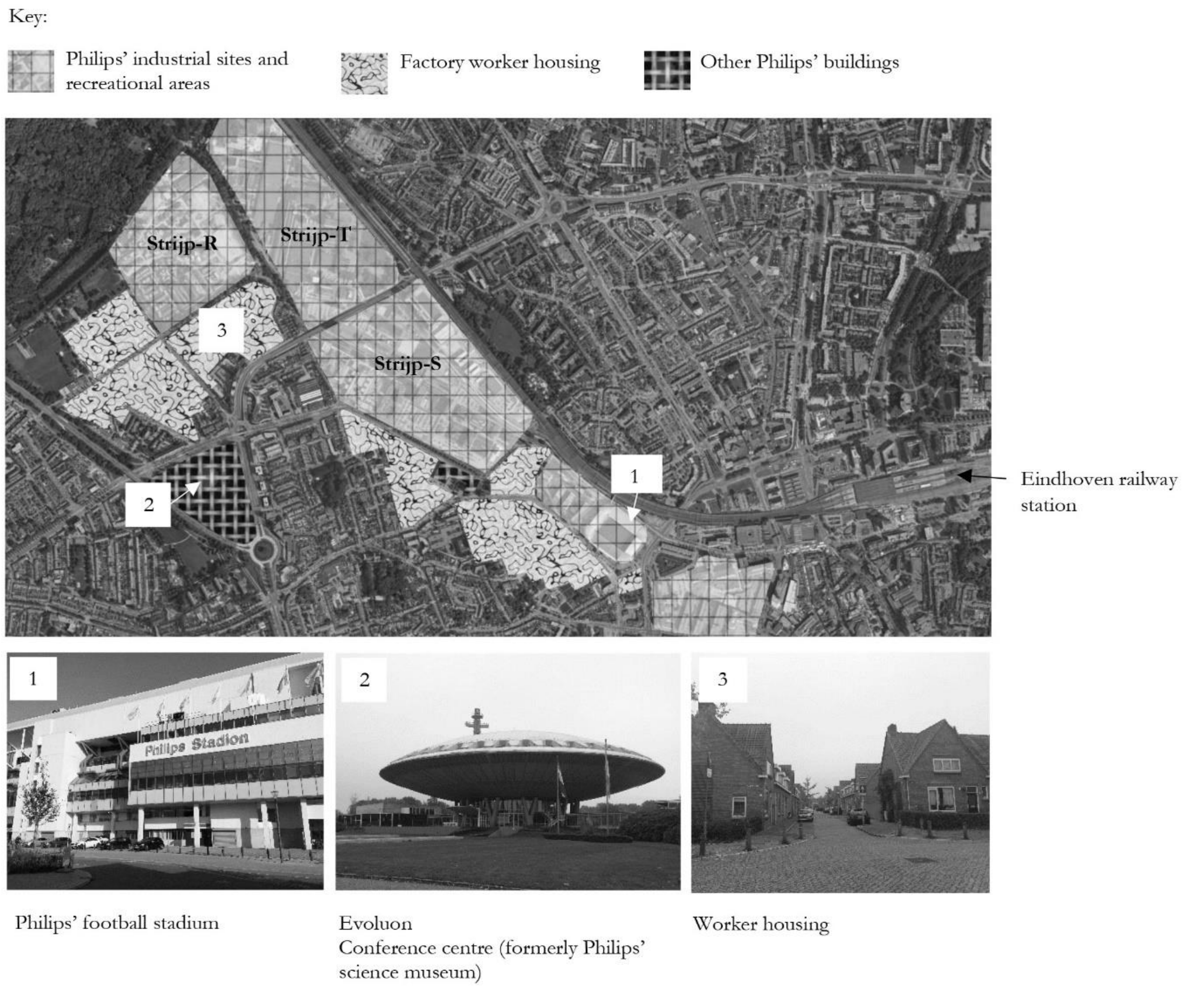

Figure 6-5: Philips influence within Eindhoven.
Image sources: Map – Google Earth. Photographs – Author
Data source: Meurs, P. et al. (2007). '*Strijp R, Eindhoven. Cultuurhistorische verkenning (Strijp R, Eindhoven. Cultural-historical exploration)'.* Urban Fabric | Steenhuis, Schiedam, Netherlands.

6.1.2 Group and ensemble values

The previous section discussed both individual buildings and former industrial areas in the context of heritage values, showing that heritage is applicable to larger areas of land beyond the individual building level. This is often achieved through the grouping of buildings or telling the story of a whole industrial site. One heritage consultant described how there might be a "*group of buildings and not all of them are of high significance but they have a group value and perhaps contribute to a streetscape or townscape as a group*" (ref.PI-18). Other interviewees discussed landscape features within masterplan sites such as canal networks and explained how these were considered as heritage features (ref.PI-4, ref.PI-26). These group and ensemble values are particularly relevant to the masterplan scale of decision-making.

A holistic focus and move towards considering the whole site was particularly noticeable on Strijp-R where two heritage investigations took place, one focusing on the individual buildings and the other on the heritage of the whole area (Meurs et al., 2007; van der Hoeve, 2006). As expressed by one interviewee, this was required as the:

> "*Cultural historical value might be on a different level, on an urban level instead of only on an architectural level, so an ensemble.*" (ref.CS-SR-4)

For this reason, the objective of Strijp-R's heritage assessment, according to one of the heritage consultants, was to:

> "*…understand the story of the place…so rather than say, our agenda was these buildings all have to be preserved. Our agenda was that the urban plan would be addressed in such a way that history would be present, even if you teared down lots of buildings.*" (ref.CS-SR-8)

The heritage consultants therefore felt that it was important to understand the narrative behind the site and that heritage goes beyond the individual building level and its physical fabric. This was also reflected in the core principles for the masterplan set out by the design team (figure 6-6). These principles include relics, which consisted of buildings and former structures including a former railway platform and industrial metal work (figure 6-7); the 'ring' which reflects the former road network; the 'schakelpark', which is a park following the line of the former railway; and the 'zoompark', a ring of trees, many of which are mature, which define the site's boundary. According to interviewees, the trees were considered to be part of the heritage as Frits Philips (the fourth chairman of Philips) *"loved very much to plant trees, so it is one of the most green industrial areas you have"* (ref.CS-SR-8) and they "*give you the feeling the place exists already*" (ref.CS-SR-2).

However, despite these efforts, the site has still received criticism from an architectural journalist who felt that the heritage of the site (and the neighbouring Strijp-S) had not been sufficiently acknowledged. The journalist felt that factory buildings which were "*perfect for use as loft [studio apartments] or business premises were demolished*"[29] and that the retained buildings were just "*an island sat within a boring new building district in a location where technology previously flourished*[30]"(Noorlander, 2016). The heritage consultant expressed frustration that the journalist did not fully understand the site or did not know that the original intention was to demolish everything (ref.CS-SR-8). However, this does raise the question of how well the heritage principles are understood if visiting the site for the first time. Clearly to this individual, the heritage

[29] Original text: "*perfect te gebruiken als loft of bedrijfsruimte, zijn gesloopt*".
[30] Original text: "*een eiland in een saaie nieuwbouwwijk op een locatie waar voorheen de technologie floreerde*".

considerations at the masterplan scale were not apparent, emphasising the subjective nature of heritage and design.

Thinking beyond the individual building level was also visible on the other case study sites but not to the same degree. On Central Park, the Conservation Management Plan (Godden Mackay Logan, 2005) identified the heritage values of individual existing buildings, as well as townscape elements, including a former gate portal which was retained (figure 6-8). A heritage drain was also considered to be an important archaeological feature, whilst three of the four pubs depicting the corners of the previous brewery site were retained to help define the former boundary (figure 6-9). The developer's community consultant stated that *"[it is] not just heritage buildings but sensitive urban design and master planning that recognises the heritage of the place*" (ref.CS-CP-5).

The grouping of buildings on Kensington Street were regularly considered to be a successful part of the masterplan, which had its own character (ref.CS-CP-1a, ref.CS-CP-1b, ref.CS-CP-5, ref.CS-CP-7, ref.CS-CP-8, ref.CS-CP-10, ref.CS-CP-11, and ref.CS-CP-14). The original heritage consultant felt "t*he only thing really missing from the site is all the industrial paraphernalia. The pipes and infrastructure that gave the buildings character*" (ref.CS-CP-2), which indicates the ensemble and/or narrative could have been better reflected. Instead, the site's narrative is provided through photographs in a retained building now used as a hotel, and visitors to the area, can use an app for additional information when touring the site (Frasers, 2015). Therefore, heritage is recognised beyond the individual building level but the narrative of the site is less apparent than on Strijp-R. As identified in the previous section, it is likely this is the case as the social values did not appear to be as important on Central Park in comparison.

In the initial masterplan application for CB1, there was said to be group value by retaining both the silo and mill. However, as the silo burnt down in a fire, this did not come to fruition in the final construction (figure 6-10). Within the curtilage of the site, there are some links to the industrial past through public art installations. These include an industrial crane base and a statue of Ceres (goddess of agriculture) from the former Rank Hovis site (figure 6-11). These however are not readily noticed and as described in the original heritage assessment are "*an incident in the street rather than a dominant feature*" (QUBE, 2008, p.8-26).

There was considerable debate over the alignment of Station Road in the development of the masterplan. This was due to the relocation of a war memorial. A key principle of its original location was that the soldier had eye-contact with the station to see his men come home after the war. Hence, when relocated the local authority wanted this to be maintained (figure 6-12). However, without reading about this, the design strategy is likely to be unnoticed by passers-by. Unlike the other sites there is not a grouping of existing buildings or narrative which comes across from the whole CB1 area. The retention of buildings is much more fragmented and there is a lack of an ensemble. This is partly due to what buildings were already on site as they did not offer the design team the same opportunity as Kensington Street (in Central Park) to group a set of buildings together. However, it is also likely to be influenced by the weaker sense of identity established in the heritage assessment compared to Strijp-R and that the industrial area only formed part of the CB1 site rather than all of it.

The transition from understanding heritage as individual objects to an understanding of the whole site and the underlying narrative reflects the changing heritage discourse discussed in the literature review (Ashworth, 2011; Pendlebury, 2013). Ensemble value sits within the conservation discourse and was recognised to some extent on CB1 but more so on Central Park as buildings were grouped together. Understanding the narrative is aligned with the 'heritage planning' discourse and was apparent in the aspirations of Strijp-R's design team. The use of the word aspirations is important here as criticism of the Strijp-R development indicated the subjective nature of heritage and plurality of viewpoints, as the narrative was not always acknowledged by people visiting the site for the first time.

This image has been removed.
Available at: https://www.diederendirrix.nl/en/projecten/masterplan-strijp-r-2/

Figure 6-6: Core masterplan design principles on Strijp-R.
Image source: Diederendirrix (2018) *Masterplan Strijp-R - Transformation former industrial area Philips to residential area.* Available at: https://www.diederendirrix.nl/en/projecten/masterplan-strijp-r-2/ (Accessed: 17 July 2018).

Figure 6-7: Retained railway platform and industrial metalwork on Strijp-R.
Photographs by author.

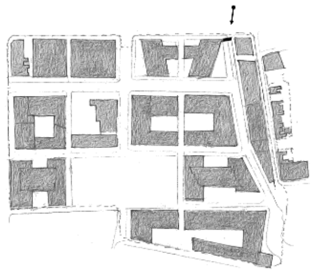

Figure 6-8: Retained portal gate for former brewery, Central Park.
Photograph by author.

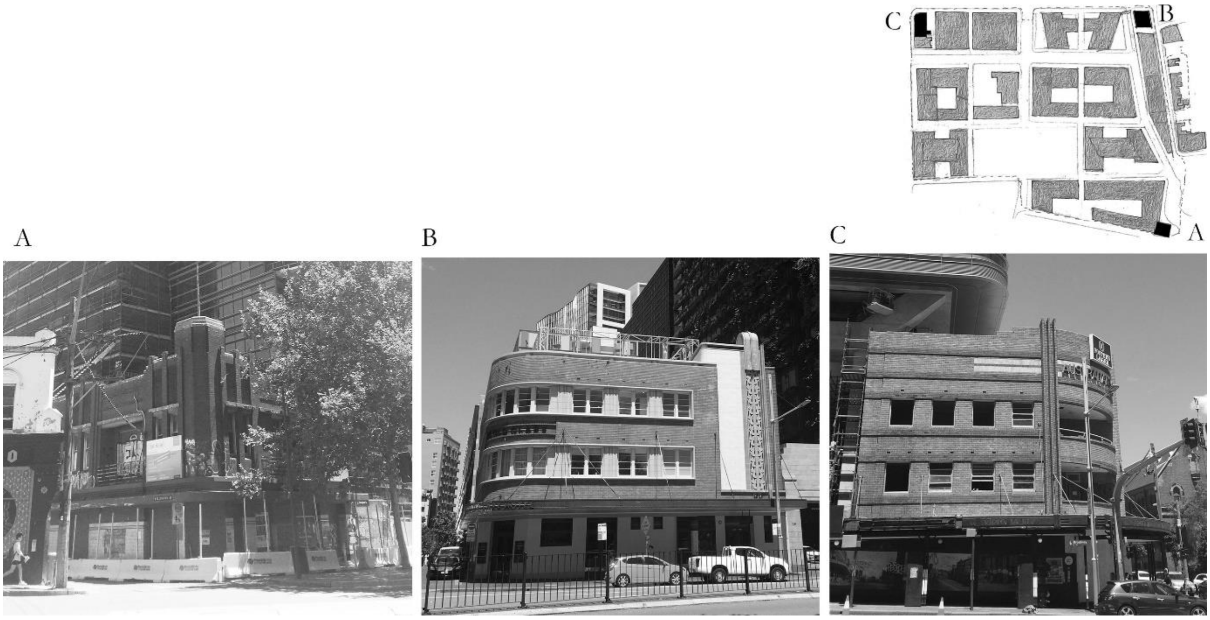

Figure 6-9: Retained pubs on three corners of the Central Park development.
Photographs by author.

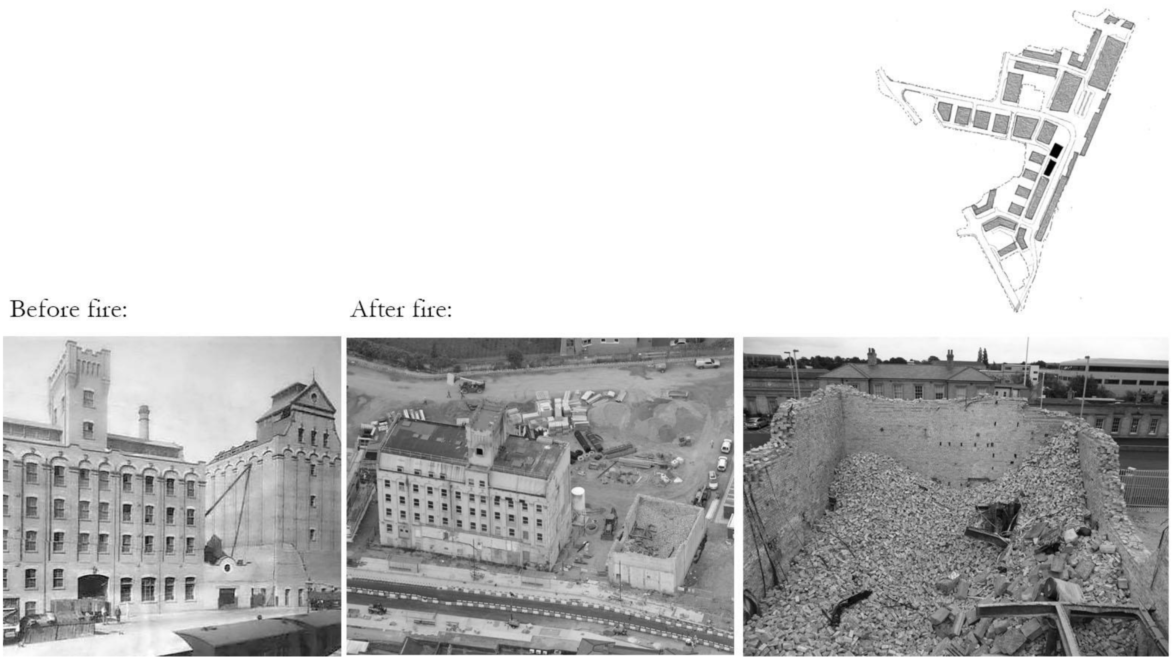

Figure 6-10: Mill and silo buildings, CB1, were to be retained as a group of buildings until the silo was damaged by fire.
Image source: Beacon Planning Ltd. (2015) *I1 & K1 Station Square – Heritage* Statement (Planning application reference: 15/1759/FUL), Cambridge City Council, Cambridge, UK.

Figure 6-11: Retained industrial crane base (left) and Cere Statue (right) from former industrial site, CB1.
Photographs by author.

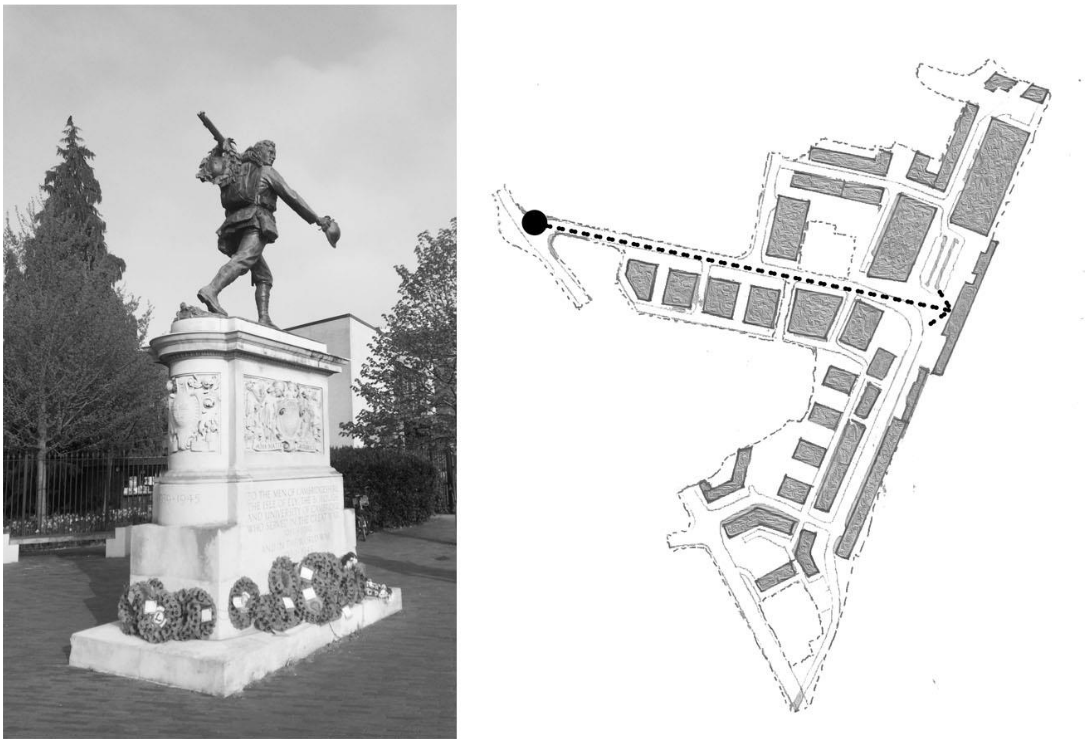

Figure 6-12: War memorial and alignment of Station Road, CB1. Aligned to enable the soldier to have direct eye contact with the station to see his troops come home.
Photograph by author. Sketch by author using images and information from Ashwell CB1 Ltd. (2006). *Planning. Application Summary. (Planning application reference: 06/0008/OUT)*. Cambridge City Council, Cambridge, UK.

6.1.3 Heritage protection through planning policy

All three case study countries have ratified a number of international treaties that concern culture and heritage. Signing these shows a commitment by a country's government to adhere to the principles that are set out within it, which may result in the development of country specific laws and policies (Historic England, 2019b). These include designations which can protect both individual buildings and larger areas of land from demolition or change.

Building designations, also known as listings, provide protection from alterations to a building or structure through planning policy at international, national, regional and local levels. If a building is nationally designated, it is often a legal requirement under planning law for the relevant heritage organisation to be consulted for alterations (including internal) to the building. These organisations differ from country to country but they have similar roles in making recommendations for nationally listed buildings and providing guidance for assessing their significance. Respectively, the national heritage bodies for England, Netherlands and Australia are Historic England, Rijksdienst voor het Cultureel Erfgoaed (Cultural Heritage Agency) and the Australian Heritage Council. As would be expected, each country also has different heritage legislation. In England, the Planning (Listed Buildings and Conservation Areas) Act 1990 is applicable; the Netherlands use 'Mounmentenwet van 1988' (The Monument and Historic Buildings Act 1988) and in Australia, the national legislation is the Environment Protection and Biodiversity Conservation Act 1999. As well as national designations, in all three countries there are local listings for individual buildings. These are enforced by Local Authorities (LAs), rather than national heritage organisations, and perceived as significant in local planning policy and identified in local plans.

Whole areas of land that are designated are called conservation areas. According to Historic England (2018a)…

> "…[a] *conservation area designation introduces a general control over the demolition of unlisted buildings and provides a basis for planning polices whose objective is to conserve all aspects of character or appearance.*"

In the Netherlands, the Monuments and Historic Buildings Act 1988 describe conservation areas as "*Groups of immovable objects that are of general importance because of their aesthetic quality, their spatial or structural association or their scientific or cultural interest, such groups including one or more monuments or historic buildings*" (Cultural Heritage Agency, 2019). Both definitions emphasise that conservation area designations are applicable beyond the individual building level. Appendix 10 provides further detail on heritage policy in each case study country.

The following sub-sections discuss the influence of designations, at both the individual building level and the larger scale of conservation areas, on adaptation and demolition decisions. Policies in place to mitigate any negative impact demolition may have are then examined.

6.1.3.1 Significance and individual building designations

Heritage significance is defined as the sum of heritage values. This can be used to assign a building with a heritage designation (Historic England, 2018b). Heritage impact assessments identify buildings and their level of significance, as well as determining the impact that the planned intervention will have on the building and its surrounding area. The one building surveyor interviewed felt "*the basis of all of these things is a subjective judgement*" (ref.PI-6). Conversely, during email correspondence, one heritage consultant felt that the guidance of assigning significance provided by heritage organisations overcomes any subjectivity but emphasised that these assessments should be written by experts with IHBC membership (ref.PI-e1). However, although there is guidance, it is highly likely, as shown by the understanding of social values, that this will be considered in different ways, depending on the context and will always have a degree of subjectivity.

Opinions from the professional interviews (in a UK context) suggest that national designations provide significant protection to existing buildings from change and therefore demolition. Nationally designated buildings are often retained as "*the demolition of a listed building is very difficult to get approved*", as one building surveyor stated (ref.PI-1). Another interviewee described national listings as "*quite a strong tool*" which influences the decision to retain existing buildings (ref.PI-22). At an individual building level, interviewees suggested "*there are a lot of people out there that won't touch them*" (ref.PI-3) due to the extra planning obligations.

In addition to a building itself being protected, interviewees indicated the setting of designated assets has to be considered due to planning policy (ref.PI-18). Although described as "*a little fuzzy*" by one heritage consultant, indicating this judgement is also subjective, he proceeded to say that it still "*has the potential to kill things*" (ref.PI-27) and is therefore considered.

The one heritage consultant stated that it is rare to have nationally listed buildings on masterplan developments (ref.PI-e1) and in practice, there was only one case study that included nationally listed buildings[31], which were the train station building and a former police office on CB1. Multiple interviewees stated that the station had never been considered for demolition due to its national designation (ref.CS-

[31] There are three levels of national designations in England: Grade I, Grade II* and Grade II, with Grade I being the most significant. The station building and police office was/were Grade II listed.

CB1-1, ref.CS-CB1-4, ref.CS-CB1-6, ref.CS-CB1-8, ref.CS-CB1-9), therefore agreed with professional interviewees that national designations provide protection from demolition. Additionally, one of the reasons for the refusal of the first masterplan application was the height of new buildings surrounding the station, which would have been detrimental to the setting (ref.CS-CB1-9).

However, the nationally listed police office was demolished to enable the construction of the taxi-rank. As described by one interviewee, this indicates that "*even listing doesn't give them total protection*" (ref.CS-CB1-10). In this situation, the taxi-rank was justified as a public benefit which Planning Policy Guidance (now the National Planning Policy Framework[32] (NPPF)) stated must be demonstrated to justify the harm or loss of a nationally listed building (DCLG, 2012; MHCLG, 2019). This suggests that at the masterplan scale, where infrastructure is required for the development to work effectively (as discussed in the previous chapter), the public benefits brought about by this infrastructure, which is rarely required at the individual building level, can outweigh the strength of national listings over the decision.

The significance of buildings with a local listing which are assigned by local authorities are generally perceived to be lower than national designations:

> "*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.*" (ref.PI-18)

At an individual building level, the general consensus from the professional interviews was that local listings are not given the same weight as national designations in the decision-making process due to their lower level of significance. For example, one public planner stated: "*if a building is locally listed, then it's not really that difficult to get rid of if you really wanted to*" (ref.PI-5). Another described the influence of local listings as "*pretty weak*" (ref.PI-14) and a different planner stated: "*I mean ultimately your local list has limited weight*" (ref.PI-28).

Interviewees also felt that local listings are inconsistently enforced across LAs: "*it may be that one jurisdiction goes one way and another goes another way*" (ref.PI-11). One heritage consultant (in the context of local listings) noted that some LAs "*have a reputation for being very difficult to work with… [others] have excellent reputations for being pragmatic, helpful and constructive*" (ref.PI-22). This variability in enforcement was attributed to different development pressures by one property consultant: "*some [LAs] are very rigorous and*

[32] The National Planning Policy Framework (originally published 27 March 2012 and revised on 24 July 2018) sets out the government's planning policies for England and how these are expected to be applied. At the time of the masterplan application the framework was published by the Department for Communities and Local Government (DCLG). After a re-structure, this is now the Ministry of Housing, Communities, and Local Government (MHCLG).

others less so, particularly if there is development pressure" (ref.PI-13), whilst another interviewee suggested that it came down to the experience of the conservation officer by saying "*a lot of it is about personal interpretation and professional interpretation*" (ref.PI-5). These viewpoints suggest that the implementation of heritage policy is affected by wider forces including financial pressures and the people involved.

In the context of masterplan sites, some interviewees felt local listings can still help to safeguard some existing buildings and have a degree of influence on adaptation and demolition decisions. For example, one conservation officer felt that local listings act as a starting point in conversations between developers and LAs:

> "*The bottom line is, you have to have that designation, some form of designation in place to be able have that conversation in the first place, it's much harder when talking about undesignated assets.*" (ref.PI-15)

This comment suggests that the decision-making process involves negotiations between developers and planners as to what locally listed buildings are retained and which others can be demolished. This process was described as "*smoke and mirrors and persuasion*" by one planning consultant (ref.PI-14), suggesting that the strength of local listings within the decision-making process is defined by the relationship between the developers and the planners and the former's ability to persuade the latter.

This negotiation between the developers and planners as to which locally listed buildings should be retained was also identified in practice in both the CB1 and Central Park case studies. Cambridge's Local Plan', which set out the local policy applicable to the masterplan planning application stated:

> "*There are a number of key constraints which need to be considered in the development of this site. The Station Area contains a number of Listed Buildings, notably the Station (Grade 2 Listed) and Buildings of Local Interest.*[33]" (Cambridge City Council, 2006, p.119)

When the approved application was submitted in 2008, there were a variety of different perspectives about the retention of locally listed buildings, including those from an independent reviewer, the design team and county council officer[34]. The application was criticised in an independent 'Design and Conservation Review' which concluded:

[33] Building of Local Interest (BLIs) is the terminology used in the plan for a building with a local listings.
[34] Cambridgeshire County Council were a statutory consultee.

"*The application proposals in their present form still fall short of meeting the minimum conservation and townscape objectives set out in the [Station Area Development Framework] or required by statute, relevant policies and guidance*" (Warshaw, 2008, p.26).

The same reviewer felt that if a building was locally listed, the presumption should be in favour of retention (referring to Paragraph 4.27 of PPG15[35]) and sufficient justification had not been provided for the demolition of some locally listed buildings including Sleeperz Hotel, which he felt could have been retained within the new Station Square.

Members of the CB1 design team highlighted that demolition was necessary and the Station Area Development Framework (SADF) had not been commercially tested or designed with "*input from architects about how you would actually make everything work*" (ref.CS-CB1-6). Therefore, they argued that changes from the aspirations set out in the SADF were necessary for the development to be economically viable, and this included the demolition of locally listed buildings.

The County Council officer also discussed economic viability and explained how the city and county benefited from the development through developer contributions, therefore compromise was necessary as there needed to be a balance between the authority's aspirations and creating a profitable development for the developers:

"*this comes back to the tension between commercial reality and public expectation…local people wanted a lovely station, much much better access, huge amounts of cycle parking but no commercial development. And the world just doesn't work like that.*" (ref.CS-CB1-7)

In total, from the seven locally listed buildings outlined in the SADF, three were proposed for retention (figure 6-13). Although the SADF was used as a starting point for discussion, compromises were made due to the commercial realities of the developer.

Nonetheless, the local listings appear to have offered protection to some of the buildings. This was especially apparent with the retention of 125 Hills Road (shown previously in figure 5-20). Whilst the masterplan design was being developed and the developers were in discussions with the LA, the LA was also being advised by a Design and Conservation Panel. A review of the planning documentation indicated that the panel were influential in pushing for the retention of 125 Hills Road which the developers initially proposed to demolish. As a result of the panel's view, the city council said: "*we would like to see an option prepared*

[35] Planning Policy Guidance 15 (PPG15) was a set of government policies for planning and the historic environment. Replaced by NPPF.

which shows the retention of 125 Hills Road before we are convinced that the masterplan requires the demolition of this [Building of Local Interest]" (Dyer, 2008b, p.23). Alongside the fact the other buildings retained were all locally listed, this acts as an indication that local listings might provide a higher degree of protection at the masterplan level compared to the individual building level as it is highly unlikely the demolition of all the locally listed buildings would have received planning permission.

The nuance in the understanding of significance at the national and local level was also reflected in the following statement describing a pub on Central Park: *"[it's] significant but it's not groundbreakingly significant. It's a surviving example of an inner-city pub, so the building should be retained but it's not the Opera House or the Town Hall or whatever"* (ref.CS-CP-13). There were also local heritage items on the Central Park site. These were initially identified in the Sydney Local Environment Plan (SLEP) (Sartor, 2005). However, during the development of the Conservation Management Plan (CMP), additional listings were proposed. The majority of those listed in the SLEP were retained, however there were negotiations over the additional items deemed locally significant in the CMP.

In the Expert Advisory Report, which provided recommendations to the State minister it was stated that some of the heritage buildings outlined for demolition including 35A, 35B, 32 and 13A (figure 6-14) could be removed if it provided better design outcomes for the site. However, the City of Sydney, argued this was "*not in accordance with the recommendations put forward by the proponent and endorsed by the [New South Wales] Heritage Office in the Conservation Management Plan*" (City of Sydney, 2006, p.45). As with CB1, this emphasises there are different viewpoints towards local listings and reinforces the message that buildings considered significant at the local level are likely to be subject to negotiation. In both cases, the developers were relied upon to bring development forward in the cities, and it is likely this is how they could persuade planners that demolition was required to ensure the development was economically viable. However, local conservation policies still acted as a starting point on both sites for those conversations to take place, and appears to have provided a degree of protection.

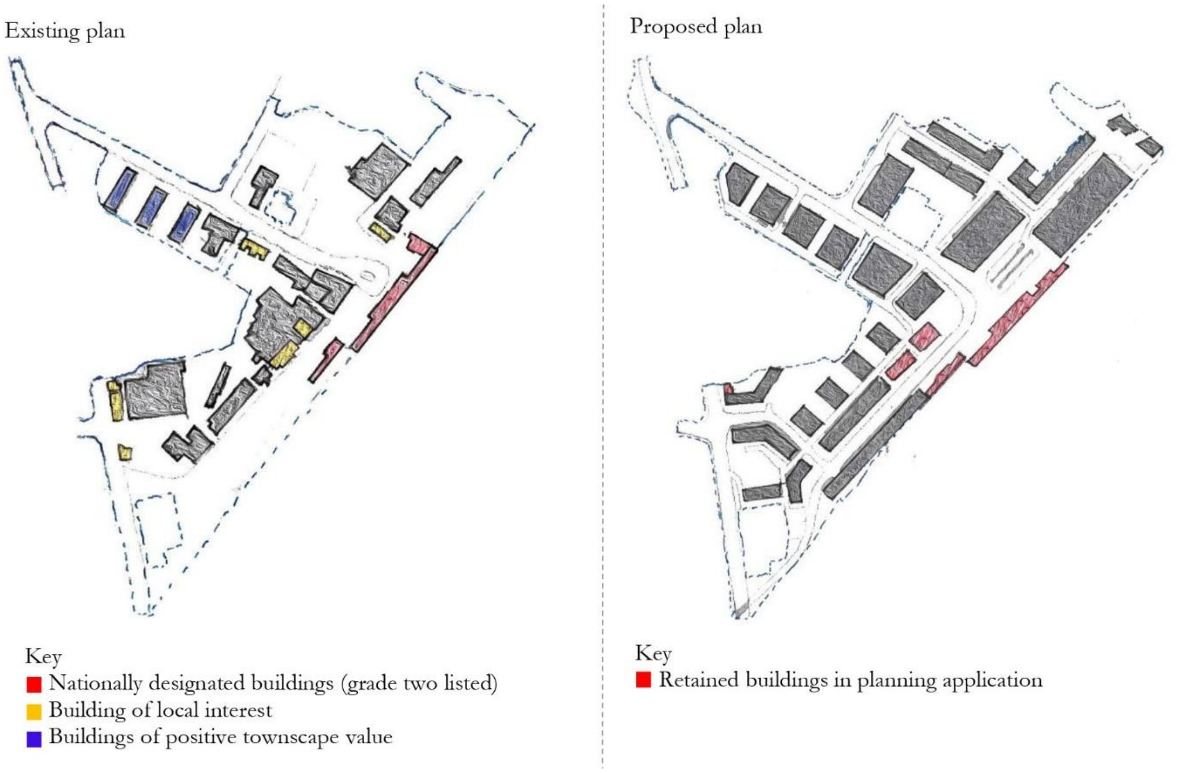

Figure 6-13: Difference between designations and buildings retained in masterplan planning application on the CB1 site.
Left - designated buildings. Right - buildings retained in masterplan planning application
Sketches by author using images and information from: Cambridge City Council. (2004). *Station area development framework* (No. April). Cambridge City Council Environment & Planning, Cambridge, UK.

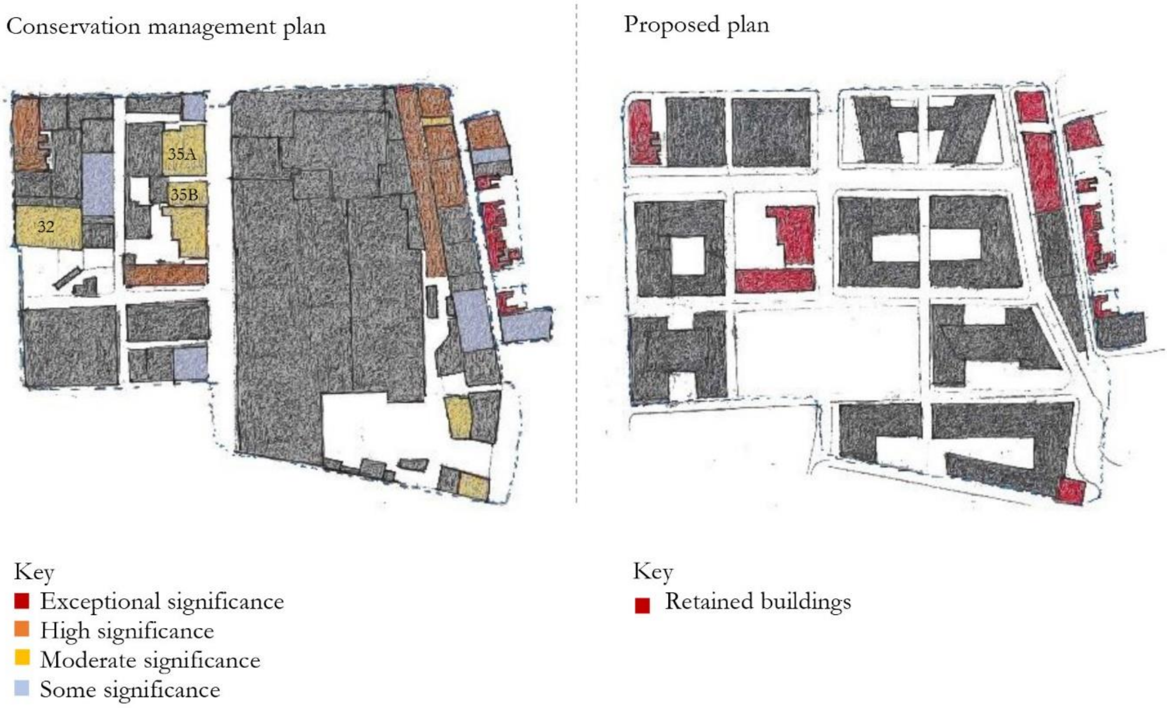

Figure 6-14: Difference between designations and buildings retained in masterplan planning application on the Central Park site.
Left - heritage significance assigned in conservation management plan. Right – buildings retained in original masterplan application.
Sketches by author using images and information from NSW Department of Planning. (2007). *Major Project Assessment. Carlton United Brewery Site. Director-General's Environmental Assessment Report. Section 75I of the Environmental Planning and Assessment Act 1979* (No. MP 06_0171). NSW Government. Department of Planning, New South Wales, Australia.

6.1.3.2 Conservation area designations

Conservation area designations give protection to a wider area than the designation of individual buildings, and during the professional interviews were considered to be influential over the retention of buildings. One building surveyor posed the following questions when describing the decision-making process for the adaptation of an individual building:

> "*I think the first basic question that you would be asking is, is it listed? Is it in a conservation area? If the answer is yes to either of those, you're probably going to have to keep that building.*" (ref.PI-6)

Conservation area designations were regularly perceived, in a UK context, to have a higher degree of influence over the retention of individual buildings than local listings, with one heritage statutory consultee stating that "*a greater protection is obviously a conservation area*" when comparing the two (ref.PI-5). If a building is both locally listed and in a conservation area, this was thought to have even more influence: *"[a] locally listed building in a conservation area is a slight step up*" (ref.PI-3).

Due to this policy influence, one public planner discussed how he was unlikely to receive requests to demolish buildings in conservation areas:

> "*From my experience, a request for the demolition of heritage buildings are quite unusual. If you're looking at sites within conservation areas…then there is strategy protection for heritage assets whether they be listed or not.*" (ref.PI-20)

In England, conservation area's greater degree of protection was attributed to their designation being part of national planning legislation: *"Conservation areas are covered by the 1990 Act*[36] *as well as statutory listings, so that is what makes it stronger than the local listings" (*ref.PI-23*).* In general, local listings do not affect planning permission requirements, whereas additional planning permissions are required for the demolition of a nationally listed building and buildings in conservation areas. Hence why professional interviewees felt that, at an individual building level, if a building is in a conservation area, the designation offers a higher degree of protection from demolition.

The only case study to contain a conservation area was the CB1 development (figure 6-15). A conservation area appraisal was conducted in 2004 and forms an appendix to the SADF. This includes an assessment of the individual buildings and a townscape appraisal which identifies masterplan considerations such as trees and vistas (Cambridge City Council, 2004). The 'townscape' was compared to the historic core of

[36] This is referring to the Town and Country Planning Act 1990 which is a legal document regulating land development in England and Wales.

Cambridge and described as "*generally weak and incoherent*" by the planning officer (Dyer, 2008a, p.'8-27'), and the Northern and Southern Sidings were described as "*industrial wastelands*" (p.'8-50').

Cambridge city's former conservation officer explained how the conservation area around the station was declared in 1993 and that "*the area of that time was really pretty grotty… [but] we got it declared a conservation area with a specific intention in mind of getting it improved*" (ref.CS-CB1-12). This was reiterated in the SADF which differentiates between the significance of individual buildings and the site as a whole:

> "*In spite of the poor quality of some individual sites, the overall quality of the area has been recognised though its designation as part of the Central Conservation Area*" (Cambridge City Council, 2004, p.10).

The heritage consultant explained that all of the existing buildings needed to be assessed for their significance as Conservation Area Consent was required for their demolition (section 4.4.2): "*because we are in a conservation area, even the rubbish ones, the old ones…we had to justify the demolition*" (ref.CS-CB1-6). This demonstrates the point made earlier that conservation area status requires additional assessments and planning consents.

However, despite these extra requirements being in place, only the nationally listed station and three locally listed buildings were retained in the final CB1 masterplan. This suggests that the influence of conservation area designations differs at the masterplan scale compared to the individual building level, as several buildings were demolished. The heritage consultant recognised that it is rare for masterplans to be granted permission in a conservation area and said "*generally there is an unwritten rule that you won't accept outline versions of it*" (ref.CS-CB1-6). He proceeded to say that the ultimate test is whether or not the loss of buildings will ruin character and appearance of the conservation area. A limitation here, is that masterplan developments are highly likely to change the character of an area due to their large scale. This was referred to by the planning consultant when he said "*[when] you are looking at a masterplan, you are accepting a fairly substantial change in the character of the area*" (ref.CS-CB1-9). The character of the conservation area was defined as "*industrial and commercial*" (Dyer, 2008a, p.8-24). Due to the demolition of the majority of former industrial buildings, the character is now dominated by the commercial aspects and the references to the industrial past come across as fragments and the industrial character is not very apparent.

The rarity of granting masterplan approval in a conservation area was also evident in the Commission for Architecture and the Built Environment's (CABE) response to the masterplan's planning application. CABE were a statutory consultee[37] at the time and opposed the initial application as it only set out the parameters for the site rather than a detailed plan, through 'outline planning permission' (discussed in Section 4.4.2). CABE felt outline planning was inappropriate as the site was in a conservation area and "*the significance of the site for Cambridge means that the proposals must be of exemplary quality; something which cannot be guaranteed by an outline application*" (Dyer, 2008d, p.45). This demonstrates the complex nature and dominance of masterplan considerations and why there is concern over masterplan developments in conservation areas, as they inevitably change the character.

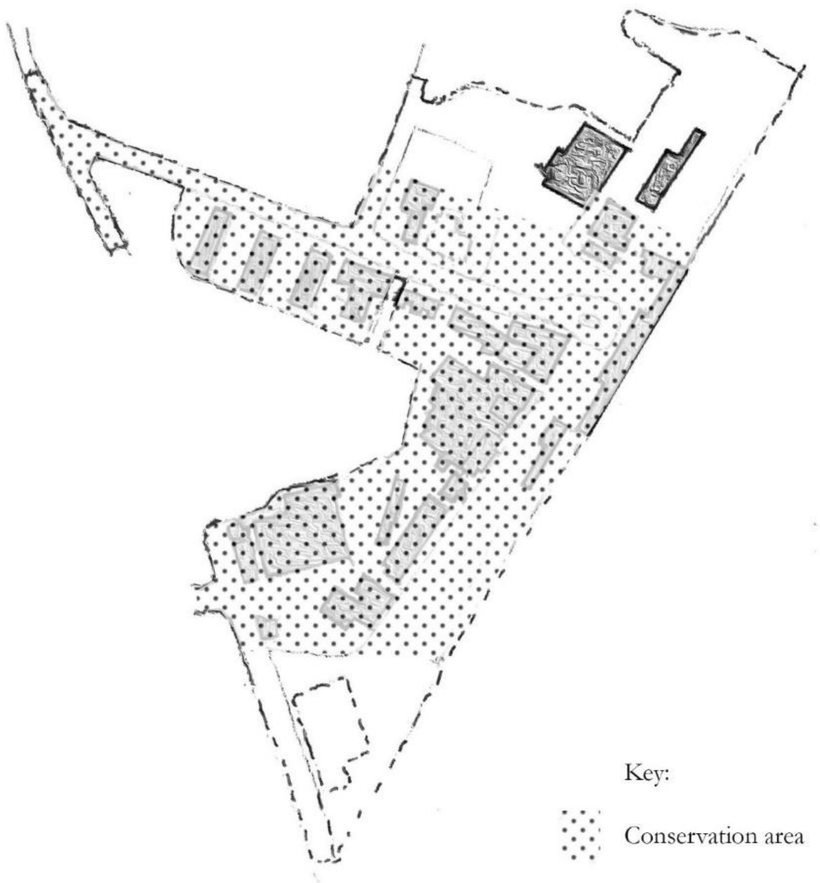

Figure 6-15: Area of land within the CB1 development which is part of the Cambridge Station conservation area.
Sketch by author using images and information from: Cambridge City Council. (2004). *Station area development framework* (No. April). Cambridge City Council Environment & Planning, Cambridge, UK.

[37] "*CABE was a non-departmental public body responsible for advising government on architecture and urban design. It merged into the Design Council in 2011*" (HM Government, 2019b)

6.1.3.3 Mitigating negative impacts of demolishing buildings

Planning policy often dictates that the negative impact of demolishing a designated building or building in a conservation area should be mitigated, which is therefore applicable to both the individual building and masterplan scales. This mitigation can include making a written record of the building and ensuring that the replacement is of a high quality. One heritage consultant conveyed that "*the buzzword is mitigation…in any heritage impact assessment there are mitigation measures to reduce negative impacts on heritage*" (ref.PI-22). If a nationally listed building was to be demolished, another heritage consultant explained:

> *"As a matter of principle, should it be lost, yes or no?…if it's going…clearly high-quality design has to be there." (*ref.PI-27*)*

One public planner argued that existing buildings should be retained as replacement new builds are not built to a sufficient quality by saying: "*it is in our interest to keep [existing buildings] because what is coming in place of it, is not of good enough standard*" (ref.PI-23). As with determining heritage values, as expressed by one interviewee: "*it is very subjective, views on design*" (ref.PI-8). This is relevant to adaptation and demolition decisions as the design of the replacement new building ties in with the mitigation measures when a heritage building is demolished.

The subjectivity of design quality for replacement new builds at the masterplan scale was particularly visible on the CB1 development (figure 6-16). Concern was expressed by the conservation officer during the planning process "*whether there was sufficient detail in the application to determine quality or establish a clear basis for demolition of existing buildings*" (Dyer, 2008c, p.21), and after the construction commenced he commented that "*there is no sign of quality and flair in any of this lot*" (ref.CS-CB1-12). In a national newspaper article, local residents are quoted describing the development as "*rubbish*", "*unfit*" and "*soulless*" and the journalist states "*visitors arriving by train are greeting with a generic clone-town scene*", suggesting the development has a lack of character and aesthetic appeal (Wainwright, 2017). However, the planning consultant stated that "*the planning officers…firmly believe what we produced was a high-quality scheme*" (ref.CS-CB1-9) and proceeded to discuss how the site has attracted large businesses such as Amazon Research and Microsoft, whilst also winning awards, such as a British Council for Offices' Workspace Award (Brookgate, 2019).

Two methods of providing character through new buildings were identified in the case studies. On Central Park this was through 'progressive architecture' which differentiated the area from its surroundings. The key example here being the heliostat, a landmark building with a green façade (figure 6-17). On Strijp-R, the creation of character was subtler and also accommodated for the loss of heritage as references were made to the past through the new buildings. For example, lettering in the relief of the brickwork indicated the name of the building that was demolished in that location (figure 6-18). All Philips buildings were named using a lettering system, which is why this is considered relevant. These different approaches highlight that requiring quality does not necessarily mitigate for the loss of heritage and that character can be created in different ways.

Figure 6-16: New buildings on the CB1 development.
Photographs by author.

Figure 6-17: The Heliostat, Central Park. Landmark building with a green façade.
Photographs by author.

Figure 6-18: Lettering in relief of brickwork on Strijp-R's new build housing. Letters represent name of building that was demolished in that location.
Photographs by author

6.1.4 Character and place-making within a masterplan

Heritage is not only about designations, it is also attributed to the ability of existing buildings to add character and contribute to place-making in an area or masterplan's design. This character helps provide 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*" (ref.PI-5).

One property consultant described the idea of knocking down all the existing buildings on a masterplan site and starting with something new as "*old-fashioned*" (ref.PI-3). The property consultant expanded on this explaining that rather than understanding heritage as significance and designations, they "*would take heritage in the broader sense – anything that exists and may add value moving forward…what we are beginning to talk about is place-making*". He proceeded to describe a brownfield area ready for redevelopment where they have…

> *"…a selection of very nice industrial looking buildings, they are not listed and it's not a conservation area and yet the plan moving forward is to potentially keep quite a lot of it because it adds a sense of history and place and is a point of differentiation." (*ref.PI-3*)*

In a separate interview, a public planner also made a distinction between heritage understood as significance through designations and heritage understood through place-making, suggesting that there were two strands of understanding: "*part of the heritage sector is purely on significance and another part which can focus on heritage, is planning, place-making*" (ref.PI-14). This distinction implies that buildings are retained and considered as heritage assets even if they are not designated. The reason for this is that often the character and/or place-making provided through building retention is attributed to adding economic value (ref.PI-5, ref.PI-7, ref.PI-8, ref.PI-11, ref.PI-14, ref.PI-21), thus considering heritage retention through a market lens. However, some people commented that this added value is difficult to quantify due to the subjective nature of heritage (ref.PI-3, ref.PI-6, ref.PI-7, ref.PI-9, ref.PI-11, ref.PI-20, and ref.PI-21). Others highlighted that new buildings are preferred by some people: "*for all those people that like old buildings, there are those that like new buildings*", and that you should also not "*over sentimentalise*" (ref.PI-8), indicating there needs to be a balance between the old and new on masterplan developments.

The retention of non-designated assets occurred on Strijp-R. None of the existing buildings were designated, yet four were sill retained. Eindhoven's urban designer also described the demolition of all existing buildings as "*old-fashioned*", agreeing with the viewpoint of the property consultant in the professional interviews (ref.CS-SR-10). As explained by the masterplan architect "*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*" (diederendirrix, 2018). Buildings were retained as they were thought to "*give character, a sense of place-making, [and] diversity*" according to the one interviewee (ref.CS-SR-3), whilst the contractor felt that diversity was achieved as the existing buildings helped to provide "s*omething different to new building [because] we know every Dutch house is mainly the same*" (ref.CS-SR-7). Other interviewees also felt that if all of the existing buildings had been demolished, it would have been difficult to tell the story of the former industrial site (ref.CS-SR-9), and that it is "*nicer than having a completely new area were everyone has to settle and find their way*" (ref.CS-SR-1). These viewpoints agree with those put forward in the professional interviews and indicate that heritage policy is not always required for the retention of existing buildings.

In the Central Park case study, the developer stated that "*the site would not be anywhere near as great a site without Kensington Street, Abercrombie Hotel, Old Clare and the Brewery Yard*" (ref.CS-CP-11), all of which were retained buildings. The masterplan architect felt building retention "*gave a bit of continuity to the site and its history. They had relatively strong character*" (ref.CS-CP-12b). The Kensington Street architect referred to the economic value added by heritage retention as the character makes sites attractive to future occupiers and acts as a merging of cultural and financial capital (ref.CS-CP-9). However, the majority of buildings retained were designated which makes it difficult to establish whether the driver behind their retention was policy or character/place-making or both. This is also applicable to the CB1 site as members of the design team said that the retention of buildings added character and diversity to the area (ref.CS-CB1-3, ref.CS-CB1-9), but all the buildings that were retained were designated.

Comments were made on both Strijp-R and Central Park suggesting that heritage is often considered as significance (linked to designations) despite buildings being retained due to their character. For example, Strijp-R's heritage consultant stated "*as place-making Strijp-R is a very interesting example. In terms of heritage transformation, Strijp-R is not heritage, maybe it will become heritage*" (ref.CS-SR-8). A similar interpretation of heritage was put forward on the Central Park site, where the heritage consultant stated:

> "*Heritage is contextualised and people can engage with an understanding, so it's being used as a resource to enhance the development….is it a great conservation outcome? No. Is it terrible? Absolutely not. It's an interesting piece of major intervention that goes a bit beyond adaptive reuse.*" (ref.CS-CP-2)

Additionally, the architect for the Kensington Precinct stated "*the buildings that are kept are not heritage but…we knew if we kept them we would get a more interesting outcome*" (ref.CS-CP-9). Although these interviewees are saying that the buildings are not heritage, it is clear that they have still been retained due to the character that they add either through their connection to history and/or importance to the community, which are considered heritage values. These practitioners are instead referring to heritage in its traditional sense, where it is understood as significance. As shown in the professional interviews, there is also a second interpretation which is understanding heritage as character and place-making.

6.2 Whole life energy and carbon

The second major benefit of retention which was identified in the academic literature was savings in materials and therefore a reduction in embodied energy and carbon impacts. This section is based on the professional interviews, focus groups and case study interviews to establish whether whole life energy and carbon is a factor currently considered in practice at either the individual or masterplan scales.

Figure 6-19 displays the frequency distribution of criteria sitting within the overall theme of environmental factors. It is clear that there are other environmental aspects, beyond energy and carbon, which were discussed during the interviews. These include ground contamination and noise pollution. However, when reviewing these criteria and the relevant quotations, it was clear that for the selected case studies, these were general issues with the masterplan and construction of the development rather than aspects directly affecting adaptation and demolition decisions. Therefore, the following section is limited to those factors related to or as a result of questions about whole life energy and carbon.

The focus groups were specifically focused on whole life energy and carbon at an individual building scale by asking: "*How can embodied carbon be incorporated in the decision to demolish or retain existing buildings?"* The viewpoints include those of industry and academic experts. Figure 6-20 provides a breakdown of the main discussion points. The focus groups used a different set of codes from the interviews as a pre-defined list was not used (discussed in section 4.3.3).

The structure of this section and topics discussed reflect the dominant points of discussion from both the interviews and focus groups. It begins by discussing the understanding of embodied and operational impacts and whether or not they are considered in adaptation and demolition decisions. This is followed by an examination of what people said about life-cycle costs and sustainability assessments, which were key factors linked to whole life energy and carbon identified in interviews and/or focus groups. The section ends discussing methodological barriers and the affect these have on policy implementation, which were key aspects that emerged from the focus group discussions.

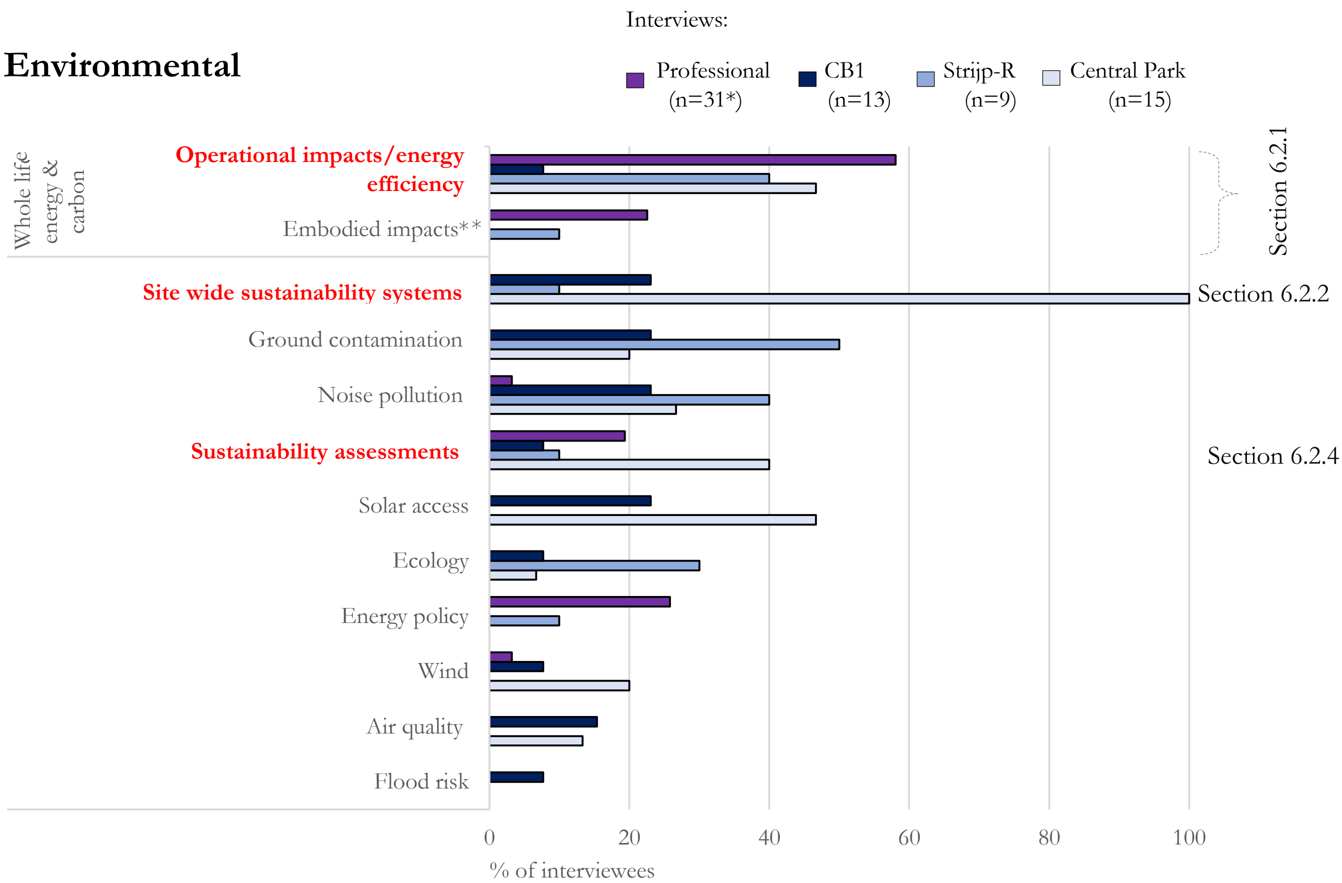

Figure 6-19: Theme - Environmental. Frequency distribution of codes mentioned across interviews.
* Excludes interviews with academics specialising in embodied energy.
**Only includes if embodied impacts discussed without asking a follow-up question directly about them.

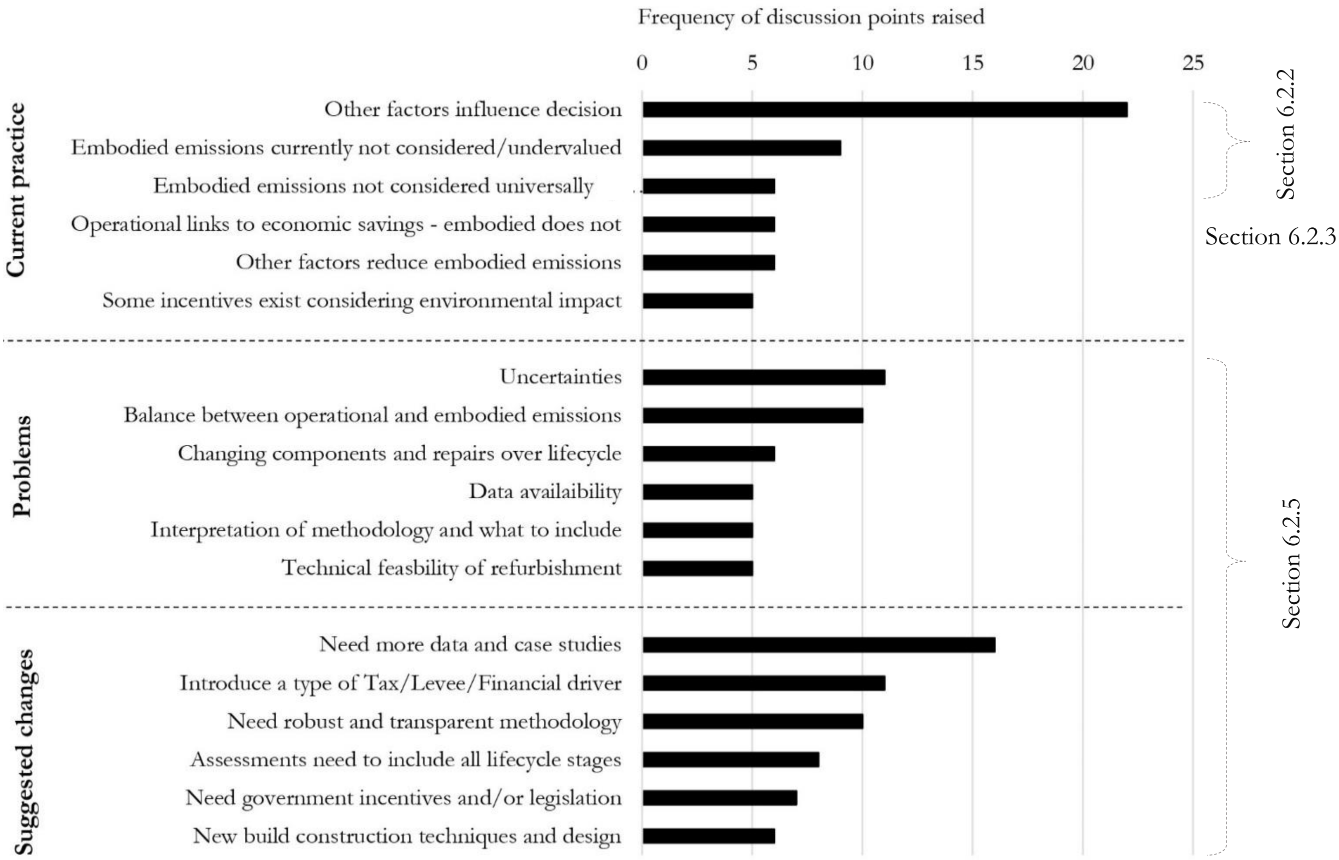

Figure 6-20: Points of discussion during focus groups. Only showing those with frequency of 5 or more. Question posed: "How can embodied carbon be incorporated in the decision to demolish or retain existing buildings?" Reproduced from: Baker, H. & Moncaster, A. (2018, p.16) Embodied Carbon and the Decision to Demolish or Adapt, *Zero Energy Mass Custom House (ZEMCH) Annual Conference*, 29 January – 1 February 2018, Melbourne, Australia.

6.2.1 Understanding embodied and operational impacts

To assess whole life energy and carbon impacts of adaptation options compared to demolition and new build, both embodied and operational impacts need to be considered. Savings in materials were identified as advantages of retaining buildings during the professional interviews. One interviewee stated "*it is better if you can reuse the building as opposed to demolish and complete rebuild because you are then using up new materials and new resources which in its very nature are short-term and finite*" (ref.PI-2), whilst another said "*if we are maintaining fabric then it is a more sustainable approach*" (ref.PI-22). One of the focus group participants felt strongly that if considering energy and carbon in adaptation and decisions "*it should be a slam dunk in favour of refurbishment*" (ref.FG2-1). All of these viewpoints suggest retention is considered as favourable when evaluating energy and carbon impacts at an individual building level.

However, one energy consultant acknowledged: "*it usually but not always makes sense to preserve and adapt rather than to knock down and build new*" (ref.PI-11). The main reason provided that a retained building does not always have a lower impact than a replacement new build was the lower operational energy consumption of a new building in comparison. This is why operational and embodied impacts need to be assessed alongside one another in a LCA: "*we have to talk about whole life-cycle carbon from the start because I don't think we can talk just about embodied carbon*" (ref.FG1-6).

Embodied and operational impacts have to be balanced alongside one another as you might have "*an incredibly low carbon building but is very inefficient to run*", as described by one focus group participant (ref.FG2-2), or as explained by a building surveyor: "*the amount of energy that it takes to build a Passivhaus*[38] *building is enormous in comparison to simply upgrading an existing structure to reasonable standards*" (ref.PI-7). Additionally, one academic from the focus groups argued: "*[as] operational carbon declines, embodied carbon will become relatively more important*" (ref.FG2-4). Improvements in operational energy were said to be: "*happening as a consequence of technological change in the equipment…air-conditioning systems, chillers are becoming more efficient*" by a developer (ref.PI-26). These viewpoints all indicate an understanding that both embodied and operational impacts both need to be considered to accurately calculate the energy and carbon impacts over a building's life-cycle.

The energy efficiency standards of existing buildings are dependent on the original design and proposed interventions. A private planning consultant discussed how the form of the building determines the ease of intervention required to improve energy efficiency standards: "*a steel building with a basic interior, we can actually bring it up to a very high spec and high level in terms of energy use*" (ref.PI-14). When a high level of intervention is required to improve standards, it is "*more difficult to make thermally efficient but it's not impossible…it will cost more money*" as conveyed by one building surveyor (ref.PI-6). Evidently, the operational impacts of a building are dependent on the energy efficiency standards which are determined by a building's form and amount of intervention required based on the proposed function, which affects the construction costs.

Difficulties upgrading an existing building's thermal performance can be caused by heritage constraints on potential interventions. One interviewee explained how these constraints are "*relatively strict…if you are actually removing fabric but not so much if you are adding things*" (ref.PI-5). He proceeded to say that changes should be reversible as technology is likely to change in another fifty years. For others, this perception of heritage designations being a barrier to energy improvements was described as an "*erroneous idea*" (ref.PI-8). In one interviewee's professional experience, they found that dealing with listed buildings was not that difficult (ref.PI-7). To try to overcome this perception another interviewee conveyed how the attitude

[38] *"A Passivhaus is a building, for which thermal comfort can be achieved solely by post-heating or post-cooling of the fresh air mass, which is required to achieve sufficient indoor air quality conditions – without the need for additional recirculation of air"* (BRE, 2011).

towards retention should be "*about keeping the buildings alive not just preserving them*" (ref.PI-12). Consequently, heritage organisations are trying to promote the message that their role is about managing change, rather than preventing it (ref.PI-17, ref.PI-21). Clearly, there is an overlap between improving operational impacts and conserving heritage values.

6.2.2 Consideration of embodied and operational impacts

The overall concept of embodied and operational impacts appeared to be understood by the interviewees. Operational impacts appear to be considered in adaptation decisions to some extent, however, embodied impacts are rarely considered. As stated by one heritage consultant:

> "*There is such a high amount of lost embodied energy through unnecessary demolition [but] I don't think that's factored into the decision-making process at the moment but perhaps it should be.*" (ref.PI-15)

The general consensus during the focus groups was that the drivers behind adaptation and demolition decisions are likely to be something else and the participants referred to factors outlined in the previous chapters including fitness-for-purpose, target market, designation constraints, planning and increasing density (ref.FG1-1, ref.FG1-6, ref.FG2-2, ref.FG2-3, ref.FG2-4, and ref.FG2-5). The one academic felt that, even at the individual building level, "*in practice, [embodied carbon] is only going to be a very small part of the decision*" (ref.FG1-6).

A lack of policy was provided as the main reason for the absence of embodied impacts consideration in decision-making. One urban designer commented "*we need help from, I guess Government policy, national policy to help us*" (ref.PI-23) and a conservation officer felt that for it 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*" (ref.PI-15). During the focus groups, where the participants were experts in embodied energy and thus aware of changing and up to date policy, they noted there was some policy implementation within the UK but enforcement was inconsistent. The one developer stated "*there are some bodies who are really starting to look at embodied carbon, but it is very hit and miss*" (ref.FG2-2). An energy consultant in the other group felt that it will not be considered "*unless you have a particularly inspired LA*" (ref.FG1-7).

In the UK, there are currently no building regulations related to embodied impacts, however, there are examples of standards such as EN 15643-2 (BSI, 2011a)[39] and EN 15978 (BSI, 2011b)[40], as well as RICS (2017) code of practice for the 'Whole life carbon measurement: implementation in the built environment', which came into circulation after the focus groups took place. Developments can also be seen at a regional scale though the London Mayor's draft London Plan, published 13th August 2018, which states:

> "*Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions*" (Kahn, 2018, p.118)

The Netherlands is currently (as of 2019) the only case study country that has an environmental cap for embodied impacts. This is included in the Dutch building regulations which are set by the Building Act (Bouwbesluit) which comprises of law and a detailed Building Decree. In 2013, embodied impacts needed to be measured as part of an LCA, and in 2018, the cap was introduced. The LCA should use the national assessment method (Bepalingsmethode Milieuprestatie Gebouwen en GWW-werken) and the national environmental database (National Milieudatabase) (Pasaman et al., 2018). The Dutch academic specialising in embodied energy, discussed this mandatory module during the interview, but noted that its introduction into policy had taken time and faced resistance from the construction industry (ref.PI-32).

In Australia, although the embodied energy expert said that recent updates to the construction codes only focused on operational energy, he did indicate that people in industry are starting to 'pick up on it', in reference to embodied impacts. However, there are currently no building regulations which include embodied considerations. In cases where embodied impacts are considered, the academic said this was more for credit rather than reducing emissions (ref.PI-33). The adoption of embodied impacts within policy is therefore clearly different between the three case study countries, but there are indications that they are gaining traction in all three (see Appendix 11 for further detail). If embodied impacts are considered through policy, this will almost always favour retention options as fewer materials are required in comparison to demolition and new build.

In practice, there were no buildings identified which were adapted on the masterplan case study sites where the driving force behind their retention (or demolition) was based on the environmental benefits of saving materials. The reason for retention was always heritage, and for demolition it was often due to economic

[39] EN 15643-2:2011 – 'Sustainability of construction works. Assessment of buildings. Framework for the assessment of environmental performance'.
[40] EN 15978:2011 – Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method'

viability and masterplan design principles such as increasing densities and providing transportation networks. Despite this lack of consideration of embodied impacts, there were some references to material savings in particular for the end-of-life stage when a building was demolished. During the Strijp-R interviews, members of the design team discussed the re-use of bricks from the demolished buildings for the construction of the road network and said this led to lower environmental impacts (ref.CS-SR-5, ref.CS-SR-8). 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*" (ref.CS-CP-10). Therefore, in practice it appears that the end-of-life stages, which contribute to embodied impacts, are partially considered and the limited discussion about embodied impacts during the product and maintenance stages implies that they are rarely factored into adaptation and demolition decisions at either the individual building or masterplan scales.

This focus on recycling materials is likely to be influenced by tax disincentives. This was apparent during the focus groups when the landfill tax, which is a type of policy instrument, was discussed. In 1996, a landfill tax was introduced into the UK with the intention to encourage the recycling or reuse of materials (Seely, 2009). In the Netherlands, landfill bans were introduced in 1995 and in Australia the policy varies from state to state. In NSW, a waste levy was introduced in 2014 (Parliament of Australia, 2018).

One focus group participant felt that the UK's landfill tax had influenced recycling rates 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.*" (ref.FG2-2)

In contrast to the embodied impacts, operational impacts are more readily considered in decision-making. One architect from the focus groups said: "*we are only focused on operational energy, we are trying to reduce operational but no one is looking at embodied*" (ref.FG1-4). This was also reflected in the professional interviews when one property consultant explained how the focus in terms of energy consumption is getting the operational consumption as low as possible (ref.PI-4).

It is likely this difference in consideration is due to the historic focus of regulation on operational impacts rather than embodied. In all three case study countries, there has been an awareness of the operational energy consumption of individual buildings since the 1970s oil crisis, with a growing interest in energy efficiency in the 1980s. Rovers (2015, p.2) states "*for some 40 years now the building sector has targeted energy reduction measures. At first reduction measures focused on making housing and buildings airtight, and was* *followed by a more integral approach, supporting and stimulated by government regulation and legislation about methodology, [and] setting mandatory targets in energy demand for houses and offices*".

A key piece of legislation affecting the UK and the Netherlands was the European Energy Performance of Buildings Directive (EPBD) of 2002, which led to the definition of building regulations in European member states (Moncaster et al. 2018). In Australia, minimum operational energy standards were introduced in 2003 (Berry and Marker, 2015). In comparison to embodied impacts, energy efficiency requirements have therefore been part of regulations for some time in all three of the case study countries, which was preceded by an awareness from the 1970s. Appendix 11 also provides a summary of the development of operational energy policy in the three countries.

The one property consultant in the UK emphasised this influence of operational energy policy by discussing the effect of changes to Energy Performance Certificates (EPCs)[41] which now requires buildings to reach minimum operational energy standards if renting:

> "*Very rarely will energy associated with the existing materials be a material consideration. It's more about the long-term efficiency…this is what's quite interesting about the EPC environment we now work in…moving forwards next year or so, you won't be allowed to undertake lettings in the worst bands. That really comes up on people's agenda…the regulations have created a corporate response.*" (ref.PI-3, January 2016)

Nonetheless, some interviewees still felt that operational energy standards were not that readily considered in the decision-making process and were more of an afterthought. One planner felt that they are "*always considered at the end [and]…it's always just a light touch and never seems to be taken that seriously*" (ref.PI-23). Although some decision-makers will address operational energy standards at the beginning of the process, in which case the operational impacts might affect decisions, in others they are only considered at the end as they have to be, which indicates policy has its limitations.

The primary focus in practice was also on the operational impacts of the individual buildings. This was evident in the focus on energy efficiency standards of new build replacements during the case study interviews. On Central Park operational impacts were further thought-out beyond the individual building level. A district energy scheme was constructed using tri-generation[42], with the intention of reducing operational emissions by supplying power and hot water to the whole of the development. This site-wide

[41] Energy Performance Certificates (EPCs) set the energy efficiency rating of a property. From the 1st April 2018 there are now requirements for any private rented property (domestic or non-domestic) in England or Wales to reach at least an Energy Performance Certificate (EPC) rating of E before granting a new tenancy (HM Government, 2019c).
[42] Tri-generation is also known as combined cooling, heat and power.

sustainability system was discussed by every single interviewee (figure 6-19). Due to the size of the masterplan the developer said: "*we had the critical mass of this site that we could have tri-generation, generate the power, the thermal energy for the site and also recycled water*" (ref.CS-CP-10). As part of this system, the project director explained how they "*decided to keep the chimney [of the brewery building] and make it functional, so that is the exhaust for the central thermal plant goes through that*" (CS-CP-11). A new steel pipe was therefore installed inside the existing brick chimney on the old brewery building and the cooling towers are located on top of the former structure (figure 6-21).

The lack of focus on embodied impacts in the case studies agrees with the viewpoints put forward in the professional interviews and focus groups in that they are currently not influential over adaptation and demolition decisions, for individual buildings in isolation or within the context of a masterplan. The focus is instead on the operational energy standards, particularly of new buildings, which if considered independently from embodied impacts, are likely to be used as justifications for demolition.

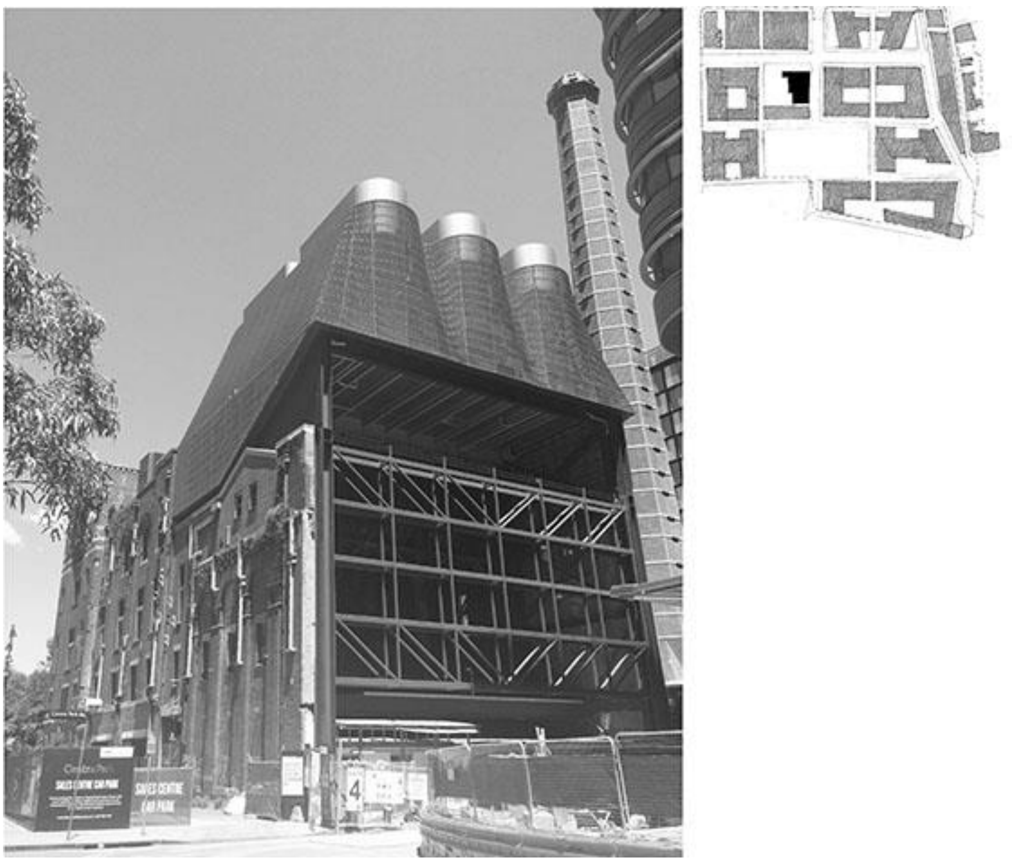

Figure 6-21: Tri-generation cooling towers on top of retained brewery building, Central Park.
Photograph by author.

6.2.3 Life-cycle costs

There were suggestions that a driver towards reducing whole life energy and carbon (if considered at all) is the potential financial savings rather than reducing carbon emissions. These savings include capital expenditure, operational and maintenance costs, at both the individual building and masterplan scales. One engineer discussed how environmental principles were rarely considered to 'save the planet', instead the driver towards their consideration is savings in costs:

> *"Ultimately, nobody is really building green for the goodness of, if you like, the goodness of society. There are a few and that is moving into the realms of philanthropy, but we build green generally because it actually makes sense." (*ref.PI-19*)*

The interviewee clarified on what "*actually makes sense*" by discussing how energy efficient buildings are cheaper to run and that if you reuse or use fewer materials, reductions in embodied carbon are directly proportional to reductions in capital expenditure. This message was reiterated in a focus group conversation:

> "*We see evidence again and again that reducing embodied carbon by refurbishment can significantly reduce the cost, versus demolition and a new building. Almost that can be used to inversely drive the decision.*" (ref.FG2-2)

An environmental consultant in the same group elaborated on this and said "*the conversation is about the economics of it, how much of a saving is there using demolition rather than refurb*" (ref.FG1-7). In the other focus group, a participant said: "*a common theme that it comes to is the cost in practice"* (ref.FG1-3). These viewpoints show that costs are a key driver behind decisions at an individual building level. These are relevant to embodied impacts, as savings in materials can lead to a decrease in construction costs.

However, professional interviewees made comments that suggested there were no financial incentives linked to reductions in embodied impacts:

> "*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*" (ref.PI-20).

Another interviewee stated that it "*doesn't appear on balance sheets of profit or loss*" (ref.PI-3) and during one of the focus groups, participants discussed how the metric of kg/CO_2 is difficult to understand, particularly to those outside the industry. This last point is key to explaining the difference in these attitudes. Those that discussed the financial benefits of reducing embodied impacts were from the focus group conversations which consisted of experts in embodied energy. Those casting doubt on this were professional interviewees, who might not have a full understanding of the concept and cost benefits.

The financial saving brought about by reducing operational impacts was better understood and was also visible on the case study sites. Central Park's developer discussed how the metric of embodied impacts was difficult to understand in comparison to operational at an individual dwelling/building level:

> *"I guess the average person…cares how much energy [it takes] running a car or something like that, but to manufacture the façade, it doesn't register with them." (*ref.CS-CP-10*)*

He described how all the residential units within the masterplan had been installed with smart meters which allowed occupants to know how much energy they are using: "*they can see how much…they bought a radiator or a heater, if I turn that on for that hour….my power consumption has gone up. So, they start thinking about how much they are using*". The contractor interviewed in the Netherlands had a similar viewpoint. He felt that people had solar panels on their roof as it saves them money (ref.CS-SR-7), suggesting operational impacts are considered more than embodied in practice for individual buildings as reductions in operational energy consumption often lead to direct monetary savings which can easily be observed. Although not as readily considered during the interviews, this viewpoint is also applicable to the masterplan scale as the Central Park developer stated that the main driver behind the implementation of the site-wide sustainability system was that it made economic sense to do (ref.CS-CP-10).

6.2.4 Sustainability assessments

One way in which whole life energy and carbon are included within decisions is through voluntary certification schemes such as sustainability assessments including BREEAM, LEED[43] and Green Star, which are applicable at both the individual building and masterplan scales. At the individual building level, sustainability assessments were regularly referred to when professional interviewees began discussing savings in operational impacts for adaptation and demolition decisions. In particular, the energy efficiency of new buildings, as many felt that the use of them gave buildings 'green credentials' which could help increase the income through marketing and/or help obtain planning approval (ref.PI-19, ref.PI-20). It was suggested that the sustainability agenda "*is being considered more because there are so many issues about carbon now*" (ref.PI-8). Achieving high scores on sustainability assessments was described by one architect as "*a massive issue and one the contractors take very seriously… [because] one has to adopt the benchmarks in industry*" (PI-31b).

[43] Leadership in Energy and Environmental Design (LEED).

However, LCAs only form a small part of sustainability assessments for individual buildings, which is why one developer felt that they do not sufficiently credit the carbon savings of retention (ref.PI-31a). Only one focus group participant briefly referred to sustainability assessments as a passing comment (ref.FG2-6). This in itself acts as an indication that sustainability assessments currently have little influence on adaptation and demolition decisions in the context of embodied impacts, as these decisions were the subject of the focus group conversations. It is likely sustainability assessments were referred to in the interviews due to the strong focus on energy efficiency in the environmental agenda. However, since the focus groups took place there have been developments in sustainability assessments. In 2018, BREEAM UK New Construction replaced the old Green Guide, with the aim being: "*enabling and encouraging the construction industry to rise to the challenge of further reducing the environmental impact of buildings*" (Doran, 2018). This version uses a whole-building life cycle approach, rather than the elemental approach previously used and the methods used should be EN 1584-compliant (Moncaster et al., 2018).

The marketing and brand value of sustainability assessments at an individual building level was visible on the case study developments. Similar to the professional interviews the focus was on the operational energy standards of individual buildings but within the context of a masterplan rather than on their own. This was particularly the case for new build rather than refurbishment. On the CB1 development, the developer discussed BREEAM excellent ratings for new buildings as an indication of quality (ref.CS-CB1-1), whilst the assessment commonly used in Australia, Green Star, was said to help benchmark the Central Park development against others. The sustainability consultant explained how sustainability assessments had "*really taken off and been influential…. it will attract a higher level of tenant and a higher level of rent*" (ref.CS-CP-3). This message was repeated by the contractor in the Netherlands who felt that without a BREEAM Excellent rating it would be difficult to sell a building: "*if you are a developer and want to sell it…you can't sell it without that*" (ref.CS-SR-7). However, it was the assessments themselves, rather than the embodied and operational impacts that were being considered.

Sustainability assessments are also applicable beyond the individual buildings level. On Central Park, the site-wide sustainability principles were introduced into the modified masterplan by Frasers after purchasing the site from Carlton and United Brewery (CUB). Following the approval of the original CUB masterplan, there was a court case within the Land and Environment Court on behalf of Mathew Drake-Brockham (EDO, 2007) where community members challenged the application of the Environmental Planning and Assessment Act 1979 (NSW). It was argued the State Minister had failed to consider the principles of Ecological Sustainable Development. Although this challenge was unsuccessful as the judge felt that these principles had been satisfactory thought-out, some of the interviewees felt that this led to changes and the consideration of new sustainability principles in the modified planning application submitted by Frasers (ref.CS-CP-6, ref.CS-CP-14a). The final masterplan plan design reached a 5* Green Star rating, the highest achievable at the time. This was thought to help with the re-branding of the site by the City planner and former deputy Mayor, which was believed to be important to Frasers as they had a longer-term involvement in comparison to the original planning proponents (ref.CS-CP-6, CS-CP-12). The consultant for the original masterplan proponents recognised that their plan had limited environmental principles and attributed this to their intention being to obtain planning permission and sell the site as they were the land owners rather than developers:

> "*We had considered [sustainability principles] but we felt that was a detail that the developer would take on. All that we were trying to do was to achieve a reasonable planning outcome and a framework…so that we could sell it for a reasonably commercial figure and move on*" (ref.CS-CP-8).

6.2.5 Methodological barriers and policy implementation

Problems with quantifying whole life energy and carbon impacts, even at an individual building level, act as barrier towards LCAs being considered in practice for adaptation and demolition decisions. Methodological problems identified with quantifying embodied impacts include data uncertainty and the choice of different life-cycle stages. Consequently, professional interviewees questioned the validity of embodied impact calculations. For example, one property consultant discussed issues with the materials travelling from "*place-to-place*" (ref.PI-4), whilst a building surveyor questioned where you start with the calculations:

> *"Do you start at the power station? Just after the coal mine? Where exactly do you start? I don't think there's actually anything in this zero-carbon building concept. I think it shows complete pie in the sky. I am not saying you should not make the effort of course, you should make the effort but you can only go so far." (*ref.PI-6*)*

Methodological issues and therefore reasons for the concerns expressed above by the professional interviewees were explored in more detail during the focus groups (figure 6-20), reflecting the participants' expertise in the topic. For the product stage, one participant discussed how uncertainty can "*stem from the producer of the product and every company has different standards*" (ref.FG1-4), whilst another felt that this meant it was currently easy for people to "*jig the numbers*" to get the results that they want (ref.FG2-1). LCAs also consider future changes in the building including maintenance. Participants discussed how these are difficult to predict as building ownership changes, as well as fashion trends: "*fashion is a big factor of obsolescence…you don't want a fashionable pattern on [tiles] because they will go obsolete*" (ref.FG2-5).

Despite efforts made in the academic literature to standardise methods for calculating embodied impacts, it is clear that methodological inconsistencies are still a concern. Due to this, the widespread inclusion of embodied impacts in policy was thought to be hindered:

> *"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" (*ref.FG2-7*).*

To overcome these methodological barriers, focus group participants felt there needed to be more case studies comparing the whole life energy and carbon impacts of adaptation versus demolition decisions: "*there needs to be research out there on case studies to show some good conclusions…more confidence on processing the calculations in a consistent way" (*ref.FG2-6*).* Another environmental consultant stated that more data is needed to "*back up the studies*" (ref.FG1-7). If these methodological problems are overcome, it is likely to further encourage the consideration of embodied impacts and incorporation into policy and sustainability assessments which will favour retention options.

Uncertainty was also referred to in the context of operational impacts, in particular how the actual energy consumption of the building differs to that which is predicted will be consumed by energy models. As conveyed by one community consultant, this is on account of operational energy consumption being reliant on user behaviour:

> "*Operational energy consumption is also dependent on the building user…often people are complaining they are too hot and they open the windows…it's because they want air because that is the natural desire.*" (ref.PI-25).

These changes were referred to as "*unintended consequences*" by one focus group participant who proceeded to say that "*you end up with a total carbon footprint which is horrendous compared to the choices*", meaning the calculated emissions (with the choices being the assumptions made) are not representative of the actual carbon emissions produced (ref.FG2-2). Although, there is more focus on operational energy consumption in policy and consequently industry, these viewpoints indicate there is still uncertainty which should be factored in when undertaking LCAs comparing the energy and carbon impacts of adaptation compared to demolition and new build for individual buildings. This is likely to be exacerbated when increasing the scale to the masterplan level containing multiple buildings each carrying their own uncertainties.

6.3 Discussion

Retaining heritage and savings in materials and therefore embodied energy are two arguments commonly put forward in the academic literature for building adaptation. Heritage was found to be the one fundamental driver towards the retention of existing buildings in the case studies, whilst embodied impacts were never provided as the primary reason for adaptation or demolition, for buildings on their own or within the context of a masterplan. This chapter has examined the understanding of these two concepts and why, or why not, they are considered in adaptation and demolition decisions in practice.

Heritage values are applicable to the individual building and masterplan scales. Values related to the historical development of an industrial building or site were well understood by professional interviewees, reflecting the high weightings given to these values in previous academic studies (Gang et al., 2014; Liu et al., 2018). Although the built heritage of Australia is considerably newer relative to the two European countries, there were similar perceptions of historical values on the three case study sites. It is likely this is due to the sites being industrial and therefore built at similar times to one another. The historical values were considered due to the former industrial processes and "*knowledge base behind those sites*" (ref.PI.2) rather than age. However, these historical values are often balanced alongside the aesthetics, some buildings were demolished despite their historical value due to their lack of visual appeal.

Professional interviewees also felt that social values, such as a sense of identity, are increasingly becoming recognised, which reflects changes in the heritage discourse explained in the literature review, whereby the consideration of social values sit within the 'heritage planning' discourse. In the case studies, the extent of social values' consideration varied and it was argued to be dependent on the industrial company's influence on the surrounding community and city, as well as when the industrial site closed down. As Strijp-R was located in a former 'company town' and the site had recently closed in comparison to the other case studies, this is why the social values were thought to be conveyed so strongly.

On large development projects containing multiple buildings, the masterplan scale provides developers with the opportunity to consider heritage beyond the individual building level by incorporating a grouping of buildings and reflecting the story of the site's history and industrial processes. This transition from understanding heritage as individual objects to an understanding of the whole site and its underlying narrative reflects the changing heritage discourse (Janssen et al., 2017). On the case study sites, the ensemble and narrative of the developments were focused on to varying degrees. The design team for Strijp-R emphasised the importance of the narrative and of the site's role in developing television tubes, reflecting the former industrial landscape (Copic et al., 2014). On Central Park, the developers retained a group of buildings on Kensington Street, which was commonly perceived as a successful design strategy. On CB1, the retention of existing buildings was more fragmented. The degree of the ensemble or narrative is therefore dependent on the aspirations of the design team and the heritage values which are identified in the heritage assessments, in particular social values, as their consideration, as with considering the narrative, sits within the 'heritage planning' discourse.

In the context of whole life energy and carbon, at an individual building level, professional interviewees and focus group experts felt that if an existing building reaches the same operational energy standard as a new building, the impacts are almost always likely to favour retention as fewer materials, resulting in fewer embodied emissions, are often required for a refurbishment in comparison to new build construction. As suggested in the literature focusing on the UK residential sector, from an environmental perspective, demolition is therefore unnecessary (Morelli et al., 2014; Palmer et al., 2003; Power, 2008). Although interviewees suggested that it is possible for existing buildings to reach the same energy efficiency standards as new buildings, they felt that the barrier to this being achieved in practice is due to construction costs which are determined by an existing building's form and heritage controls.

Interviewees and focus group participants discussed how the operational impacts from both new builds and existing buildings are likely to decrease in the future due to technological advantages. However, there was no direct mention of the decarbonisation of the electricity grid, which was identified in the literature review (Alderson et al., 2012; Crawford et al., 2014; Kannan and Strachan, 2009). The move towards renewables will mean that operational energy will be much less carbon intensive than the embodied energy used in new construction. This decrease in operational impacts, will result in a larger proportion of life-cycle emissions being embodied, thus likely to favour retention options in LCAs.

Policy is a key driver as to whether or not heritage and whole life carbon are considered in the decision-making process. It is suggested this is the reason heritage is currently considered in adaptation and demolition decisions at the individual building level and in some instances, beyond this, at the masterplan scale, whilst embodied impacts are not universally considered at either scale. It is likely this difference is due to heritage considerations being included in planning policy for some time, with the current national legislation for each case study country being introduced in the 1980s/90s.

The chapter discussed how the influence of heritage policy can differ at the masterplan scale compared to the individual building level, due to the change in context of a building assessed on its own compared to within a larger urban development. At an individual building level, professional interviewees felt national heritage listings and conservation area designations have a strong influence towards the retention of buildings and protection of their setting. In practice, at the masterplan scale, a nationally listed building was demolished to make space for vehicles and pedestrian access on the CB1 site. The developers argued that this provision of infrastructure was a 'public benefit', as defined by planning policy, which justifies the demolition. Additionally, the CB1 development was the only case study containing a conservation area. Despite this, a number of existing buildings were demolished and interviewees noted that masterplan developments in conservation areas are rare as they inevitably change the character of an area.

Conversely, examples of the potential positive effects of the scale of masterplan developments were identified for the influence of local listings. At the individual building level, local listings were perceived as weak by professional interviewees and the CB1 and Central Park case studies did indicate that they are subject to negotiation. However, the influence of these designations over retention was particularly apparent for 125 Hills Road on the CB1 site, as the authority felt sufficient arguments for demolition had not been made to justify its loss, whilst on Central Park, the local designations led to several buildings being kept. Local listings therefore act as a starting point for negotiations between developers and planners and provide a degree of protection for the LA's interests.

Heritage can also be considered in a broader sense beyond its inclusion in policy. Professional interviewees discussed how heritage can add character to a development and contribute to place-making, consequently adding economic value to the area, which is clearly in the interests of the developer. On Strijp-R, buildings were retained, despite not being designated, whilst the demolition of all existing buildings on masterplan sites and starting from a blank canvas was referred to as 'old-fashioned' by some interviewees. These viewpoints reflect principles set out in the 'heritage planning' discourse, in particular 'value creation' through heritage retention (Janssen et al., 2017), as well as notions underlying the concept of heritage-led regeneration which argues developers should take opportunities to conserve and enhance the historic environment as it adds a sense of place to developments and the surrounding areas (BPF et al., 2017). As part of this concept, the quality of the new buildings should also be considered and be in harmony with any retained existing buildings or structures (Alsalloum and Brown, 2010). The case study interviews showed that perceptions of quaility varied between different people involved.

In the context of whole life energy and carbon policy, the historical focus has been on operational impacts and not embodied, hence the lack of consideration for embodied impacts in adaptation/demolition decisions. In all three case study countries, there has been an awareness of operational energy consumption of individual buildings since the 1970s, with a growing interest in energy efficiency in the 1980s. As of 2019, the Netherlands is the only one of the case study countries to have an environmental cap for whole life energy and carbon emissions, which includes embodied impacts, in their building regulations (Pasaman et al. 2018). However, there have been recent developments in other countries. For example the incorporation of LCAs in the draft London Plan (Kahn, 2018).

If embodied impacts are included in policy, it is likely to result in a greater degree of consideration (due to the necessity to) in development decisions. The main reason provided for the delay and lack of inclusion in policy were methodological problems and inconsistencies. Professional interviewees questioned the validity of embodied impact calculations, whilst the experts from the focus groups discussed some of these problems in more detail including data uncertainty and the temporal system boundaries. As discussed in the literature review, these methodological inconsistencies between academic studies are likely to be a fundamental reason (alongside the different design choices of individual buildings) for the lack of consensus as to whether adaptation or demolition and new build options have a lower whole life energy and carbon impact.

As with heritage, there were some indications that policy might not always be required for embodied impacts to be considered. Focus group participants felt that embodied impacts may be considered indirectly due to reduced capital expenditure, whilst professional and case study interviewees also referred to sustainability assessments and felt that they can help with the marketing and branding of individual buildings and in some cases, as with Central Park, masterplan sites. Despite this, as the focus of sustainability assessments (in terms of energy) tends to be on operational impacts and there is only a light touch on embodied, if undertaken they are likely to be used as a justification for demolition. However, as with developments in policy, there have also been developments in sustainability assessments, as LCAs now have a greater degree of recognition. If this extends to existing buildings, retention scenarios are likely to be favoured.

Overall, the opinions put forward during the interviews and focus groups indicate that heritage is considered in practice, at the individual building level and in some instances beyond this at the masterplan scale, and is the overarching reason for retaining existing buildings on masterplan sites. Embodied impacts are not considered in adaption and demolition decisions for individual buildings or within the context of a masterplan development. Heritage is likely to be considered due to its inclusion within planning policy, whilst embodied impacts are not as they are only just starting to be included in policy/regulations.

CHAPTER 7:

Underlying reasons governing decisions

Local Authority (LA) aspirations and involvement, the importance of long-term flexibility, public opposition, and the role of individuals involved in decisions are all additional complexities and reasons for different factors being considered when deciding to adapt or demolish existing buildings within the context of a masterplan. These all emerged as influencing factors from the interviews and sit within the themes of 'planning structure and requirements', processes and people (figures 7-1, 7-2 and 7-3). Decisions are also governed by economic conditions which were referred to earlier in the thesis (figure 5-3). The case study investigations were particularly useful here, as these were analysing how the decisions were made within a context and provided the extra level of depth required to identify these governing factors. Each of these factors is now examined and the concluding discussion helps to answer the third research question: "*Are there underlying reasons governing the consideration of different factors, including heritage and whole life energy and carbon, when deciding to adapt or demolish existing buildings on masterplan sites?*'.

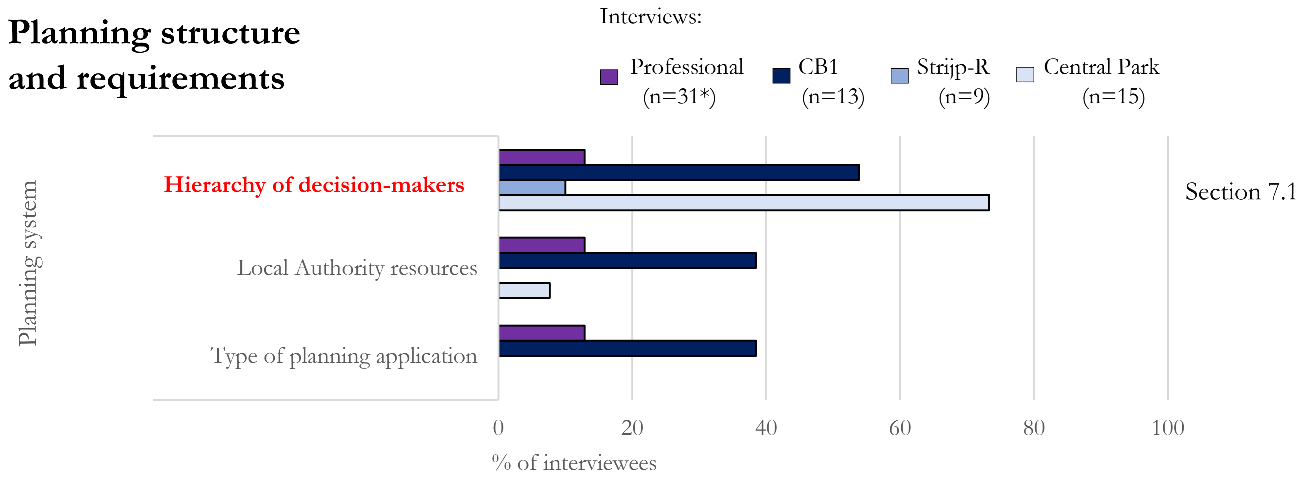

Figure 7-1: Theme – Planning structure and requirements. Frequency distribution of codes mentioned across interviews.
* Excludes interviews with academics specialising in embodied energy.

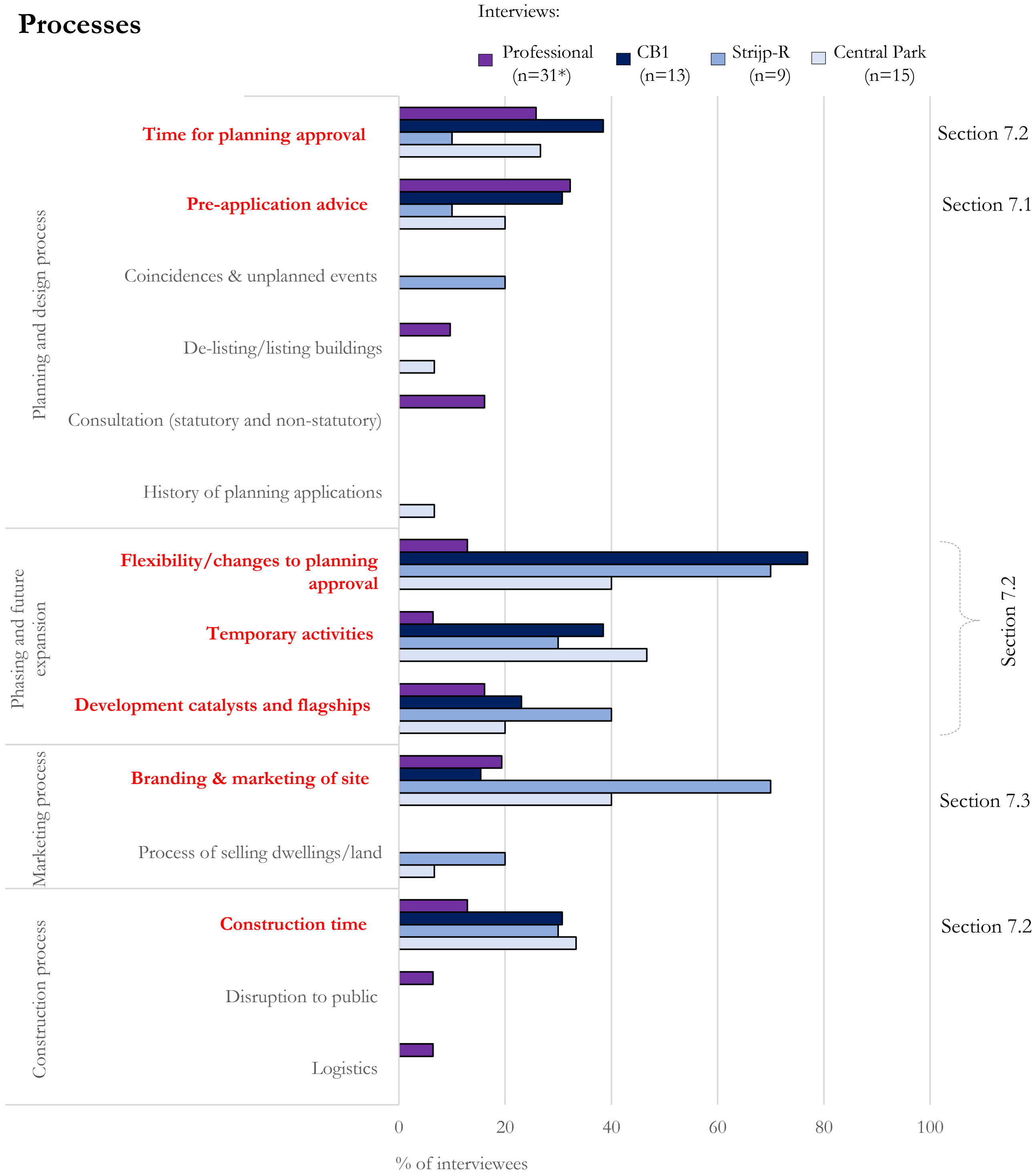

Figure 7-2: Theme – Processes. Frequency distribution of codes mentioned across interviews.
* Excludes interviews with academics specialising in embodied energy.

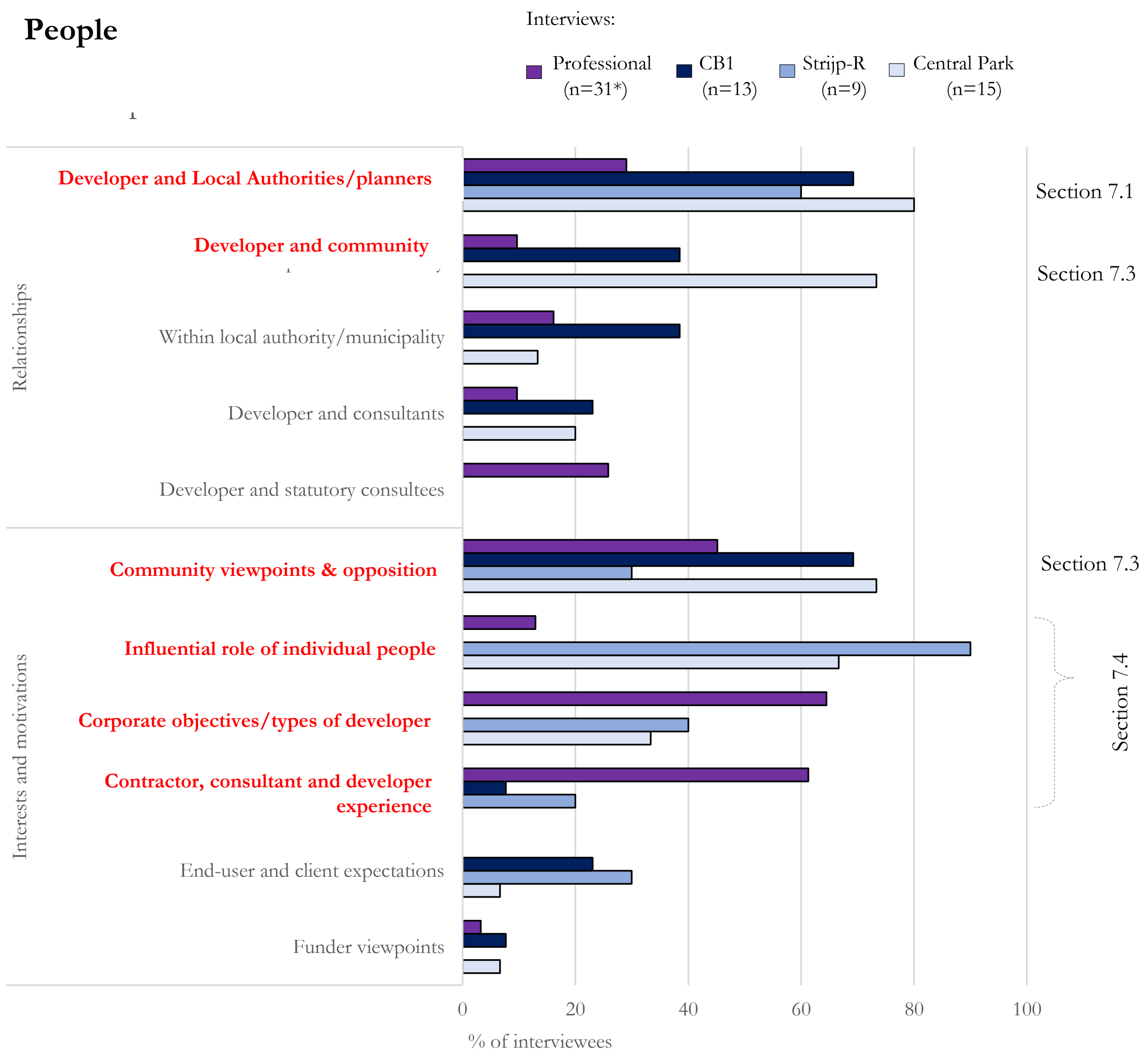

Figure 7-3: Theme – People. Frequency distribution of codes mentioned across interviews.
* Excludes interviews with academics specialising in embodied energy.

7.1 Local Authority aspirations and involvement

The aspirations of a LA and their level of involvement has an impact on adaptation and demolition decisions during the preparation of the masterplan and its subsequent planning application. As discussed in the previous chapter, parameters set out in local plans, which include locally listed buildings, are often subject to compromise (aspects associated with heritage policy shown in figure 6-2 sit within the theme of planning structure and requirements). One public planner stated: "*it wouldn't be unexpected for a developer to bring something forwards slightly different, as long as they can justify that, that would be appropriate*" (ref.PI-28).

Professional interviewees felt proactivity of LAs is required to formulate local plans and set out the principles if they are to be used as the starting point for these conversations and influence decisions, "*rather than sitting there and waiting for things to come in*", as one conservation officer commented (ref.PI-20). From a developer's perspective, interviewees suggested they should form a good relationship with the planners, through pre-application advice which will highlight the planners concerns or why an application could be refused before it is submitted. This was described as a "*red-flag exercise*" by one interviewee, which allows developers to know what they are dealing with before they "*jump-in*" (ref.PI-18).

However, there are constraints which can hinder the ability of a LA to be proactive. These include a decline in financial resources within public authorities which can limit the number of planners and time available to undertake the detailed investigations required to prepare local plans. As explained by one conservation officer: "*there is ground work that needs to be gone through….and often resources are stretched*" (ref.PI-15).

This decline in financial resources also affects the ability and usefulness of pre-application discussions. One private heritage consultant described how it was now difficult for developers to take advantage of the pre-application process and how he was…

> "*…really quite fearful for what happens next… [because] we used to be able to take phone calls and talk to people and possibly go out and visit them at the council…but now you can't get through to people….it is making it harder for people in the profession who actually want to be those proactive people and make a difference.*" (ref.PI-27)

Therefore, although proactivity and pre-application advice is suggested to be beneficial, these processes are affected by the resources available to LAs, which in turn is affected by the economic conditions and political makeup of the planning system in a country.

Pre-application advice also does not always lead to a resolution of different opinions. This was an observation in the CB1 case study through the refusal of the first application. The planning officer stated: *"There was lot of pre-app on the first application but we could not resolve our differences". Despite this "the then applicants Ashwell made the decision to submit an application .... the key issues were building design and transport impact." (ref.CS-CB1-e1)*. Following the refused application, interviewees from the CB1 design team said the application was stripped back, and some of the consultants commented that communication with the planning officer was key to achieving success in gaining planning consent (ref.CS-CB1-6, ref.CS-CB1-9), thus the relationship between developers and planners has an influence over decisions. As discussed in section 6.1.3, the plan that came forward did differ from the initial aspirations of the SADF, as locally listed buildings were demolished. Although this received critique from the independent reviewer, the planning officer recommended that planning permissions should be granted and stated: "*I am satisfied that the applicants have properly justified the loss of historic fabric and* trees" (Dyer, 2008a, p.79). Therefore, for the second application, the viewpoints towards pre-application align with those set out in the professional interviews. The development which came forward was different to the original aspirations of the LA but a resolution was found.

The main starting point for discussions on Central Park were the City of Sydney's aspirations set out in the brief for the design competition (section 4.4.4). As the City and site owners were unable to resolve design issues, the City encouraged the developers to go for the design competition:

> "*frustrated by progress on the resolution of design issues related to the masterplan, Australand*[44] *under pressure from the City of Sydney, agreed to undertake a relatively novel design excellence competition conceived and endorsed by relevant authorities.*" (Tzannes, 2016, p.19)

The outcome of the competition however was that "*none of the entrants produced a scheme that the Jury would unreservedly endorse*" (Jahn et al., 2004, p.5). Alongside concerns with the height and density of development, there were reservations form the competition jury about the demolition of heritage items:

> "*Few competitors sought to retain more than the bare minimum of heritage buildings. Several of the brewery buildings, whilst having no heritage listing, have a very strong character and presence, and their retention warrants serious consideration.*" (Jahn et al., 2004, p.4)

This was the reason for a preferred scheme being selected, rather than a winner by the jury/City, as they felt the design still needed to be refined through conversations with the city's planners. Hence, a City representative stated that the highest ranked design "*wasn't suitable to actually proceed as a development*" (CS-CP-12). Further conversations were therefore required before the site owners were likely to receive planning permission. These conversations included the preparation of the Conservation Management Plan (CMP) which was completed to "*inform decisions about the future of the site including its proposed conservation and development*" (Godden Mackay Logan, 2005, p.iii). Detailed heritage investigations identified additional heritage buildings with greater significance than the competition brief and recommended that they should be locally listed (figure 7-4 provides a comparison).

[44] Australand later rescinded their offer to purchase the site from Carlton and United Breweries (CUB). CUB submitted the original masterplan planning application which was approved by the State.

Once the concept plan was submitted in 2006, objections were put forward by the City of Sydney (2006, p.6), a consultee in the process as the State Minister was the consent authority. They felt it was "*remarkable that the concept plan does not evaluate, or even discuss the work that was undertaken by the Council, the [Central Sydney Planning Committee] and the site's owner over the past two to three years*". On reflection, the City planner felt that when the design competition was launched "*the planning controls were deficient*", as additional heritage items had been identified in the CMP (ref.CS-CP-12a). He proceeded to say it had been difficult to establish detailed principles during the competition stage due to a lack of access to the industrial site. He felt that as the developer started formulating their plans during/after the competition, they were able to argue that the additional heritage items, identified after the brief, were not part of 'the game' when they started. This suggests that establishing a strong set of parameters earlier on in the process is key for LAs and that it is difficult to make these more stringent at a later date. Changes later on create difficulties as they might be considered as back-tracking from the original aspirations. Despite pre-application advice and conversations between the proponents and the City, a resolution clearly could not be found, and this was the main reason for the site becoming State Significant. The Minister of Planning for New South Wales (NSW) was contacted by the planning proponents. Their consultant explained that "*[they] had many many months, I guess you call them heated discussions with the city council and their planners and in the end a decision was taken to go and talk to the Minister*" (ref.CS-CP-8). CUB wrote to the Minister of Planning in August 2005 expressing concern over the Council's management of the planning process (NSW Department of Planning, 2007). Following this, the development was declared State Significant. This move was justified by the Minister in the media as…

> "*…the project had become tangled in red tape for three years…this will streamline planning, provide ample opportunity for public consultation, and deliver more certainty for local residents and investors.*"
> (Australian Associated Press, 2006)

In another article he was quoted saying that "*he would save it from becoming a "constipated camel" not worthy of the city's gateway*" (Nixon, 2006).

The process in the Central Park case study therefore shows that it is not always possible to reach an agreement between developers and LAs, as was the situation for the first CB1 application. Due to the size of both development sites/masterplans and their locations next to key transport interchanges they are bound to be subject to controversy and disagreement due to the large number of factors that need to be considered and their high profiles, more so than for individual buildings in isolation. On both sites, contentious issues included the proposed density and increase in traffic (Chapter 5), emphasising that adaptation and demolition decisions only form part of these complex negotiations and discussions. Compromises about existing buildings and other design principles by both the developer and planners are inevitable as the developers need to gain planning consent, whilst the LAs are reliant on private developers for areas to be redeveloped, reflective of the planning systems and structures in all three of the case study countries (Section 4.4.5 and Appendix 9)

In juxtaposition to CB1 and Central Park, on Strijp-R, there was very little municipality or national institution's involvement during the development of the masterplan and, as previously mentioned, there was no local plan as the site had been sold quickly (ref.CS-SR-5). In addition to this, interviewees felt the municipality's attention was on the neighbouring Strijp-S, where they were part of a joint venture. An urban designer for Eindhoven's municipality declared:

> "*[Strijp-S] more or less became the focus for a number of years…because we co-operated with Philips in a joint venture and with the social housing company and the developer…Strijp-R was more in the slip-stream of Strijp-S you can say.*" (ref.CS-SR-10)

The lack of involvement from the municipality was almost certainly due to the fact that Strijp-R is significantly less high profile than Strijp-S within Eindhoven, which regularly has a key role in Dutch Design Week, an event every October advertised as "*the biggest design event in Northern Europe*" (DDW, 2019). Strijp-R is also less high-profile than the other case studies as it is located on the outskirts of the city rather than next to a key transport interchange and had significantly lower densities proposed.

The developer's design team felt that they had more influence on the final masterplan design due to this detachment of the municipality. As explained by the process manager: *"we were very happy that the municipality was not involved that much, we were at the steering wheel"* (ref.CS-SR-5). Additionally, an architect for some of the retained buildings described how *"[the] local government said from the beginning this area is a sort of play garden for architecture and urban planning to do some new things"* (ref.CS-SR-1). She also felt that this, as well as the buildings not being listed, allowed them to make substantial changes to the existing buildings' fabric. Therefore, this step back from the process by the LA gave the design-team more leeway in the decisions being made and the approach was bottom-up, rather than top-down where principles set out by the LA need to be adhered to. Importantly, this still included the retention of non-designated assets due to their place-making qualities (Section 6.1.4).

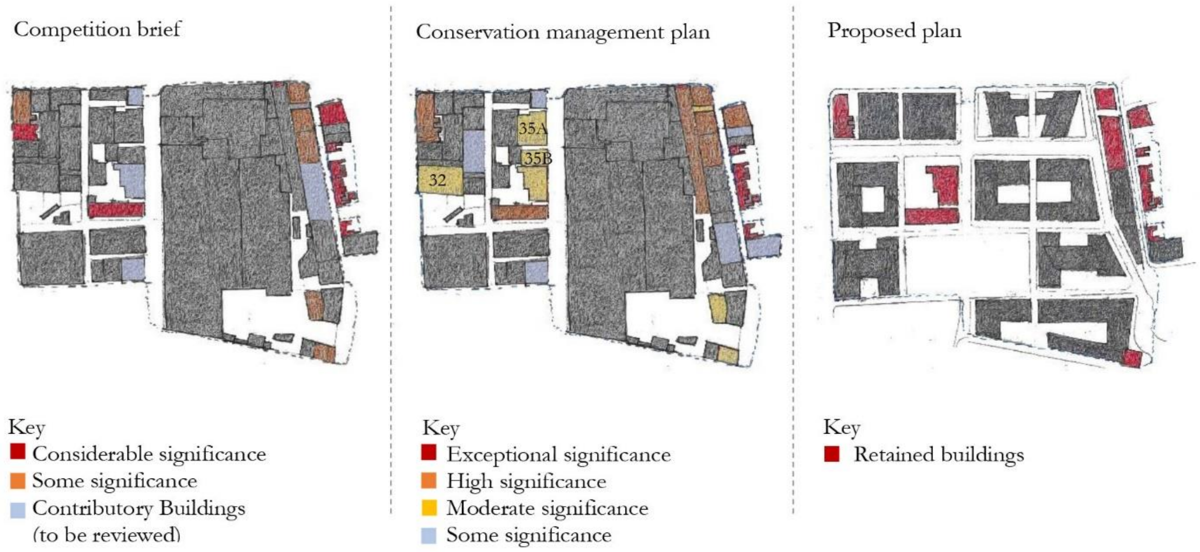

Figure 7-4: Difference between buildings' significance in competition brief and conservation management plan, and retained buildings in proposed masterplan on Central Park.
Sketches by author using images and information from NSW Department of Planning. (2007). *Major Project Assessment. Carlton United Brewery Site. Director-General's Environmental Assessment Report. Section 75I of the Environmental Planning and Assessment Act 1979* (No. MP 06_0171). NSW Government. Department of Planning, New South Wales, Australia.

7.2 The importance of long-term flexibility

The long timespan of masterplan developments[45] means that there is a need for flexibility and ability to make changes to the approved design which is rarely the case (to the same degree) when considering planning applications for individual buildings. As stated by one developer: "*I think with big schemes you do need that flexibility…it's over such a long time*" (ref.PI-26). This is due to changing market conditions which can occur during the subsequent design and construction stages.

Flexibility was also valued by the developers and their design teams in the case study investigations. On the CB1 development, the planning consultant stated that "*the skill of a good masterplan is adaptability…if you have got a masterplan which is great but not adaptable, it is utterly pointless*" (ref.CS-CB1-9). On Strijp-R a press release by Peeters (2019), from Amvest, the developers, discussed how they decided to work with strong frameworks rather than an exact blueprint. Meanwhile, on Central Park, the planning consultant stated:

> "*Had it not had that flexibility, you would still have a hole in the ground at the corner of Broadway…they would not of found a use, commercial use for that site.*" (ref.CS-CP-13)

[45] CB1, Strijp-R and Central Park obtained planning approval for the masterplan in 2008, 2010 and 2007 respectively and all three, as of 2019, are still under construction.

He proceeded to say that flexibility was required to respond to "*change in circumstances, changing markets, changing economy*". This was reiterated when the developer discussed how the commercial office market "*just died*" after the global financial crisis (GFC) (ref.CS-CP-10), which also affected the other case study sites.

However, despite interviewees (both professional and case study) highlighting the need for flexibility within a masterplan, it was suggested that the decisions about adaptation and demolition are made early on in the process, at the planning application stage. One developer described a masterplan site where the original planning permission was obtained by the site owners before the land was sold to them, 'them' being a volume house builder (ref.PI-29). She explained how the negotiation process about which locally listed buildings would be kept occurred between the original owners and the LA. When the site was sold, no changes were made as to which buildings should be retained or demolished:

> "*[we are] still seeking to retain them all, they are locally listed…they have to be incorporated… [we] didn't really assess any other ones to be demolished, kind of took it at face value really.*" (ref.PI-29)

On another development, the masterplan architect said that the decision to retain the façades of existing buildings had been made at the masterplan stage but detailed investigations about what intervention was needed were still required: "*the original application, sort of retained the façades that are here with us today and…we have had to find a way technically to make that possible*" (ref.PI-31b). The intention of the masterplan is therefore to create the physical constraints for the site's development, rather than to design the individual buildings. The retention of certain buildings as part of the heritage of the site forms part of these physical constraints, whilst the details of what will be done with them is defined later on in the process.

There was evidence of the importance of the decisions taken early on in the process in the case studies. On the CB1 development, this was particularly apparent due to the decision to demolish Wilton Terrace. Approval for the demolition of this building was granted at the outline application stage subject to Conservation Area Consent (section 4.4.2). At a later date when CAC was sought, alongside full planning for the replacement building as it was not in accordance with the approved masterplan permission due to an increase in height, there were conflicting viewpoints between the developers, planning officer and planning committee. The planning officer recommended that the proposed scheme was approved. She said that although CAC was required "*it [was] recognised that the Masterplan anticipated the demolition of 32-38 Station Road*" (Dyer, 2012, p.17). Despite this recommendation, in July 2012, the planning committee refused CAC and the planning application for the replacement new build. In December 2012, a new application was submitted, this was also recommended for approval by the planning officer but refused by the councillors. In July 2013, a third application was submitted, and as with the previous two, this was recommended for approval but rejected by the councillors[46]. The reasons for the refusal of planning consent included the dominant impact on surroundings caused by the scale and massing of the replacement buildings, inadequate parking provision and inappropriate transport mitigation measures, whilst planning and CAC were both refused as:

> "*The public benefit arising from the development fails to provide sufficient justification for the demolition of Buildings of Local Interest which are recognised as heritage assets. The development is therefore contrary to policy 4/12 of the Cambridge Local Plan 2006 and to guidance provided by the National Planning Policy Framework.*" (Edwards, 2013, p.1-2).

The developers took the planning committee to a national appeal for the first two refusals. The decision of the planning committee was overturned by the Planning Inspectorate[47], an executive agency of the national government. The inspector stated that:

> "*since the outline permission clearly anticipates the demolition, on the basis of the public benefit arising from the CB1 development as a whole, conservation area consent could only reasonably be refused if the reserved matters proposal was thought to be of inadequate design quality.*" (Gray, 2013, p.5)

Public benefits were referred to on both sides of the argument, reiterating the importance of considering these in adaptation and demolition decisions on masterplan sites. The planning inspector concluded that these public benefits were established at the outline stage. Although CAC was needed, the focus was on the quality of the replacement new build rather than whether or not the building could be demolished (section 6.1.3.3). The rejection of the application by the planning committee despite the planning officer's recommendations, and this being overturned by the planning inspectorate, reflects a hierarchy in and influence of the planning system. This was also seen on the Central Park development when the decision for approval was made by the State rather than the City.

The approval for demolition at outline stage was also applicable to the other buildings on the CB1 site. However, there was one building that was demolished although identified for retention in the original masterplan application. This was the fire damaged silo (shown previously in figure 6-10). The surviving fabric was described as having "*little architectural interest*" (Burgess, 2015, p.11) and the change in circumstances

[46] Planning application numbers: 12/0502/FUL, 12/0496/CAC, 12/1556/FUL, 12/1553/CAC, 13/0997/FUL, 13/0978/CAC.
[47] The Planning Inspectorate deal with planning appeals; national infrastructure planning applications; examinations of local plans and planning related case work. It is an executive agency, sponsored by the Ministry of Housing Communities and Local Government and the Welsh Government (Gov.uk, 2018).

was considered as a sufficient justification for the adjustment from the original approval. Thus, even if early decisions have been made, if there is a change in circumstances following the original application, the case studies showed that adaptation and demolition decisions can change.

On both Strijp-R and Central Park sites, changing circumstances led to the retention of additional buildings and these were accommodated for by the flexibility in the masterplan design. The original intention on Strijp-R was for the majority of existing buildings to be demolished, and the design team were considering keeping only one arm of the RK building (ref.CS-SR-1, ref.CS-SR-5, and ref.CS-SR-8). However, during the formulation of the core principles and masterplan design, Piet Hein Eek's visit to the site and purchase of the whole of the RK building, led to changes in the design. The landscape architect discussed how "*[Piet] was interested in the whole length of this [RK building], so then we had to change our urban plan"* (ref.CS-SR-2*),* as he wanted to retain an additional wing. As the former use of the site had been industrial, the planning restrictions allowed for some industrial processes to still be on site (Gemeente Eindhoven, 2010a). This was described as "*very fortunate*" by the process manager as Piet was able to establish his factory, within the RK building, early on in the process without additional planning permission (ref.CS-SR-5). In this case, the change in circumstances was a change in people involved in the process as Piet Hein Eek was not involved at the very beginning, yet was a fundamental reason that existing buildings were retained.

One of the heritage consultants described Piet's arrival as a "*coincidence*" meaning that not everything is predicted from the outset. He elaborated on this further by discussing the retention of the RAG building (ref.CS-SR-9). This pump building (shown previously in figure 5-11) was not identified as a 'relic' in the original masterplan investigations and was to be demolished. However, it was not demolished at the same time as the other buildings as it contained a number of pipes from different utility companies and appropriate permissions were still being sought for decommissioning. Due to this, the building was seen by Piet when he moved to the site, and the process manager described how "*he came saying we think we have a nice plan for that building*" (ref.CS-SR-5). Due to the adaptability of the plan, the design team were able to relocate some of the new buildings. This change in circumstances was only possible due to the long timespan of the masterplan development.

On Central Park, the developer stated that as soon as the masterplan had been approved "*the decision as far as heritage buildings are concerned was largely made*" (ref.CS-CP-10). This was the situation for the existing buildings that were located within the curtilage of the original masterplan application. However, the change in circumstances on this site was that additional buildings just beyond the site's original border were purchased by the developer later in the process and therefore added to their property portfolio. This was identified during the interview with the developer who said:

> "*When we bought the site, it didn't include one terrace and one other building…we purchased those two sites, one stayed as a terrace and has formed part of our Kensington Street development, the other one was knocked down to make way for a new building.*" (ref.CS-CP-10)

These newly acquired buildings included 18-20 and 42-44 Kensington Street (HBO and EMTB, 2008) (figure 7-5). The terraces at 18-20 Kensington Street were considered to have similar heritage value to the other terraces being kept along this street and were retained. The brick warehouses at 42-44 Kensington Street were demolished to form pedestrian access to Spice Alley through a pocket park located in front of a new building. The architect for the precinct declared that there were no issues with this demolition as the buildings had little heritage value (ref.CS-CP-9). The change in circumstances on the Central Park development were therefore the acquisition of additional buildings, of which one was retained and the other demolished, indicating that there can also be flexibility in the original site's boundary and that it is difficult to predict from the outset the final outcome of a masterplan development due to the long timescale and flexibility.

To ensure that a building is retained that is set out to be in the original masterplan approval, case study interviewees emphasised that it is important to keep an open mind about their final function and that the use does not always need to be determined at the early masterplan stage. With reference to the walkway on Strijp-R, the process manager discussed that it could be demolished in the future if it is not feasible to keep it but that in the interim period it is being kept in case someone was willing to retain it: "*just let it stand there as long as we like, as long as it's not in the way, and then as soon as someone has a great idea, then we use it.*" (ref.CS-SR-5). This message about having an open mind was repeated by one of the heritage consultants who said:

> "*We always had a fall-back scenario that we would tear things down…it's about an evolution of a plan…you need to keep options open…you demolish something, it's gone and you can't use it anymore.*" (ref.CS-SR-8)

These attitudes highlight that it is impossible to bring a building back once it has been demolished, therefore suggest it is better to retain the building and see what happens. This is only possible due to the long timespan of developments as the developer can invest in the building's adaptation later on in the process.

At the individual building level, this is unlikely as the attention is solely focused on that building and income is not being created elsewhere (except with it forms part of a portfolio of assets).

The benefits of having an open mind were also put forward by the masterplan architects on Central Park, with a particular focus on the brewery building which was undergoing feasibility studies to determine a use at the time of interview (February 2018):

> "*if you have significant heritage in a big old industrial area, it's probably prudent to not try and solve the heritage straight away, time will fix what should happen…. because usage and requirements change, markets change*" (ref.CS-CP-7a).

This attitude reiterates that the long timespan of masterplan developments gives the developer more time to decide what happens with the building in comparison to the individual building level.

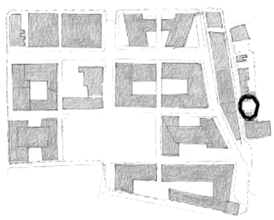

Figure 7-5: Plots of land acquired after initial masterplan planning application on Central Park.
Left - pocket park created by demolishing existing buildings. Right – retained cottages.
Image sources: Left: Google Street View. Right – photograph by author

7.3 Public opposition to demolition and time of involvement

Public opposition is common on masterplan developments and frequently includes concerns over the demolition of existing buildings. During the professional interviews, interviewees implied that community opposition to the demolition of an individual building can influence the final decision made by the planning authority:

> "*If people catch wind of development and they go wait a minute, I really like this building, this has significance to myself and my local community…there is quite a power that comes from people, particularly now.*" (ref.PI-18)

Another interviewee, a heritage statutory consultee felt that this community influence is greater depending on the number of people affected:

> "*I would also say we would have quite a lot of influence on anything that is in an area where quite a lot of people live because LAs want to irritate as few people as possible.*" (ref.PI-5)

However, an issue identified by a public planner was that the community members often do not express their viewpoints early enough in the process which is when they will be the most influential over strategic decisions: *"you quite often find that at those early stages you don't get the numbers…it's so strategic, they can't get their head around it"* (ref.PI-28). These professional opinions therefore suggest that community input is beginning to have an influence on the LA's decision to refuse permission for building demolition, particularly if the opposition is put forward collectively. However, this input is required early on in the process, where it is currently difficult to engage the public.

Community opposition and arguments need to be constructed around planning policy in order to have weight. One architect explained that if the community viewpoints are irrelevant to planning, they have no value in the decision-making process (ref.PI-24). A property consultant also discussed how the community should not come across as too radical and accept that there will be a level of compromise:

> "*I think the community viewpoint is listened to, it is important, especially if the community themselves are not too radical either, I think everybody's looking for a bit of a middle ground.*" (ref.PI-13)

Therefore, professional interviewees suggest that the community can have an influence over adaptation and demolition decisions, however they are likely to have more influence if arguments are based on policy and they do not come across as too radical. This further emphasises the influence of policy on adaptation and demolition decisions and that negotiations are considered the norm.

Public objections were regularly referred to in the case studies. On the CB1 site, although there were some consultee responses objecting to the demolition of existing buildings at the masterplan application stage, an analysis of consultation responses and minutes of meetings, by the author in Baker and Moncaster (2017b) showed that the main concerns were increased traffic congestion, the height of proposed new builds, open space provision, public transport and cycle routes, and the proposed station square design (see Appendix 12 for breakdown of discussion points). This affirms the complexity of masterplan decision-making and number of considerations, of which adaptation and demolition is only part.

The main objection to demolition came later in the process and was about the demolition of Wilton Terrace (shown previously in figure 5-12 and also discussed in section 7.1). When the developers submitted the first application for the CAC and full planning consent, local residents became vocal against the demolition and formed a group called 'Friends of Wilton Terrace'. This group created a petition which received 1347 signatures and the demolition was condemned by organisations including SAVE Britain's Heritage (SAVE, 2017; Save Wilton Terrace, 2015). In an attempt to save the building, members of the local community attempted to get the terrace spot-listed, meaning the building would become nationally designated, thus more difficult to demolish (The Friends of Wilton Terrace, n.d.), however this was unsuccessful.

This community opposition was reported by the local media, with headlines including: "*Campaigners launch last-ditch bid to save Wilton Terrace from the bulldozers by getting it listed*" (Havergal, 2013a) and "*Wilton Terrace in Cambridge set to be flattened as council surrenders to developers – again*" (Havergal, 2013b). It is likely that this collective opposition against demolition influenced the planning committee in their decision to go against the planning officer's recommendation to approve demolition, as they needed to "*be seen as listening to [their] constituents*", as expressed by one interviewee (ref.CS-CB1-6).

Local residents expressed frustration over the outcome of the appeal as the decision had already been made at the masterplan stage:

> "*It had all been agreed back in the masterplan, so it had been 10 years ago, at which point everybody thought, that was just lines on paper, nobody really had any understanding of what was happening when the masterplan was being drawn up.*" (ref.CS-CB1-13)

Another local resident stated: "*if I could go back again, I would have involved myself earlier. It was a lost cause by the time I became involved*" (ref.CS-CB1-2). Both these viewpoints emphasise the importance of early engagement and complexity of issues at the masterplan application stage which means the demolition of a building might be overlooked.

In the initial consultation responses for the masterplan, the only comments about the demolition of Wilton Terrace by the public were related to the height and density of the replacement new build, rather than the demolition itself. Additionally, the Victorian Society, who later opposed the demolition gave "*no response*" (Dyer, 2008b, p.37). This further supports the argument that the demolition of the terrace was overlooked at the masterplan application stage. It is likely this is due to the size of the development and the focus of the objections were on other issues. Therefore, although the professional interviewees suggested that a large collective of people opposing the demolition of a building is likely to be influential over the outcome, in practice, the CB1 case study has demonstrated the importance of this input being made early on in the process at the masterplan application stage when the decision is made.

Community opposition was also apparent on Central Park. The development of the masterplan was described by the community consultant as: "*a bit bumpy because its big, it is very high profile, it's political and it's in the community of Chippendale, which had a history of being attacked*" (ref.CS-CP-5). Although there was some opposition to the demolition of heritage items, interviewees felt that the main objections were due to the increase in density and height of the proposed development. The CUB's consultant discussed how these objections created difficulties in the process through negative press coverage:

> "*They mounted press campaigns, did all sorts…which was quite difficult for us to manage, so we had a public perception issue.*" (ref.CS-CP-8)

For some, the opposition was considered to be worsened through the removal of the planning approval from the City to the State Minister, Frank Sartor (ref.CS-CP-6). At the time the site became State Significant, the City's mayor, Lord Mayor Clover Moore MP, reacted in a media release saying that "*This is all about looking after developers. It's at the expense of the community and open accountable process*" (AAP MediaNet Press Releases, 2006). Other headlines included: "*Sartor slammed for planning power play*" (Munro, 2006) and "*Sartor's grab for control puts residents in a froth*" (Nixon, 2006). This hierarchy in the decision-making process created more distance between the community and the decision-makers and exacerbated the opposition to the development.

Hence, when the site was purchased by Frasers in partnership with Sekisui House, they…

> "*…embarked on a mission to regain the confidence of the local community and the City of Sydney through commitments to design excellence and more environmentally sustainable urban development.*" (Tzannes, 2016, p.20)

This 'mission' also included the early refurbishment and temporary use of the buildings on Kensington Street as artistic studios, which was referred to by several interviewees (ref.CS-CP-1a, ref.CS-CP-5, ref.CS-CP-6, ref.CS-CP-9, ref.CS-CP-11, and ref.CS-CP-12a). The former deputy mayor said this showed the developers had a "*social conscience*" (ref.CS-CP-6). Another interviewee described the retention of these buildings as "*very successful as a community, cultural exercise, and I think that generosity of spirit helped with the council*" (ref.CS-CP-5). The City representative also acknowledged it "*sort of immediately started to repair the relationship with the community around them and also gave the site a sort of vibe of its own*" (CS-CP-12). These viewpoints, from people opposed to many aspects of the original scheme (and some of the modified), suggest the new developers recognised the benefits of having the community 'on board' with the development. It is highly likely this was due to their long-term involvement and aspirations for the site.

On Strijp-R, tensions between the developers and the community did not dominate interview conversations in the same way as the other case studies. The main objection (three in total) to the initial application for the masterplan's 'destination plan' was from industrial premises on the neighbouring Strijp-T, who were concerned that their future expansion space would be compromised by noise restrictions imposed by the new housing (Gemeente Eindhoven, 2010b). The process manager described how "*nothing came on our path that we didn't really want. We had no objections, so we could go on…that was very fortunate*" (ref.CS-SR-5), suggesting that the community did not act as a barrier in the development process. As with the lesser involvement of the municipality, the lack of community objection is likely to be due to the development being less high profile than the other case studies.

Additionally, fewer objections might have been received as the Strijp-R interviewees felt that the consultation events had a positive influence on the preparation of the masterplan (ref.CS-SR-2, ref.CS-SR-5, ref.CS-SR-6, and ref.CS-SR-10). One public participation activity which was advertised in the local media was an open day where residents could see the cultural and historical research about the site and watch a film depicting the future aspirations for the area (Eindhovens Dagblad, 2007). The process manager felt that the open day also gave the opportunity…

> "…*for everybody to say goodbye to the buildings [and] tell us their stories if they wanted to or they could ask what is going to happen.*" (ref.CS-SR-5)

At the time of the masterplan's design development, she felt that these public participation activities were considered to be forward-thinking. Although public consultations took place in the other case studies, including exhibitions, the developer of CB1 recognised that public participation procedures have since progressed (ref.CS-CB1-1).

7.4 Liability, opportunity and the role of individual people

The role of an individual person has the ability to influence the decision to retain or demolish existing buildings at both the individual building and masterplan scales. During the professional interviews, the inherent risk of retaining existing buildings was discussed and it was acknowledged that some people will be more willing to take the risk than others:

> "*One person's liability is another person's opportunity. So, you know they might see something that is run down as hopeless, someone else might say, well I can get that cheap and I can afford to throw some money at it.*" (ref.PI-17)

This understanding and acceptance of risk is tied in with different types of developers. One public planner stated that "*your better developers have got professional teams who can handle historical buildings, your volume house builders when they get involved they've usually got substantial skill sets*" (ref.PI-14). Another interviewee who worked for a volume house builder recognised that the company's specialism was not in historic buildings, but that on masterplan developments the risk attached to existing buildings can be transferred by selling them on to those with relevant skills (ref.PI-29).

In the case studies, existing buildings were also adapted by other developers and not the overall masterplan developers. On the CB1 development, the mill was converted to apartments as part of the Ceres plots, which consisted of the mill and four new build residential buildings within the site (previously shown in figure 5-10). This area was sold by Brookgate to Hill, a UK housebuilder (Hill, 2015). Brookgate's project manager said this was because Brookgate's specialism was not in residential construction (ref.CS-CB1-1).

On Strijp-R, the majority of the existing buildings were redeveloped by Piet Hein Eek and a decision (at the time of the interviews – December 2017) was still being made about the retained walkway. On Central Park, the retention of Kensington Street came into fruition due to the purchase of the district by Frasers' former CEO, Dr Stanley Quek, and three other investors (HBO and EMTB, 2008). In addition, at the time of the interviews (February 2018), planning permission was being sought for the brewery building before it was sold on. Planning permission was being obtained as this was considered to add value to the property by reducing planning risk (ref.CS-CP-10). These examples indicate that not all developers are suited to the retention of existing buildings, however the size of the masterplan site gives the masterplan developers the option to sell existing buildings on to someone/companies with the expertise and the risk can be transferred. Although the new owner will benefit from any added revenue directly linked to the existing building, the masterplan developer will still benefit from the value that building adds to the masterplan scheme as a whole.

On Strijp-R and Central Park, the inductive research strategy led to the identification of two individuals who several interviewees felt were highly influential in the process. Both Piet Hein Eek and Dr Stanley Quek were dominant points of discussion throughout both sets of interviews (figure 7-3), as they were referred to by almost every interviewee.

On Strijp-R, Piet Hein Eek was described as having the "*X-factor*" by the contractor (ref.CS-SR-7) and one of Eindhoven's urban designers felt Piet was the heart of the site and he was "*the main guy who brought in this identity*" (ref.CS-SR-10). Another interviewee described Piet's role as:

> "*a success for sure…there are always people from outside Eindhoven…you see many people walking around the area and taking pictures… basically Piet Hein Eek draws them there*" (ref.CS-SR-3).

The RK building which is now includes Piet's factory, shop and restaurant (figure 7-6) were converted early on in the process. This was reported on in the local media:

> "*Even before the first residents settle down, the successful designer Piet Hein Eek and his companion Nob Ruigrok open their new complex in the old factory RK2 at Strijp R.*[48]" (De Leeuw, 2009b)

Piet's presence on site was considered to be attractive to future occupants as it created 'life' early on within the development and his involvement was considered as a success. This was demonstrated when the process manager said: "*Thank God for Piet Hein Eek…he helped us enormously with the place-making*". As a follow-up question, she was asked whether the development would have been as successful without his involvement. She felt that it could have worked, but it would have been very different with a higher density and less diversification in terms of building types and uses (ref.CS-SR-5). This diversification was attributed to the existing buildings which Piet played a fundamental part in retaining. This clearly suggests that one individual and their aspirations can have a significant influence on adaptation and demolition decisions.

On Central Park, Dr Stanley Quek was the CEO of Frasers and responsible for the modified masterplan. Dr Quek was described as "*a very insightful and astute developer and wants to do the right thing and wants to get good outcomes*" by the Kensington Street architect (ref.CS-CP-9). Another interviewee believed Dr Quek played a key role easing the pre-existing tensions with the City as "*he built up that relationship [with the City Mayor] and part of that is because of his good track record*" (CS-CP-1a). The Kensington Street architect felt that despite leaving Frasers later on in the development process, Dr Quek purchased Kensington Street as he wanted to see his original design aspirations come into fruition:

[48] Original text: "*Nog voordat de eerste bewoners zich er settelen, opent de succesvolle ontwerper Piet Hein Eek samen met zijn compagnon Nob Ruigrok zijn nieuwe complex in de oude fabriekshal RK2 op Strijp R*".

"*…he wanted to deliver his dream…and the original concept he put forward to council and the authorities… the project could have ended up in a heap and it only came to life because he stepped in and took it over.*" (ref.CS-CP-9)

It was recognised by the head of planning at the City that Kensington Street and Spice Alley were successful components of the scheme that had been driven by Dr Quek's vision (ref.CS-CP-14), whilst one newspaper quoted City councillor, Philip Thalis (who was responsible for the original competition design brief): "*Reopening the streets has been a very important move and Kensington street and Spice Alley are a tremendous success*" (Fuary-Wagner, 2016).

Without Dr Quek's input, as with Piet's role on Strijp-R, the final developments could have had very different outcomes. Additionally, both of these influential people got involved in the developments after the original masterplan had been approved, reiterating the argument made that the people involved in the development are not fixed and it cannot always be predicted. Evidently their own personal aspirations which are based on their previous experiences had significant impacts on adaption and demolition decisions.

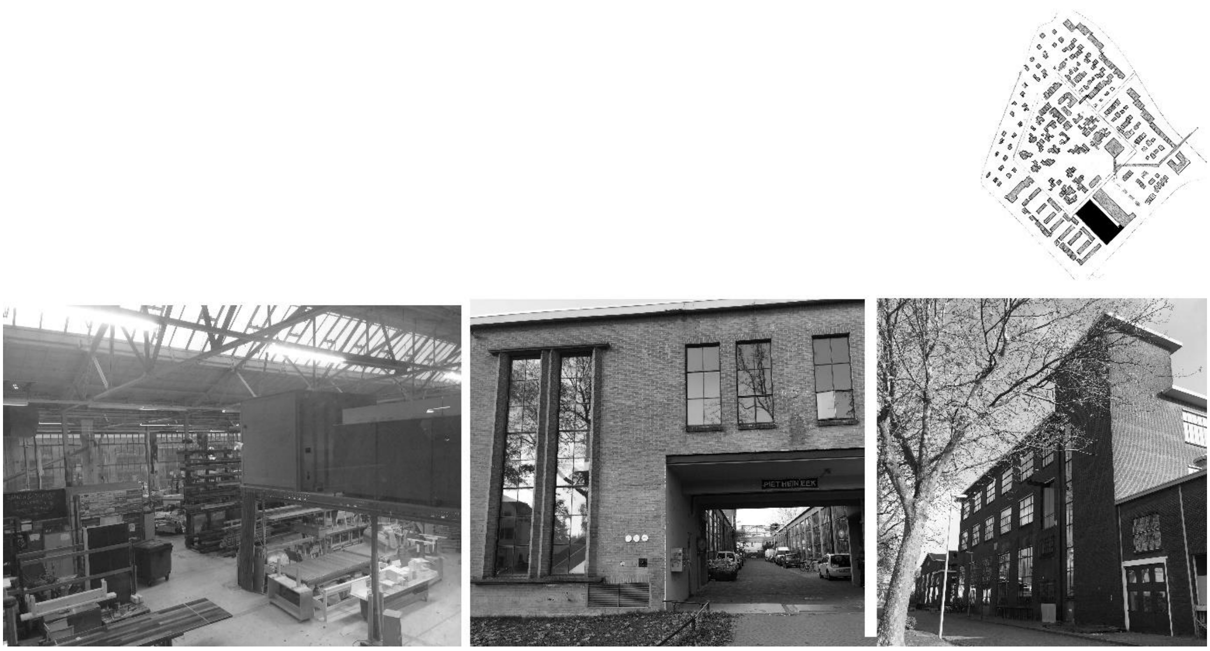

Figure 7-6: Piet Hein Eek's furniture factory within retained RK building, Strijp-R.
Photographs by author.

7.5 Discussion

Local Authority (LA) aspirations and involvement, the importance of long-term flexibility, public opposition and the role of individuals involved in decisions are all additional complexities and reasons for different factors being considered when deciding to adapt or demolish existing buildings on masterplan sites. These were predominately identified through the case study investigations as viewing the decision in a context allowed for these factors governing decisions to be uncovered. These sit within the themes of processes, people, planning structure and economic conditions.

This chapter has shown that the level of involvement and influence of a LA over adaptation and demolition decisions is varied and is determined by the profile of a masterplan site's development within a city, including the proposed density which is bound by market demands. LAs were heavily involved in both the CB1 and Central Park case studies as the sites were located next to key transport hubs and high densities were proposed relative to the other areas of the city, thus the economic conditions suited high profile developments. On Strijp-R, the LA had much less involvement as the site was significantly less high profile and their attention was on the neighbouring Strijp-S where they formed part of a joint venture.

Consequently, all three case studies went through different processes for the development of the masterplan. Parameters were set by the LAs through local planning policies on both CB1 and Central Park, whilst on Strijp-R the design team were said to be at the 'steering wheel' and developed their own core principles for the masterplan. Both professional interviewees and the case studies showed that it is not uncommon for the proposed masterplan submitted for planning to differ from what is initially set out by LAs and a negotiation process is therefore considered the norm. This was the case on both CB1 and Central Park where some buildings considered significant by the LA were demolished following negotiations. Furthermore, the Central Park case study emphasised the importance of setting parameters early on as it is difficult to make these more stringent at a later date. Although planning policy requirements were identified in the previous academic literature on building adaptation (Wilkinson, 2011), it is clear that these are not 'set in stone' and when there are multiple buildings in the same area, as with a masterplan, negotiations take place. This is influenced by the level of the LA's involvement, which in turn is influenced by the economic conditions and significance of the site's development to the city.

Negotiations often take place before a planning application is submitted and is referred to as pre-application advice. The case studies however showed that this process does not always lead to a resolution of differing aspirations. On CB1 this led to the refusal of the first planning application, whilst on Central Park, as the developers were able to argue that the site's development was significant to the State of New South Wales, when a resolution could not be found, the decision was removed from the local planning tier to the regional planning tier. This change in who the decision-makers were reflects a hierarchy in the planning system which can influence adaptation and demolition decisions. A hierarchy in decision-makers was also visible on

CB1 when the decision about Wilton Terrace made by the local planning committee was overturned by the national Planning Inspectorate. These examples also reflect the different planning structures in England and Australia. As England is a unitary state, the Planning Inspectorate, a national body was used in the appeal process, whilst Australia uses a Federal system, which is why it was possible for the development to be determined as State Significant with the State Minister being the final consent authority.

The decision about adaptation and demolition tends to be made at the masterplan application stage, which was the pivotal argument for allowing Wilton Terrace on CB1 to be demolished despite the community objection later in the process. However, even if early decisions have been made, if there is a change in circumstances following the initial application, the case studies showed that adaptation and demolition decisions can change. A change in circumstances which led to the demolition of a building originally marked for retention was the fire in the silo on the CB1 development which caused significant structural damage. On the two other case studies, changing circumstances led to the retention of additional buildings. In the Central Park case study, the developers purchased buildings originally outside the curtilage of the masterplan, of which some were retained and others demolished. On Strijp-R, the arrival of Piet Hein Eek on site, and therefore a change in people involved in the process, led to the retention of several existing buildings which were previously subject to demolition. These changes were all facilitated by the long timescale of and ability to make changes to the masterplan. These observations support the critique of linear decision-making frameworks discussed in Chapter 1. Although the majority of decisions were made at the outline planning stage, which is referred to in the RICS (2009) practice standards for development management, due to changing circumstances brought about by the long timespan of masterplan developments, decisions changed during the construction stage. These included the acquisition of additional land and requirements to re-obtain planning permission, which are stages preceding construction in the decision-making frameworks presented. Even at an individual building level, Bullen (2012) describes the dynamic and diverse nature of the process, this appears to be exacerbated at the masterplan scale due to its physical and chronological scale, thus supporting comments made by BRE (2003) that the masterplan process is iterative and that activities may not always be carried out in the same order as the frameworks.

The long timescale and flexibility of masterplan developments also provides developers with more time to find a use for an existing building, which was identified as a critical factor to consider in both the literature review and Chapter 5. Interviewees from both the Strijp-R and Central Park case studies emphasised the importance of having an open mind and that a use might be found later in the process, even when construction has begun elsewhere on site. They conveyed that once a building is demolished it is gone forever. The long timespan of developments can in some circumstances provide the developers with additional time to overcome the technical complexities of adaptation, whilst income is being created elsewhere on site. This observation further highlights the limitation of considering the decision-making process as a set of linear stages, particularly at the masterplan scale, as the different buildings or plots within it will be developed in more detail at different times to one another. The aim of the masterplan is to set out the physical constraints.

At an individual building level, professional interviewees felt that community opposition could prevent the demolition of an existing building provided the community acted as a collective, based their arguments on policy, and were not too radical by accepting that a degree of compromise in the planning system is the norm. However, the case studies showed that at the masterplan level there are a range of issues which are considered, of which adaptation and demolition is only part. As suggested by the London Assembly (2015) report, these include the desire for a public realm and open space. For this reason, the demolition of an existing building might be overlooked at the masterplan application stage, when the decision is made. The CB1 case study emphasised the importance of early engagement, as the community opposition towards the demolition of Wilton Terrace came too late in the process, suggesting that the complexity of large masterplan developments can make it more difficult for lay stakeholders to influence adaptation and demolition decisions.

Reducing the community opposition to a development can help with a development's public image and brand value. This was visible on Central Park, where the developers of the modified masterplan undertook design strategies to try and reduce previous community tensions caused during the development of the masterplan application by the site's previous owners. This included the use of existing buildings on Kensington Street as temporary artist studios early on in the process, which was commonly perceived as a successful design intervention. These temporary uses, as well as the retention of the factory early on in the Strijp-R case study both reflect principles set out by the heritage-led regeneration discourse, as they acted as catalysts for the rest of the development (Alsalloum and Brown, 2010).

On Strijp-R, the design team were proud of what the process manager (ref.CS-SR-5) described as "*forward-thinking*" public participation events that engaged with the community including the open day where former workers were invited to the area to tell their stories. It is likely this strong focus on community viewpoints was connected to the strong sense of identity which was discussed in Chapter 6.

The 'inherent risk' of adapting existing buildings is also perceived differently at the masterplan scale as there is the opportunity to sell the building on to someone (or a company) with the relevant skills and experience.

In the academic literature focusing on individual buildings, the risk of uncovering latent defects was identified as a disincentive for adaptation. Although this is true for the majority of buildings within the masterplans analysed, the Strijp-R and Central Park case studies show that in practice an individual person, such as Piet Hein Eek or Dr Stanley Quek, can have a significant influence over adaptation and demolition decisions, as they are likely to have different perceptions of risk. As identified in the literature review, risk is better managed by people with experience working with existing buildings (Bell et al. 2014; Irelands and Koerth, 2012; IStructE, 2010).

The case study analysis has demonstrated that different factors govern adaptation and demolition decisions depending on the context of a masterplan site. These context dependent factors can be related back to economic conditions, such as the level of demand for development; differing policies and planning systems; a variation in processes; and the different people involved in the decisions. Table 7-1 summarises some of the key differences within these themes for each case study.

Table 7-1: Key differences between case studies for factors governing decisions: economic conditions, planning structure, processes and people.

Theme	Case Study CB1	Strijp-R	Central Park
Economic conditions	Housing/commercial demands: high density due to location next to key transport gateway.	Housing/commercial demands: family housing, less dense in comparison to other case studies as located on outskirts of city.	Housing/commercial demands: high density due to location in centre of city and next to key transport interchange.
Planning structure	Consent authority: local authority (Cambridge City Council). Planning inspectorate, a national body, overturned decision of City for subsequent application (Wilton Terrace).	Consent authority: local authority (Eindhoven municipality)	Consent authority: State of NSW planning minister. Due to site being declared State Significant, City of Sydney were a consultee in the process rather than decision-maker.
	LA development plans: Station Area Development Framework 2004 & Cambridge Local Plan 2006.	LA development plans: no local plan in place when the site was purchased by developers.	LA development plans: Sydney Local Environment Plan 2005. Competition brief set out initial parameters. Conservation Area Management Plan then developed by LA alongside developers.
	Heritage designations: contained nationally and locally listed buildings, as well as a conservation area.	Heritage designations: contained no designated buildings	Heritage designations: contained locally listed buildings.
Processes	Change in circumstances affecting existing buildings: fire in silo, which was to be retained, caused significant damage and led to decision to demolish.	Change in circumstances affecting existing buildings: Piet Hein Eek purchased buildings during the masterplan design's development, which were subsequently retained.	Change in circumstances affecting existing buildings: acquisition of additional buildings outside the curtilage of the original masterplan by Frasers. Some retained, others demolished.
		Example of early retention: furniture factory, shop and café considered to bring people to site.	Example of early retention: temporary artist studios on Kensington Street acted as a catalyst for rest of development.
People	Community opposition: focused on density and height for initial masterplan. Petition with over 1300 signatures at a later date about the demolition of Wilton Terrace.	Community opposition: few objections. Public engagement considered to be 'forward-thinking' by design team.	Community opposition: community tensions caused by initial masterplan approval. Thought to be eased with improved engagement and early retention of Kensington Street, after site purchased by Frasers.
		Role of individual: Piet Hein Eek considered influential for building retention.	Role of individual: Dr Stanley Quek considered influential for building retention and design quality.

CHAPTER 8:

Applying the theoretical underpinnings of urban development

The decision to adapt or demolish existing buildings individually or within a masterplan is complex, multifaceted and differs depending on the context. The context-dependent nature of decisions was reflected in a range of the professional interviews where the phrase "*it depends*" (ref.PI-5, ref.PI-13, ref.PI-15, ref.PI-21, ref.PI-22, and ref.PI-28) was repeatedly used to answer questions about how decisions are made. Others commented that the decisions need to be made on a "*case by case basis*" (ref.PI-23, ref.CS-CB1-9).

This chapter provides an analysis of the decision-making factors discussed in the previous chapters and their level of consideration and/or influence over adaptation and demolition decisions at the masterplan scale. It is then proposed that the complexities of adaptation and demolition on masterplan sites can be explained through reference to the theoretical underpinnings of urban development. This is followed by a discussion which helps to answer the last research question: "*What theoretical framing can be used to explain the findings and develop previous adaptation and demolition theory*?".

8.1 Considerations and factors governing adaptation and demolition decisions on masterplan sites

The chapters so far have discussed factors which are considered when making adaptation and demolition decisions (Chapters 5 and 6), as well as factors which influence/govern decisions (Chapter 7). These are all depicted in Figure 8-1 (a breakdown of the data sources was provided in Appendix 8). The lines are colour coded to show whether a factor is considered in, or influential over, decisions. For some factors, namely policies and economic conditions, can be both considered when making decisions but also be influential over the consideration of other factors, such as density. Thus, the factors presented are not mutually exclusive from one another and key connections are also shown. The thickness of the lines indicates the degree of consideration or influence relative to other factors based on the case studies. These interpretations of consideration and influence are now justified in the following sub-sections using the three questions put forward by Haigh (2009, p.119) referred to earlier in the thesis: 1) Did the interviewees agree or contradict one another? 2) Did the interview data contradict any of the research ideas or what was discovered in the literature review? 3) Did the interviews uncover anything which was not identified in the literature?

8.1.1 Contradictory opinions within the primary data analysis

People have a significant influence over the decision-making process and their different perspectives lead to contradictory opinions. Addressing the first of Haigh's questions, two key issues in which contradictory opinions were expressed connected to heritage retention and policy – people's perceptions of heritage and design quality, and their interpretations of alternative 'public benefits' used as a justification if a building is demolished. At the national level, there are guidelines to determine an asset's heritage significance. These assessments are made by 'experts' in the relevant heritage organisation. At the local level, there is a higher level of subjectivity as social values tend to have more influence and factors such as the 'sense of identity', will differ from person to person depending on their connection to the site. At this local level, although buildings or sites may not be considered nationally or even locally significant in planning policy, they may still be considered significant by some and retained, as was the case on Strijp-R through the retention of non-designated assets. This contradictory and subjective nature of perceiving heritage reflects notions put forward by Schofield (2014) in that everyone has a view, and also supports the critique in the literature review of academics attempting to weight heritage values (section 3.1.2).

National designations can be overruled if other 'public benefits' can be proved, such as the provision of transport infrastructure and open spaces. These public benefits, as well as the design quality of replacement new buildings, are required as part of planning policy to mitigate the negative impact associated with the loss of heritage items (section 6.1.3.3). The contradictory opinions seen in the case studies between either the developers and their design team and local authorities and/or the local community shows people consider public benefits and design quality in different ways. In the CB1 case study, the development was critiqued by an architectural journalist due to the quality of the replacement new buildings, yet some of the individual buildings have won awards, including the British Council for Offices' Workspace Award (Brookgate, 2019) and attracted flagship companies such as Microsoft.

The first question presented by Haigh also asks whether there was any agreement between interviewees. This was seen in the perceived successes of the masterplans. On CB1, despite community objections and some local residents thinking that there had been a lost opportunity, the economic benefits and general improvement of the area compared to what was previously there as an entrance to Cambridge was noted.

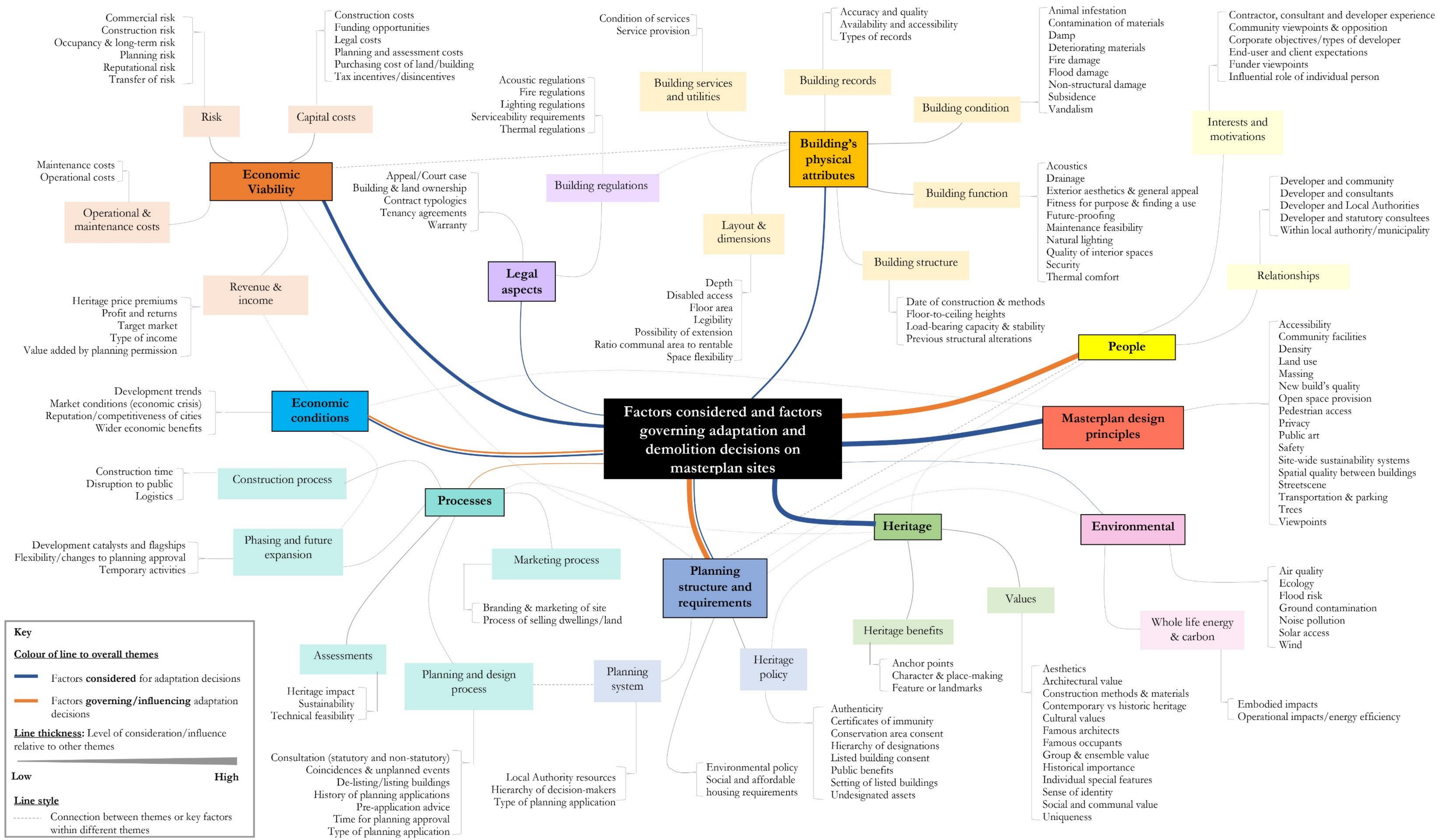

Figure 8-1: Factors considered and factors governing adaptation and demolition decisions on masterplan sites (based on the three case study investigations).

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On both Strijp-R and Central Park, it was the roles of Piet Hein Eek and Stanley Quek where agreement was found. Both individuals were considered to have a positive influence over either heritage retention and/or the quality of the masterplans' development.

The causes of these differing opinions comes back to people and their perceptions which is often based on their own experiences. People therefore have a significant influence over adaptation decisions as their input affects both how heritage and design quality is understood and how policy is enforced.

8.1.2 Contradictions between literature review and primary data analysis

Key considerations in adaptation decisions differ between the individual building level and within the context of a masterplan. Due to this change in scale (as well as looking at decisions in practice), contradictions between the literature review and primary data analysis, addressing Haigh's second question, were identified.

One of the fundamental differences between the case study findings and the academic literature is the consideration of heritage and embodied energy in the decision-making process. In the academic literature these were two factors regularly considered as benefits of adaptation (Chapter 3). Although there was a general understanding of both concepts being a benefit during the interviews, in practice, heritage was the fundamental reason for retention. Heritage was universally considered at the individual building level and in some cases beyond this at the masterplan scale, whereas embodied impacts are not yet considered at either scale. Chapter 6 argued that this is due to heritage being part of policy for some time, whereas the focus of policy related to whole life energy and carbon has previously been on operational impacts. Additionally, due to the long time frame in which heritage has been considered through policy, there are now examples of it being considered without this push. Hence why planning policies have been interpreted as both a consideration and influencing factor in Figure 8-1.

Another difference identified between the literature review and primary data analysis was the consideration of a building's physical attributes and masterplan design principles. If a building has no heritage value, Chapter 5 argued that the physical characteristics identified in the literature review can lead to demolition at both an individual building level and in the context of a masterplan. A key aspect here is whether or not a building is fit-for-purpose which depends on the aspirations of the occupants and housing or commercial demands in an area, once again linking back to people and also economic conditions, which influence decisions. However, despite the relevance of an individual building's physical attributes at the masterplan scale, the case study interviewees spoke in more detail about issues related to the masterplan design. Masterplan design principles are therefore key to consider, potentially more so than the technical feasibility of adaptation, which is determined by the physical attributes of individual buildings. This may also have been why specific details relevant to the individual building level, such as building regulations were rarely discussed in the masterplan context, as these details are established later on in the decision-making process after adaptation/demolition decisions have been made.

Many of the masterplan design principles were identified in the literature review as locational characteristics, such as the distance to transportation services, open spaces and the general appeal of an area (section 2.3). At the individual building level, these are outside the control of the decision maker. However, for large urban developments, these locational characteristics form part of the masterplan design as this requires new infrastructure provision. This can lead to the demolition of buildings, even with heritage value, which may have been retained at the individual building level.

In the literature review, economic viability was linked to the technical feasibility of adaptation strategies. This is still applicable at the masterplan level, however the physical and temporal scale of the masterplan allows economic viability to be interpreted differently as the cost of retention can be recovered by the rest of the development (section 5.4). Furthermore, one issue that was not considered in the literature review, when discussing economic viability, was the target market and that bigger is not always better, as the density is influenced by housing and commercial demands in an area. On Strijp-R, larger buildings were demolished and replaced by smaller new buildings. In contrast, larger buildings replaced the existing on CB1 and Central Park. The key difference being the latter two sites are in prime city locations next to key transport interchanges and the developers used this as an argument for higher densities. Strijp-R is located on the edge of Eindhoven and the target market for the development was families requiring houses rather than apartments or studios. People's attitudes towards the target market and appropriate densities were therefore influenced by the economic conditions.

8.1.3 Factors uncovered by the primary data analysis

Local authority (LA) aspirations, the impact of a masterplan's long timescale in comparison to individual building projects and the transfer of risk and role of individuals, all influence adaptation decisions within the context of a masterplan (Chapter 7). Turning to the last of Haigh's questions, the case study investigations uncovered these underlying factors that govern decisions. These influential factors which sit within themes relating the people, planning structure and processes, are not sufficiently considered in the existing literature focusing on building adaptation at the individual building level.

The level of LA involvement varied on the three case study sites due to the economic conditions in the area. On the CB1 development, the LA had aspirations for some time to provide a 'transport gateway' to the city (Cambridge City Council, 2004). In the Central Park case study, the design competition was launched by the City of Sydney and masterplan developed alongside additional investigations. However, the final decision was made by the State of NSW and the City was a consultee objecting to the scheme. In contrast to the other two case studies, on Strijp-R, no plans were in place by the municipality and the developers and their design team were responsible for establishing the core principles and initial parameters to work from. These differences indicate that LA aspirations dictate the process, whilst in turn the LAs involvement is governed by the planning structure.

Planning policy requirements were identified in the literature review as a consideration for the adaptation of individual buildings. However, as masterplan developments are likely to contain multiple existing buildings, if these buildings are protected by planning policy, this research has shown that it is common for negotiations to take place between developers and planning officers about which ones are kept. Negotiations can still take place at an individual building level but obviously cannot have the same level of compromise of demolishing one building but keeping another. The fact that these parameters are not 'set in stone' is therefore exacerbated at the masterplan level. Although there are requirements for developers and their design teams to consider policy, the level of enforcement is dependent on their relationship with the public authorities and their persuasive abilities. This supports the argument that the people involved and hierarchies within the planning system are highly influential over decisions.

All three of the case studies went through different processes, but one similarity is the long timespan from the initial aspirations for development to construction. As a masterplan development's economic viability is more vulnerable to changing market conditions than the individual building level, the case study developers and/or their design teams valued flexibility within the masterplan's design and ability to make changes after the initial planning approval. On all three sites, decisions about the adaptation and demolition of the majority of the existing buildings were made at the masterplan planning application stage, which is why Chapter 7 argued LA parameters and community engagement should happen early on in the process to have an influence. However, a change in circumstances, including the acquisition of land or changes in the people involved who are willing to invest in existing buildings, can result in changes to these initial decisions. The decision-making process therefore affects the point in time decisions are made.

8.2 Theoretical underpinnings of urban development processes

The key considerations for adaptation and demolition decisions highlighted above, and the reasoning as to why different factors governed decisions on the masterplan case study sites can be explained using the four theoretical underpinnings of urban development: equilibrium, structural, event-sequence and agency models

(Drane, 2013; Healey, 1991; Squires and Heurkens, 2016). These theoretical models focus on different aspects of planning and urban development. Equilibrium models reflect the supply and demand in the market. Structural models relate to institutional arrangements and formal/informal rules. Event-sequence models break the development up into different time stages, and agency models recognise that there are different people, commonly referred to as actors, involved in the development process (Squires and Heurkens, 2016).

The rationale for selecting this theory is due to its relevance to the larger scale of the masterplan and large urban regeneration projects. Referring back to a quotation used in Chapter 1: "*more than refurbishing or renovating buildings…urban regeneration is seen as being part of the broader planning process…[and] masterplans have been the main vehicle used for addressing urban regeneration policies*" (Fonseca and Ramos, 2019, p.240). Previous building adaptation studies and theories, such as Wilkinson (2011) and Bullen (2012), focus on adaptation and demolition decisions at the individual building level. Although the previous section showed that aspects associated with individual buildings are still applicable, within the context of a masterplan there are also key differences and additional influences that are not addressed. These uncovered complexities are due to the chronological and physical scale of masterplans, particularly the influences of people, the planning system, economic conditions and point in time decisions are made. Although the concept of heritage-led regeneration is relevant to the masterplan, this in itself sits within the context of urban development with the main focus being the tension between economics and conservation, rather than other complexities associated with the planning system and decision-making. The theoretical underpinnings of urban development help to explain underlying factors and why they govern decisions. They can then build upon and therefore extend previous adaptation and demolition theories to ensure that they are applicable for adaptation and demolition decisions within a masterplan context.

In the following sub-sections, each model is described and then used to explain why different factors govern decisions. The chapter concludes with a discussion about composite models which includes all four underpinnings demonstrating that viewing adaptation and demolition on masterplan sites through a single lens is not sufficient for explaining decisions.

8.2.1 Equilibrium models

Equilibrium models are centred on the notion of supply and demand and have a positivist outlook towards economics. The assumption is that the urban development process is driven by the demand for property and then the supply is brought forward to meet that demand (Squires and Heurkens, 2016). Decisions based on corporate demands for open plan office spaces and increasing the density on site to provide the supply, both housing and commercial, are therefore applicable to equilibrium models. This is why land uses and density considerations differ. Depending on the location of a development within a city, the city's population and site's distance to key transportation networks, the economic conditions and therefore the site's significance to a city's development will vary.

The positivist outlook of equilibrium models has been critiqued for being unrealistic as economic activity is also a social and cultural process (Squires and Heurkens, 2016). Critics argue that by reducing the decision-making process to a stimulus and response of economic forces, the social and cultural aspects which can shape and determine economic activities are ignored and the complexity of the decision-making process cannot be untangled (Guy and Henneberry, 2000; Pryke and Lee, 1995). The primary data analysis also reflects this critique. Interviewees suggested demolition is often driven by 'straight-forward' economic forces if the existing building has no heritage value. These forces include construction costs due to unfavourable structural morphologies and poor building condition (Chapter 5). However, in the case studies, the fundamental reason for adaptation, even if construction costs were high, was related to heritage principles (Chapter 6). As demonstrated in the literature review and analysis chapters, heritage can be interpreted as a social or cultural value. These values were frequently considered to add economic value to the masterplan development through place-making, reflecting notions of heritage-led regeneration. Interviewees recognised that economic values associated with heritage retention are difficult to quantify and that the decision to adapt existing buildings goes beyond "*straight excel spreadsheet mathematics*" (ref.CS-CP-11). Equilibrium models therefore explain some of the factors related to adaptation and demolition decisions, particularly those related to the influence of economic conditions over decisions. However, the analysis also indicates that other theoretical perspectives need to be considered.

8.2.2 Structural models

The consideration of both heritage and whole life energy and carbon is significantly influenced by policy (Chapter 6). This is related to structural models. Structural models focus on institutions, environments, markets and organisations which can frame development activities (Squires and Heurkens, 2016). A planning authority can either regulate how development occurs or shape it (Adams et al., 2012). Planning literature describes how urban development was seen in the 1940s and 50s as a physically deterministic activity whereby planning institutions set out blueprint plans such as the footprints and massing of buildings for an area's physical development (Taylor, 1998). These plans were enforced by the planning institution with little leeway for negotiation with developers. As shown in Appendix 9, in the UK, Netherlands and Australia, there was a shift (albeit at different times from one another) from this regulating approach to one which was more collaborative where the planning department are considered to be facilitators rather than regulators (Verhage, 2003). This transition in the institutional arrangement is referred to as the 'communicative turn', and collaborative planning is now considered to be mainstream thinking (Allmendinger and Haughton, 2012).

Squires and Heurkens (2014, p.227) discuss this transition as a global trend where a relaxation in regulation for real estate development has favoured the 'free' markets. In all of the countries that their book assessed including the UK, Netherlands and Australia they state "*planning systems seem to transform into instruments that shape and stimulate private investment in times of austerity, combined with regulations that to different degrees enable private interests to materialize through real estate development*". This helps to explain why the parameters set out by the LAs on CB1 and Central Park about which existing buildings should be kept were subject to compromise. The LAs were facilitators for discussions, rather than regulators and negotiations were considered the norm by both the planners and the developers.

There are different ways that theorists suggest LAs can influence developer behaviour during these negotiations (Adams et al., 2012). These include (but are not limited to) regulatory and shaping instruments. Heurkens et al. (2015) describe how regulatory instruments constrain the decision environment through regulating or controlling market actions. Shaping instruments, as the name suggests, shape the decision environment by setting a broad context for these market actions and transactions. An example of a regulating instrument is granting planning permission. As was seen on the CB1 development, if an agreement cannot be met between the developer and LA when a planning application is submitted, it is likely to be refused planning permission. Shaping instruments include indicative plans, such as the Station Area Development Framework in Cambridge, and the competition brief on Central Park. Both of these set the broad context for conversations and the negotiation process to take place. Carmona (2017) argues that conservation protections within urban developments are discretionary, whilst factors such as regulations are fixed. This was certainly the case for the heritage listings on the case study sites. Although the literature review noted planning policy as an influencing factor on adaptation decisions, these ideas of negotiation and potentially keeping one building but not another were not reflected due to the focus on the individual building level rather than wider urban development practices.

Nonetheless, the previous chapters showed that heritage policy is not always required for factors related to heritage to be considered in decisions. Both professional and case study interviewees felt that retaining buildings, even if they are not designated, adds character to a development. In the context of urban design, Carmona (2016) discusses the notion of placeless design and whether government intervention is required to overcome this. In situations where non-designated assets have been retained, this intervention was evidently not required as the developers felt the retention of these buildings added economic value to the masterplan. The description of demolishing all the existing buildings as "*old-fashioned*" (ref.PI-3, ref.CS-SR-10) in interviews suggests that the consideration of heritage without the push from policy is starting to become the norm. Thus, developer behaviour can also be influenced by informal instruments which reflect institutional habits (Carmona, 2017; van Karnenbeek and Janssen-Jansen, 2018). Daamen (2010, p.24) describes how going against social norms can lead to a loss of reputation and social disapproval. As more developments retain existing buildings to distinguish themselves from others, the dismissal of starting from a blank canvas is more likely to become standard. Additionally, Carmona, (2017) lists 'promotion' as a type of informal instrument. This helps to explain why the early adaptation of existing buildings on Central Park and Strijp-R were thought to help with the marketing and branding of the areas, as their retention acted as a promotional instrument.

In the context of whole life energy and carbon, sustainability assessments such as BREEAM and GreenStar, were also discussed by professional and case study interviewees due to their impact on marketing and branding. They felt that as more developments obtained green credentials, other developers will use this as a reference point for standards. Although the consideration of whole life energy and carbon is currently limited in these assessments, LCAs are beginning to gain weight. The same benchmarking principles for heritage retention therefore apply, as sustainability assessments are beginning to be considered without policy and becoming a social norm they can also act as a promotional instrument.

Structural models are also relevant due the effect of the institutional structure and hierarchy of decision-makers on adaptation decisions. Adams and Tiesdell (2010) discuss how negotiation is either competitive or collaborative and ideally is the latter as this is a 'win win' situation. As an agreement could not be found in the situation of Wilton Terrace on CB1 and for the whole of the masterplan on Central Park, decisions were made at the national and state planning tiers, respectively. These hierarchal relationships and the ability of the developers to persuade the planners and vice versa sits at the heart of the urban development process (Carmona, 2014), explaining why factors related to people, which include both interests and relationships have such a fundamental and influential role in adaptation and demolition decisions at a masterplan scale. Furthermore, as demonstrated in the previous chapters, the hierarchy of decision-makers, which is dependent on the planning structure, is heavily influenced by the significance of the development site to the city and economic conditions.

8.2.3 Event-sequencing models

All three case study sites went through different processes to obtain planning approval. The processes that developers and their design teams go through and the time at which decisions are made are all applicable to event-sequence models. As shown in Chapter 1, the decision-making process for development proposals, at both an individual level and masterplan scale, consists of different stages where different actors are likely to be involved (Wilkinson, 2011).

Daamen (2010, p.6) argues that due to the timespan of urban development projects, they need to be thought about as a process rather than just a project or final outcome. He describes this as "*projects-as-process type of thinking*". This helps to explain why the different processes that the case study sites went through, such as parameters being set by LAs, and when they were set, led to different factors being considered for the decisions about adaptation and demolition. There is also significant overlap here with the structural model's discourse as the processes were influenced by the LA's involvement and use of planning instruments. Carmona (2017) define a design competition, which was used on Central Park, as an evaluation instrument, and as previously discussed, local plans are shaping instruments.

The long timescales of masterplans make a development's economic viability more vulnerable to changing market conditions than the individual building level. A critique of equilibrium models is that they assume stable market conditions (Squires and Heurkens, 2014) and as changes were made on all the case study sites following the 2007-8 global financial crisis, this demonstrates that stable market conditions cannot be assumed. In the context of conservation-planning, Pendlebury (2013) discusses how there are lots of moving parts including the structures, policies and actors. This helps to explain why having a plan that is flexible and that can respond to a change in context, such as the market and housing demands, is desirable. Verhage (2003) discusses how this is facilitated by a shaping approach rather than regulating where little discrepancy is allowed from the plan initially set by the LA.

Event-sequencing models are therefore applicable to adaptation and demolition decisions as the processes which the stakeholders go through, which is often determined by the institutional arrangement, can affect how adaptation and demolition decisions are made. This includes when the decision is made and whether this is likely to change, as well as when the buildings are retained or adapted during the masterplan's implementation.

8.2.4 Agency models

The decision to adapt or demolish existing buildings is heavily influenced by the people that are involved. The impact of people, known as actors in urban development practices, is related to agency models. The range of actors depends on the scale and complexity of the site, thus is increased at the masterplan level. Theorists recognise actors are likely to have different aspirations for development and will require different resources to assist in decision-making (Doak and Karadimitriou, 2008; Verhage, 2003). As expressed by Faludi (1987, p.117, cited by Verhage, 2003): "*physical development involves a stream of decisions taken by private as well as public actors, each pursuing ends of their own*".

For urban development to take place, as expressed by Priemus (2002, p.202) "*private actors depend here on the creation of opportunities by public authorities. In their turn are dependent on private investors for financing of some of their public ambitions*". There is a degree of overlap here with the quotation used in Chapter 6, from Cambridge's county council officer, describing how compromise is often necessary and "*this comes back to the tension between commercial reality and public expectations*" (ref.CS-CB1-7), which explains the contradictory opinions about heritage, design quality and public benefits (section 8.1.1). This subjectivity is recognised by Carmona (2016) who refers to the debatable concept of good design.

A difference in aspirations is not only applicable across different stakeholders but also within stakeholder groups. All of the case studies investigated in this thesis were private developer-led (Heurkens, 2017). Through a survey with developers, Coiacetto (2000, p.354) found that developers have differing motives and cited Rudin (1978, p.26) saying: "*development companies differ from one another, not just in size or scope, but their norms or constraints, their decision-making procedures, and their whole 'corporate personality*". Due to this, Adams et al. (2001) emphasise the importance of understanding developers and their incentives in order for planners to negotiate with them. Therefore, grouping developers as one is considered misrepresentative as they have different corporate agendas to one another. This explains why the attitudes towards retention varied across the case study sites and also highlights the importance of understanding the role that one individual may have. In the context of brownfield sites, some developers are referred to as 'pioneers' as they have developed alternative and innovative design solutions (Adams and Tiesdell, 2010; Payne, 2009). Others are referred to as 'sceptics' if they are unwilling to redevelop brownfield sites due to the associated risks. On the case study sites, these 'pioneers' were Piet Hein Eek and Dr Stanley Quek.

The enforcement of local listings which form part of policy is dependent on the aspirations and experiences of the people involved in the negotiation process. This is why Adams et al. (2001) argue it is difficult to separate agency models from structural models. Additionally, Adams and Tiesdell (2010) argue the use of the terms 'actors' and 'roles' should be used separately. Although people in LAs might have the same job (role), the person (actor) affects the enforcement of the policy. When LAs and planners are evaluating a scheme, there is a balance between the objective measurable dimensions and complex subjective judgements which commonly relies on expert opinion (Carmona, 2017).

This overlap between structure and agency is also applicable to public participation. The notions of collaborative planning and changes in institutional arrangement in the planning system are dependent on consensus building. However, as identified by Allmendinger and Haughton (2012), a key issue with consensus building is that it is often difficult to find unanimity with the community when LAs are trying to implement housing growth. This is why the London Assembly (2015) report commented that there will always be winners and losers in social housing estate regeneration.

In Habermas' (1981) discussion about a 'deliberative democracy', the structure revolves around individuals reasoning with one another and exchanging knowledge and ideas through debate (Healey, 1997; Taylor, 1998). Building upon this concept of deliberation, in the move towards collaborative planning, there was a greater awareness of public participation, which is complex in itself because it can include a spectrum of different levels of involvement. For instance, Arnstein's (1969) ladder of participation is well known and regularly cited in planning theory. She outlines varying levels of participation including non-participation, tokenistic participation and participation when the community has a genuine influence over decisions. Varying degrees of public participation and influence over adaptation and demolition were evident in the case studies. This helps to explain why Strijp-R's methods were considered 'forward-thinking' by the design team, as they felt the communities' input had an influence over decisions. Whilst frustration was expressed by some local residents on CB1 as they felt that the events that were held were tokenistic as their viewpoints had little or no influence over the decisions that were made, a key part of this was that the decision was made early on at the masterplan planning application stage.

It is therefore clear that agency models are applicable as adaptation and demolition decisions are heavily influenced by the people involved, whose viewpoints are often determined by their own personal and professional experiences. The relationships between stakeholders is influenced by the planning structure.

8.3 Discussion

The analysis so far has shown that all four theoretical underpinnings of urban development processes are applicable to adaptation and demolition decisions on masterplan sites. This demonstrates that these decisions cannot be fully understood through one theoretical lens in isolation from the others. Viewing development through a 'single lens' has been described by previous academics as a reductionist way of thinking (Carmona, 2014; Drane, 2013; Guy and Henneberry, 2000; Healey, 1992). Initial critics include Gore and Nicholson (1991); Healey (1991, 1992) and Ball (1998). They proposed theoretical models which considered one or more of these perspectives. Guy and Henneberry (2000) argue that positivist methodologies such as those taken by equilibrium models cannot untangle the complexity of the urban development process and that the interrelationships between the different theoretical lenses are important for a realistic understanding. Hence the rationale for applying these theories to adaptation and demolition decisions in the context of a masterplan.

Contemporary academics have responded to these ongoing critiques through the development of composite models which include all four of urban development's theoretical perspectives. Examples include Squires and Heurkens' (2016) conceptual model for real estate development and Zamanifard et al.'s (2018) model for public space governance. Although the latter considers governance in urban design, the theoretical underpinnings outlined are all applicable. To demonstrate how these models include all four theoretical underpinnings, they have been colour-coded by the author for the purpose of this thesis (figure 8-2). The layers within Squires and Heurkens' (2016) model include environments, markets, agencies, processes and outcomes. In Zamanifard et al.'s (2018) model, the influence of institutional structure, actors, and the processes are also recognised. In both models, arrows indicate that the different theoretical underpinnings influence one another.

Key research findings from this thesis which are specific to each of the theoretical perspectives are shown in Figure 8-3, alongside an indication of how these link to other key findings which, on the surface, are more applicable to other theoretical perspectives within urban development. This helps to show how all four perspectives are applicable for explaining the complexity of adaptation and demolition decisions on masterplan sites, and that it is impossible to accurately explain decisions by only considering one of these perspectives. It is likely there are even more connections than those shown, which would further support the argument that decisions cannot be thought about through the separate lenses and a composite approach is required.

For clarity, a few of these key findings and connections are now explained. Within the equilibrium model category, it states '*Building use and density on site (two key factors in adaptation and demolition decisions) are determined by economic viability which is affected by market demands*'. This relates to density uplift often being a driver to demolish existing buildings in order to build back bigger. However, the building use and density is affected by, and also affects the consideration of other factors. For example, a key finding related to event-sequencing models is that – '*Due to the large time-span of masterplan developments and changing market conditions, designs need to be flexible*'. As previously stated, a common critique of equilibrium models is that they assume stable market conditions, thus this long-time span needs to be considered as housing demands and therefore use and applicable densities may change over the duration of the urban development's construction. The flexibility in the masterplan, as well as building uses and densities, is also linked to the planning institutional structure and policies. This is because shaping instruments, such as local plans which set out parameters for uses and densities, are subject to negotiation but also seen as more flexible than traditional blueprint plans. This is connected to the key finding '*Local listings are a type shaping instrument and negotiation between developers and LAs is considered the norm. However, enforcement is inconsistent across LAs'*. Density targets can be affected by economic conditions and therefore housing pressures, which in turn affects the significance of the site to a city and the level of involvement of the local authority or those at a higher tier in the planning system.

A second example is the impact of community viewpoints as '*community opposition to demolition can lead to negative press coverage'*, which is situated within the key findings for agency models. Another key finding related to this, is that tensions can be eased through '*the early retention of buildings for community facilities [as these can] act as a catalyst of development'*, which is applicable to the process and therefore event-sequencing models. Furthermore, in terms of the process, '*adaptation and demolition decisions tend to be made at the masterplan application stage but may change if there is a change in circumstances'*. Due to this, this thesis has argued that the community need to engage early on with the planning process. This can cause frustration as numerous factors need to be considered at this point in time and, as seen in the CB1 case study, the demolition of individual buildings can be overlooked. Community opposition can also be exacerbated if decisions are removed from the local level, as the '*hierarchy of decision-makers in the planning process can affect decisions*', which is applicable to structural models.

Overall, these key findings have shown that even when considering only one aspect of masterplan designs, the adaptation and demolition of existing buildings, the theoretical underpinnings of urban development are useful to help explain what is considered and why factors governing decisions vary. These underpinnings consider the effect of housing or commercial demands, how aspects such as a compromise over parameters set by the LA are considered the norm in the current planning system, why the long timespan of masterplan developments affects when decisions are made, and how people can have a significant influence over decisions to retain existing buildings.

Consequently, current academic studies and theory focusing on adaptation and demolition decisions at the individual building level are limited if used to understand decisions at the masterplan scale as they do not present these complexities and the influence of different factors including economic conditions, planning structures and requirements, processes and people. Although some of these influencing factors are applicable at the individual building level, the physical and chronological scale of the masterplan exacerbates their influence. As expressed by Carmona (2016, p.718):

> "*Design at any scale beyond that of the individual building typically needs to deal with shifting and complex economic, social, political, legal and stakeholder environments, and with how these adapt and change over sometimes very long-time horizons*".

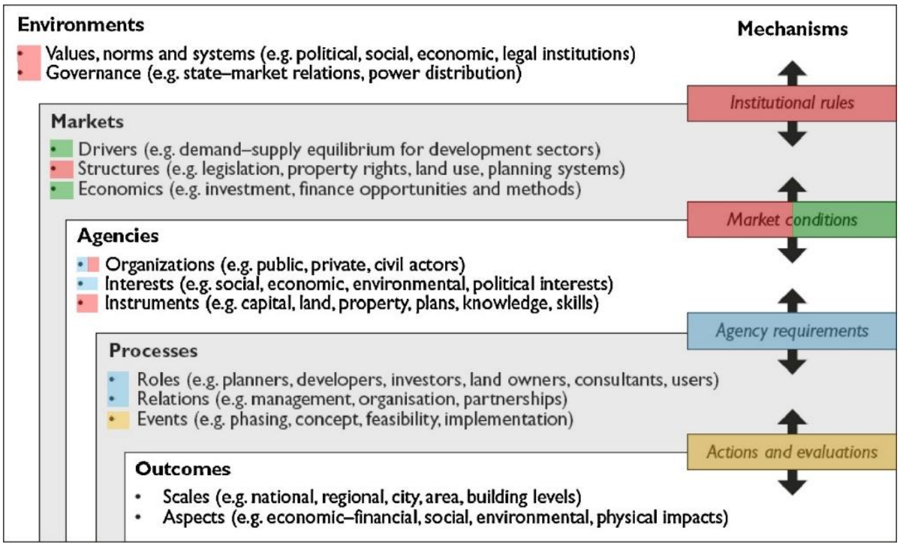
Therefore, explaining adaptation and demolition decisions on masterplan sites through the multiple theoretical lenses applicable to urban development, provided by composite theoretical models, helps to gain a realistic understanding of what happens in practice due to the additional complexities of the masterplan scale. By recognising that considerations differ at the masterplan scale in comparison to the individual building level, and that different factors are exacerbated by this change in scale and govern these considerations, previous adaptation theory is developed.

Key: planning/urban development theoretical underpinnings

Equilibrium models   Institutional/structural models   Event-sequencing models   Agency models

Composite model 1:

Conceptual model for real estate development (Squires and Heurkens, 2016)



Composite model 2:

Public space governance framework flowchart (Zamanifard et al.'s, 2018)

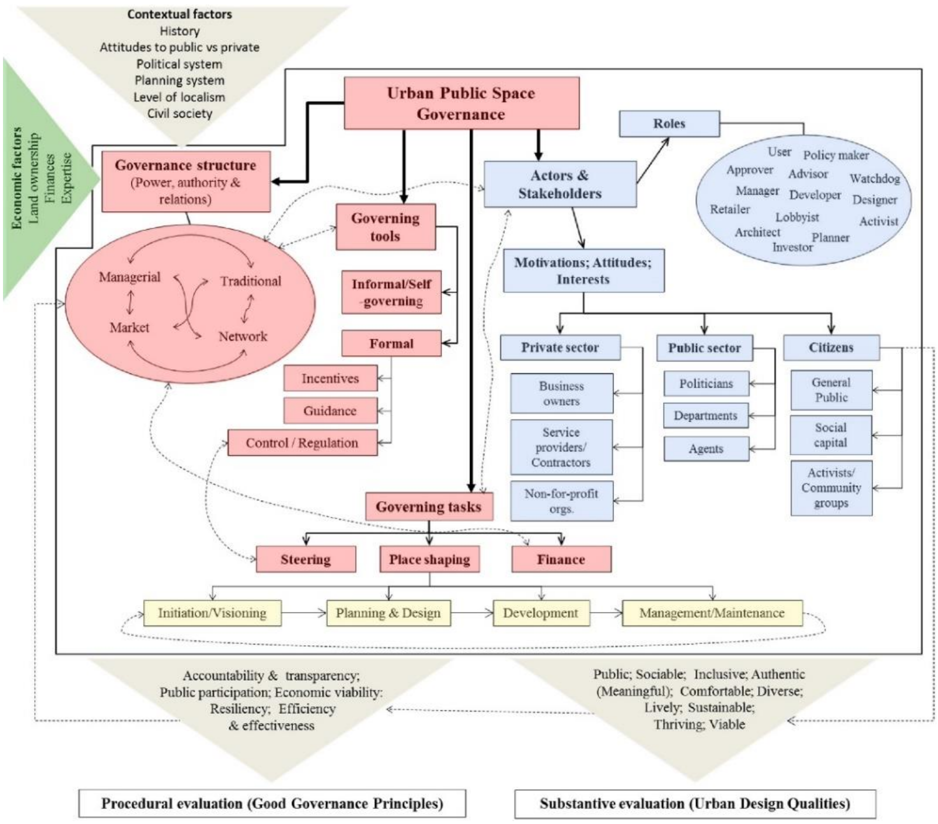


Figure 8-2: Author's interpretation of the applicability of urban development's theoretical underpinnings within composite models presented in the academic literature.

Sources of composite models and background images: Squires, G. and Heurkens, E. (2016). 'Methods and models for international comparative approaches to real estate development.' *Land Use Policy*, 50(Supplement C): pp. 573–581. & Zamanifard, H., Alizadeh, T. and Bosman, C. (2018). 'Towards a framework of public space governance.' *Cities*. 78(August): pp. 155-165.

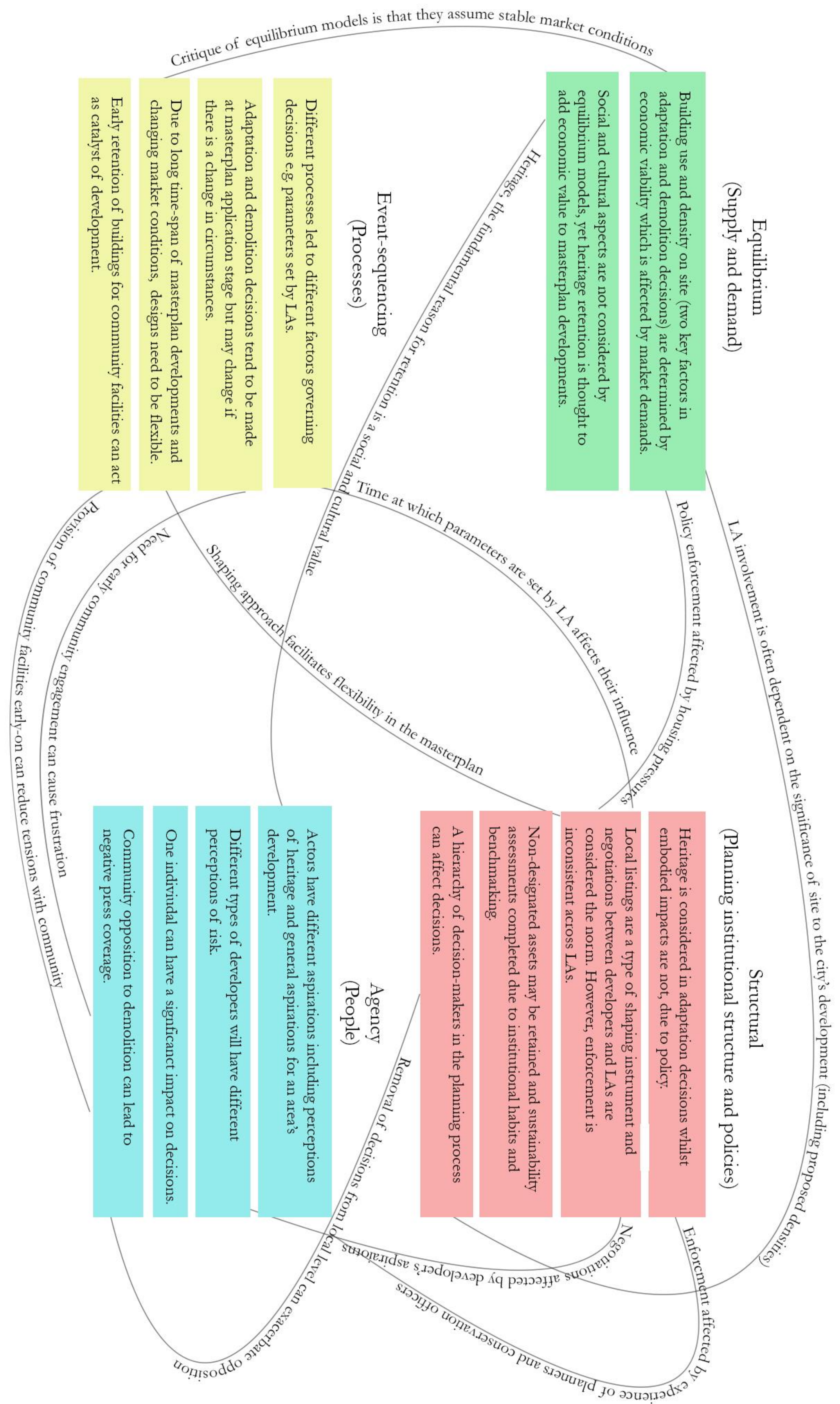


Figure 8-3: Key research findings applicable to the four theoretical underpinnings of urban development.

CHAPTER 9:

Conclusions

This thesis extends current adaptation theory by considering the practical realities of adaptation and demolition decisions at the masterplan scale. The overarching aim was to explore and understand what is considered for the decision to adapt or demolish existing buildings on large urban developments containing former industrial sites being regenerated by private developers through the implementation of a masterplan, and why this is so. Chapter 1 began by discussing the continuing interest in brownfield redevelopment due to global population increases and migration towards urban centres, which are leading to housing shortages and pressures to redevelop previously developed areas in cities through urban regeneration strategies. It was also highlighted that there is an acceleration of industrial vacancy in prime locations within cities due to economic restructuring and deindustrialisation (Belláková, 2016; Petković-Grozdanovića et al., 2016). A fundamental decision that is made by developers during the redevelopment of vacant plots of land within a city, including these former industrial sites, is whether to keep the existing buildings.

Existing academic studies focusing on adaptation and demolition tend to focus on either the individual building level, or the urban scale where the centre of attention is on energy modelling and the building stock is assumed to be the same. Furthermore, the author's previous Master's thesis highlighted that existing decision-making toolkits focusing on individual buildings do not transfer well for use on masterplan developments (Baker et al. 2017). The small number of reports that focus on larger areas of land being redeveloped through the implementation of a masterplan are from the 'grey literature' focusing on housing estate regeneration (Bell et al., 2014; Crawford et al., 2014). Thus, the exploration of adaptation at the masterplan level is an under researched topic and this thesis has generated new knowledge.

Barriers to and benefits of adaptation were first identified in the academic literature with a detailed breakdown provided in Appendix 1. A common driver towards demolition was found to be when construction costs for adaptation are seen to be higher compared to new build, but these costs vary depending on the technical feasibility of the project. Two benefits of adaptation were identified as the retention of heritage, and savings in materials and therefore reductions in embodied energy and greenhouse gas emissions. Consequently, Chapter 2 provided a review of decision-making criteria identified in previous academic studies, including economic viability. Chapter 3 provided an in-depth review of literature relating to heritage and whole life energy and carbon.

The research methodology, described in Chapter 4, explained that an inductive research approach was used to explore adaptation and demolition decisions at the individual building and masterplan scales. Methods included preparatory and exploratory studies, 33 professional interviews, and two focus groups with experts in embodied energy. These were followed by three detailed case study investigations of large areas of land, all containing former industrial sites and being redeveloped through the implementation of a masterplan. The case studies included the CB1 development in Cambridge, UK; Strijp-R in Eindhoven, Netherlands; and Central Park in Sydney, Australia. In total 38 additional case study interviews were conducted alongside site visits and a review of publicly available documentation and media articles. All of these methods provided new and rich qualitative data from a wide range of fresh perspectives focused on the research topic. Findings from and analysis of this data were discussed in Chapters 5-7. The theoretical underpinnings of urban development were then used to explain the findings and develop current adaptation theory (Chapter 8).

This chapter provides answers to the four research questions:

1) What is considered in the decision to adapt or demolish existing buildings on masterplan sites?
2) Are heritage values and whole life energy and carbon considerations taken into account in practice when decisions are made to adapt or demolish existing buildings on masterplan sites?
3) Are there underlying reasons governing the consideration of different factors, including heritage and whole life energy and carbon, when deciding to adapt or demolish existing buildings on masterplan sites?
4) What theoretical framing can be used to explain these findings and develop previous adaptation and demolition theory?

One section is dedicated to each question. A summary of the research's contribution to knowledge and in practice is then provided. The thesis concludes by outlining its limitations and potential options for future work.

9.1 Considerations for adaptation and demolition decisions on masterplan sites

This section responds to the first research question: "*What is considered in the decision to adapt or demolish existing buildings on masterplan sites?*". This research has shown that a large number of disparate factors are considered by developers and their design teams when deciding whether to adapt or demolish existing buildings. At the individual building level, previous academic studies identified considerations as the physical attributes of a building, economic viability, and locational factors beyond the individual building level (Chapter 2). At the masterplan scale, all of the factors identified at an individual building level were found to be applicable. However, there was a changing interpretation of economic viability due to the scale of the masterplan and additional factors that need to be considered, such as making space for vehicles and pedestrians (Chapter 5).

One of the most obvious and commonly cited arguments for demolition is economic viability (Crawford et al., 2014; Plimmer et al., 2008). Construction costs and potential revenue and income are partly determined by the physical attributes of a building. Both of these are considered by developers when deciding if a project is economically viable. If an existing building has no perceived heritage value, either by the design team or through policy, this research has shown that a key driver towards demolition is when the potential profits are higher for the new build option.

When assessing economic viability, interviewees suggested that a fundamental consideration is whether or not an existing building can be made fit-for-purpose. This is established by assessing whether the existing form of a building can accommodate the desired function which is commonly determined by housing or commercial demands in the area. Important attributes here are constrained internal spaces, for example through internal structural walls rather than columns, and low floor-to-ceiling heights which create difficulties updating a building's services. Interviewees felt that large corporate companies demand large open plan floor areas, and on both CB1 and Central Park, existing buildings described as 'pokey' were demolished for this reason. Other considerations which lead to demolition, particularly if there is no perceived heritage, is limited load-bearing capacity or poor building condition; both of these can increase the cost of intervention and were identified in the literature review at the individual building level (Brennan and Tomback, 2013; Geraedts and Van der Voodt, 2007; Wilkinson, 2011).

A building's physical attributes can also favour adaptation options. If a building has high floor-to-ceiling heights, which is particularly common in former industrial buildings, this can act as a driver towards adaptation. This is due to the aesthetic appeal of large volume spaces. An example from the case studies was the retained RK building, a former industrial factory on Strijp-R, which now includes a restaurant and has ample daylight due to the large windows and internal space. Additionally, if a building is robust and has a high load-bearing capacity, according to professional interviewees, buildings are retained as it is more expensive to demolish and rebuild. These physical attributes are likely to differ depending on the previous property type. An example being that industrial buildings are more likely to have higher load-bearing capacities than former residential dwellings.

In some instances however, buildings were retained on the case study sites despite having undesirable physical attributes, such as low floor-to-ceiling heights, constrained internal spaces and limited load-bearing capacity. The future function was chosen to fit the form, with the driver behind the retention being heritage conservation. The final use of the existing buildings on Strijp-R includes bespoke residential dwellings, cafés, restaurants, retail units and creative industries, reflecting findings in the literature that heritage buildings are often occupied by start-ups rather than large corporate companies (Heritage Lottery Fund, 2013).

Economic viability was clearly a concern at the masterplan scale, however at this scale it can be determined differently to the individual building level. For example, in the case studies investigated there were no examples of an individual building being kept because it was cheaper to retain it than demolish. This is almost certainty due to the scale of the masterplan making these savings insignificant relative to the whole development. Conversely, at an individual building level, if a private developer is unable to receive funding or make profit on an adaptation project this will be a driver towards demolition (Wilkinson, 2011), yet due to the size of a masterplan site, in some cases, there is potential for this cost to be recovered elsewhere on the development.

One way of improving economic viability is maximising density, which is applicable at both an individual building and masterplan level and is a common justification provided by developers for the demolition of buildings (Been et al. 2016). On housing estate regeneration projects identified in the literature, existing buildings were often demolished and replaced with new buildings which used the land more efficiently and/or were taller and therefore had more rentable or sellable floor area, especially if land values were high (Power., 2008; London Assembly., 2015). At the masterplan scale, there is more opportunity to increase density across the entire site. On both CB1 and Central Park, existing buildings were demolished to increase density by building back bigger as there was a demand for higher densities due to the sites' locations being next to key transport interchanges. However, this was not the case on Strijp-R, where some larger existing buildings were replaced by smaller residential dwellings. This was due to the demand for smaller family housing in this area, which was located on the outskirts of the city. The density of the development was determined by the economic conditions.

One justification provided for the demolition of buildings within the case studies was that the building was 'out of place' with the rest of the development. However, within the same developments there were examples of a juxtaposition of scales between the old and new buildings. This was especially visible on the Central Park development where a twelve storey new build cantilevers over a retained four storey pub. As an existing building which is a different scale to the surrounding new buildings can clearly be accommodated within a masterplan design, this thesis argued the real reason behind the demolition of buildings considered to be 'out of place' is likely to be maximising density and/or meeting market demands.

There are additional issues to consider on masterplan sites. Although factors beyond the individual building level were identified in the literature review (section 2.3), these locational characteristics which include the accessibility to services and facilities, parking, and transportation networks, were considered to be outside of the control of the decision-makers (Geraedts and Van der Voordt, 2007). In contrast, on large urban developments some of these factors are considered in the masterplan's design as they are required as part of the physical intervention brought about by urban regeneration projects. These requirements include the need to make space for vehicles and pedestrians. These additional considerations can result in the demolition of existing buildings, which might have otherwise been retained if assessed on an individual building level. Examples from the case studies include the former police station which was protected by national heritage policy on the CB1 site. Despite the national designation, it was demolished in order to provide a taxi-rank in front of the railway station. Furthermore, on both CB1 and Central Park, public spaces built in-front of heritage assets and said to enhance their setting resulted in the demolition of other existing buildings considered less significant in terms of heritage. This extra level of intervention is referred to in the heritage-led regeneration literature as "*the hierarchy of space organisation*" (Mosler, 2019. P.4), as there is competition between heritage and other urban typologies (Ashworth and Tunbridge, 2017).

In comparison to factors related to the technical feasibility of retention, considerations related to the masterplan design dominated discussions during the case study interviews. This helps to explain why specific details associated with individual buildings thought to be important in the literature review, such as building regulations, were overlooked. The intention of the masterplan is to create the physical constraints for a site's development rather than design the individual buildings. Hence, the high degree of consideration assigned to masterplan design principles in comparison to a building's physical attributes in Figure 8-1 which maps out considerations and influencing factors for adaptation and demolition decisions on masterplan sites.

In summary, numerous previous academic studies have shown the consideration of a building's physical attributes on adaptation and demolition decisions at the individual building level. However, at the masterplan scale, there is both a changing interpretation of economic viability and extra factors that are included in a masterplan's design which affect adaptation and demolition decisions. The reason for these differences is due to the significant cost differences between the individual building level and masterplan scale, as well as the additional obligations in terms of infrastructure provisions required by large urban developments.

9.2 Heritage values and whole life energy and carbon considerations in practice

This section now turns to the second research question: "*Are heritage values and whole life energy and carbon considerations taken into account in practice when decisions are made to adapt or demolish existing buildings on masterplan sites?*". This question was proposed as retaining heritage and savings in materials, and therefore reducing embodied energy, were identified as two key benefits of building adaptation in the academic literature. The retention of heritage is considered as a benefit due to the positive social impacts brought about by providing a sense of place and urban identity (Bürklin and Peterek, 2017; Metzger et al., 2014; Oktay, 2002). Savings in embodied energy are important as global warming is one of the most pressing issues facing humanity today, as demonstrated by international efforts to reduce greenhouse gas emissions (Chapter 3). Despite both factors being considered and understood as benefits of retention during interviews, in practice, only heritage was considered, particularly if provided to do so by heritage policies (Chapter 6).

The academic literature provides two different ways of understanding heritage: a values-based approach and a changing heritage discourse (Pendlebury, 2013). Firstly, theory suggests that heritage is a heterogeneous term as multiple values are attached to it. For industrial buildings and sites, these include (but are not limited to) architectural, historical and social values. Secondly, the different heritage discourses (preservation, conservation and 'heritage planning') reflect the types of values that are considered, as well as differing decision-makers for and attitudes towards intervention (Ashworth, 2011).

In the case studies and therefore in practice, heritage was found to be the one fundamental driver towards the retention of existing buildings. Heritage was universally considered at the individual building level and in some cases beyond this by considering a building's settings and/or the wider area within a masterplan. There were similar perceptions of heritage across the case studies despite the built heritage of Australia[49] being considerably newer than England and the Netherlands, with history and aesthetics being regularly

[49] Within the main text it was noted that Aboriginal and Torres Strait Islander heritage is also an important part of Australian heritage and precedes the built heritage which has been referred to.

discussed values. Similar attitudes towards historical values are almost certainly due to the former industrial sites being built at a similar time to one another and that the historical value was less about age and more about the industrial processes that used to take place, and therefore the knowledge base behind those buildings and sites.

The history of industrial sites is closely aligned with social values, including peoples' attachment to buildings or areas through their experiences and memories (Belláková, 2016). The literature and some interviewees suggested that social values are growing in importance as we live in a globalising world, where buildings/sites can provide a sense of attachment for a geographic community, which reflects the 'heritage planning' discourse (Copic et al., 2014; Hall, 1999; Winter, 2014). On Strijp-R, the sense of local identity was significantly more apparent than on the other case study sites. This was attributed to the influence of Philips, the company that used to occupy the site, over the whole city of Eindhoven and that the closure of the site had been more recent in comparison to the other case studies.

Another important point is that masterplan sites offer the opportunity for heritage to be considered beyond the individual building level. In heritage theory this is applicable to the conservation discourse which considers heritage as an ensemble, and the 'heritage planning' discourse where the narrative of an area's past is acknowledged (Ashworth, 2011; Janssen et al., 2017). When heritage is considered beyond the individual building level, it also reflects principles of heritage-led regeneration as "*individual buildings can be less important than the overall ambience of the areas*" (BPF et al. 2017. p.9). Thus, a building may not be considered important on its own but valuable as part of a group.

The consideration of heritage beyond the individual building level was evident to varying degrees on the case study sites reflecting the adoption of different heritage discourses. On Strijp-R, the design team regularly discussed the narrative of Philips and the manufacture of television tubes and how this had influenced the design of the whole masterplan, whilst on Central Park, the retention of a group of buildings on Kensington Street were frequently discussed in a positive manner. In contrast, on CB1 the retention of buildings was fragmented and a less holistic approach was taken. These variations in approach were aligned with the consideration of social values on the sites and the influence of the former industrial company on the city in which the development was located and the point in time that it had closed.

Heritage, particularly in the 'preservation discourse' is thought of through the lens of heritage policy were values are determined by heritage experts (Ashworth, 2011; Janssen, 2017). This research showed that the weighting of a designation's consideration can differ at the masterplan scale compared to the individual building level. This can have both positive effects – in that some buildings are retained which would otherwise be demolished – or negative effects – in that some buildings will be demolished which would individually have been retained. One example of the latter is offered by the CB1 case study, which showed that even the protection offered by a national heritage designation can be overruled by masterplan considerations, such as the need for transportation systems justifying demolition to enable an alternative 'public benefit'. Conservation area designations were also perceived as having a strong weighting for protection at an individual building level and professional interviewees felt that it is unlikely a building will be demolished especially if it is locally or nationally listed in a conservation area. However, on the CB1 case study, the only site to include a conservation area, a number of existing buildings including some which were locally listed were demolished and negotiations over the enforcement of policy were considered the norm. Conversely, examples of the potential positive effects of masterplan development on heritage designations were also found in the case studies. Professional interviewees felt that local listings are weak and at an individual building level it is not that difficult for a developer to obtain planning permission to demolish a building with this level of designation. However, on the CB1 masterplan site, the locally listed 125 Hills Road was retained despite the developer's initial aspirations to demolish, and on Central Park, negotiations between the local authorities led to several buildings being kept. If a masterplan contains multiple locally listed buildings, it is unlikely planning permission will be granted to demolish all of them and instead 'trade-offs' as to which ones are kept take place.

Heritage can also be considered in a broader sense beyond its inclusion in policy and there are examples of buildings which are retained due to values related to heritage despite not being designated. In these instances, their retention is thought to add character to a masterplan and a point of differentiation. This helps to benchmark the development against others. Consequently, this place-making is thought to add economic value to the area. On this point, heritage-led regeneration is once again applicable to consider as it addresses the tension between economic growth and conservation, highlighting opportunities for growth may still be taken whilst also enhancing the historic environment (BPF et al. 2017). Non-designated buildings were retained on Strijp-R for exactly these reasons.

In notable contrast to heritage, embodied impacts were never provided as the primary reason for either adaptation or demolition at the individual building or masterplan scale, despite they too being identified through the literature as an argument for retention. The reason for the difference is possibly due to the long inclusion of heritage considerations within policy in comparison to embodied impacts. In the UK, Netherlands and Australia, international treaties that concern culture and heritage have been signed showing a commitment by each country's government to adhere to the principles that are set out within it (Historic England, 2019b). The current legislations for national heritage designations in each country were established in the 1980s/90s (additional detail was provided in Appendix 10).

In the context of whole life energy and carbon, the regulatory focus has been on operational energy and carbon and only over the last few years has the importance of embodied impacts started to become a focus in the academic literature. In practice, the focus of conversations about energy consumption was on operational impacts and the energy efficiency, especially when talking about sustainability assessments and new buildings at the individual building level. Energy implications beyond the individual building level were rarely considered except in the Central Park case study, where the site-wide district energy system was discussed by all interviewees and was thought to make sense economically but also help with the marketing of the site. Similar to heritage considerations, as operational energy has been considered for some time in policy, the necessity of considering it is better understood than embodied. In all three case study countries, there has been an awareness of the operational energy consumption of individual buildings since the 1970s oil crisis with a growing interest in energy efficiency in the 1980s (additional detail was provided Appendix 11). A key piece of legislation affecting the UK and the Netherlands was the European Energy Performance Directive (EPBD) of 2002 (Moncaster et al. 2018), whilst in Australia, minimum operational energy standards were introduced in 2003 (Berry and Marker, 2015). As of 2019, the Netherlands is currently the only case study country that has an environmental cap which includes embodied impacts within their building regulations (Pasaman et al. 2018). However, there are now indications that embodied impacts are starting to gain traction in policy in the other countries. For example, the London Mayor's draft London Plan requires life-cycle assessments (LCAs) to be completed for development proposals referred to the Mayor (Kahn, 2018).

In the academic literature, there is a lack of consensus in LCA studies comparing adaptation and demolition options at the individual building level (several of these were shown in table 3-2). It was argued that although some of these discrepancies will be caused by variations in property types and design choices, they are significantly impacted by different methodological choices (Birgisdottir et al., 2017; Rasmussen et al., 2018; Schmidt, 2018). These choices include: modelling approaches and data sources, temporal and physical system boundaries and operational energy predictions. Despite this inconsistency presented in the literature review, embodied energy experts from the focus groups felt that if an existing building reaches the same energy efficiency standards as new build, then this will almost always favour retention from a whole life energy and carbon perspective as fewer materials are used and therefore there are lower embodied impacts. Often people that use poor energy efficiency as a reason to demolish an existing building do not consider embodied emissions. Additionally, an important point to note is that as new technology improves energy efficiency standards and the electricity grid is decarbonised through a move towards renewable energy sources, studies have shown the proportion of embodied emissions over a building's life-cycle will increase relative to operational emissions. As the main difference between retention and new build will then be caused by the embodied impacts, retention options are more likely to be favoured from an environmental perspective.

A critique of existing LCA studies focusing on adaptation and demolition by the author showed that the majority of investigations for individual buildings assume a like-for-like replacement at either the individual building or masterplan scales. The professional interviews and case studies have made it evident that this is not a realistic assumption. If the existing building is replaced by a larger building, the total amount of emissions will increase which will be hidden by only reporting the relative emissions per square metre, as was the case for the majority of studies assessed in Chapter 3.

In summary, currently from the two benefits of adaptation regularly referred to in the academic literature focusing on adaptation and demolition, heritage is considered in practice at an individual building level and sometimes masterplan level but savings in materials and therefore embodied impacts are rarely (if at all) considered at either scale. The impact of heritage and operational energy standards being included in policy is evident. Due to this, it is likely that embodied impacts will be considered more in the future, initially at an individual building level, as they become part of policy. This will happen at different times in each country as the Netherlands is already considered to be a frontrunner.

9.3 Underlying reasons governing decisions on masterplan sites

This section addresses the third research question: "*Are there underlying reasons governing the consideration of different factors, including heritage and whole life energy and carbon, when deciding to adapt or demolish existing buildings on masterplan sites?*". The use of case study investigations were fundamental in answering this question due to variations in context which helped to uncover factors governing decisions about adaptation and demolition within the context of a masterplan (Chapter 7). Topics discussed included Local Authority (LA) aspirations and involvement, the importance of long-term flexibility, public opposition to demolition, and liability, opportunity and the role of individuals.

The case studies demonstrated that the level of involvement and influence of a LA over adaptation and demolition decisions is varied. In all three case studies, the developments were privately led and planning permission for the masterplan needed to be sought from the relevant public authorities (discussed in detail in Appendix 9). In England and the Netherlands, due to both being unitary states, planning policy is designed to be implemented by the local government and communities in adherence to national planning policy. In

Australia, there is a federal system, meaning the planning system is not co-ordinated by the national government and the constitutional authority is with the states (Ruming and Gurran, 2014). In New South Wales (NSW), the state in which Central Park is located, there are several pathways for planning approval which depends on the size and scale of the development, including local, regional and State significant developments (NSW Government, 2019a).

One issue that governs the level of influence of the LA is the importance of a site's development to/within a city. This importance is often determined by the scale and size of the urban development including the proposed densities which is influenced by economic conditions and market demands (section 9.1). The CB1 and Central Park case study sites are both located next to major transport hubs and considered as significant developments in their respective cities. CB1 had been identified as an area for redevelopment for some time in local planning policy, whilst the importance of Central Park was evident by the area being granted State Significance by the NSW Planning Minister, under Part 3A of the Environmental and Assessment Act 1979, and the City of Sydney being a consultee rather and the consent authority.

Parameters for redevelopment were set early on by Cambridge City Council through the Local Plan, and by the City of Sydney in a brief for a design competition. As these parameters are rarely commercially tested, interviewees suggested that it is not uncommon for the proposed masterplan design from the developers to differ from what was initially set out by the LAs. Negotiations, which are influenced by the relationship between the developers and planners, are considered the norm. This was the case on both Central Park and CB1. However, due to the City of Sydney being a consultee rather than a decision-maker, the approval was the responsibility of the State, thus the LA's influence was less than if the decision had remained at the local level, demonstrated by the City's objections to the original scheme which included the demolition of some of the existing buildings. In contrast to the other two case studies, on Strijp-R, members of the design team felt that they were at the 'steering wheel' and had quite a lot of leeway for the proposed design. In this case, the local authority had much less involvement as the site was much less high profile and located on the outskirts of the city.

Planning policy requirements were identified within the adaptation literature as a consideration for individual buildings (Wilkinson, 2011). However, complexities associated with the negotiations of local plans, showing that they are not 'set in stone', and the various hierarchies with the planning systems influencing these decisions were uncovered by the case studies. This was probably due to the physical scale of the sites which exacerbates these issues and increases the significance of the development to a city and relevant public authorities.

To ensure that LAs do have an influence over adaptation and demolition decisions within a masterplan development, this thesis argued that parameters need to be set early on, ideally before the preparation of the developer's initial brief to their design team. This was evident on Central Park where heritage considerations became more stringent after the initial competition brief due to additional investigations, including the development of the Conservation Management Plan (CMP). Few of the buildings which were later identified as significant within the CMP (but not in the initial competition brief) were retained. As the more stringent conditions were not 'the game' when the design process started, some interviewees felt that they were more easily negotiated. Decisions to adapt or demolish an existing building are therefore made at the early masterplan planning application stage. The fact that the decision had already been made at this stage was a pivotal argument in the demolition of Wilton Terrace in the CB1 case study, despite significant community opposition later in the process.

However, even if early decisions have been made and priorities set, changing circumstances can later change these. A change in circumstances following an initial planning approval is more likely on a masterplan site compared to the individual building level due to the longer timespan of the developments. This is why flexibility in the design of the masterplan, which allows adjustments to be made from the initial planning application, was considered favourably by developers and their design teams. A change in circumstances which led to the demolition of a building marked for retention on the CB1 site, was a fire in the silo, which led to significant structural damage. In the two other case studies, changing circumstances led to the retention of additional buildings. On Strijp-R, this was a change in the people involved. Piet Hein Eek entered the process during the formulation of the masterplan and had aspirations to retain buildings, such as the RAG building, which was subject to demolition before his involvement. On Central Park the developers were able to purchase additional buildings beyond the curtilage of the original masterplan application, some of which were then retained. At the individual building level, adaptation decisions have been described as "*diverse and dynamic*" (Bullen, 2012, p.35). This is exacerbated at the masterplan level as decisions need to be made and details finalised for each individual building within it. Furthermore, the long time span of masterplan developments increases the unpredictable nature of events and vulnerability to changing circumstances. Thus, supporting the critique of the decision-making process frameworks, such as the RIBA's (2013) Plan of Work, provided in Chapter 1. Presenting the process as a series of linear stages is an oversimplification and not realistic.

The complexity of large masterplan developments can make it more difficult for lay stakeholders to influence adaptation and demolition decisions, yet public participation is considered to be key to overcome negative social impacts of urban regeneration (Bell et al., 2014; Crawford et al., 2014; London Assembly, 2015). At the individual building level, professional interviewees felt that community opposition could prevent the demolition of an existing building especially if the community acted as a collective and based their arguments on planning policy. Unfortunately, from the perspective of some community members on the CB1 site, the demolition of Wilton Terrace was not objected to, and consequently overlooked at the masterplan application stage as the focus of objections had been on other masterplan considerations including traffic congestion and increased densities. The community opposition came later on when the 'magnifying glass' was on the redevelopment of that one plot of land within the much larger masterplan. Interviewees felt that if the same level of opposition to Wilton Terrace's demolition, which included a petition with over 1300 signatures, happened when the masterplan application was submitted, planning permission might not have been granted for its demolition.

Finally, individuals within the design process are able to significantly influence adaptation and demolition decisions. Although this is applicable at the individual building level, it was uncovered by the case study interviews as the risk involved with individual adaptation projects/buildings was transferred to these individuals within the context of the masterplan developments. The roles of both Piet Hein Eek on Strijp-R and Dr Stanley Quek on Central Park were considered to be fundamental towards decisions to retain existing buildings. They were willing to purchase the buildings and undertake the design work. Without their involvement, it is highly unlikely that as many buildings would have been retained. Their aspirations were based on their own personal and professional experiences, which will obviously differ from person to person and are difficult to predict, yet they can have a significant influence on adaptation and demolition outcomes.

This thesis has shown that people including those from local planning authorities, local communities and individuals can all have a significant influence on adaptation and demolition decisions at the masterplan level, but this influence is contingent on other circumstances including economic conditions, policies and planning institutional structures, which in turn affects the decision-making process. Decisions are also time-dependent and the length of time of a masterplan often means that these considerations are not fixed.

9.4 Applying the theoretical underpinnings of urban development

This section uses the theoretical underpinnings of urban development processes to explain why factors governing decisions vary on masterplan developments and therefore addresses the fourth research question: "*What theoretical framing can be used to explain these findings and develop previous adaptation and demolition theory?*".

Figure 8-1 (in Chapter 8) provided an overview of decision-making factors and their level of consideration and/or influence over adaptation and demolition decisions at the masterplan scale. In this chapter, sections 9.1 and 9.2 summarised the factors which are considered (discussed in detail in Chapters 5 and 6), whilst section 9.3 highlighted what other issues govern these decisions (discussed in detail in Chapter 7). The overarching themes for factors, which are considered to various degrees, in the decision making process are economic viability, legal issues, buildings' physical attributes, masterplan design principles, environmental aspects and heritage. Influencing factors include people and processes, whilst economic conditions and the planning structure, in particular planning policies, are both considered and govern decisions.

Chapter 8 argued that the factors governing decisions can be explained using the four theoretical underpinnings to urban development: equilibrium, structural, event-sequence and agency models (Drane, 2013; Healey, 1991; Squires and Heurkens, 2016). The rationale for selecting this theory was due to its relevance to the larger scale of the masterplan and urban regeneration: "*more than refurbishing or renovating buildings…urban regeneration is seen as part of a broader planning process…[and] masterplans have been the main vehicle for addressing urban regeneration policies*" (Fonseca and Ramos, 2019, p.240). As previous adaptation studies, such as Wilkinson (2011) and Bullen (2012) focus on adaptation decisions at the individual building level, it was argued that the application of the theoretical underpinnings of urban development can help develop current adaptation theory by considering these complexities which are exacerbated by the chronological and physical scale of a masterplan.

Equilibrium models focus on supply and demand and were considered relevant due to aspirations to increase density within masterplan developments. On CB1 and Central Park, the demolition of smaller buildings to be replaced by larger ones was due to the sites' significance to both cities' development and the aspirations for a density uplift. In Strijp-R's case, the larger buildings were demolished to meet the demand for smaller family housing. The density, which is a consideration of the masterplan's design, is therefore determined by the economic conditions and housing demands in an area.

Structural models focus on institutions including the type of policy instruments which can be used to frame development activities (Squires and Heurkens, 2016). Planning theory suggests that a planning authority can either regulate how a development occurs or shape it and that urban development practices have transitioned from being a physically deterministic activity whereby LAs set out fixed blueprint plans to a regulating approach, which is considered to be more collaborative and the authorities are a facilitator (Adam et al., 2012, Taylor, 1998; Verhage, 2003). This understanding explained why parameters, such as local listings, set out by LAs were not 'set in stone' and were subject to negotiation. The structure and hierarchy within planning institutions is also applicable here. On both CB1 and Central Park, planning approval decisions were removed from the local planning tier to either the national or regional level, demonstrating that there is a hierarchy of decision-makers in the planning system. Carmona (2014) places hierarchical relationships and the ability of the developers to persuade the planners and vice versa at the heart of the urban development process, hence the strong influence both the planning structure as well as people have over adaptation decisions on masterplan sites (as depicted in figure 8-1).

Structural models also consider institutional habits. Examples were provided where non-designated assets were retained, whilst some interviewees felt demolishing all existing buildings on a masterplan site is an 'old-fashioned' way of thinking, reflecting a change in development customs. In the context of real estate development, Daamen (2010) describes how going against social norms can lead to a loss of reputation and social disapproval. This explains why there are now examples of heritage being retained without policy requirements, as this can help with the marketing and branding of the site and act as a promotional instrument (Carmona, 2017).

Event-sequence models apply to processes including developing and implementing a masterplan. All three case study sites went through different processes which were determined by the economic conditions in the area and the planning structure. Daamen (2010, p.6) argues that due to the long timespan of urban development projects they need to be thought about as a process rather than just a project or final outcome. He coins this as "*projects-as-process type thinking*". This explains why the case studies have shown that adaptation and demolition decisions on masterplan sites are time-dependent. Although parameters need to be set by planners early on in the process, the length of time that the implementation of a masterplan takes means there will often be changes in circumstances which allow decisions to be changed. Furthermore, the phasing of a development and the point in time when existing buildings are adapted can influence community perceptions, particularly if existing buildings are adapted early on and used to provide community facilities, as was seen through the provision of a restaurant on Strijp-R and temporary artist studios on Central Park.

Agency models concentrate on the people involved in decisions. This theoretical standpoint is relevant as people within local planning authorities, local communities and individuals can all influence decisions to varying degrees. Theorists recognise actors are likely to have different aspirations for urban developments (Doak and Karadimitriou, 2008; Verhage, 2003), which explains why contradictory opinions were expressed about heritage, design quality and the definition of public benefits across the interviews. Furthermore, Adam et al (2010) emphasise the importance of understanding developers and their objectives. Within the context of brownfield sites, some developers are seen as 'pioneers' as they are willing to develop alternative and innovative design solutions (Adam and Tiesdall, 2010; Payne, 2009). This explains why attitudes towards retention varied across the case study sites and why it is important to understand the roles of individual people, such as, Piet Hein Eek on Strijp-R, and Dr Stanley Quek on Central Park. As people will inevitably have different personal and professional life-experiences, these will affect their aspirations for development and the final decisions that are made.

Contemporary composite models for urban development consider all four of these underpinnings, and the relevance of all four models to adaptation and demolition decisions on masterplan sites has been demonstrated in this thesis. Figure 8-3 displayed the key research findings about adaptation and demolition decisions on masterplan sites that are applicable to each of the four theoretical underpinnings, as well as highlighting the connections between each one. The complexity of this demonstrated that each individual model does not explain decisions adequately on its own as certain aspects are left out. For instance, equilibrium models do not consider the long timespan of developments which makes the economic viability of the project vulnerable to changing market conditions. Additionally, cultural and social values, such as the value associated with heritage retention, are not considered from the equilibrium perspective. The enforcement of policy instruments, including local listings, is dependent on the people involved and their professional experience. The processes are determined by the institutional structure and in turn the degree of LA involvement is governed by the significance of the site and market demands in the area.

Evidently, viewing adaptation and demolition on masterplan sites through a single theoretical lens for urban development is not sufficient for explaining decisions. It is clear from the analysis that decisions are complicated and both objective and subjective factors are considered. The reasons different factors govern decisions is due to different people, processes, economic conditions and planning structures. These factors are encompassed within composite models where all four theoretical underpinnings of urban development are considered. This complexity is not reflected in previous studies focusing on the adaptation and demolition of individual buildings as the multifaceted nature of adaptation and demolition decision-making is exacerbated by the scale of the masterplan in both physical and chronological scale.

9.5 Contribution to knowledge

This thesis has extended current adaptation theory by considering the practical realties of adaptation and demolition decisions at the masterplan scale. As existing adaptation theory mainly focuses on individual buildings or the urban scale where the centre of attention is only on energy modelling, it is not sufficient for explaining decisions on large brownfield sites being redeveloped through the implementation of a masterplan. The thesis therefore has generated new knowledge on adaptation decisions specific to the masterplan scale and former industrial sites.

Considerations for the adaptation and demolition of individual buildings identified in the literature review were found to be applicable at the masterplan scale. However, this research has demonstrated that some factors, such as economic viability are interpreted differently and there are additional issues, such as the relative scale of buildings and making space for vehicles and pedestrians, which need to be taken into account when making these decisions in the context of a large urban development. These often dominate the decision-making process and are physical constraints which are set out in the masterplan's design (section 9.1).

Two benefits of retention regularly referred to in the previous literature are retaining heritage and savings in embodied carbon (section 9.2). By extending the literature review to include the theoretical underpinnings of heritage and embodied impacts, which are not explored in the same level of depth in previous adaptation studies, the thesis was able to explain why these factors were, or were not, considerations in practice at both the individual and masterplan scales. In the case studies, heritage was found to be a fundamental reason for retention. It was considered at the individual building level and in some instances was thought out at a larger physical scale, notably as part of place-making within a masterplan. Embodied impacts however are not yet readily considered in adaptation decisions at either the individual building or masterplan scales. The thesis therefore has identified a contradiction between theory and practical realities.

This PhD research has also contributed to industrial heritage and whole life energy and carbon theories. The case studies have shown that historical values on previous industrial sites are less about age and more about the processes that occurred and therefore the "*knowledge base behind those sites*" (ref.P1.2). Additionally, social values such as the sense of identity are more subjective and were found to vary depending on the industrial company's influence over a city and how recently the site closed down.

Industrial processes often go beyond the individual building level and heritage values can be considered as a group or ensemble, reflecting the conservation and 'heritage planning 'discourses (Ashworth, 2011). However, this research has demonstrated that different approaches to heritage consideration are taken depending on the context. In some situations, the push for retention is from policy and buildings being designated, as was seen on the CB1 development. In other cases, such as Strijp-R, buildings might be retained without the push from policy, notably as part of place-making within the masterplan. This is dependent on the people involved and economic conditions.

In the context of whole life energy and carbon, this research has shown that despite international attempts of academics to standardise LCAs, there is still concern behind the consideration of embodied impacts and its inclusion in policy due to methodological issues including data uncertainty. One issues with existing LCA studies identified by the author is that they assume a like-for-like replacement, the case study realities have shown this is unrealistic.

Another contribution of this thesis to building adaptation theory is that it has not only highlighted what is considered in adaptation and demolition decisions, it has helped to uncover factors that govern and influence the extent of which these decision-making criteria are taken into account (section 9.3). By conducting case studies in different contexts, it is apparent that different people, planning structures, economic conditions and processes are all influential. The complexity of these issues, including negotiations over planning policies, hierarchies within the planning system, the ability to transfer risk to individuals willing to take it, are not explained by literature focusing on the individual building level as their influence is exacerbated by the increase in scale, both physically and chronologically, provided by the masterplan. This is why the theoretical underpinnings of urban development are applicable to explaining these issues as this is a theory focusing on the larger scale of development practices rather than individual buildings (section 9.4). Explaining decisions through the multiples lenses provided by composite urban development models allowed current adaptation theory to be expanded upon.

To the author's knowledge, this is the first time that heritage, whole life energy and carbon and the theoretical underpinnings of urban development have been combined to obtain an in-depth understanding of adaptation and demolition decisions on masterplan sites, with a particular focus on industrial areas. This has uncovered that there is an added layer of complexity that needs to be applied if reviewing adaptation and demolition decisions within the context of large urban developments.

9.6 Practical contribution

Recommendations have been established based on the findings provided by this research, therefore providing a practical contribution for the work. If adopted, these recommendations should help to ensure that policy-makers, planning officers and communities have more of an influence over adaptation/demolition decisions, whilst developers can benefit by adding economic value to the masterplan due to the increased desirability of heritage retention and reducing whole life energy and carbon.

9.6.1 Policy-makers

Three different types of policy have been discussed in this thesis and there are recommendations based on the research findings applicable to all three: local plans setting out the parameters for development, heritage, and whole life energy and carbon policy. These are outlined below. Beforehand however, it is important to note that although similar recommendations about policy are put forward and these are applicable to each case study country, policy-makers need to recognise that policy from one country cannot just be transferred to another, instead lessons should be learnt and inspiration gained (Spaans and Louw, 2009).

Local plans are often established by strategic planning teams and planning officers make decisions for approval based on whether or not planning proposals are in accordance with this. This research has shown that clear parameters for development, including building designations, should be set by LAs early on in the development of a masterplan if they want to influence adaptation and demolition decisions. This is due to decisions about adaptation and demolition being made at the masterplan application stage and negotiations between developers and LAs occurring before the application is submitted. Parameters act as a starting point for the conversations and help safeguard at least some of the buildings. LAs should set these parameters at the earliest possible opportunity as it is difficult to make these more stringent at a later date, as was evident in the Central Park case study. Setting parameters early on is also applicable to conservation area designations. As masterplan developments will inevitably change the character of an area, conservation area designations should include clear principles for what the LA aspire the character to be, a lesson learnt from the CB1 case study.

Heritage policy should not be seen as a barrier to growth but instead reflect the principles of both heritage-led regeneration and the heritage planning discourse and be seen as an opportunity. This is why heritage organisations and policy-makers should demonstrate that retention can be beneficial to developers, as this might encourage the retention of existing buildings without the push from policy, as policy's enforcement is sometimes inconsistent across LAs due to the availability of financial resources and variations in experience of the people making decisions. This research has demonstrated that there are examples where heritage retention is considered as an opportunity to add economic value to a development through place-making within the masterplan. The provision and publication of examples of economically successful developments which have retained buildings may help to overcome the perception that heritage is a barrier to development. One example of this is the 'Constructive Conservation' publication by Historic England (2019d) which focuses on "*actively managing change*". These precedents can act as a benchmark for other masterplan developments and consequently encourage other developers to consider the benefits of heritage retention and value added through place-making.

In the context of whole life energy and carbon, in order to ensure that embodied impacts are considered, they need to continue gaining traction in policy. Ideally policy needs to change within the higher tiers of the planning system or building regulations. In the UK and Netherlands, this responsibility is likely to be with national bodies due to the unitary planning system, whereas in Australia, it is likely to be the States, due to the federal system. Change has already been seen in the Netherlands, and other countries can learn from their experiences. Similarly at a regional level, in the UK, the Draft London Plan (Kahn, 2018) has set a precedent for whole life energy and carbon being considered for development decisions, and other local authorities should follow suit.

In order for whole life energy and carbon policy to be effectively implemented, policy-makers need to continue engaging with academics specialising in LCAs and international efforts to standardise the methodology. As suggested by the focus group experts (Chapter 6), additional case studies are required focusing solely on the whole life energy and carbon impact of adaptation and demolition decisions. The current lack of consensus between academic studies due to variations in design choices and methodologies (Chapter 3) is a current barrier to widespread policy implementation. Additional data which is collected using standardised approaches should help to overcome this.

9.6.2 Planning officers

Planning officers within LAs should encourage community members to express their viewpoints towards adaptation and demolition decisions at the masterplan planning application stage and that their opposition should be based on planning policy in order to have an influence. The author recognises that this suggestion for early engagement might be frustrating for LA's due to limited resources, and for a community due to the complexity of issues that are considered at this early stage. Therefore, to help with this engagement, it is suggested that charities such a Planning Aid England (RTPI, 2019), which assist with community consultation, should help LAs to ensure the community understand all aspects of the masterplan application and what is or is not a reasonable justification for the demolition of existing buildings. The findings of this thesis can assist with what arguments might be used. One argument particularly relevant to the masterplan scale, is the notion of public benefit. If alterative public benefits specific to the masterplan scale can be proved, such as transportation requirements, it can change the weight of designations in the planning process, as was seen in the CB1 case study.

Officers also need to be aware that masterplan developments take place over a long period of time and are subject to changing circumstances. Although the use of frameworks showing the decision-making process for developments, such as RIBA's (2013) Plan of Work, are useful as a general guide, it is unrealistic to expect the development to occur as a linear set of stages (Chapter 1). The iterative nature of decisions could be better reflected in these frameworks.

9.6.3 Developers and their design teams

There are several recommendations that are applicable to developers and their design teams due to their fundamental role as decision-makers in the process. Firstly, developers should be aware that negative press coverage caused by public opposition to demolition has the potential to have a detrimental impact on the marketing and branding of a development and should therefore be avoided, especially if they have long-term interests in the site. One way in which opposition can be reduced is through public participation and demonstrating that community opinions are being listened to, as well as retaining some buildings early on in the development process to provide community facilities. Both the Strijp-R and Central Park case studies showed that this early adaptation is considered favourably by community members as it creates activity on site.

Secondly, developers and their design teams should ensure that at least some of the replacement new buildings reflect the heritage of an area. This is beneficial to them as it offers a point of differentiation from other developments and acts as a 'promotional instrument'. This does not necessarily mean pastiche designs but design strategies such as the relief in the brick work on Strijp-R's residential dwellings, reflecting the name of the existing building that was demolished in that location (section 6.1.3.3). Even if small, these gestures indicate an acknowledgement of the area's heritage and are often appreciated by the community, heritage organisations and LAs.

Thirdly, the size of the masterplan also gives developers the opportunity to consider heritage beyond the individual buildings and if possible this should be utilised. This can be achieved through the grouping of buildings or the use of holistic design strategies to tell the narrative of the area's past. For example, the grouping of buildings on Kensington Street, Central Park, were regularly referred to as a successful design strategy which added character to the development. As with references to the past through new buildings, the understanding of heritage beyond the individual building level is considered favourable by the community and other stakeholders.

Lastly, developers should be aware that embodied impacts are starting to gain weight in policy. This will require them to undertake additional assessments when submitting a masterplan planning application. If/once thresholds are introduced and increased, these requirements will intensify and developers will need to show how LCAs have informed decisions.

9.7 Limitations

All research will inevitably have limitations due to methodological choices and practical constraints. This section outlines limitations to this research and if applicable, how they were overcome.

An arguable weakness is that the collection and analysis of qualitative data is prone to subjectivity (Creswell and Creswell, 2018). One area in which this is applicable is the interpretation of interview transcripts and assignment of codes through analytic induction. As the codes were determined by the author, the choice of coding is reliant on her judgement; another researcher might have assigned codes differently. Additionally, the semi-structured nature of the interviews meant that the author was responsible for the direction of conversation. This has the potential to influence the discussion. Although the analysis chapters were based on the dominant themes that emerged from the transcripts (Figures 5-1, 5-2, 5-3, 5-4, 6-1, 6-2, 6-19, 7-1, 7-2 and 7-3), the author recognised that the number of times a code occurred was not necessarily statistically significant. Despite this limitation, this method was considered the most appropriate as the study was exploring an under-researched topic (Saunders, 2015) and there was only one researcher.

The scope of the study was limited by practical constraints. This is applicable to both the choice of case studies and how they were conducted. Firstly, a drawback of all three case studies is that the original adaptation and demolition decisions for the masterplans occurred over a decade ago. This can affect the quality of recollections which was evident in some of the interviews when phrases such as "*that's testing my memory*" (ref.CS.CP-5) were used. Secondly, for each case study, it was not possible to interview everyone who took part in the decisions. This was due to refusals to be interviewed or unsuccessful attempts to make contact. To overcome both of these constraints, references to publicly available planning documents and archived media articles helped to validate what was said or express the viewpoints of those not interviewed.

One limitation with conducting a case study in the Netherlands, from the author's perspective as she is not fluent in Dutch, was that the documents tended to be in Dutch and all those that were interviewed had to be fluent in English. Due to limited financial resources, it was not possible to employ a professional translator and online translation services had to be used to understand the documents. To ensure that these had been interpreted correctly, the author validated any direct quotations with a fluent Dutch speaker.

The choice of case studies is also limited by the number that could be undertaken. This research has demonstrated that adaptation and demolition decisions are context specific. As noted by Dainty (2009) interviews and case studies only reflect the context in which they took place. Firstly, all of the case study investigations were located in developed nations. It is likely that decisions in developing nations, which might have different planning structures, would be different from those in developed countries (Squires and Heurkens, 2014). Secondly, although all the case studies were private developer-led, none were volume house builders, who are the type of developer commonly critiqued for building monotonous new build housing (CABE, 2003). Thirdly, only Strijp-R had no heritage designations. Despite the benefits of retention being recognised by the developers on the other case study sites, it is difficult to know if buildings would have been kept without the designations. Furthermore, Figure 8-1 weighted the level of consideration and influence of factors in the decision-making process, these interpretations were based on the case study findings and are therefore context specific. It is possible these would vary and additional issues would be uncovered through further explorations. Conducting case studies in even more contexts would have been advantageous to the study, however this was not possible to achieve by one researcher in the given timeframe.

The theoretical underpinnings of urban development were applied to explain the findings from the analysis. Due to the breadth of the research topic, it would have also been possible to use other theories. As discussed by Flyvbjerg (2001), this is important to acknowledge as readers should not be given the impression that truth only lies at the end of one theoretical path. It was beyond the scope of this study to analyse all theories that could have been applicable and urban development theory was considered to be the most relevant by the author due to its holistic focus which is suitable for both the large physical and temporal scales of masterplan developments.

Notwithstanding these limitations, the overarching aim set out at the beginning of this thesis has been met, as the conclusions drawn have contributed to knowledge by developing an understanding of what is considered during decisions to adapt or demolish existing buildings on masterplan sites, and why this is so.

9.8 Future work

The exploratory and inductive nature of this research means that it is difficult to reach an end-point and that there will always be potential for future work. This section outlines some suggestions based on the research findings and limitations outlined.

A natural progression of this research would be to undertake additional case studies using both different methods and contexts. Firstly, the author previously noted that the investigations took place some time ago. Due to this limitation, the research could be usefully extended by examining a masterplan site where the adaptation and demolition decisions are in the process of being made and the researcher acts as an observer. To enable this type of study, the researcher would need to identify a developer willing to grant access to meetings and the required information. Secondly, additional case studies could be conducted in different contexts to develop understanding further. As discussed in the previous section, this could include masterplans in developing nations, masterplans being developed by different types of developers, and case studies with different proportions of designated and non-designated buildings that have been retained or demolished.

In the recommendations section, the author stated that heritage organisations should publicise precedents of economically successful developments where existing buildings have been retained. This would benefit from additional research that provides quantitative evidence to support the qualitative judgements that retention adds economic value to a masterplan.

Lastly, it may also be useful to develop a decision-making toolkit or framework for adaptation and demolition on masterplan sites. As discussed in Chapter 1, existing toolkits assessing adaptation and demolition decisions tend to focus on the individual building level. This research has demonstrated that the decision-making criteria included in these toolkits and theories of adaptation at the individual building level are interpreted differently at the masterplan level, as well as there being additional considerations specific to the large scale of the masterplan. The complexities of masterplan decisions in comparison to the individual building level means that these existing toolkits cannot be easily transferred for use on masterplan developments. Now that this research has explored what factors are considered at the masterplan scale, the findings could be used as a foundation for developing a new toolkit or framework specific to the adaptation and demolition of existing buildings on large urban developments.

Appendices

Appendix 1: Table of adaptation advantages and barriers

Using the abstracts, introductions and a search for the words: 'benefit', 'advantage', 'disadvantage' and 'barrier', the author documented and categorised the advantages and disadvantages of adaptation expressed within forty academic papers focused on building adaptation and/or demolition.

Table A-1 displays these papers' references, country of which the study took place, the property type (pre-adaptation) and the advantages and barriers/disadvantages referred to – this includes the author's categorisation and the exact wording used in the paper.

Benefits include: saving in embodied energy, conserving heritage, the provision of housing in often prime locations, cost savings (referred to as viability) due to shorter construction times and fewer materials, and wider economic benefits such as an increase in tourism or general regeneration.

Barriers include: regulations (including heritage restrictions) being a barrier to development, low energy efficiency standards, new build having more potential to increase density, and demolition being cheaper/being more economically viable.

The terminology used differs throughout these papers. For example, some papers refer to savings in materials, which has been documented as embodied energy, whilst others refer to historic preservation which has been documented as the conservation of heritage. Using the author's judgement and analysis these have been grouped for ease of comparison.

A count of the advantages/disadvantages is provided at the bottom of the table, indicating that conserving heritage and savings in embodied energy are the benefits most commonly referred to, followed by wider economic benefits and cost savings at an individual building level. At the same time, the potential cost savings of demolition and new build compared to adaptation is commonly referred to, indicating an inconsistency across studies as the viability is dependent on the technical complexity of the adaptation project.

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Table A-1: Advantages of and barriers to building adaptation referred to in the academic literature.

Reference	Existing property type	Country of study	Benefits of adaptation						Barriers to adaptation				
			Embodied energy savings	Heritage conservation	Housing provision	Economic viability	Wider economic benefits	Text Extracts	Building regulations	Energy Efficiency	Increase density with new build	Economic viability	Text Extracts
Alba-Rodriguez, M.D. et al. (2017)	Residential	Spain	x			x		"*It can be deduced that, even with a severely damaged building, the repair and retrofit work incurs a lower economic and environmental impact than that of the total replacement with a new construction.*" (p.115)				x	"*in those cases where the building is so damaged that rehabilitation costs reach the levels of new construction cost" (p.115)*
Ball (2002)	Industrial	UK		x				"*there is a move towards a wider appreciation and a more enlightened attitude towards the heritage value of everyday industrial buildings*" (p.93)					
					x			"*The benefits of re-use rather than refurbishment, and the negative connotations of the use of the word 'obsolete' to describe older vacant industrial floorspace, have begun to take on greater significance. This partly follows from standard market factors such as need and availability*" (p.94)					
			x					"*it is an outcome of the sustainability debate, as ideas of recycling and re-use*" (p.94)					
Been (2016)	Residential	USA		x				"*reservation advocates argue that the market-driven process of urban development will not adequately protect a city's architectural heritage, as individual owners will not internalize the full benefit to society of historic preservation*" (p.16)			x		"*Owners value the option to redevelop, particularly for older structures like these found in historic districts and especially when new construction can result in higher density*" (p.16)
							x	"*Proponents argue that historic districts not only preserve architectural history but also generate economic externalities by increasing tourism and nurturing the city's art and culture*" (p.16)	x				"*Preservation critics, conversely, argue that preservationists are just another well-organized lobby of incumbents opposing change and development*" (p.17)
Bullen (2007)	Commercial	Australia	x					"*The importance of this trend is that extending the useful life of existing buildings supports the key concepts of sustainability by lowering material, transport and energy consumption and pollution*" (p.20)				x	"*However, Holyoake and Watt (2002) argue it is often expensive and sometimes (Ball, 2002) requires substantial and costly refurbishment*" (p.21)
						x		"*One reason for the interest in adaptation is the growing perception that old buildings are often cheaper to convert to new uses than to demolish and rebuild*" (p.20)		x			"*older buildings may be unable to meet current sustainability standards*" (p.28)
				x				"*there are other benefits in the form of visual amenity and cultural heritage values which are powerful drivers of sustainability*" (p.27)			x		"*This should also assess whether increased density and plot ratios from demolition and rebuilding may in fact be more beneficial in terms of sustainability outcomes*" (p.25)
Bullen and Love (2010)	Commercial	Australia	x					"*The adoption of this process for buildings can contribute to sustainability and climate change through mitigation of CO2emissions (Bullen, 2007). This can occur through reusing the functionality of the building, components, materials and recycled materials and therefore reduce the amount of embodied energy*" (p.215)				x	"*Responding to declining performance has resulted in decisions to purely demolish and redevelop buildings based on economic grounds*" (p.215)
						x		"*in a similar vein Kohler and Yang (2007) proffer that the costs of reusing buildings are lower than the costs of demolition*." (p.215)		x			"*According to Ellison et al. (2007) refurbishing a building to meet the standards needed to make a contribution to sustainability may be 12% more expensive than a standard reuse project."* (p.215)
				x				"*Heritage buildings provide a glimpse of the past, lend character to Australian communities and, as well as serving practical purposes now, they should be conserved for future generations*" (p.215)					
Chan, A. et al. (2015)	Industrial	Hong Kong					x	"*In the 2009–2010 Policy Address, the Chief Executive of Hong Kong highlighted the importance of revitalizing old industrial buildings hoping to boost local economic growth by enabling owners to revitalize their industrial buildings as well as creating job opportunities and more usable floor spaces at competitive price for different trades*" (p.57)					
Chen, J. et al (2015)	Industrial	China		x				"*Adaptive reuse of inner city industrial heritage for cultural purposes has emerged as a way to preserve China's dramatic urban industrial heritage*" (p.3)					
							x	"*Recent studies of heritage have focused on the historical development of cultural precincts with heritage, the use of heritage in tourism and economic development, the heritage effects on global city-branding or national identities*" (p.4)					
Clark (2001)	Naval	Europe		x				In reference to demolition of defence heritage sites "*Its short-termism militates against many longstanding conservation and environmental policies and good long term planning*" (p.619)					
Conejos, S. et al. (2011)	Commercial	Australia	x					"*Building adaptive reuse is an alternative to traditional demolition and reconstruction; but entails less energy and waste*" (p.1)					
				x				"*adaptive reuse can...conserve cultural and heritage values for the benefit of future generations*" (p.8)					
Davison et al (2006)	Commercial	UK	x					"*Using data from previous studies relating to embodied energy and energy expended in office buildings, Larsson estimates a 15% reduction in (a) air emissions and (b) demolition solid waste*" (p. 3)					

Reference	Existing property type	Country of study	Benefits of adaptation: Embodied energy savings	Heritage conservation	Housing provision	Economic viability	Wider economic benefits	Text Extracts	Barriers to adaptation: Building regulations	Energy Efficiency	Increase density with new build	Economic viability	Text Extracts
Geraedts and Van der Voordt (2007)	Commercial	Netherlands										x	"Example of risk at building level: poor financial feasibility" (p.19)
Giuliani, F. et al (2018)	Industrial	Italy		x				"Italian grain silos of the early 20th century...are worthy of preservation since they witness a particular period of the economic, rural and political history of Italy, and possess technological and, sometimes, aesthetic values" (p.146)				x	"Besides, reuse is penalized by the negative attitude toward the memory of the Fascist regime and by the construction material itself (i.e. reinforced concrete) that exhibits an unfavourable aged aspect (as opposed to, for example, stone or brick masonry). Its repair typically requires innovative technologies and also high costs" (p.146)
Harun (2011)	UNESCO world heritage sites	Malaysia					x	"In that conservation of heritage buildings become a main agenda especially in tourism industry whilst in practice, it become a great demand" (p.42)					
				x				"Conservation of heritage buildings contributes the emotional ties to the people and the sensitivity towards the past" (p.42)					
Heath (2001)	Offices	Canada & UK			x			"Indeed, conversions can play an important role in the revitalisation process and help to meet the growing pressure for residential accommodation" (p.173)					
						x		"Developers are clearly alert to the viability of adaptively re-using obsolete office accommodation and—having witnessed a substantial amount of such activity during the 1990s" (p.174)					
Kee, T. (2014)	Industrial	Hong Kong			x	x		"In response to the urban shortage of affordable housing, this paper elaborates on research findings on potential solutions for alleviating the current housing crisis in Hong Kong...One obvious solution is to expedite the construction of new housing blocks; however, this takes a tremendous amount of time and resources." (p.1)					
				x				"The proposition of converting existing building blocks into mass housing establishes a dialogue between an old context and a new function, and is potentially a feasible architectural expression of new sustainable planning" (p.1)					
Kim et al (2010)	Registered heritage buildings	Republic of Korea		x			x	"In Korea, 14 cultural heritages, which have historical significance, symbolism, and economic benefits, were investigated to illustrate the efficiency of the proposed model" (p.434)					
Kutut et al. (2014)	Historic city buildings	Lithuania		x			x	"Today, historical significance, symbolism and economic benefits have turned restoration and preservation of cultural heritage in old towns into an important task" (p.287)					
Laefer, D. and Manke, J. (2008)	Commercial	Ireland		x				"in cases where reuse is in part motivated by other factors such as heritage protection, substantial economic and environmental savings can be realized in tandem" (p.217)				x	"As each building project has its own specific requirements, reuse is not always the most economical solution" (p.217)
			x					"Building reuse as an alternative to demolition offers reduced debris generation, maximized material reuse, and minimized resource consumption" (p.217)					
						x		"The main benefits of building reuse include sustainability, direct and indirect monetary savings, an accelerated construction schedule, and decreased liability exposure" (p.218)					
Langston and Smith (2012)	Commercial	Australia	x					"Adaptive management (AM) is a powerful approach to reducing ecological uncertainty and improving the overall performance of many resource-based systems" (p.406)					
				x				"The sub-criterion 'collective utility' is defined as reflecting the net benefits accruing from the property across all stakeholders. In icon-CUR, this is expressed in terms of three key attributes (economic performance, culture and heritage, and environmental value" (p.408)					
LianPing R. et al. (2014)	Industrial	Hong Kong	x			x		"Proponents of adaptive reuse argue it can extend the useful life of buildings, maybe more cost effective than demolition and rebuilding, and has the added benefits of reducing material, transport and energy costs associated with new builds" (p.33)				x	"Owners often resist adaptive reuse for they fear the return on investment will be lower than building new" (p.33)
				x			x	"Its benefits also extend well beyond the building's footprint to help revitalize existing neighbourhoods, reduce land consumption and urban sprawl, create a valuable community resource and, importantly, retain the character of existing neighbourhoods to enhance place attachment and lead to the aesthetic continuity of urban landscape" (p.33)		x			"Moreover, revitalized buildings may be less energy efficient than new buildings and require more ongoing maintenance (Bullen and Love, 2010), increasing operating costs, which have to be translated into higher rents" (p.33)
Lin and Low (2012)	Residential	Singapore	x					"Likewise, Wilkinson et al. (2009) observed that building adaptation is more sustainable compared to new building works, as the former normally requires less natural resources and generates less air pollution and waste" (p. 1)	x				"A number of regulatory challenges must also be addressed, especially if the building has been heritage listed" (p.33)
Mısırlısoy, D. and Günçe, K. (2016)	Public e.g. museums	Austria, Cyprus, France Hungary, Italy, UK	x	x				"Adaptive reuse is an alternative to demolition and replacement of buildings since it requires less energy and waste. It also provides social benefits by revitalizing familiar landmarks and giving them a new life" (p.92)	x				"Adaptive reuse poses quite difficult challenges for designers. Changing the function of building introduces new regulatory conditions" (p.91)

Reference	Existing property type	Country of study	Benefits of adaptation						Barriers to adaptation				
			Embodied energy savings	Heritage conservation	Housing provision	Economic viability	Wider economic benefits	Text Extracts	Building regulations	Energy Efficiency	Increase density with new build	Economic viability	Text Extracts
Olsson, S. et al. (2016)	Residential	Sweden	x					"Thus, with an increasing significance of impacts associated with material production, the need for a life cycle perspective in renovation processes also becomes more apparent" (p.20)		x		x	"In addition to the fear of high investment costs and problems with profitability, key barriers identified in these studies include a lack of knowledge about sustainability issues, insufficient knowledge of building stocks, a lack of simplified evaluation tools (for decision making), and a lack of coordination between energy-saving and other measures" (p.20)
									x				"cultural heritage values make some building envelope measures impossible" (p.30)
Petković-Grozdanović a, N. et al. (2016)	Industrial	Austria, Italy, UK			x			"Conversion of these buildings through the adaptive reuse into residential ones could solve the problem both of obsolete and housing shortage market" (p.1836)					
			x	x			x	"Revitalization of the existing industrial stock through the process of conversion and adaptive reuse provides: 1) the protection of historical and architectural integrity of those building, 2) the regeneration of obsolete and outdated urban areas, 3) minimal negative impacts on the environment and positive outcome when it comes to the material and energy resources." (p.1837)					
Plevoets and Van Cleempoel (2011)	n/a	n/a		x				"in contemporary conservation theory and practise, adaptive reuse is considered an important strategy towards conservation of cultural heritage" (p. 1)					
Power, A. (2008)	Residential	UK				x		"We argue that upgrading this stock to high environmental standards can actually be achieved more cheaply than demolishing it, and with as significant a carbon reduction" (p.4487)		x			"since 2004, the idea that demolishing the poorest and oldest homes will improve the environmental efficiency of the overall stock has gained ground" (p.4488)
			x					"Throwing away material objects is harmful to the environment, wasteful of energy and materials, and careless in the face of diminishing resources. Demolishing houses, which are bulky and valuable material objects, should be a last resort" (p.4488)					
Remøy, H. and Van der Voordt, T. (2006)	Commercial	Netherlands				x		"One advantage of a transformation project is the short time-span through which a transformation project can be developed" (p.94)		x		x	"The existing building had various technical disadvantages: for example, the facade was outdated and not energy efficient...during construction it also became clear that the building was not built to modern standards...This caused high extra costs" (p.99)
			x				x	"Converting nondescript and unarticulated buildings makes sense from the point of view of sustainability, both ecologically and in an urban regeneration context" (p.99)					
Shipley, R. et al. (2006)	Residential, Commercial and Institutional	Canada				x		"Some developers argue that reusing older buildings always represents a financial advantage" (p.506)				x	"in many jurisdictions hundreds of historic buildings have been demolished because developers and bankers argued that the cost of adapting them for new uses is too high" (p.507)
			x	x				"Older buildings represent an important aesthetic, cultural and economic resource—as well as a non-renewable one" (p.507)					
Snyder, G. (2005)	Industrial	USA	x					"We can no longer afford to squander our natural resources and pollute our environment. The investment that has already been made in the built environment, be it infrastructure or buildings, must be utilized to the fullest" (p.6)					
				x				"The reuse of an industrial structure on an urban brownfield site preserves a piece a history" (p.6)					
						x		"If the building is in good structural condition and is easily adapted to its new program, there are economic advantages. These include the potential for lower construction cost, lower land acquisition cost, and less construction time depending on the extent of the work done" (p.18)					
							x	"Residual benefits include preserving a historic structure, contributing to the vitality of the neighborhood, and improving the local economy." (p.28)					
Tan, Y. et al. (2018)	Industrial	Hong Kong			x			"a shortage of affordable housing has been a problem in Hong Kong for many years. Adaptive reuse of industrial buildings may be a way of solving this problem" (p.1)	x				"the adaptive reuse of industrial buildings is affected by many factors, such as town planning zone allocation, building regulations, building age, current use, and accessibility" (p.15)
			x			x		"Adaptive reuse of industrial buildings has a shorter sustainable development, such as GGE reduction and waste reduction. An awareness of the delivery time compared with new buildings" (p.2)					
Thomsen and Flier (2009)	Residential	Netherlands	x					"The growing number of demolitions in the Netherlands have caused an increasing stream of demolition waste which has obvious ecological consequences" (p.650)					

Reference	Existing property type	Country of study	Benefits of adaptation: Embodied energy savings	Heritage conservation	Housing provision	Economic viability	Wider economic benefits	Text Extracts	Barriers to adaptation: Building regulations	Energy Efficiency	Increase density with new build	Economic viability	Text Extracts
						x		"The increasing volume of capital loss begs questions about the economic sustainability of demolition and rebuilding" (p.650)					
Van der Flier and Thomsen (2006)	Residential	Netherlands	x					"Recent research shows that, from a sustainable viewpoint, life cycle extension of existing dwellings is (often) a better choice than replacement by new construction" (p. 2)			x	x	"In our recent survey we questioned housing associations about their demolition plans and motives. We distinguished motives related to building quality (technical /physical, functional and urbanistic), market performance, economic motives and other reasons" (p. 2)
Wang, H. and Zeng, Z. (2010)	n/a	Taiwan		x				"historic buildings are regarded as world cultural heritage properties since they are of outstanding universal value from the point of view of history, art or science" (p.241)	x				"there are some conflicts between cultural preservation and economic development in reuse selection, especially between the people working in disparate worlds with regard to reuse" (p.241)
							x	"There are many historic buildings with local historic and cultural value recognized by governments all over the world. These buildings may also become important assets to develop a local tourism industry" (p.241)					
Watson (2009)	Commercial and residential	UK	x	x				"Social factors: energy and/or resource conservation, preservation of historic buildings and social resistance to change" (p.218)				x	"To give the subject matter a balanced view, the paper also contained factors that may make refurbishment less desirable. These were called 'Limiting Factors' and contained the following: diminishing returns, suitability for reuse, marketable features, life expectancy, occupancy cost, high cost of borrowing, outdated facilities, management of refurbishment, cost of providing safety, security etc." (p. 218-219)
						x		"Economic factors: shorter construction periods, a desire to keep a business running, condition of building, planning constraints, insufficient funds, need to upgrade a building, expectation of high land values, uncertain long-term value, loss of investment, unwillingness of neighbours to develop and constraints on development." (p.218)					
Weber et al. (2006)	Residential	USA										x	"the profit margins on new construction would lead to the wholesale rebuilding of the built environment in neighborhoods where land values are rising at a certain pace" (p.20)
Wilkinson (2011)	Commercial	Australia	x					"One method of reducing mankind's environmental impact is to adapt existing buildings rather than default to demolition and rebuild" (p.15)					
						x		"Moreover, the situation is compounded with a construction labour skills shortage in Australia which has driven new build construction costs upwards and adaptation can be an attractive economic alternative in some cases" (p.19)					
Wilson, C. (2010)	Industrial	Canada					x	"Infill development, including the reuse of vacant and derelict industrial buildings, is a desirable form of development as municipalities face the pressure of continuous growth" (p.i)	x				"properties may have historical significance whether designated as a heritage site or not and that can have both benefits and disadvantages for the developer" (p.15)
			x					"The environmental benefits are experienced through the reuse and recycling of the existing materials and structure, reducing the amount of waste entering landfills." (p.4)					
				x				"The social benefits of reuse projects include rejuvenating the heritage and cultural values of a building" (p.5)					
							x	"There are economic benefits as a result of adaptive reuse projects that can be experienced by both the municipality and the developer. The municipality benefits from the increased property tax that the developed site creates over a vacant site" (p.5)					
Yung and Chan (2012)	Commercial, government & residential	Hong Kong	x					"Adaptive reuse of buildings is a form of sustainable urban regeneration, as it extends the building's life and avoids demolition waste, encourages reuses of the embodied energy and also provides significant social and economic benefits to the society" (p.352)					
				x				"This environmental benefit, combined with the energy savings, carbon emissions reduction, and the social and economic advantages of recycling a valued heritage building, make reuse an essential component of sustainable development" (p.352)					
							x	"Job creation and the revitalisation of the immediate area can be one of the major benefits" (p.355)					
Yildirim, M. (2012)	Historic city area.	Turkey		x				"Re-use means historical values will be enlivened, history will be rediscovered and the characteristics of the structure will be maintained" (p.379)					
						x	x	List of advantages adaptive reuse: impact on tourism, significance enhanced and protected; financial and technical feasibility (p.386)				x	List of disadvantages of adaptive reuse (compared to do nothing option): detrimental effect on significance, vehicular access, financial unfeasible, unavoidable number of people. (p.386)
Total number of times benefit mentioned			**24**	**25**	**5**	**16**	**15**	**Total number of times barrier mentioned**	**7**	**6**	**3**	**14**	

Appendix 2: List of professional interviews

Table A-2: List of 'professional interviews'.

ID	Date	Length (mins)	Phone	Meeting	Stakeholder category	Additional information	Recorded
ref.PI-1	14/12/2015	30	x		Regulator	Building surveyor	
ref.PI-2	04/01/2016	55	x		Amenity group	Heritage society specialising in industrial buildings	
ref.PI-3	08/01/2016	40	x		Consultant	Property consultant	✓
ref.PI-4	08/01/2016	60		x	Consultant	Property consultant	
ref.PI-5	12/01/2016	45	x		Amenity group	Heritage society specialising in Georgian buildings Name: David McKinstry Organisation: Georgian Group	✓
ref.PI-6	14/01/2016	30	x		Regulator	Building surveyor specialising in historic buildings	
ref.PI-7	15/01/2016	30	x		Regulator	Chartered building surveyor, a member of RICS Name: Antony Gibb Company: Historic Building Conservation	
ref.PI-8	15/01/2016	50	x		Amenity group	Heritage society	✓
ref.PI-9	15/01/2016	20	x		Amenity group	Heritage society	✓
ref.PI-10	16/01/2016	30		x	Amenity group	Archaeological heritage society	
ref.PI-11	18/01/2016	40	x		Consultant	Engineering consultant	✓
ref.PI-12	18/01/2016	45	x		Developer	Charitable organisation specialising in historic buildings Name: Caroline Stanford Company: The Landmark Trust	✓

ID	Date	Length (mins)	Phone	Meeting	Stakeholder category	Additional information	Recorded
ref.PI-13	19/01/2016	25	x		Consultant	Property consultant	✓
ref.PI-14	25/01/2016	60	x		Consultant	Planning consultant	✓
ref.PI-15	26/01/2016	30	x		Planner	Conservation officer	✓
ref.PI-16	01/02/2016	60		x	Amenity group	Heritage society	
ref.PI-17	02/02/2016	30	x		Consultant	Heritage consultant Name: Eddie Booth Company: The Conservation Studio	✓
ref.PI-18	25/02/2016	45	x		Consultant	Heritage consultant	✓
ref.PI-19	26/02/2016	65	x		Designer	Engineer	✓
ref.PI-20	02/03/2016	40	x		Planner	Conservation officer	✓
ref.PI-21	15/03/2016	60		x	Policy makers	Senior planning and regeneration advisor for national heritage body. Name: Tim Brennan Organisation: Historic England	
ref.PI-22	17/03/2016	60		x	Consultant	Heritage consultant	✓
ref.PI-23	26/03/2016	60	x		Designer	Urban designer	✓
ref.PI-24	06/04/2016	65		x	Designer	Architect specialising in listed buildings	✓
ref.PI-25	16/09/2016	65		x	Consultant	Community	✓
ref.PI-26	07/04/2017	75		x	Developer	-	✓
ref.PI-27	09/05/2017	55		x	Consultant	Heritage consultant	✓
ref.PI-28	30/05/2017	50		x	Policy maker	Strategic planner	✓
ref.PI-29	30/05/2017	45		x	Developer	-	✓
ref.PI-30	20/06/2017	60		x	Consultant	Environmental consultant	✓

ID	Date	Length (mins)	Phone	Meeting	Stakeholder category	Additional information	Recorded
ref.PI-31a, ref.PI-31b	22/07/2017	90		x (2 persons)	Developer & designer	Developer & architect	✓
ref.PI-32	02/11/2017	60		x	Academic	Embodied energy (Netherlands)	✓
ref.PI-33	01/02/2018	45		x	Academic	Embodied energy (Australia)	
Email correspondence							
ref.PI-e1	29/01/2016	-			Consultant	Heritage consultant	

Appendix 3: Ethics committee approval

Figure A-1 shows the ethics approval granted by the Department of Engineering, University of Cambridge. Documentation required for approval included: an ethics review form; PhD proposal; interview guide, information sheet (figure A-2) and consent form (figure A-3).

UNIVERSITY OF CAMBRIDGE
Department of Engineering

Mr Philip Guildford
Director of Research

Miss Hannah Baker
Department of Engineering
University of Cambridge

Ref:pg/jh

25 July 2016

Dear Hannah

The decision to demolish or adapt existing buildings on brownfield sites

The Department's Research Ethics Committee has considered the documentation you provided in support of your research project in line with recommended procedures concerning ethical approval of research. I am pleased to inform you that, with respect to ethical considerations, approval has been given to your project.

Please note that this approval is based on the documentation you provided. You must re-submit your application to the Committee should you subsequently make any substantive changes relating to matters reviewed by the Committee.

We are content for this letter to be forwarded to your grant sponsors or to any partner institutions you may be working with if appropriate.

Yours sincerely

Philip Guildford
Director of Research

Philip M. Guildford
Director of Research
Department of Engineering
University of Cambridge
Trumpington Street
Cambridge CB2 1PZ
director-of-research@eng.cam.ac.uk

Figure A-1: Ethics approval letter from Department of Engineering, University of Cambridge.

UNIVERSITY OF CAMBRIDGE
Department of Engineering

Information sheet for participants

Study Title: The decision to demolish or adapt existing buildings on brownfield sites

Researcher: Hannah Baker, Future Infrastructure and Built Environment CDT, University of Cambridge

I would like to invite you to take part in my research regarding the decision to demolish or adapt existing buildings on brownfield sites. I am a PhD student in the Engineering department at the University of Cambridge and previously completed degrees in Architecture and Planning.

The overarching aim of my research is to identify criteria to produce a decision-making tool, which can be used by different stakeholders to work collectively. This will appropriately consider the benefits and drawbacks of demolition and adaptation on masterplan regeneration projects.

How do I want you to participate?

I would like to arrange an interview with you to discuss your experience working with existing buildings and the decision to demolish or adapt. The interview will be semi-structured, meaning that I will produce a set of questions to ask before the interview takes place but depending on what we discuss, there may be additional questions to allow for elaboration of a particular topic of interest.

The interview should take less than one hour and will take place on the phone or in person – this will be organised via email and arranged to be at a time which is convenient for you.

Who is funding this study?

The PhD research is funding by the Engineering and Physical Sciences Research Council (EPSRC) as part of a course called Future Infrastructure and Built Environment CDT, based in the Engineering department at the University of Cambridge.

Will your participation be confidential?

If you agree to be interviewed, your name will not be included in any research reports or papers and will not be circulated to others, unless permission is received to do so.

Who else is taking part?

I am contacting a range of stakeholders involved in the decision to demolish or adapt existing buildings including (but not exclusively): public and private planners; architects; engineers; heritage societies; statutory consultees; developers; building surveyors and quantity surveyors.

What are the advantages of taking part?

I will keep you up to date with papers and reports that I am publishing, this will allow you to keep track of how the research is progressing. The end goal of the PhD is to create a tool that will allow stakeholders to work collectively, if implemented, this could be of benefit in the long-term.

What else do you need to know?

Ideally I would like to record the interview using a voice recorder. This will then be transcribed. Before the interview takes place, I will remind you of this and check with you verbally that it is ok. Transcripts will not be circulated. If you want to discuss anything 'off the record' during an interview, recording will be stopped. If you would prefer not to be recorded, please inform me before the interview takes place.

What happens now?

Please read through the consent form and confirm via email that you are happy to be interviewed and we will arrange a date for the interview to take place.

Figure A-2: Information sheet sent to interviewees.

UNIVERSITY OF CAMBRIDGE
Department of Engineering

Participant Consent Form

Study Title: The decision to demolish or adapt existing buildings on brownfield sites

Name of researcher: Hannah Baker

Address: Future Infrastructure and Built Environment CDT, Engineering Department, Trumpington St, Cambridge CB2 1PZ

Contact phone number: [redacted]

1) I confirm I have read and understood the information sheet which explains the research project.
2) I understand that my participation is on a voluntary basis and I am free to withdraw at any time without giving reason and without there being any negative consequences. I am free to decline to answer any questions during the interview.
3) I understand that the interview will be recorded and transcribed by the researcher. If I am not happy to be recorded, I have informed the researcher of this.
4) I understand that my responses will be kept confidential (unless permission is obtained otherwise).
5) I am happy for the research to be used for papers published relating to the PhD project.

If you are happy with all of the above, please confirm your willingness to participate and acceptance by emailing Hannah Baker (heb51@cam.ac.uk)

Figure A-3: Consent form sent to interviewees.

Appendix 4: Additional 'professional interview' questions

Due to the semi-structured nature of the interviews, the author was able to ask follow-up or probing questions to explore particular topics of interest in more detail. Before the interviews took place, the interviewees were researched and if there were any specific questions to that person e.g. a project they worked on, they were asked about this if it had not been brought up by the interviewee in conversation. Furthermore, to build a rapport and make conversation, follow-up questions were prompted by things the interviewee said. To avoid interrupting the conversation, these were noted on a piece of paper during the conversation by the interviewer and referred back to at a convenient point.

Table A-3 provides a breakdown of the questions specific to the interviewees prepared beforehand and the follow-up questions and their prompts.

Table A-3: List of additional 'professional interviewee' questions (specific to interviewee and follow-up).

Interviewee reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Ref.PI-1 (Building surveyor)	x		n/a	-On your website, it says that the Local Authority approves you to undertake listed building work, what does this mean?
		x	-The roof had rotted and it had to be replaced	-Did you have to replace it as it was? Was it reusing materials which were there before?
		x	-Inspections are mainly visual.	-Have you ever come across problems after the visual inspection?
		x	-You can find all sorts of things (relating to problems with building)	-Does that cause delays?
		x	-When costing a job, you need to account for risk and price increase	-In terms of the risk, who takes that?
		x	"-"	-Do you use fixed price contracts?
		x	"-"	-Are there any warrantees or guarantees on renovation projects?
		x	-Engineers will be involved if replacing timber beams with steel	-What tests to the engineers tend to do?
		x	-Asbestos is often a problem with existing buildings	-How easy is that to identify and how much time does it take to get rid of?
Ref.PI-2 (Heritage society specialising in industrial buildings)	x		n/a	-What are the goals of your Association? How do you define endangered sites (focus of interviewee's work)?
	x		n/a	-Is there a certain age bracket you are focused on?
	x		n/a	-How many applications for funding does the Association get a year?
	x		n/a	-Are the majority of buildings you look at listed?
	x		n/a	-Does your work include public consultations?
		x	-Asked interviewer – how familiar are you with a National Amenity Society?	-A little. It would be useful if you could talk me through them.
		x	-I looked at about 110 applications and commented on 27 in 2015	-Are you commenting on the appropriateness of the planned intervention?
		x	"-"	-How much influence do you feel that your comments have?

Interviewee reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Continuation…		x	-The buildings we look at will be listed or in a conservation area or locally listed	-How powerful are local listings in comparison to national?
Ref.PI-3 (Property consultant)	x		n/a	-In the documents you sent, it talks about heritage assets. How do you define heritage?
		x	-Heritage helps with place-making	-Is there any quantitative evidence to show this?
		x	-Some existing building are not energy efficient and that is seen as a reason for replacements	-Is embodied energy a concept that you have come across?
		x	"-"	-Have you found that technological improvements have made it easier to bring existing buildings up to the same energy standards as new?
		x	-Buildings can be listed	-How much power do you feel national and local listings have in the decision-making process?
		x	-No contractor will give you a fixed price contract for an existing building	-What sort of percentage do you expect that that the price could increase by?
		x	-(mentioned a masterplan site that currently submitting planning permission for)	-Are you able to tell me the name of the site you mentioned so that I can look it up?
		x	-At the moment I can't say name of site	-Will the planning application be submitted later this year?
Ref.PI-4 (Property consultant)	x		n/a	-Are there any examples of projects that you have worked on that are larger masterplan sites and it was decided to keep some of the existing buildings? If so, why was this?
Ref.PI-5 (Heritage society specialising in Georgian buildings)	x		n/a	-How much influence do you feel your comments have on the decision-making process?
	x		n/a	-Is it correct that your organisation provides grants?
		x	-We also put buildings forward that we think should be listed	-When you talk about a building becoming listed or being removed from the list, do you have a set of criteria that needs to be met?
		x	"-"	-Does your association/society think that buildings should be retained even if not listed?
		x	-Developers may try and get a building de-listed	-If a developer does want to demolish a listed building, what process do they go through?
		x	"-"	-How much time does that process take?
		x	"-"	-Have you come across any examples where owners have deliberately altered a building to compromise its significance?
		x	-Comments are also applicable if the surroundings of a listed building are affected	-What constitutes as surroundings?
		x	-We provide some small grants	-Does that money come from membership or charitable donations?
		x	-We may become aware of a building that is not listed but people think it should be	-How do you become aware of those?
Ref.PI-6 (Building surveyor specialising in historic buildings)		x	-If there was nothing seriously wrong with a building, you would not get an engineer involved	-Is it quite clear whether you need an engineer or not?
		x	-For larger buildings, there tends to be building records, but often very few for smaller ones	-Do you think Building Information Modelling will help overcome that?
		x	-We might advise on what can be done with the building	-Is that part of the building condition survey or the next step?
		x	-For determining use, you need a measured survey	-Are there optimum dimensions that you look for?
		x	-The first question you ask, is it listed?	-How powerful are local listings compared to national?
		x	"-"	-Have you come across any evidence to show heritage adds value?

Interviewee reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Continuation…		x	-It's rare for a listed building to be in such dire condition it can be demolished	-How dire is dire?
Ref.PI-7		x	-A key problem is damp	-How do you overcome damp problems?
(Chartered building surveyor)		x	-People need to recognise that everything is repairable, you can't just say 'it's not economically viable'	-How do you overcome that attitude?
		x	-You need to find a use	-When looking at these buildings and trying to suggest a use, is that mainly through a measured survey?
		x	-Building records do not exist for many properties	-If they do exist, am I right in thinking they are often different to what is there?
		x	-Need to encourage people to work with listed buildings, rather than see as restrictive	-So do you think I should be looking into the stigma associated with listed buildings?
Ref.PI-8 (Heritage society)	x		n/a	-Is there a certain age bracket you are focused on?
		x	-Developers need to be sympathetic to heritage	-Is that when the building is listed? Or have you come across occasions that developers have seen benefits of keeping non-designated assets?
		x	"-"	-How powerful are local listings compared to national?
		x	-Cuts in conservation officers are having an impact on the retention of locally listed buildings	-Do you find that some developers have a negative attitude towards working with listed buildings and try to avoid them?
		x	-We are interested in a lot of post-war buildings	-Do you find that they are more political and subjective?
		x	-There can be questions on authenticity during the delisting process	-Apart from authenticity, what other arguments are used for delisting?
		x	-If it's not listed, it has got to do with neighbourhood planning	-Is neighbourhood planning taking off?
		x	"-"	-Is it up to the planning authority to make sure there is sufficient public consultation?
Ref.PI-9 (Heritage society)	x		n/a	-With the projects that your organisation funds, do the buildings need to be listed?
	x		n/a	-How much are the grants and how many are given?
	x		n/a	-What is the application process for a grant?
	x		n/a	-Is it common for large development companies to apply for grants from you?
		x	-The projects need to have some form of statutory protection	-How powerful are local listings compared to national?
		x	-Grants are only applicable to early-stage development	-What is meant by early-stage development?
		x	-We can offer advice on what other funding is also available	-Are there any constraints on how many funding streams a project can have?
		x	-Heritage adds value	-You mentioned heritage adds value, have you come across any quantitative evidence to support this?
Ref.PI-10 (Archaeological heritage society)	x		n/a	-What do you see as the difference between archaeology and built heritage?
Ref.PI-11 (Engineering consultant)	x		n/a	-I saw that you had conducted a study on multiple housing stock. Can you tell me about it?
		x	-With housing estates from the 1950s and 60s, there is a suspicion of social cleansing	-Like gentrification?
		x	-Embodied carbon does not appear on profit or loss sheets	-Is it something that you think might be taken more seriously in the future?
		x	-There is a desire for sustainability badges like BREEAM or LEED	-I know that these badges are common on new build, are they also common on renovation projects?

Interviewee reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Continuation…		x	-Developers take large risks to make substantial profits	-Have you come across any evidence to show heritage adds economic value?
		x	-Floor to ceiling heights affect the services that you can put in	-Is there an ideal storey height?
		x	- You need to investigate the building thoroughly early on	-Are any technological changes helping to improve inspection techniques?
		x	-LADAR scanning is immensely useful	-Is the use of LADAR common?
		x	"-"	-Talking about emerging technologies, are there any that can help improve the energy efficiency of buildings?
		x	-There are some 'get-out' clauses for changes in EPC regulations	-What are those?
		x	-If you change a kitchen, which is disruptive, you could renovate the whole house at same time	-Is that because it causes all the disruption in one go?
Ref.PI-12 (Charitable organisation specialising in historic buildings)	x		n/a	-On your website, I saw that you said a building can be important historically, culturally and architecturally, what is meant by each of these?
	x		n/a	-What are the main criteria you look at for the feasibility of retention?
	x		n/a	-Do members of the public submit ideas for building projects?
	x		n/a	-Is the funding charitable donations?
		x	-Culture is to do with human activity and the story that can be told	-So more about what the building was used for?
		x	-Some of the buildings we work on are listed	-You mentioned some of the buildings are listed and others not, what are the main differences?
		x	-The Landmark Trust will not take on some projects, as they have already been restored.	-What are the other reasons that you might not take on a building project?
		x	-Every project has a different funding breakdown	-After a building has been renovated, have you come across any evidence to show that this has added value in comparison to demolition and rebuild?
		x	-Heritage can be subjective	-How do you overcome that? How is it that you are determining significance?
		x	-We essentially only work on buildings at risk	-As in, they are in poor condition or finding a viable use is difficult?
		x	-We don't buy the buildings unless they are bequeathed to us or there ate external funds.	-Just to clarify, the buildings that you work on are often in the ownership of someone else?
Ref.PI-13 (Property consultant)	x		n/a	-Does the place-making research you conducted, focus on heritage and existing buildings in any way?
	x		n/a	-Have you come across any research, similar to your own that shows that retaining heritage adds value?
	x		n/a	-In your report, you mention community influence, how do you recommend community participation is conducted?
	x		n/a	-I read that you try and balance place-making with density, how do you go about that?
		x	-For heritage to add value, the developer really has to get it and take it on board	-Is that the same for your place-making principles, some developers embrace it and others don't?
		x	-Hosting community events can mean you are not seen as the evil developer	-So you think it creates a good image for the developer?
		x	"-"	-How much influence do you feel the community have over decisions?
		x	Poundbury has done well with the phasing of the development	-Poundbury divides opinion, do you think that character can be created through new build in this way?

Interviewee reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Ref.PI-14 (Property consultant)	x		n/a	-With your neighbourhood planning consultations, what type of events do you host, especially in the context of heritage?
		x	-Cultural values can be part of the economic value	-Is there any evidence to show that heritage adds economic value?
		x	-The viability equation can be very different in the North and South of the country	-When you are looking at viability, what are the main criteria you are looking at?
		x	-When I was in the local authority, we made sure we hammered the economic arguments for heritage	-So do you think it is important to ensure the person at the council is backing heritage retention during the planning committee meeting?
		x	-Listings are worth doing as they highlight buildings of interest	-If a building is not listed but seen as valuable from a heritage point of view, what are the main reasons it is not listed?
		x	"-"	-Have you ever come across authenticity and previous alterations to listed buildings as an argument for demolition?
		x	"-"	-How do you define significance?
		x	-Lack of skills and awareness is a problem in the decision-making process	-How can that be overcome?
		x	"-"	-Do you find that some developers have a stigma working with listed buildings?
Ref.PI-15 (Conservation officer)	x		n/a	-In your constituency, what are the main criteria for local listings?
		x	-Our local list is something we have completed as a proactive approach	-So that links with spot listing, so are you saying you have already done all that work beforehand and hopefully haven't missed a building which people argue should be listed?
Ref.PI-16 (Heritage society)	x		n/a	-Does your Trust comment on applications?
	x		n/a	-What were the Trust's inputs on the NPPF (this was stated on website)?
	x		n/a	-After the purchase of [a masterplan site], were any of the buildings demolished?
	x		n/a	-What was your business plan?
	x		n/a	-Would restoration have been possible if you were not a charity?
Ref.PI-17 (Heritage consultant)	x		n/a	-Your website talks about a collaborative approach to projects, what is meant by this?
		x	-If a building is in disrepair, one test of economic viability is to see if someone else will go through with the same economic strategy	-What are the main problems that occur with an individual building in terms of economic viability?
		x	-One of problems with the process is valuing: one person's liability is another's opportunity.	-So whether they are willing to take the risk on it?
		x	-Some people are more scared of risks than others	-Is there a way that this can be overcome?
		x	-Increasingly you see communities hiring conservation professionals and fighting their case	-How do you establish if a building is important to a community? Is it mainly public participation events?
		x	-We did some work on applying economic values to conservation areas	-Was that ever published?
		x	-Previous extensions and changes to a building can compromise authenticity	-Should compromised authenticity be a reason for demolition?
		x	"-"	-In terms of making changes for energy efficiency, is that more lenient now?
Ref.PI-18 (Heritage consultant)		x	-There is planning guidance for listings and significance	-Is the retention of non-designated assets ever considered?
		x	-Our company aim to undertake an unbiased assessment of heritage	-If a developer was of the nature that they just want to demolish everything, how to you ensure their heritage impact is not bias?

Interviewee reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Continuation…		x	-Policing heritage assessments is difficult in areas without conservation officers. Which is an issue facing the industry.	-Conservation officer roles are being cut aren't they? If this continues, will it have an impact?
		x	"-"	-Is there a way to overcome the stigma associated with retaining listed buildings?
		x	-A developer could save so much money by demolition and rebuild, but could equally spend that much fighting council and public opposition	-So by saying you are keeping some existing buildings there might be less opposition?
		x	"-"	-At what point in the process do financial viability arguments come in?
		x	-(Discussed masterplan project where industrial buildings were retained early on in project)	-Did the developers receive any funding from heritage bodies on that project?
		x	"-"	-Why did they decide to convert the existing buildings early on?
		x	"-"	-Do you think 20th Century architecture is considered more now or is it still developing as a concept?
		x	-Historic buildings are such unknowns	-Are inspection techniques improving?
Ref.PI-19 (Engineer)		x	-The sub-structure is probably the hardest bit of re-use	-Are techniques for analysing what is underground improving?
		x	-There is a BRE guide	-Is that a BRE guide for general refurbishment or the re-use of the sub-structure?
		x	-The foundations are often the differentiator as to whether or not you can re-use a building	-Is that because, like places in London, there is not space to put in new foundations?
		x	"-"	-Is knocking down the main structure and just using the sub-structure becoming more common?
		x	"-"	-If there is a desire to keep a building but the foundations are not sufficient, what are the methods for overcoming that?
		x	-Intrusive investigations can be used to assess foundation material	-Do the intrusive investigations come after the initial viability appraisal?
		x	-One of the problems with existing buildings and foundations is deteriorating concrete	-Apart from deteriorating concrete, what other issues are you looking for?
Ref.PI-20 (Planning committee member)	x		n/a	-During your time at the Council, how was heritage defined?
		x	-An issue with qualitative arguments (in reference to heritage) is it is hard in terms of economic arguments and quantitative information	-Have you come across any quantitative evidence showing heritage retention adds value?
		x	-If just operating solely on the NPPF, it can lack some of the vital support a local plan can give	-So you do not have a local plan and are currently working to the NPPF?
		x	"-"	-If a building is not listed, can demolition be refused on other grounds?
		x	"-"	-In terms of energy efficiency, what stance does the council take on changes to listed buildings?
Ref.PI-21 (National heritage organisation – Historic England)	x		n/a	-The report you sent mentioned that there have been some unsuccessful heritage regeneration projects. What examples are there and why did they fail?
	x		n/a	-The paper you sent written by Historic England mentioned embodied energy, how long has this been recognised for?
	x		n/a	-The paper talks about the need for a collaborative agreement but that there can sometimes be deadlock between planners and developers. How can this be changed?

Interviewee reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Ref.PI-22 (Heritage consultant)	x		n/a	-With the masterplan projects you are/have been involved in, how big do/have those tend to be?
		x	-The first thing we do is a heritage assessment	-For the heritage assessment, do you follow Historic England guidelines or does our company have their own?
		x	-No building ever fits completely within the guidelines for assessment	-Does it then come down to experience?
		x	"-"	-How do you go about defending the more subjective values at appeal?
		x	-We have to take a professional judgement on the demolition of listed buildings as it can sometimes be justified by policy	-Where do you think the tipping point is?
		x	"-"	-If you were to support an application for demolition, what grounds would that be on?
		x	"-"	-If a client disagrees with your assessment, what do you do?
		x	-You need to have evidence to show what has been considered	-From a developer or client point of view, is that the most important thing you can do?
Ref.PI-23 (Urban designer)		x	- You need to show new build is of a good quality	-How do you show that replacement buildings are of a good quality?
		x	-Keeping heritage buildings can be part of the design agenda	-Have you come across any evidence to show that keeping buildings can add value?
		x	-We would never state that a public space or building adds economic value	-Is that because it is not your job to talk about the economics?
		x	"-"	-Going back to viability, do developers ever need to prove a project is not viable?
		x	-I have been in pre-application discussions were a developer says a scheme is not viable, but that is not my interest/focus	-Is pre-application advice common?
Ref.PI-24 (Architect specialising in existing buildings)			n/a	n/a
Ref.PI-25 (Community consultant)	x		n/a	-Is your organisation a charity or a company?
	x		n/a	-How was it set up?
	x		n/a	-How is your research/work funded?
	x		n/a	-In terms of public participation events, what are the main ones that you think work well?
		x	-Our research has shown the benefits of smaller dense housing, rather than big blocks	-Why do you think some developers still prefer big blocks?
		x	-I think in my children's lifetime, London will stop booming and masterplans relying on commercial big blocks will be impacted (gave example of a scheme)	-Because the centre of that development is all retail and commercial isn't it?
		x	-There are polls were people can choose their preference between new builds	-Have you seen or completed any polls which compare existing buildings to one another?
		x	-We have a framework for decision-making. Have you seen it?	-No, please could you send it to me?
		x	"-"	-Is the framework useful to practitioners?
Ref.PI-26 (Developer)	x		n/a	-Was the Mailbox (adaptation project in Birmingham) listed or was that just your company's decision to keep it?
	x		n/a	-I saw that you are involved in the Post and Mail building (another adaptation project in Birmingham) and keeping part of it, why has that been retained?

Interviewee reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Continuation…		x	-(In reference to Brindley Place masterplan development in Birmingham, UK). There was no value and no sense in keeping the buildings that were there, other than the ones that had some important character.	-So a few buildings were kept?
		x	"-"	-Were they listed?
		x	"-"	-At the time the masterplan was developed, were heritage impact statements required?
		x	"-"	-What condition were the buildings you decided to keep in?
		x	"-"	-Was there any public opposition to demolition?
		x	-(referred to different architects within a masterplan development)	-So there were different architects involved?
		x	-The public square was built before anything else to demonstrate this was going to be the heart of the development	-Was that a planning requirement or the developer's decision?
		x	-There was a lot of care put into how the development would be managed because they effectively got their own security team	-Is it still private land?
		x	-The development didn't really impact that many people, although some businesses did have to be relocated	-Was it mainly businesses on site?
		x	-Place-making creates value, so they are not really incompatible	-Have you come across any quantitative evidence to show that retaining heritage adds value?
		x	-(in reference to the Mailbox) we said that if it is such a robust structure, we can add floors on the top of the roof	-Did you add many?
		x	-These things only work if you have got critical mass, we couldn't have done a tiny little building.	-In terms of risk and uncertainty, is there a general figure you attach to existing buildings compared to new builds?
		x	-We owned the building (Mailbox) for about 12 years	-Did you always own the land behind and the Cube?
		x	-We didn't know what to do with the Cube building for a while and decided to go for a statement building.	-Was it always the intention to develop that area as well?
		x	-We had a design competition for the design of the Cube	-Do you tend to prefer competitions?
		x	-In the Cube the restaurant was a challenge	-In what way?
		x	-When we brought the Post and Mail, there was a huge empty hole in the ground were the presses used to be, we are using that as a car park	-From an engineering perspective, how did you ensure that the foundations were sufficient?
		x	-If we had kept the existing column grid, there would have been 450 spaces rather than 600	-Was it quite a small column grid then?
		x	-There are lots of 60s and 70s buildings that just don't work for technology nowadays	-In terms of future-proofing current projects, what do you do?
Ref.PI-27 (Heritage consultant)	x		n/a	-Why do you think the decision was made to set up a heritage team in your office (planning consultants)?
	x		n/a	-What is the main differences in your role from your private and public experience?
		x	-As a result of local authority cuts, it's much more front-loaded on this side.	-Cuts in conservation officers has also come up in previous conservations, how has that impacted the process?
		x	-We can't believe that some developers, clients and advisors are prepared to push heritage into the long grass for as long as they do.	-Why do you think that is?

Interviewee reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Continuation…		x	-The metro (as part of a city's development) went through on the balance of public benefit.	-How do you go about defining public benefit?
		x	-Place-shaping was included in PPS-5 but now that's gone	-Is that the same as place-making?
		x	-I think we have developed a strong method for assessing heritage	-Is there a consistency between different heritage consultants?
		x	-Case law has had to follow the wording used in the NPPF	-Is case law considered at the planning application stage or just if it goes to appeal?
		x	-(discussed an application that went to appeal)	-In terms of the decision makers, at the end of the day does that come down to the councillors and planning inspectorate?
Ref.PI-28 (Strategic planner)	x		n/a	-At what stage is your authority in developing their local plan?
	x		n/a	-Which role within your team assesses the historic environment?
	x		n/a	-Has the Housing and Planning Act and automatic planning permission on brownfield sites affected policy here?
		x	-We are mapping strategic development allocations	-Are they mainly brownfield or greenfield sites?
		x	-A legal challenge to our strategy caused delays	-What was the legal challenge about?
		x	-A land owner was arguing that their site was more appropriate for redevelopment	-Does that site have existing buildings on?
		x	-We have just produced a draft Statutory Planning Document (SPD) for a site	-What is the legal standing of an SPD? Is it a material consideration?
		x	-Previously developers or their agents may have done viability assessments, so you can use those in the evidence base	-Do you have to test their assessments?
		x	-There are processes to bring the local plan back to policy at the national level	-Can you explain that further?
		x	"-"	-What type of consultation has to take place with the public?
		x	"-"	-Who else do you consult with?
		x	-Productive consultation, with the Arnstein ladder, that would come earlier, that would come at your more strategic level	-In terms of the early stages then, what sort of consultation happened there?
		x	-We have got a list of buildings associated with the built environment and then a supplementary SPD.	-Are they called local listings or buildings of local interest?
		x	-It's a matter of judgement really, but I could see the benefits there of saying demolition of certain buildings to bring something new in.	-How do you define public benefit?
		x	-Instead of a focus on embodied energy, there has been more of a focus at national level on providing housing	-Is that because of changing policy?
		x	-Some local authorities have included policy on embodied energy	-Do you know which ones?
		x	-Normally we have pre-application advise with developers	-How long does pre-application take?
		x	-There needs to be more education somehow for the public on the difficulties on bringing forward existing buildings, so there is lots of benefits of doing that and that certainly should be our first port of call, but it's not always possible in the short to medium term and when you have got this pressure for housing that you need to deliver	-How do you think the public could be educated on this?

Interviewee reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Ref.PI-29 (Developer)	x		n/a	-When your development company became involved with the project (referring to a masterplan development), did you make any changes to the outline planning permission?
	x		n/a	-Were the majority of engineers and designers in house?
		x	-I joined the company when the central office opened	-What year was that?
		x	-When I became involved, we were looking at what we could do with the buildings which were going to be retained.	-Like feasibility studies?
		x	-It had to be a full application, rather than reserved matters for the planning permission of individual buildings	-Why was that?
		x	"-"	-How much change is normally allowed between outline planning and reserved matters?
		x	"-"	-If these are full applications, what consultation is required with the public?
		x	"-"	-At this stage, have you had any public objection?
		x	-Part of the masterplan is likely to be developed by [my company] and others will be sold on	-Is that the new build or the existing?
		x	-Existing buildings may have a value attached to them	-Do you think there is a price premium for existing buildings?
		x	-There was some 'toing and throwing', it's a negotiation process	-What were the negotiations about on this project?
		x	-The council were insistent on the design of the new build windows	-Was that through conditions?
		x	-I'm working on a project now as public planning officer	-Is that publicly owned land?
		x	"-"	-What work have you done so far?
		x	-I think Historic England considered listing some of the buildings but decided not to	-Were they locally listed?
Ref.PI-30 (Environmental consultant)	x		n/a	- (In reference to a masterplan development) Why did you organisation obtain outline planning before selling?
	x		n/a	- Is (your organisation) still involved in the project after selling?
	x		n/a	- How many existing buildings were on site?
	x		n/a	- Whose decision was it to undertake BREEAM communities' sustainability assessments?
Ref.PI-31a & 31b (Developer & architect)	x		n/a	- (In reference to a masterplan development) My understanding is the previous developer went into administration, when did your company get involved with the project and how?
	x		n/a	-When you purchased the site, were there other developers competing against you?
	x		n/a	-In the original application, facades were retained and you have chosen to keep them, why was that?
	x		n/a	-What is happening with this (large obsolete building)?
		x	-Some of the brickwork is not exposed as the insurance company wanted an independent insulation stud.	-Was that a concern over thermal or fire regulations?
		x	-There is an original brick spine wall running through the building which caused complications and had to be retained.	-Can you see that when you are inside?
		x	-You cannot see the spine wall from the inside	-So are people aware it is actually there?

Interviewee reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Continuation...		x	-Flood barriers can be slotted into these openings	-If there is flood risk?
		x	-They (previous developers) replicated the stone detail on this façade	-Did you manage to get the same material?
		x	-We are still identifying a use for this buildings	-Is that by looking at what the demand is in the area?
		x	-One of the next phases is the existing generator building	-Has that had many complications?
		x	-This is what the design and access statement will look like (in reference to large existing building within the masterplan)	-Is that in the public domain yet?
		x	"-"	-What was the building used as before?
		x	"-"	-What is the expected completion date?
		x	-The window frames within the façade of existing building were tricky	-Are those walls load-bearing?
		x	-The façade walls are not load bearing (showed construction drawing)	-So you have the wall and then whole new structure behind, basically independent from one another?
		x	"'-"	-Did the façade need to be strengthened in anyway?
		x	-If we had used aluminium rather than steel the sleeve build up would have been bigger	-Why did you use steel?
		x	"-"	-Were the windows all bespoke?
		x	-Some of the façades were kept with buildings behind before we came on board	-Do you think the previous developers had similar or fewer issues?
		x	-We had issues with floor areas as apartments were sold off plan before detailing had been completed	-Did you manage to keep all the floor areas the same?
Ref.PI-32 (Academic specialising in embodied energy - Netherlands)	x		n/a	-From your experience in the UK, do you think there are any key differences in attitudes within the Netherlands towards heritage buildings and environmental impacts?
	x		n/a	-How did the consideration of embodied energy in policy develop in the Netherlands?
	x		n/a	-Is the policy for embodied energy well enforced?
	x		n/a	-Does the assessment include the energy needed to demolish the existing building?
	x		n/a	-What is next for embodied energy in the Netherlands?
	x		n/a	-Does the policy apply to existing buildings as well?
	x		n/a	-What other environmental assessments are commonly used in the Netherlands?
		x	-A lot of the time when people talk about a circular economy, it's rubbish	-Rubbish in what way?
		x	-There are flaws with LCA	-What are these?
		x	"-"	-Is there a national framework or guidance to undertake this analysis?
		x	-Implementing the embodied energy policy was controversial	-What were the main arguments against its implementation?
		x	-There are environmental assessments such as BREEAM and LEED	-What are the other common environmental assessments that are used in the Netherlands?
		x	"-"	-In my UK case study, I have found that offices often need to be excellent or outstanding to rent/sell them. Is that the same in the Netherlands?
		x	-The Netherlands are ahead in terms of waste management	How?

Interviewee reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Ref.PI-33 (Academic specialising in Embodied Energy - Australia)	x		n/a	-From your experience in the UK, do you think there are any key differences in attitudes within Australia towards heritage buildings and environmental impacts?
	x		n/a	-Has the consideration of embodied energy in policy develop in Australia?
	x		n/a	-What is next for embodied energy in Australia?
	x		n/a	-What other environmental assessments are commonly used in Australia?

Appendix 5: List of focus group participants

Table A-4: List of focus group participants.

ID	Stakeholder category	Additional information
ref.FG1-1	Investor	Insurer
ref.FG1-2	Designer	Architect
ref.FG1-3	Academic	-
ref.FG1-4	Designer	Architect
ref.FG1-5	Consultant	Sustainability consultant
ref.FG1-6	Academic	-
ref.FG1-7	Consultant	Environmental consultant
ref.FG2-1	Designer	Structural engineer
ref.FG2-2	Developer	-
ref.FG2-3	Consultant	Sustainability consultant
ref.FG2-4	Academic	-
ref.FG2-5	Consultant	Environmental consultant
ref.FG2-6	Consultant	Environmental consultant
ref.FG2-7	Planner	-

Appendix 6: List of case study interviews

Table A-5: List of case study interviews - CB1, Cambridge, UK.

ID	Date	Length (mins)	Phone	Meeting	Stakeholder category	Additional information	Recorded
ref.CS-CB1-1	18/01/2017	120		x	Developer	-	
ref.CS-CB1-2	23/01/2017	130		x	Community member	Resident	✓
ref.CS-CB1-3	30/01/2017	60		x	Consultant	Strategic engineer	
ref.CS-CB1-4	04/02/2017	90		x	Community member	Resident	
ref.CS-CB1-5	07/02/2017	80		x	Consultant	Structural engineer (station building)	✓
ref.CS-CB1-6	08/02/2017	100		x	Consultant	Heritage consultant	✓
ref.CS-CB1-7	14/02/2017	60		x	Policy-maker	County council officer	✓
ref.CS-CB1-8	30/03/2017	110	x		Designer	Masterplan architect	✓
ref.CS-CB1-9	19/04/2017	60		x	Consultant	Planning consultant	✓
ref.CS-CB1-10	16/05/2017	70		x	Planner	Chair of planning committee	✓
ref.CS-CB1-11	18/05/2017	60		x	Consultant	Quantity surveyor	
ref.CS-CB1-12	22/05/2017	60		x	Planner	Conservation officer	✓
ref.CS-CB1-13	22/05/2017	135		x	Community member	Resident	✓
Email correspondence							
ref.CS-CB1-e1	02/03/2016	-			Planner	Planning officer	

Table A-6: List of case study interviews - Strijp-R, Eindhoven, Netherlands.

ID	Date	Length (mins)	Phone	Meeting	Stakeholder category	Additional information	Recorded
ref.CS-SR-1	02/11/2017	75		x	Designer	Architect (for some of the existing buildings)	✓
ref.CS-SR-2	03/11/2017	45		x	Designer	Landscape architect	✓
ref.CS-SR-3	07/11/2017	75		x	Designer	Architect (new build)	✓
ref.CS-SR-4	07/11/2017	90		x	Academic	PhD: Strijp-S masterplan (Geevers, 2014)	✓
ref.CS-SR-5	08/11/2017	90		x	Consultant	Process Manager Name: Erna Van Holland Company: COB-WEB advies	✓
ref.CS-SR-6	15/11/2017	75		x	Designer	Masterplan architect	✓
ref.CS-SR-7	16/11/2017	60		x	Construction company	Contractor (existing buildings)	✓
ref.CS-SR-8	22/11/2017	75		x	Consultant	Heritage consultant (site history) Name: Paul Meurs, Company: Steenhuismeurs.	✓
ref.CS-SR-9	24/11/2017	60		x	Consultant	Heritage (building history)	
ref.CS-SR-10	05/12/2017	70		x	Planner	Municipality Urban Designer Name: Cees Donkers.	✓

Table A-7: List of case study interviews - Central Park, Sydney, Australia.

ID	Date	Length (mins)	Phone	Meeting	Stakeholder category	Additional information	Recorded
ref.CS-CP-1a,	09/02/2018	70		x (2 persons)	Designers	Masterplan architect Name: Alec Tzannes	✓
ref.CS-CP-1b						Landscape architect	
ref.CS-CP-2	09/02/2018	70		x	Consultant	Heritage	✓
ref.CS-CP-3	14/02/2018	60		x	Consultant	Sustainability	✓
ref.CS-CP-4	16/02/2018	30		x	Community member	Local resident	✓
ref.CS-CP-5	20/02/2018	65		x	Consultant	Strategic development advisor and community consultant	✓
ref.CS-CP-6	20/02/2018	60		x	Policy-maker	Former deputy Mayor	✓
ref.CS-CP-7a, ref.CS-CP-7b, ref.CS-CP-7c	20/02/2018	60		x (3 persons)	Designer	Masterplan architects (first application)	✓
ref.CS-CP-8	21/02/2018	50		x	Consultant	Planning proponents' (CUB) consultant	✓
ref.CS-CP-9	21/02/2018	70		x	Designer	Architect for Kensington Street Name: Tim Greer Company: Tonkin Zulaikha Greer Architects	✓
ref.CS-CP-10	27/02/2018	70		x	Developer	Project director Name: Mick Caddey Company: Frasers Property Australia	✓
ref.CS-CP-11	27/02/2018	80		x	Developer	Development director	✓

ID	Date	Length (mins)	Phone	Meeting	Stakeholder category	Additional information	Recorded
ref.CS-CP-12a, ref.CS-CP12b	28/02/2018	60		x (2 persons)	Planner & designer	Public & masterplan architect (first application)	✓
ref.CS-CP-13	28/02/2018	70		x	Consultant	Planning Name: Gordon Kirkby Company: Ethos Urban	✓
ref.CS-CP-14	01/03/2018	60		x	Planner	Planner (public) & chair of design competition panel	
ref.CS-CP-15a, ref.CS-CP15b	02/03/2018	70		x (2 persons)	Designer	Masterplan architects (revised application)	

Appendix 7: Additional 'case study interview' questions

Similar to the professional interviews (Appendix 4) due to the semi-structured nature of the case study interviews the author/researcher was able to ask follow-up or probing questions to explore particular topics of interest in more detail. Before the interviews took place, the interviewees were researched and if there were any specific questions to that person e.g. their role within the project, they were asked about this if it had not been brought up by the interviewee in conversation. Furthermore, to build a rapport and make conversation, follow-up questions were prompted by things the interviewee said. To avoid interrupting the conversation, these were noted on a piece of paper during the conversation by the interviewer and referred back to at a convenient point.

Tables A-8, A-9 and A-10 provide a breakdown of the questions specific to the interviewees prepared beforehand and the follow-up questions and their prompts.

Table A-8: List of additional case study interview questions (specific to interviewee and follow-up) - CB1, Cambridge, UK.

Interview reference	Question Type		Prompt for follow-up question (paraphrased)	Question (paraphrased)
	Specific to interviewee	Follow-up		
Ref.CS-CB1-1 (Developer)	x		n/a	-Whilst the company was Ashwells, the first appeal was withdrawn, why was this?
	x		n/a	-Wilton Terrace got quite a lot of media attention, from your point of view should Brookgate of done anything differently?
		x	-Councillors kept rejecting the Wilton Terrace application	-Why do you think the councillors kept rejecting the scheme?
		x	-The silo was destroyed in a fire	-Was retention considered after the fire?
		x	-Microsoft was secured as a flagship development	-How was it secured?
		x	-22 Station Road has been demolished and replaced by new build	-Why are the other two deities still there?
Ref.CS-CB1-2 (Resident)	x		n/a	-How was the 'Friends of Wilton Terrace' group set up?
	x		n/a	-How many members were in the 'Friends of Wilton Terrace'?
	x		n/a	-What process did the Friends go through for the campaign?
	x		n/a	-What process did you go through to try and get Wilton Terrace spot-listed?
	x		n/a	-How did the appeal work?
	x		n/a	-I saw that you had submitted an alternative scheme, was this ever considered?
		x	-I had got involved in the process too late	-Was your involvement after the outline planning permission?
		x	-Friends of Wilton Terrace put leaflets through doors	-Were leaflets the main way of getting attention about Wilton Terrace?
		x	-I sent the developers a document with the alternative scheme	-Did the developers respond to the alternative scheme?
		x	-This is the proposed alternative scheme to retain Wilton Terrace (showed floorplan)	-Did you envisage the atrium attaches to that existing building?

Interview reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Continuation…		x	"-"	-Do you think this proposed design would have been more expensive than what they went for?
		x	-Needed representation at planning meeting	-How do you ensure the local community is represented at planning meetings?
		x	-Changes to applications are problematic for the planner	-Do you think changes are inevitable for developments of this size?
		x	-There had been opposition by local residents against the demolition of Wilton Terrace	-Were there any other buildings apart from Wilton Terrace that caused conflicting opinions?
Ref.CS-CB1-3 (Strategic engineer)	x		n/a	-Has [your company's] work influenced the phasing of development?
	x		n/a	-From a company point of view did the transition between offices work well?
	x		n/a	-Did [your company's] work influence whether existing buildings should be demolished or retained?
Ref.CS-CB1-4 (Resident)		x	-There were emissions in the planning report	-What were these and why do you think that was the case?
		x	-Public benefit was used as an argument for demolition	-How is public benefit defined?
		x	-Conservation Area Consent requirements have changed since the CB1 application	-Is this potentially a lesson learnt then?
Ref.CS-CB1-5 (Structural engineer – station)	x		n/a	-As an engineer, are you a specialist in heritage buildings?
	x		n/a	-Was your [company] the only structural engineers for the station?
	x		n/a	-How was the relationship with English Heritage?
	x		n/a	-Had retention been confirmed before your involvement?
	x		n/a	-What documents were available for your assessment?
	x		n/a	-What did the majority of the proposed work include?
		x	-There was a change in the brief	-What changed in the brief?
		x	- We came across heritage intricacies and protection zones	-When you say that you came across heritage intricacies, what do you mean?
		x	- Some internal parts were demolished	-Was the reasoning for the demolition of internal parts functional or structural condition?
		x	- Uncovered unknowns during construction	-What did the unknowns you uncovered include?
		x	"-"	-Who takes the risk in terms of warranty?
		x	-There were defects (had also mentioned asbestos earlier in the conversation).	-When you talk about defects, what were they apart from asbestos
		x	-There were rotting beams	-Were the rotting beams replaced? Was that using steel?
Ref.CS-CB1-6 (Heritage consultant)	x		n/a	-What was the process the City went through to develop the Conservation Area appraisal? Did this include site visits?
	x		n/a	-How did the work for the planning application build upon this?
	x		n/a	-Was the technical feasibility or heritage considered first?
		x	-The red house, which isn't in the curtilage of the application, was demolished before the masterplan application	-Do you think that set a precedent for demolition?
		x	-The silo burnt down	-Did they ever consider re-using it after the fire?

Interview reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Continuation…		x	-(discussed Wilton Terrace)	-Did the developers ever try and work around Wilton Terrace and consider retention?
		x	"-"	-At the masterplan stage were there many objections against the demolition of Wilton Terrace?
		x	"-"	-I have seen an alternative scheme which the local residents designed for Wilton Terrace, was this ever considered?
		x	-Public benefit is a justification for demolition	-How do you go about defining public benefit?
Ref.CS-CB1-7 (County council officer)	x		n/a	-When was the station area first thought about for redevelopment?
	x		n/a	-Which parts of the county council were involved?
		x	-The county council are only a consultee	-How does the relationship work with the city council?
		x	-We were responsible for the transport assessment including the Hills Road junction.	-Who decided on the final location of Brookgate road?
		x	-The guided busway was a key aspect of the council's work	-Did intentions for the busway come before the masterplan application?
		x	"-"	-When was the route decided and how?
		x	"-"	-Who funded the busway?
		x	-The initial plans included a car park and cycle park.	-Is there still going to be a multi-story car park?
		x	-Wilton Terrace began getting public opposition when the application for full planning and conservation area consent were submitted	-Did the county council get involved with public participation events?
		x	-Need to consider the provision of public benefits.	-Is that mainly through Section 106 agreements?
Ref.CS-CB1-8	x		n/a	-What was the brief given to you?
(Masterplan architect)	x		n/a	-What were the main changes between the 1st scheme which was rejected and the second scheme which was accepted?
	x		n/a	-What documents did you refer to for the development of the masterplan?
	x		n/a	-At the masterplan level, to what extent was the technical feasibility of retention considered?
	x		n/a	-Were you involved in the public enquiry for Wilton Terrace?
		x	-Process involved public participation events	-What format did the public participation events take?
		x	"-"	-Were there any concerns about the demolition of existing buildings expressed during public participation events for the development of the masterplan?
		x	-The mill building was retained alongside the silo	-Was it always the intention to keep the mill building?
Ref.CS-CB1-9 (Planning consultant)	x		n/a	-Demolition is justified in the application because it provides a public benefit, how do you define this?
	x		n/a	-Were you involved in the appeal about Wilton Terrace? If so, what evidence did you put forward?
		x	-Heritage adds character and place-making	-Is there a price that can be calculated for the added value brought about by heritage?
		x	-There was public opposition to Wilton Terrace for the full planning permission	-Was there any opposition to Wilton Terrace's demolition at the masterplan stage?
		x	-People were not really aware of Wilton Terrace at masterplan stage	-Why do you think that was?

Interview reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Continuation…		x	-Needed conservation area consent for the demolition of Wilton Terrace	-Do you think that is a problem with outline planning for the public, as it gives that flexibility to developers?
		x	-Replacement building will be bigger than that proposed in the outline planning	-Is that why you had to obtain full planning permission?
		x	-Silo building was going to be kept	-After the Silo burnt down, did you ever consider keeping it?
		x	- The Microsoft building has large floor area and open spaces	-Is that why the original buildings were demolished?
		x	-Inevitably there is a risk adapting existing buildings	-Is there a percentage that you can assign to that?
		x	"-"	-Technically, were there any problems adapting the existing buildings?
		x	-The best part of the process was the relationship with the council	-How often did you meet?
		x	-Historic England initially opposed the application but then formed a good relationship with the developers	-What do you think changed their attitude?
		x	-In three years' time we will see the public square	-Is three years the expected completion date?
Ref.CS-CB1-10 (Chair of planning committee	x		n/a	-How do you get on the planning committee and do you need to have a background in planning?
	x		n/a	-Were you involved in the review for the masterplan (outline) or the subsequent ones involving existing buildings?
	x		n/a	-Could you talk me through the structure of a planning council meeting?
	x		n/a	-How does the voting system work?
		x	-Between applications (refused and approved masterplans) there had been a change in political parties represented by council	-Do political parties agree to vote the same as one another?
		x	-Local residents would try and get in contact but you need to careful not to express opinion before planning meetings.	-Were the pressure groups involved at the masterplan stage or more so during the subsequent applications?
		x	"-"	-Were you contacted by both the developer and the community?
		x	-There was a refused application before the approved one	-Between the refused application and the second, what were the main differences?
		x	-CB1 was one of the largest projects/applications we had ever seen at the council	-How much time did you have to assess the planning documents?
		x	-There was local opposition to the demolition of Wilton Terrace when developers applied for full planning	-Why do you think the local opposition towards Wilton Terrace came later in the process?
		x	-Planning conditions can help to ensure certain criteria are met.	-What happens if conditions attached to a planning approval are not met?
Ref.CS-CB1-11 (Quantity surveyor)			n/a	n/a
Ref.CS-CB1-12 (Conservation officer)		x	-There will be a Guardian article on the development	-Do you know when that will be published?
		x	-There was an agreement between the council and developers after the fire in the silo	-An agreement in what sense?
		x	-There was going to be an archive in the silo	-Are there still plans for an archive?
		x	-There was coverage of the site in media due to a lack of affordable housing provisions	-Which media?
		x	-Needed to ensure quality in new build replacement	-How do you try and ensure that replacement buildings are of a high quality?
		x	-Inadequate information was provided with the application	-Inadequate, how?

Interview reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Continuation…		x	-I had recommended the retention of 125 Hills Road	-Do you think 125 Hills Road's retention was pushed by you then?
		x	-Arguments were put forward towards demolition	-Why do you think others arguments towards demolition were accepted?
		x	-Public benefit is a justification for the demolition of listed buildings	-How was public benefit demonstrated?
		x	-There was a development control forum assessing the application	-How to you perceive the development control forums input over the design?
Ref.CS-CB1-13 (Resident)		x	-Student housing was put in place rather than affordable	-Did the student housing count as affordable then?
		x	-Some dwellings are being used for bed and breakfast	-Like Air B'n'B?
		x	-There were going to be public realm elements	-At that stage, was there quite a positive buzz about the development?
		x	-I got involved too late	-So was your involvement after the outline planning permission was granted?
		x	-Developers used the argument that it was not economically viable to retain buildings	-Do you know if they have to provide proof about viability that can be seen by the public or is that a private conversation with the developers and the planners?
		x	-The planning process was weak	-Why was it weak?
		x	-There are a lack of retail units in the development	-When the masterplan was designed, was the intention for there to be more?

Table A-9: List of additional case study interview questions (specific to interviewee and follow-up) – Strijp-R, Eindhoven, Netherlands.

Interview reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Ref.CS-SR-1 (Architect for some of the existing buildings)	x		n/a	-Was it Amvest or Piet Hein Eek that decided to keep the existing buildings?
		x	-There is a report looking at heritage and value in the Netherlands	-Have they come up with any conclusions yet?
		x	“-“	-Do you know if the residential dwellings in the RF and RAG buildings sold for more or less than the new build?
		x	-There were issues with the concrete roof panels in the RF building	-Did the material still exist?
		x	“-“	-Were these all replaced or are some existing?
		x	-It’s useful that as a practice we were near to the buildings under construction	-Is that so you could have a presence on site?
		x	“-“	-Had your contractor worked on existing buildings before?
		x	-The future residents had an influence on the RAG design	-Are the dwellings all really different?
		x	“-“	-Did you have any future residents drop out after initially agreeing to buy one of the dwellings?
		x	-The RAG building was advertised on Facebook	-When the building was advertised, did you already have the design in mind or had you started on site?
		x	-There was a freedom of architecture	-Was this made possible by having the design panel?
		x	-The RF building was going to stay the whole time.	-How come?
		x	“-“	-Did it have monument status?
		x	-There was a change in the window detail	-Was this to wood or steel?
		x	-More buildings were kept on Strijp-S	-Do you think more were kept because it was a public project?
		x	-We have stayed involved with the construction rather than design and leave.	-Do you have in-house engineers?
		x	-Our engineers were external	-Did they engineers disagree with any of your ideas?
Ref.CS-SR-2 (Landscape architect)	x		n/a	-What was the brief given to you?
		x	-I produced a landscape plan for the area	-How detailed does the landscape plan need to be?
		x	-At the start of the process, I went around the site to see what was there.	-So there had been no demolition when you did the initial assessment?
		x	-There is a diagonal relic running through the site	-What is the diagonal relic?
		x	-Piet Hein Eek chose to retain the RAG building	-So the RAG building wasn’t going to be kept originally?
		x	-The design panel will look at the design of proposed buildings/plots	-Do the design panel review the design before it goes to the municipality?
		x	-A heritage consultant did the building report	-Did they make recommendations on what buildings should be kept?
		x	-There are reflections of the past in the design	-For people who do not know the design process, have they commented on the references to the past?
		x	-In the green spaces, there has been an issue with the height of the hedges	-How do you overcome that?
		x	“-“	-Talking about green, has there been any type of environmental assessments? Does that influence the design?

Interview reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Ref.CS-SR-3	x		n/a	-What was you brief?
(Architect – new build)	x		n/a	-Before your involvement were the existing buildings already demolished?
	x		n/a	-How and when did the co-housing project come about? Was this intended by the developers from the start?
	x		n/a	-When and why did you start looking at the design for the walkway?
	x		n/a	-What were your aspirations for the walkway?
	x		n/a	-What is happening to the walkway now?
		x	-Previous new build housing in Eindhoven was not selling, so needed new type	-What type were the buildings not selling in Eindhoven?'
		x	-Target market on Strijp-R was family homes	-Was the target market for the co-housing also family housing?
		x	-There were design requirements in the Image Quality Plan	-Who set the requirements in the Image Quality Plan?
		x	-At the moment, the relationship between the public and private green space does not work	-In what way?
		x	-There are privacy issues with the private gardens	-Do you think they want more privacy or less?
		x	-There was a group established for the co-housing	-Did you take the lead for the design on the co-housing?
		x	"-"	-How many people were in the group?
		x	-There were environmental considerations.	-You mentioned the environment, to what extent did environmental assessments affect the design?
		x	-Piet was a key reason buildings were retained	-Do you think if Piet got involved earlier, more would have been retained?
		x	-New build could have been more progressive in terms of environmental considerations	-Do you think it wasn't as progressive because of cost?
		x	-The global financial crisis hit during construction	-Potentially did that drop in value allow the co-housing to come in?
Ref.CS-SR-4	x		n/a	-Please tell me about your PhD research
(PhD Strijp-S masterplan)	x		n/a	-What were the main outputs?
	x		n/a	-When Strijp-S was developed and from your knowledge of Strijp-R, were there any municipality requirements in place?
	x		n/a	-Have there been any changes in planning policy since the development of Strijp-S?
	x		n/a	-What were the main urban design principles missing on Strijp-S and R?
		x	-There were several monuments on Strijp-S	-How much leeway is there if the buildings are locally listed compared to nationally?
		x	"-"	-Were any listed buildings demolished on Strijp-S
		x	"-"	-Were any non-listed buildings kept on Strijp-S?
		x	-Listed buildings were demolished on Strijp-S	-How was the demolition of listed buildings on Strijp-S justified?
		x	-Bat'a and Ford were both precedents of company town and influenced Phillips	-So do you think Phillips learnt from Bat'a or from Ford?
		x	-PhD came up with a series of guidelines and policy recommendations	-How was your PhD received when you presented it?
		x	"-"	-You mentioned that your PhD work has informed policy, are you able to say which policy this is?
		x	-Need to do heritage research first and then decide what happens	-What do you think happens at the moment?
		x	-Had completed some work in the UK	-You mentioned that you had conversations in the UK as well, do you think there is a different perception of heritage between the UK and the Netherlands?

Interview reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Ref.CS-SR-5 (Process Manager)	x		n/a	-I saw the historical research report, what did this involve? Did this include recommendations of which buildings to keep?
	x		n/a	-I saw that students at Eindhoven University did a project on Strijp-R, did this inform the design in any way?
	x		n/a	-A previous interviewee mentioned that there was a design panel, who is on this and what does it do?
		x	-Municipality set a density target	-What was that?
		x	"-"	-Did the municipality have any aspirations for Strijp-R?
		x	-When the site was for sale, the developer submitted tender documents	-What do you have to submit to go to tender? Is it mainly financial information?
		x	-There are school and sports facilities nearby which can be used by residents	-Were the school and sports facility already in Eindhoven?
		x	"-"	-In the UK, there are Section 106 agreements to provide things like schools, is there something similar in the Netherlands?
		x	-There were issues with the condition of the one walkway	-What issues?
		x	-This was retained (pointing at railway station on map)	-What is that?
		x	-There is lots of green space	-Is the green space public?
		x	-There was no plan from the municipality for the area	-Is it normal for the municipality not to have a plan?
		x	-Do you know when Piet got involved?	-(discussed that Piet was looking for a new factory)…when was that?
		x	-There was an agreement between Piet Hein Eek and Amvest	-So Piet then takes the risk?
		x	-Need a demolition plan	-Is a demolition plan additional to the destination plan?
		x	-Embodied energy wasn't really a thing when we started on Strijp-R	-Is embodied energy a thing now?
		x	-The new build has industrial references	-Do you think the public pick up on the industrial references in the new build without knowing about them?
		x	-Heritage was considered near the start	-Did the technical feasibility of retention change any of the decisions?
		x	-Piet Hein Eek had a huge impact on the development	-Do you think that the development would have worked without Piet?
		x	"-"	-Is there a fear that if Piet leaves, what happens to these buildings?
		x	-There have been some noise issues in the next phase of development	-Have the noise issues slowed down the process?
		x	"-"	-What was the compromise in the end with the façade and the design of these buildings?
Ref.CS-SR-6 (Masterplan architect)	x		n/a	-For the plot that you designed, what are the main design concepts?
		x	-There is a lot of space in some Dutch cities after the war	-Is that because there was a lot of damage?
		x	-There is a connection park	-Is that the concrete slabs?
		x	-Some of the buildings had monumental quality	-How do you judge monumental quality?
		x	-The destination plan could be developed in different ways	-Was there quite a lot of flexibility in the plan?
		x	-This is a building project on Strijp-S our practice was involved in	-Was the building a monument?
		x	"-"	-Were there any issues implementing the design?

Interview reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Continuation…		x	"-"	-In terms of energy efficiency, did you make any interventions?
		x	-Retention adds economic value	-Is there any evidence or people just think retaining buildings adds value?
		x	-Piet Hein Eek retained the RAG building	-When did Piet come along?
		x	-Needed flexibility in masterplan because of Piet	-Were you able to adapt it?
		x	-There were presentations of the scheme at public participation events	-Were the public participation events well attended?
		x	"-"	-Were the municipality quite welcoming of the scheme?
		x	-There was a design panel who looked at the design	-Did having the design panel make it easier in terms of municipality planning?
Ref.CS-SR-7 (Contractor – existing buildings)	x		n/a	-Had you been a contractor on existing buildings before?
	x		n/a	-Do you assess buildings yourself or rely on the information from the architect?
	x		n/a	-As the contractor, do you need to submit any environmental investigations?
		x	-The RAG clients could influence the final design	-How much influence did they have?
		x	-Sub-contractors had difficulties with costings	-Was that because they were used to working on new builds?
		x	"-"	-Do you have fixed price contracts with the sub-contractors?
		x	-There is more leeway with transformation than new build	-More relaxed in terms of the regulations?
		x	- The client has expectations and there are also legal requirements	-If there are any problems with the construction, is that your responsibility?
		x	-More time is invested in renovation than new build	-Is renovation more time consuming because they are bespoke?
		x	-We needed to change the window frame material as there was an unexpected problem	-Apart from the windows, did you face any other unexpected problems?
		x	T-he speed of new build in Belgium with Passivhaus is much quicker	-Is new build quicker because it's pre-fabricated?
		x	-Construction took longer than expected	-How much longer did construction take than expected?
		x	-There had been some problems with the decision-making process	-What was wrong with the decision-making process?
Ref.CS-SR-8 (Heritage consultant – site history)	x		n/a	-Did your report make recommendations about which buildings should be kept? If so, were these all adhered to by the developer?
	x		n/a	-A previous interviewee mentioned that the historical conclusions had to be approved by the municipality, is this correct?
		x	-There was one building which could not be torn down because of the cables inside	-Was that the RAG building?
		x	-There was one journalist who criticised the design	-Was that the article which spoke about both Strijp-R and S?
		x	-The density on site was part of the development principles submitted to municipality	-Were the municipality quite accepting of the plan and the proposed density put forward?
		x	-There was an organic evolution of the plan	-In terms of the organic evolution, is that applicable to all masterplans in the Netherlands or specific to Strijp-R?
		x	-The Netherlands has an open mind towards heritage intervention	-Even when the buildings are monuments?
		x	-Heritage assessments are now more comprehensive compared to that completed for Strijp-R	-You mentioned that heritage assessments are more comprehensive now, it would be interesting to hear how.

Interview reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Ref.CS-SR-9 (Heritage consultant – building history)	x		n/a	-Did you use a set of guidelines for assessing the historical value of the buildings?
	x		n/a	-What investigations took place on site?
	x		n/a	-Did your report make recommendations about what buildings should be kept? If so, did the developer adhere to all of these?
	x		n/a	-Do you consider the technical feasibility of retention in your reports?
		x	-The buildings did not have monumental status	-Did it help the developers that the buildings did not have monumental status?
Ref.CS-SR-10 (Municipality urban designer)	x		n/a	-Please can you talk me through the structure of the municipality?
	x		n/a	-What is the difference in the roles of a planner in the municipality and an urban designer?
	x		n/a	-Previous interviewees have told me there was a plan to demolish all of the existing buildings, is that true?
	x		n/a	-I read that one of the aims of the municipality on Strijp-R was for the planning to be more flexible, can you tell me more about this initiative?
		x	-(Talked through the wider area of Eindhoven and the redevelopment of the White Lady)	-Did the municipality redevelop the 'White Lady'?
		x	"-"	-Was some of the development sold onto private developers?
		x	"-"	-Did the 'West Corridor' plans include any initiatives for Strijp-R?
		x	-Buildings on Strijp-S became monuments	-Were they monuments before adaptation or as a result of their retention?
		x	-Heritage adds value	-Is there any quantitative evidence to show that heritage adds value?

Table A-10: List of additional case study interview questions (specific to interviewee and follow-up) – Central Park, Sydney, Australia.

Interview reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Ref.CS-CP-1a & 1b (Masterplan & landscape architects)	x		n/a	-What was required for the design competition? -
	x		n/a	-Were there any requirements specific to the existing buildings?
	x		n/a	-What were the main changes that were required after the competition stage? Were there any additional assessments?
	x		n/a	-What changes were made between the approved and modified masterplans?
		x	- Between plans there was an increase in scale and density of the buildings	-The buildings in Kensington Street are a much smaller scale, were this included in the initial masterplan?
		x	-Heritage building were retained	-Were any of the buildings listed?
		x	-The planning process was controversial and there was a court case	-What was the court case?
		x	"-"	-I read that when Frasers took over the development, they tried to 'make peace' with the community, what action was taken to do this?
		x	-There were changes to the density after there was a new Mayor	-So changes were made because a new Mayor came in?
		x	-The landscape plan included green fingers	-What are the green fingers?
		x	-We had to consider the environmental quality of the soil	-Was remediation required?
		x	"-"	-Was the remediation paid for by the developers?
		x	-I have worked abroad	-Have you noticed similarities in heritage between different countries?
Ref.CS-CP-2 (Heritage consultant)	x		n/a	-I saw that there had been a Conservation Management Plan produced by the City, were you working from this?
	x		n/a	-Do you follow a set of guidelines to conduct the heritage assessment?
	x		n/a	-It would be useful for me if you could describe the various levels of listings in Australia.
	x		n/a	-In your email, you mentioned that there had been modifications to the masterplan since your involvement, what were these?
	x		n/a	-Did the report make recommendations about which buildings should be retained?
	x		n/a	-In terms of heritage and keeping it, has there been any evidence in Australia that it adds a price premium?
		x	-I was involved with the site before the initial proposal	-So you had produced the Heritage Impact Assessment before of as part of the design?
		x	-The reports assessed the significance of buildings	-In most cases, were the buildings with high significance kept?
		x	"-"	-Were any of the buildings listed?
		x	-It's important to note that the aboriginal heritage is much older and should refer to the heritage as built heritage.	-Have you noticed a difference in attitude regarding the built heritage between the UK and Australia
		x	-Industrial pipes which could be seen on the site were not kept	-Were there any conversations about keeping the industrial pipes?
		x	-Sustainability principles were introduced in the modified masterplan	-From what I have read, it appears that this was pushed for by the city and community objections, is that the case?
		x	-In Green Star there are no extra points for keeping a building	-Why is that?

Interview reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Ref.CS-CP-3 (Sustainability consultant)	x		n/a	-I saw that you were responsible for the sustainability strategy, what did this involve?
	x		n/a	-Who imposed the sustainability requirements on site?
	x		n/a	-I saw that the tri-generation is a joint venture between the City and Frasers, how was this agreement made?
	x		n/a	-Is cultural heritage included in the sustainability principles or is it more of an environmental focus?
	x		n/a	-I read that that the research on site showed that you can overcome design, planning and regulatory barriers, could you talk me through some of the issues faced and how they were overcome?
		x	-The Heliostat has a green wall	-Who decided that this building should have a green wall?
		x	-There were some tensions between the community and original proponents	-How did Frasers try and ease the tensions with the community?
		x	-There were objections about traffic	-Were the main objections about traffic?
		x	-There is a pipeline running through the site	-Talking about pipelines, I watched a video online about the tri-generation that showed that it is in the basement of an existing building. Have I understood that correctly?
		x	-The tri-generation is in a new basement and serves more than an individual building	-So the tri-generation serves the whole area?
		x	-(discussed research projects)	Have you got continued research projects on site?
		x	-(mentioned affordable housing)	Are there affordable housing requirements on this site? What percentage?
Ref.CS-CP-4 (Local resident)	x		n/a	-When did you first become aware of the Central Park project?
	x		n/a	-Why were you opposed to the initial proposal?
	x		n/a	-What did the legal challenge you helped develop involve?
	x		n/a	-I saw in a newspaper article that you are now more in favour of the development, what changed your mind.
		x	-After the court case there were 12 points of negotiation	-Were these points taken on board?
		x	-The site had become State significant	-Is that common in Sydney (for sites to be granted State Significance)?
Ref.CS-CP-5	x		n/a	-How were the consultees identified?
(Strategic development advisor and community consultant)	x		n/a	-In one article, I saw that you had completed various assessments on site including a social and economic impact assessment – what did this involve?
	x		n/a	-There was another article which said you led the sustainability strategy, what was the push behind sustainability principles on site?
		x	-It made economic sense to keep some of the buildings	-When you say it made economic sense to keep some of them, what do you mean by that?
		x	-The park was part of the design	-Did the park come quite early on in the construction?
		x	-Mayor initially opposed the development but now in favour	-In terms of easing that tension, did the City have any influence over the masterplan once it was State Significant?
		x	“-“	-What were the main arguments for the site becoming State significant?
		x	-There was a design panel who would review applications	-Could the design panel stop anything?

Interview reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Continuation…		x	-Push for sustainability was by the developers	-With Tier 1 developers, do you think the push for sustainability is because they see economic value in it?
		x	-Retaining buildings add character and place-making.	-Has there been any evidence in Australia that heritage buildings have price premiums?
		x	-Protests over the Rocks were a key part of the heritage movement in Australia, and they are becoming topical again	-You said that the Rocks are becoming topical again, how come?
Ref.CS-CP-6 (Former deputy Mayor)	x		n/a	-How did you go about formulating arguments against the Minister and the approval of the masterplan?
		x	-If votes are equal when picking a committee, names are put into a barrel	-So the vote is like a raffle?
		x	-Stanley Quek had a big influence over the modified masterplan	-Was that just in his nature? Why do you think he was willing to do that?
		x	-In the original masterplan there were a lack of sustainability principles and the developers were taken to court on environmental grounds.	-Do you think taking the developers to court led to a change in environmental considerations?
		x	-Many of the Chippendale community were against the development and Stanley Quek tried to ease tensions	-Could the community opposition slow down the planning process or do you think he tried to ease tensions because of a social conscience?
Ref.CS-CP-7a, 7b & 7c (Masterplan architect – 1st application)	x		n/a	-How did the dynamic work with the other architectural practice that you worked with on the masterplan?
	x		n/a	-What were the main changes to the design after the competition stage?
	x		n/a	-What were the modifications made to your scheme in the final design?
	x		n/a	-Were you still involved after the sale of the site to Frasers?
	x		n/a	-Did you design consider sustainability principles?
	x		n/a	-I have done some reading and seen there was quite a lot of public opposition to the development, what did you do to try and accommodate that?
		x	-There were different design stages	-What were the main design concepts at the different design stages?
		x	-As a design concept, the park celebrates heritage	-In what way does the park celebrate heritage?
		x	-There was a contentious 20th Century building	-Why was the 20th Century building was demolished?
		x	-One of the streets planned in the original design has been moved in the modified masterplan	-Does the same connection exist elsewhere on the site?
Ref.CS-CP-8 (Planning proponent's consultant)	x		n/a	-What were the aims of CUB for the masterplan's output?
	x		n/a	-How was the purchaser chosen?
	x		n/a	-During your involvement were sustainability principles considered?
		x	-Density had been a major issue during negotiations	-What density did the site end up being?
		x	-Land was contaminated	-Was that cost incurred by CUB?
		x	-The site was made State significant	-What were the requirements for that to happen?
		x	-There were arguments to keep the chimney on the brewery building	-Who was fighting to keep the chimney?
		x	-Arguments for the chimney's retention were to do with line of sight	-Line of sight from where?
		x	-CUB planned to sell the site after obtaining planning permission	-Did they ever consider developing the site themselves?

Interview reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Continuation…		x	-There were disagreements over the location of the park	-What were the main arguments for having the park there?
		x	-The planning minister was tough in terms of what he wanted to see	-What did the minister want to see?
		x	"-"	-Once the site was State significant, did the city have any influence over the design?
		x	-People opposed tall buildings	-Did they give a reason for that?
		x	-It was a Labour government	-What is it now?
		x	-There needed to be compliance with daylight codes	-Was it is planning minister who made sure these were met or somebody else?
Ref.CS-CP-9 (Architect for Kensington Street)	x		n/a	-During your work on Kensington Street, were you working from the modified masterplan or helping to develop it?
	x		n/a	-Did you require any additional heritage assessments?
	x		n/a	-In terms of planning for the Kensington Street application, were you dealing with the City or the State?
	x		n/a	-Have you had experience working in the UK? If so, have you seen a different perception towards built heritage?
		x	-Stanley Quek had an 'Asian sensibility' and different approach to design	-In what way?
		x	-Heritage is not just about the buildings but what they are representing	-So it is looking at it as a whole?
		x	"-"	-With the buildings that were demolished, were there any issues in getting that granted in terms of planning?
		x	-There are projects just outside the Central Park development that have benefitted from the development	-Sort of piggy-backing off the development?
		x	-Buildings on Kensington Street were temporarily used as art galleries	-How long were the artist studios there for?
		x	-There were some issues with the maintenance of Kensington Street that affected the design?	-Was that due to the City or State?
		x	-In Australia, there had been a union movement after the demolition of buildings	-Was that the Green Bans?
		x	-The design and location of the public square seemed to be more contentious than keeping heritage buildings	-Why do you think that was?
Ref.CS-CP-10	x		n/a	-Why did Frasers decide to buy the site?
(Developer – project director)		x	- The whole masterplan project runs as a business	-In terms of Frasers' involvement with the site, is that long term? You mentioned you are selling off some of the assets.
		x	-There is a residential strategy	-Is that like shared ownership?
		x	"-"	-Did you have to provide a certain percentage of affordable housing on site?
		x	-There is an inherent value to heritage retention	-Have there been any attempts in an Australian context to try and quantify the value added by heritage?
		x	-This road (indicated) does not work well	-How come?
		x	-Frasers have tried to form a relationship with the Chippendale community	-Was there any engagement with them before Frasers got involved?
		x	-The viewpoint of the City changed	-How do you think the City's viewpoint changed?
		x	"-"	-How much influence did they have over decisions?
		x	-(mentioned working abroad)	-From your work in other countries have you noticed different perceptions in heritage?

Interview reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Ref.CS-CP-11 (Development director)	x		n/a	-How were the architects selected for the modified plan?
	x		n/a	-How did Frasers try and overcome the previous local opposition to the development?
		x	-In the modified masterplan there were changes in the permeability	-What other changes were there?
		x	-Cooling towers have been placed on the top of the brewery	-Were there any issues getting that through planning?
		x	-End-use of brewery building is likely to be commercial	-Why is that?
		x	-Applications can go through a State level Planning Advisory committee	-Is that what happened to the CUB application?
		x	-There is a district energy system	-Is that performing as designed?
		x	-Frasers share of site no longer includes Kensington Street	-How come?
		x	-Frasers is in joint venture with Seikei House	-Is that more a funding role or do they have influence over decisions?
		x	-Frasers are running the central thermal plant for first 12 months of operation	-So Frasers are taking the risk?
Ref.CS-CP-12a & Ref.CS-CP-12b (Public planner & Masterplan architect) Note: Masterplan architect only joined at the end.	x		n/a	-I read that the City had completed a number of assessments before the CUB submission. What were these?
	x		n/a	-What were the City's viewpoints on the demolition and adaptation of existing buildings?
	x		n/a	-How do they City feel about the development now?
		x	-During the process a new Mayor was appointed	-Did they make changes in terms of what was allowed in terms of the density?
		x	- The City needed to assess the site in more detail at the competition stage	-So are you saying more heritage items should have been identified at this point?
		x	-Part 3A has gone	-What was the push to get rid of Part 3A?
		x	-Something else has come in to replace Part 3A	-What is the replacement for Part 3A called?
		x	"-"	-If the same thing happened now, and there was a disagreement between the City and the State, what would happen?
		x	-Sunlight requirements had been relaxed	-Who relaxed those?
		x	-There were difficulties maintaining areas of the park because of overshadowing	-Is the park maintained by the City?
		x	-A planning assessment commission will analyse a scheme for the State	-How are the people on the planning assessment commission chosen?
		x	-After the court case and the new developers taking over, energy and water is taken into account	-Is it now a good example of sustainability?
		x	-There are still some issues with the maintenance of streets/areas?	-Which areas are these and is that because the cost of maintenance comes back to the City?
		x	-The retention of some heritage buildings was more successful than others.	-Which buildings were more successful?
		x	-There have been difficulties with the brewery building	-What are the difficulties with the brewery?
Ref.CS-CP-13 (Planning consultant)	x		n/a	-What was required for the major modifications application?
	x		n/a	-Have there been additional applications since the modified one?
	x		n/a	-What were the main changes in the modified masterplan and the justifications for them?
		x	-A planning assessment commission will assess applications	-How are the members of the panel chosen?
		x	-Part 3A has ended	-Why is that?

Interview reference	Question Type: Specific to interviewee	Question Type: Follow-up	Prompt for follow-up question (paraphrased)	Question (paraphrased)
Continuation…		x	"-"	-Is there anything replacing part 3A?
		x	-The brewery building is currently in the process of getting an approved use through planning	-Do you know why it has come last?
		x	Previously the City opposed the scheme	-Do you know if the City are more on board now?
Ref.CS-CP-14 (Public planner & chair of design completion panel)	x		n/a	-What was the main brief for the original design competition?
	x		n/a	-Did the City have their own plans and assessment for the site?
	x		n/a	-During conversations with CUB what were the main concerns of the City?
	x		n/a	-What were the City's viewpoints on the modified masterplan?
	x		n/a	-Can you talk me through the changes that have been made to Part 3A
Ref.CS-CP-15 (Masterplan architects – revised application)	x		n/a	-What changes did you make from the original masterplan and why?
	x		n/a	-How were you selected as the architects for the modified masterplan?

Appendix 8: Sources for final list of considerations and influencing factors

Table A-11 below shows the final list of factors which are considered and factors governing adaptation and demolition decisions on masterplan sites (see Figure 8-1).The last three columns indicate whether or not they were identified using the different research methods e.g. an "x" in the LR column shows that a factor was identified in the Literature Review stage. An 'x' in the PI column shows the factor was identified in the professional interviews, and an 'x' in the CS column shows that a factor was identified in the case studies. The factors identified in the literature review were used as the initial set of pre-determined codes when analysing interview transcripts (discussed in Section 4.3.3). These were then built upon and refined to form the final set of codes used to analyse the primary data.

Table A-11: Data sources for list of factors considered and governing adaptation and demolition decisions on masterplan sites.
LR = Literature review; PI = Professional interviews; CS = Case study interviews.

Theme	1st Tier	2nd Tier	Criterion source		
			LR	PI	CS
Economic viability	Capital costs	Construction costs	x	x	x
		Funding opportunities	x	x	x
		Legal costs		x	x
		Planning and assessment costs		x	x
		Purchasing cost of land/building	x	x	x
		Tax incentives/disincentives	x	x	x
	Operational & maintenance costs	Insurance costs		x	
		Maintenance costs	x	x	x
		Operational costs	x	x	x
	Revenue & income	Profit and returns	x	x	x
		Target market	x	x	x
		Type of income	x	x	x
		Value added by planning permission			x
	Risk	Commercial risk	x	x	x
		Construction risk	x	x	x
		Occupancy & long-term risk		x	x
		Planning risk		x	x
		Reputational risk			x
		Transfer of risk			x
Economic conditions	Development trends in area		x	x	x
	Market conditions		x	x	x
	Reputation/ competitiveness of cities			x	x
	Wider economic benefits		x	x	
Environmental	Air quality	-			x
	Ecology	-	x		x
	Energy policy	-		x	x
	Flood risk	-			x
	Ground contamination	-	x		x
	Noise pollution	-	x	x	x
	Public health risks	-	x		
	Site wide sustainability systems	-			x

Theme	1st Tier	2nd Tier	Criterion source		
			LR	PI	CS
Continuation…	Solar access	-			x
	Sustainability assessments	-	x	x	x
	Water conservation	-	x		
	Wind	-		x	x
	Whole life energy & carbon	Embodied impacts	x	x	x
		Operational impacts/energy efficiency	x	x	x
Heritage	Heritage benefits	Anchor points			x
		Character & place-making	x	x	x
		Feature or landmark	x	x	x
		Heritage price premiums	x	x	x
	Heritage values	Aesthetics	x	x	x
		Architectural	x	x	x
		Construction methods & materials			x
		Cultural	x	x	x
		Famous architects		x	x
		Famous occupants		x	x
		Group & ensemble value		x	x
		Historical	x	x	x
		Individual special features		x	x
		Sense of Identity	x	x	x
		Social and communal value	x	x	x
		Spiritual	x		
		Symbolic	x		
		Uniqueness		x	x
Legal	Appeal/court case	-		x	x
	Building & land ownership	-	x	x	x
	Building regulations	Acoustic regulations	x		x
		Fire regulations	x	x	x
		Lighting regulations			x
		Serviceability requirements			x
		Thermal regulations	x	x	x
	Contract typologies	-		x	x
	Tenancy agreements	-	x	x	x
	Warranty	-		x	x
Masterplan Design	Accessibility	-	x	x	x
	Community facilities	-	x	x	x
	Density	-	x	x	x
	Land use	-	x	x	x
	Massing and scale of existing buildings	-	x	x	x
	Open space provision	-	x	x	x
	Privacy	-	x		x
	Public art	-			x
	Safety	-		x	x
	Spatial quality between buildings	-		x	x
	Streetscene	-		x	x
	Transportation & Parking	-	x	x	x
	Trees	-			x
	Viewpoints	-	x		x
People	Interest and motivations	Community viewpoints & opposition	x	x	x
		Contractor, consultant and developer experience	x	x	x
		Corporate objectives/types of developer	x	x	x
		End-user and client expectations	x		x
		Funder viewpoints	x	x	x

Theme	1st Tier	2nd Tier	Criterion source		
			LR	PI	CS
Continuation…		Influential role of individual person		x	x
	Relationships	Developer and community		x	x
		Developer and consultants		x	x
		Developer and Local Authorities		x	x
		Developer and statutory consultees		x	
		Within local authority/municipality		x	x
Planning structure and requirements	Environmental policy	-	x	x	x
	Social and affordable housing requirements	-	x	x	x
	Heritage policy requirements	Archaeology	x	x	x
		Authenticity	x	x	x
		Certificates of immunity		x	
		Conservation area consent		x	x
		Hierarchy of designations		x	x
		Listed building consent	x	x	x
		New build's quality		x	x
		Public benefits		x	x
		Setting of listed buildings	x	x	x
		Undesignated assets		x	x
	Planning system	Hierarchy of decision-makers		x	x
		Local Authority resources		x	x
		Type of planning applications		x	x
Processes	Building Records	Availability and accessibility		x	x
		Types of records		x	x
		Accuracy and quality		x	x
	Construction process	Construction time	x	x	x
		Disruption to public	x	x	x
		Logistics	x	x	
	Marketing process	Branding & marketing of site		x	x
		Process of selling dwellings/land			x
	Phasing and future expansion	Development catalysts & flagships	x	x	x
		Flexibility/changes to planning approval		x	x
		Temporary Activities		x	x
	Planning and design process	Coincidences & unplanned events			x
		Consultation (statutory and non-statutory)		x	x
		De-listing/listing buildings		x	x
		Time for planning approval		x	x
Technical feasibility	Building condition	Animal infestation	x	x	x
		Contamination of materials	x	x	x
		Damp	x	x	x
		Deteriorating materials	x	x	x
		Fire damage	x	x	x
		Flood damage	x	x	x
		Non-structural damage	x	x	x
		Subsidence	x	x	
		Vandalism	x	x	x
	Building function	Acoustics	x	x	x
		Drainage		x	x
		Exterior aesthetics & general appeal	x	x	x

Theme	1st Tier	2nd Tier	Criterion source		
			LR	PI	CS
Continuation…		Fitness for purpose & finding a use	x	x	x
		Future-proofing		x	x
		Maintenance feasibility		x	x
		Natural lighting		x	x
		Quality of interior spaces	x	x	x
		Security	x	x	x
		Specialist spaces	x		
		Thermal comfort	x	x	x
	Building services & utilities	Condition of services		x	x
		Service provision	x	x	x
	Building structure	Construction method & date	x	x	x
		Floor-to-ceiling heights	x	x	x
		Load-bearing capacity & stability	x	x	x
		Materials	x	x	x
		Previous structural alterations		x	x
	Layout & dimensions	Depth	x		
		Disabled access	x	x	x
		Floor area	x	x	x
		Height	x		
		Legibility	x	x	x
		Possibility of extension	x	x	x
		Ratio communal area to rentable	x	x	
		Space flexibility	x	x	x

Appendix 9: Planning structures and polices in England, Netherlands and Australia

The purpose of this appendix is to show the different planning structures and key planning policy documents in England (UK), Netherlands and Australia. As stated by Tallon (2013, p.4) "*at a basic level, policy is a course of action adopted and pursued by government; it is an approach, method, practice and code of conduct*".

At the time of the planning applications for the case studies in this PhD, the UK and Netherlands were both in the European Union. Additionally, the UK and Australia share close cultural ties due to colonisation. Consequently, all three countries have similarities in their political, legal and administrative traditions (Gurran et al., 2014). However, all three countries also have differences in their spatial planning approaches, which are reflective of the different structures of governance (ibid.). A key difference being that the UK and Netherlands are unitary states, whilst Australia has a federal system. The following sections provide an overview of the current planning structure in each of the three countries and summary of changes in planning policy that have led to this.

England (UK)

Government Structure: Unitary State – Central/local government

Primary Planning Legislation (National): Town and Country Planning Act 1990 (for England); Localism Act 2011; National Planning Policy Framework (NPPF) 2012.

Planning policy (local): Local plans, neighbourhood plans

CB1 case study specific authorities/policy

Local Authority: Cambridge City Council

Local Planning Policy: Cambridge Local Plan, 2006; Station Area Development Framework 2004

Overview of planning structure

In the UK, planning policy is designed to be implemented/applied by local government and communities, in adherence to national planning policy. Formerly (during the time of the CB1 planning application) national policy included Planning Policy Statements and Guidance, but in 2012 these were replaced by the National Planning Policy Framework (NPPF).

There are three tiers of local government relevant to planning policy. These include: county councils, borough of city councils and parish and town councils (DCLG, 2015). District Councils, such as Cambridge City Council, are responsible for the majority of planning matters including the preparation of local plans, such as the Station Area Development Framework 2004 and Cambridge's Local Plan 2006. Factors addressed by a County Council, such as Cambridgeshire county council, include wider transport and waste planning issues (DCLG, 2015). Although not applicable to the CB1 case study, The Localism Act 2011, allows local communities (led by parish councils or neighbourhood forums) to develop neighbourhood plans, which need to conform to the city council's planning policy.

At the local level, planning officers appointed by the local authority oversee planning matters, whilst a planning committee, formed of elected planning councillors, decide upon larger projects and are informed by the planning officer's recommendations (DCLG, 2015). The whole of the planning system is overseen by the Secretary of State. At the time of the CB1 application this was the Minister for the Department of Communities and Local Government (DCLG). In 2018, the department was renamed the Ministry of Housing, Communities and Local Government (MHCLG). The Planning Inspectorate deal with planning appeals; national infrastructure planning applications, examination of local plans and planning related case work on behalf of the Secretary of State (Gov.uk, 2018).

History of changes to planning structure

The first planning legislation in the UK was the Housing and Town Planning Act 1909, which banned 'back-to-back' housing, due to concerns over basic living standards. A series of other Acts followed including, the Housing and Town Planning Act 1919, the Town Planning Act 1925 and the Town and Country Planning Act 1932. A key change, still present in the current system was the Town and Country Planning Act 1947 which nationalised development rights, meaning landowners lost the right to develop their land, and the notion of obtaining planning permission from the local councils, as well as the development of local plans by the authority, was introduced (Historic England, 2019a).

Major changes were implemented to the planning system in the late 1970s and 80s, when Margert Thatcher was prime minister. These included the introduction of neoliberal ideas, meaning a reduction in government intervention and implementation of deregulation strategies (Gurran et al., 2014). At the turn of the millennium, there were further reforms aimed to increase the speed of decision-making as a response to inadequate housing provision. These reforms included the implementation of housing targets to be delivered through Regional Strategy Strategies (RSSs). However, RSSs were abolished by the Localism Act

2011, and replaced by a duty-to-cooperate between local authorities. The emphasis of the Localism Act showed further "*decentralisation and democratic engagement*" (ibid, p.191).

Netherlands

Government Structure: Unitary State – Central/local government

Primary Planning Legislation (National): The Spatial Planning Act 1965 (Wet op de Ruimtelijke Ordening) (WRO)

Planning policy (local): Local plans, neighbourhood plans

Strijp-R case study specific authorities/policy

Local Authority: Gemeente Eindhoven

Local Plan: Bestemmingsplan Strijp-R; Eindhoven.

Overview of planning structure

The Netherlands has three tiers of government: the national government (Rijk), intermediate level governments (Provinces) and local governments/municipalities (Gemeenten), with each tier having their own responsibilities (Janssen-Jansen, 2016). The basis for urban planning law is the Spatial Planning Act 1965, known as de Wet op de Ruimtelijke Ordening (WRO), where the Minister of Housing, Spatial Planning and the Environment is politically responsible and prepares the national policy. At the intermediate level, there are 12 provinces, with the provincial governments preparing regional/provincial plans, whilst the municipalities develop local/zoning plans, otherwise known as Bestemmingsplan (PV Upscale, 2007). For the Strijp-R case study the municipality was Gemeente Eindhoven and it is located in the North Brabant province.

For most construction work, a building permit (bouwvergunning) is required. This is needed for the construction of new buildings, demolish a building or change the use of a building. This is the equivalent of planning permission in the UK. The application is submitted to the municipality and checked against the bestemmingsplan (Angloinfo Netherlands, 2019). The decision for approval is made by members of the municipality. As with the British system, applicants have the right to appeal if they disagree with a decision made by members of the municipality (Janssen-Jansen, 2016). For the Strijp-R case study, a zoning plan (Bestemmingsplan Strijp-R) was developed by the developers and their design team and then approved by the municipality and their advisors.

History of changes to planning structure

Following the introduction of the Spatial and Planning Act 1965, the Dutch planning system was based on technocratic plans. However, in the 1970s, blueprints were considered as too technical by the new generation of planners and there began to be a shift in emphasis towards a participatory democracy for achieving both environmental sustainability and economic recovery (Janssen-Janssen, 2016).

At the turn of the millennium, a further shift towards the principles of localism is apparent. In 2008, there was a fundamental amendment to the Spatial Planning Act to try and simplify the decision-making process and people's understanding of it. The national, provincial plans were replaced by Structural Visions (Structuurvisie). These are now guidelines rather than legally binding plans. At the municipality level, the land use and zoning plans are known as Betemmingsplan. The new Law permits the municipalities to devise plans without the approval of the province (MLIT, 2019). A further deregulation of policy occurred in 2010, when the new centre-right wing government gave complete control of spatial planning to the provincial authorities and Janssen-Jansen (2016, p.30) comment that the National Spatial Planning Strategy 2014, the Nota Ruimte, "*marked the definitive rejection of centrally guided principles in the Netherlands… [it included] fewer rules and regulations dictated by the national government and more scope for local and regional consideration*".

In 2014, which is after the Strijp-R masterplan was approved, the Netherlands' Ministry for Infrastructure and Environment submitted the Bill for the Environmental Planning Act to the Dutch Parliament, this was published as an Act in 2016, but as of 2019 was yet to come into force. The Act "*seeks to modernise, harmonise and simplify current rules on land use planning, environmental protection, nature conservation, construction of buildings, protection of cultural heritage, water management, urban and rural development, development of major public and private works and mining and earth removal and integrate these rules into one legal framework*" (Government of the Netherlands, 2017).

Australia

Government Structure: Federal system – eight states/territories

Primary Planning Legislation (National): Planning systems subject to state/territorial laws.

Central Park case study specific authorities/policy

Local Authority: City of Sydney (site declared State Significant, resulting in Planning Minister for NSW being the consent authority for planning application).

Planning policy (state): New South Wales – Environmental Planning and Assessment Act 1979.

Local Plan: Sydney Local Environment Plan 2005

Overview of planning structure

In Australia, there is a federal system of governance rather than unitary state. This means that the planning system is not co-ordinated by the national government and the constitutional authority is with the states (Ruming and Gurran, 2014). However, in 2011 (after the Central Park masterplan application), Ruming and Gurran's (2014) note that Australia's first national urban policy was introduced, which was said to seek influence over the state-based planning systems.

There are six states and two territories, each of which have their own planning laws and rules. In each state, strategic plans provide the basis to more detailed planning documents at the local level. These are published by the Minister for Planning through the Department of Planning and Infrastructure. For "*routine planning matters*", authority is delegated to the local government (Ruming and Gurran, 2014, p.102). Central Park is located in the state of New South Wales (NSW), and the local authority was the City of Sydney.

In NSW, there are several 'pathways' to planning approval which depend on the size and the scale of the development. These include local, regional and State significant developments. For local and regional developments, the proposal is assessed by the council and/or relevant planning panel (NSW Government, 2019a). At the time of the Central Park application, Part 3A of the Environmental Planning and Assessment (EP&A) Act 1979 allowed the Minister of Planning to be the consent authority for applications considered to be State Significant, as was the case with Central Park.

Since the Central Park application, State significant development (SSD) and State significant infrastructure (SSI) have replaced Part 3A and are Part 4.1 and Part 5.1 of the EP&A Act (EDO, 2013). An Independent Planning Commission is now the consent authority for State Significant applications if they are not supported by the relevant local authorities, more than 25 public objections have been received or the application has been submitted by someone who has disclosed a reportable political donation in connection to the development application. However, the Minister remains the consent authority for all other SSD applications and has the ability to 'call in' development proposals if deemed State significant (NSW Government, 2019b).

History of changes to planning structure

As the planning system is federal rather than unitary, it is difficult to generalise about changes to the planning system at the national level. Ruming and Gurran (2014, p.102) acknowledge "*for each state, the trigger and* *timeframe for the planning system reform are unique…for states characterised by more stagnant economies (such as New South Wales and Tasmania), perceived planning impediments must be dismantled to kick-start economic growth via the building and construction sector*".

Both Freestone (2014, p.6) and Troy (2013) discuss how interest in planning grew in the 1940s, and was "*widely accepted as a legitimate activity of the state*". A condition attached to the Commonwealth State Housing Agreement 1946 was that the state should regulate and direct urban development by establishing their own planning systems (Troy, 2013). Consequently, the Sydney County of Cumberland Plan 1948 is considered to be one of the first metropolitan plans in Sydney (Freestone, 2014).

Another significant turning point was in the 1990s. Gurran et al. (2014) discusses how neoliberal ideas began to come into spatial planning policy and development control. Despite there being a shift towards environmental and, in some cases, social agendas, this was moderated by private-led development activities. Since the millennium, there have been further planning reforms in NSW reflecting a "*push for economic growth via so called simplification of the planning process*" (Ruming and Gurran, 2014, p.104), whilst also pushing a localist agenda and reduced influence of political actors, reflecting changes seen in the UK. Gurran et al. (2014, p.195) states "*seemingly impressed by the language of the UK coalition, the Liberal government's planning reform platform emphasised community engagement and local determination*".

Appendix 10: Heritage Policy in England, Netherlands and Australia

England, the Netherlands and Australia all have policy at national and local levels related to the protection of heritage. This includes the protection of individual buildings such as national monuments and the protection of larger areas of land, conservation areas, which are 'drawn up' by local authorities through the local plans. These different scales of protection exist in all three of the case study countries. This appendix summarises the key heritage legislation internationally and then for each country that the case studies are located in.

International policy and conventions

World Heritage sites are areas of land or landmarks chosen by the United Nations Education, Scientific and Cultural Organisation (UNESCO) which are of "*outstanding universal value*". These sites are legally protected by international treaties (UNESCO, 2019). Although none of the case studies in this PhD contain buildings/areas of international importance, all three countries that they are located in have ratified a number of international treaties that concern culture and heritage. Signing these treaties shows a commitment by a country's government to adhere to the principles that are set out within it, which may result in the development of country specific laws and policies (Historic England, 2019b).

Internationally, these treaties include: 1954 Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict, and The Convention concerning the Protection of the World Cultural and Natural Heritage 1972. European polices, which are ratified by the UK and the Netherlands include (but are not limited to): European Cultural Convention (Paris, 1954) and The Convention for the Protection of the Architectural Heritage of Europe (Granada, 1985).

There are also Charter's which have been established and set out guidelines for the restoration of historic monuments and buildings. For example, The Athens Charter for the Restoration of Historic Monuments was adopted at the First International Congress of Architects and Technicians of Historic Monuments, Athens 1931. This was followed by the First International Congress of Architects and Specialists of Historic Buildings, Paris, 1957; and then The Second International Congress of Architects and Specialists of Historic Buildings, Venice 1964. The Venice Charter led to the creation of the International Council on Monuments and Sites (ICOMOS) which is a non-governmental international organisation dedicated to the conservation of the world's monuments and sites (ICOMOS, 2019).

England (UK)

National heritage body: Historic England (formerly English Heritage)

Terminology for national listings: National Heritage List

Primary heritage legislation: Planning (Listed Buildings and Conservation Areas) Act 1990. National Heritage Act of 1983 established the Historic Buildings and Monument's commission.

Individual building designations

Historic England are responsible for the scheduling of monuments or listing of buildings, whilst local planning authorities are responsible for granting and refusing consent to alter or demolish listed buildings in consultation with national agencies. Listed building consent is required for any alteration to a listed building which affects its character. This includes internal and external alterations. The National Planning Policy Framework (NPPF) states that local authorities should refuse planning consent to demolish a designated asset unless it can be demonstrated their harm/loss is required to achieve substantial public benefits.

Conservation areas

According to Historic England (2019c) "*conservation areas exist to manage and protect the special architectural and historic interest of a place*". Local authorities, in the case of CB1, Cambridge City Council, are responsible for designating conservation areas and developing the policies to protect their character (Cathedral Communications Limited, 2019). At the time of the CB1 planning application, Conservation Area Consent (CAC) was required for the demolition of any building, even if unlisted, in a conservation area. Since the CB1 application, The Enterprise and Regulatory Reform Act 2013 abolished the requirement for CAC. Instead planning permission is required. It is a criminal offence to demolish buildings without planning permission in a conservation area (SPAB, 2017)

Netherlands

National heritage body: Rijksdienst voor het Cultureel Erfgoaed (Cultural Heritage Agency)

Terminology for national listings: Rijksmonument

Primary heritage legislation: Mounmentenwet van 1988 (The Monuments and Historic Buildings Act 1988)

Individual buildings designations

A national monument (Rijkmounument) is a building/structure perceived to have national importance by the Cultural Heritage Agency, is at least 50 years old and is protected by the 1988 Monument Law. A municipal monument is of local interest and has no age limit. They are designated as part of the municipalities zoning/local plan (Gemeente Eindhoven, 2019). For Eindhoven this means that a building/structure is a matter of general interest to Eindhoven's municipality due to its beauty, significance for science of cultural-historical value (Gemeente Eindhoven, 2010c).

Conservation areas

Although Strijp-R is not located in a conservation area, there are conservation areas in the Netherlands. The Monuments and Historic Buildings Act 1988 describe these as "*Groups of immovable objects that are of general importance because of their aesthetic quality, their spatial or structural association or their scientific or cultural interest, such groups including one or more monuments or historic buildings*" (Cultural Heritage Agency, 2019). The local authority is responsible for allocating conservation areas within the local plan.

Australia

National heritage body: Australian Heritage Council (formerly Australian Heritage Commission)

Terminology for national listings: National Heritage List – Heritage Items

Primary heritage legislation (national): Environment Protection and Biodiversity Conservation Act 1999.

Primary heritage legislation (NSW state): Heritage Act 1977 (amended 1998).

Individual buildings

There are three tiers of listings/designations in Australia: the federal register, state and territory. The National Heritage List is established by the Australian Government, following advice from the Australian Heritage Council and lists places of outstanding significance to Australia (NSW Government, 2018). The Australian Heritage Council is the Government's independent expert advisory body on heritage matters. They assess nominations for the National Heritage List and Commonwealth Heritage List (Australian Government - Department of Environment and Energy, 2019). The State Register lists places and items of importance to the people of the state, whilst local authorities set out their heritage schedule in the Local Environmental Plan (LEP).

Conservation areas

The City of Sydney have a number of conservation areas which are set out in Sydney's Local Environmental Plan. These are determined by the local authority. If a building is within a conservation area, a heritage impact statement must be submitted with a planning application. Development needs to be "*compatible with the surrounding built form and pattern of the development*" (City of Sydney and Architectus Sydney Pty Ltd., 2006, p.16). The Central Park case study was not located in a Conservation Area.

Appendix 11: Whole life energy and carbon policy in England, Netherlands and Australia

The purpose of this Appendix is to provide an overview of key policy changes related to operational and embodied energy in England (UK), Netherlands and Australia. This initial summary is followed by an outline of international agreements for reducing greenhouse gas emissions. For each of the case study countries, policies for operational energy, recycling/waste disposal and embodied energy are then discussed.

Internationally there has been a focus on operational energy in policy for some time due to two key drivers: the 1970s oil crisis and the growing recognition of the impacts of anthropogenic climate change (Berry and Marker, 2015; Eyre and Mallaburn, 2013). Policies focusing on operational energy include those at a national level requiring service providers to decarbonise the electricity grid, as well as those at a building level calling for improved energy efficiency of buildings. At the building level, Rovers (2015, p.2) states "*for some 40 years now the building sector has targeted energy "reduction" measures. At first separate measures were introduced, such as making buildings and houses airtight, introducing double glazing and insulated floors and roofs. This was followed by a more integral approach, supported and stimulated by government regulation and legislation about methodology, setting mandatory targets in energy demand for houses and offices*".

A survey of Annex 57 (an Energy in Buildings and Communities Programme activity specific to embodied impacts) members[50], showed that the Netherlands was the only country at the time of publication requiring the measurement of embodied impacts (Crawford et al., 2018). Since 2018, environmental impact caps have also been introduced in the Netherlands (Pasaman et al., 2018). Although elsewhere there is a lack of regulation for embodied impacts compared to operational, there are examples of embodied impacts (as well as operational) being included in voluntary certificates such as BREEAM and Green Star sustainability assessments. Furthermore, Pasaman et al. (2018) found that the number of systems including embodied impacts, such as regulations, standards, certification schemes had doubled in in the five years preceding the report's publication, indicating a growing recognition of embodied energy's importance in reducing greenhouse gas emissions.

[50] Participating countries in the Energy in Buildings and Communities Programme: Australia, Austria, Belgium, Canada, P.R China, Czech Republic, Denmark, France, Germany, Ireland, Italy, Japan, Republic of Korea, The Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and the United States of America.

International agreements

The United Nations Environment Programme (UNEP) is "*the leading global environmental authority that sets the global environmental agenda [and] promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system*" (UNEP, 2019). UNEP was first established in 1972 as a response to environmental problems in the 1950s and 60s. In the same decade, the International Energy Agency Energy in Buildings and Communities (IEA EBC) Programme was launched as a response to the oil crisis and growing recognition of the significance of the energy use in buildings (IEA EBC, 2019). The EBC programme currently (as of 2019) has 26 member countries including the UK, Netherlands and Australia.

All three case study countries are signatories to the Kyoto Protocol 1997, linked to the United Nations Framework Convention on Climate Change (UNFCCC). The Protocol came into force in February 2005 and the commitments of signatories included requirements to undertake domestic policies and measures to reduce greenhouse gas (GHG) emissions. The first commitment period began in 2008 and ended in 2012. The second commitment period, called the Doha Amendment, included new commitments from January 2013 to December 2020 and parties committed to reduce GHG emissions by at least 18 percent below 1990 levels in the eight-year time period (UNFCC, 2019). All three case study countries are also signatories to The Paris Agreement, which is a separate UNFCC instrument where the "*central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius*" (UNFCC, 2018). Pomponi et al. (2018, p.xi) discuss how many nations "*revamped their carbon plans, climate change drafts and carbon reduction targets*" following the Paris Agreement but that the majority of these amendments focused on operational energy efficiency rather than embodied impacts.

Internationally, there have been specific projects related to embodied impacts. Although produced by a European Committee, the publication of the TC350 standards by CEN/TC350 in 2011 and 2012, provided a framework at an international level for the calculation of whole-life impacts of buildings (Moncaster et al., 2018). Furthermore, international committees such as the Energy in Buildings Communities Programme (IEA EBC) Annex 57 programme took place from 2011-2016, which aimed to evaluate embodied energy and CO2 equivalent emissions for building construction (Yokoo and Yokoyama, 2016). The programme consisted of authors from fifteen countries, researching current limitations in embodied assessment methods and ways that embodied impacts can be reduced (Birgisdottir et al., 2017).

England (UK)

Operational energy

As a response to the 1970s oil crisis, in 1974, the UK government introduced a new energy efficiency programme to reduce winter fuel use (Eyre and Mallaburn, 2013). In the 1980s, there was a shift from energy conservation to energy efficiency, with 1986 being designated Energy Efficiency Year by the Energy Secretary, Peter Walker. This included a campaign called '*Get More for you Monergy*' (ibid.). The UK's first White Paper – 'This Common Inheritance' was published in 1990 (Department of Environment, 1990), The Department of Environment "*embedded environmental policy across government and committed to returning CO2 emissions to 1990 levels by 2005. It also began to position energy efficiency as the central means of delivering emission reductions*" (Eyre and Mallaburn, 2013, p.6). The Climate Change Act 2008, was the first time internationally, that national binding greenhouse gas targets were introduced.

A key piece of legislation focused on the reduction of operational energy use in buildings was the European Energy Performance of Buildings Directive (EPBD) of 2002, which helped to define the building regulations in European member states (Moncaster et al., 2018). These have subsequently been 'tightened up'. For instance in 2010 the Council Directive 2010/31/EU, recast the EPBD with a new requirement for near-zero carbon buildings by 2020 (Eyre and Mallaburn, 2013).

Recycling/waste disposal

The Landfill Tax was first introduced in 1996, following the 1990 Environmental Protection Act and publication of the Environmental White paper, encouraging the minimisation of waste (OECD, 2004).

Embodied energy

Although there are no national regulations for considering embodied impacts in the UK, there are examples of standards and certification schemes. European standards have been implemented as British Standards including: '*BS EN 15643-2:2011 - Sustainability of construction works. Assessment of buildings. Framework for the assessment of environmental performance*' (BSI, 2011a) and '*BS EN 15978:2011 - Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method*' (BSI, 2011b).

RICS (2014) published a guidance note: '*Methodology to calculate embodied carbon*' which was followed by a professional statement/mandatory code of practice – '*Whole life carbon measurement: implementation in the built environment*'. The objectives include: consistent whole life carbon measurement, comprehensive modular structure (referring to all components of a built project over its entire life cycle), and the integration of whole life carbon assessment into the design process (RICS, 2017).

An example of a voluntary certification scheme is BREEAM UK New Construction 2018, UK. This is said to build on "*BRE's long history of using LCA to assess environmental impacts of construction projects*" (Pasaman et al., 2018, p.60). This version uses a whole-building life cycle approach, rather than the elemental approach previously used and the methods used should be EN 1584-compliant (Moncaster et al., 2018).

At a regional level, the London Mayor's draft London Plan, published 13th August 2018 states: "*Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions*" (Kahn, 2018, p.118).

Netherlands

Operational energy

Similar to England, energy policy became a well-known issue in the Netherlands following the oil/energy crisis in the 1970s. The first National Energy Plan was published in 1989, with one of the key topics being environmental conservation, with quantitative targets for CO2 emission reductions being introduced the following year after a change in government (Slingerland, 1997). Simultaneously, in 1990, the Ministry of Economic Affairs published a 'Memorandum on Energy Conservation' which introduced a target to decrease the annual energy intensity (Farla and Blok, 2000; Slingerland, 1997).

In 1996, the Decree on energy efficiency standards was expanded with an Energy Performance Standard (EPN), a method used to calculate the energy performance of buildings. The threshold for this has been strengthened several times since its initial introduction (Farla and Blok, 2000). As with UK policy, further changes were informed by the European EPBD of 2002, including the requirement for Energy Performance Certificates in 2008 (Murphy et al., 2012).

Recycling/waste disposal

Landfill bans were initial introduced in 1995, and the first landfill tax was introduced in 1996. This was gradually increased before its abolishment in 2012 (WEKA, 2013).

Embodied energy

The equivalent of building regulations in the Netherlands, are set by the Building Act (Bouwbesluit) which comprises of law and a detailed Building Decree. In the Act which was implemented in 2013, a requirement was set for the embodied impacts of all residential and office buildings that exceeded $100m^2$ to be measured using an LCA. The LCA was to use the national assessment method (Bepalingsmethode Milieuprestatie

Gebouwen en GWW-werken) and the national environmental database (National Milieudatabase) (Pasaman et al., 2018). At this point in time, the Netherlands were the only country that required any measurement of embodied impacts (Crawford et al., 2018).

Amendments to the Decree in 2018 set an environmental impact cap for new construction (Milin Panelen & Profielen, 2017; Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012; UK Green Building Council, 2019). This has been described as "*the first national regulation of this type in the world*" (Pasaman et al., 2018, p.57).

As well as the regulations, there are voluntary certification schemes in the Netherlands, including BREEAM NL which includes a carbon rating scheme – this is an evaluation of the carbon performance which uses a variable scale from best to worst (Pasaman et al., 2018).

Australia

Operational energy

In Australia, as with England and the Netherlands, the 1970s oil crisis led to mandating the thermal insulation in new dwellings and reduced dependency on imported energy resources (Berry and Marker, 2015). Williamson (2000, p.103) notes "*a parliamentary Joint Select Committee on Conservation of Energy resources first made a recommendation for mandatory thermal insulation of the ceilings and walls of new dwellings in Victoria in May 1978*".

In the 1980s, there was a growing recognition of environmental sustainability and need to address anthropogenic climate change (Berry and Marker, 2015). The Australian Government established the Building Regulation Taskforce in 1989, which led to a funding commitment to create model codes for energy efficient residential and non-residential buildings by 1993, as well as the development of the Nationwide House Energy Rating Scheme (NatHERS). Minimum energy efficiency standards for new homes were introduced in 2003, with subsequent recasts, making the requirements more stringent, in 2006 and 2010 (ibid.).

Recycling/waste disposal

The equivalent of the landfill tax in Australia, is the 'waste levy'. Due to the federal system, this varies from state to state, with it being imposed in some, but voluntary or not existing in others. In NSW, the levy was introduced in the Protection of the Environment Operations (Waste) Regulation 2014 (Parliament of Australia, 2018).

Embodied energy

In Australia, there are currently no regulatory drivers for the consideration of embodied impacts. However, there are some voluntary certifications schemes. Since 2015, Green Star, has included a credit/a score for Material Life Cycle Impacts. These LCA-related attributes total 10-11% of the total possible points (Crawford et al., 2018). In addition to this, certifications originally developed for carbon-neutral products are being updated for use at a building level (ibid.). The Australian National Carbon Offset Standard has been designed to manage greenhouse gas emissions and encourage carbon neutral buildings. Although this does not yet include embodied impacts, the standard states "*embodied energy from construction materials and processes may be considered for future versions of the standard*" (Commonwealth of Australia, 2017, p.7).

Appendix 12: CB1 planning documentation

Figures A-4 and A-5 show the dominant discussion points from the consultation responses and meeting minutes within the planning officer's report and its appendices for the CB1 masterplan application (Dyer, 2008a). These meetings/consultations include: disability consultative panel, application review meeting, neighbourhood consultations, and comments from statutory and non-statutory consultees, notes from development control forum and design and conservation panel minutes.

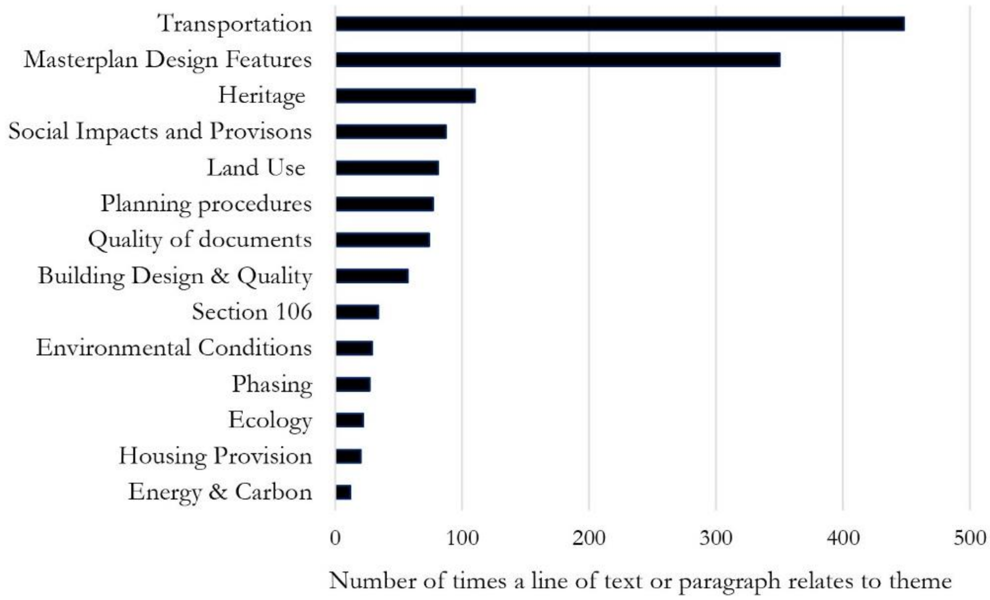

Figure A-4: Overarching themes emerging from 'document analysis' - including minutes and consultation responses. Only includes themes with frequency of mentioning > 10.
Reproduced from: Baker, H. & Moncaster, A. (2017, p.7) Demolition and adaptation at the CB1 development, Cambridge. *The European Real Estate Society's Annual Conference,* 28 June – 1 July 2017, Delft, Netherlands.

Figure A-5: Regularly mentioned topics from 'document analysis' - including minutes and consultation responses. Only includes topics with frequency of mentioning > 10.
Reproduced from: Baker, H. & Moncaster, A. (2017, p.8) Demolition and adaptation at the CB1 development, Cambridge. *The European Real Estate Society's Annual Conference*, 28 June – 1 July 2017, Delft, Netherlands.

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