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ADAPTIVE REUSE IN THE UK: A CREATIVE APPROACH TOWARDS SUSTAINABILITY

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Content

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After I had completed my exchange year at the Barlett School in London, Professor Nash suggested me the theme of retrofitting and of adaptive reuse, in a broader sense, which is a very topical issue in modern architecture. From the first day I have been motivated and interested in the theme, deciding to focus on the techniques of "Adaptive reuse in London", applied on different case studies and two projects I have developed with the assistance of Professor Murray Fraser, Vice-Dean of Research and Professor of Global Culture at the Bartlett Faculty of the Built Environment. I am thankful to him too for giving the right advice on the topic and for providing me with material and links that I could not have discovered on my own.

Last but not least, I am highly indebted and thoroughly grateful to my family, who always put huge effort and faith for me, urging me to do better and to plod on despite my constitution wanting to give up, thank you so much.

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The United Kingdom' s existing stock of buildings accounts for some 40 % of national carbon emissions, and 80 % of those structures will still be here in 2050. It is widely accepted that at the current rate of refurbishment, they will not all be fully retrofitted or otherwise decarbonised in time to meet energy or carbon-reduction targets, from the proposed 2018 mandate for private landlords through the European Union 2020, London 2025 or UK 2050 goals.

London faces an additional complication; its building stock, half of which dates to the Victorian era, includes nearly 20,000 listed buildings and hundreds of thousands more protected to some degree within more than a thousand conservation areas, including an estimate of 575,000 homes. Safeguarding London' s unique character and complying with heritage regulations requires architects to treat older buildings with special care.

The aim of this research is to analyse the different strategies of adaptive reuse in the UK, as a way of redeveloping the existing stock through sustainable techniques.

The concept of adaptive reuse and its major techniques are explained; these comprise recladding, retrofit (a wider and modern form of adapting buildings, involving the action of introducing (retrofitting) new materials, products and equipment into an existing building with the aim of reducing the use of energy of the building and reusing its spaces), facadism. These methods aim at the aesthetical and technological enhancement of an existing building, while adding more value and prolong its life through sustainable means.

Significant case studies are then analysed to understand the possible strategies of adapting existing buildings in the city of London.

In the final part of the study, I have developed two projects in central London, where retrofit techniques are contextualised and discussed, with the aim of finding new creative solutions for reusing older buildings.

Abstract

In anni recenti il tema dell' "adaptive reuse" e del retrofit tecnologico hanno definito in modo talvolta ambiguo un insieme di pratiche ed interventi che ancora stentano, almeno in Italia, a diventare tecniche codificate e definite.
Negli ultimi anni c' è stato un progressivo passaggio da una dimensione sperimentale degli interventi finalizzata all'individuazione di alcune "best practices" nei diversi contesti nazionali - che spesso riguardano non solo gli aspetti architettonici e tecnologici, ma anche i meccanismi di finanziamento e le politiche di intervento nel rapporto tra soggetti pubblici e privati - ad una fase in cui l'attenzione è rivolta principalmente ai risultati "quantitativi" in termini di riduzione del peso energetico e degli impatti ambientali, e dunque alla capacità di controllo e verifica di tali risultati nelle diverse fasi del processo edilizio. A dieci anni esatti dall'emanazione della direttiva 2002/91/CE sul rendimento energetico degli edifici, inizia a delinearsi a livello europeo un quadro generale di accresciuta consapevolezza sui temi legati all'efficienza energetica e, più in generale, alla sostenibilità ambientale, che si traduce in una prassi operativa di qualità che investe l'intero processo edilizio. Da un lato, infatti, i principali "topics" della progettazione bioclimatica sono in gran parte acquisiti nella pratica progettuale fino a diventare in alcuni casi presupposti fondativi di un valido "concept" architettonico, dall'altro, l'innovazione tecnologica si è orientata in maniera decisa sullo sviluppo di prodotti e sistemi caratterizzati da elevati livelli prestazionali in relazione ai principali parametri energetici, spesso uniti a caratteristiche ecologiche e di basso impatto dei prodotti e dei processi produttivi.
L'insieme di questi fattori ha consentito, nei contesti europei più avanzati - cioè quei paesi che nel tempo hanno maturato un livello elevato di capacità programmatica, progettuale e tecnica (oltre che normativa) - di avviare programmi particolarmente ambiziosi che puntano al cosiddetto "retrofit di massa", con interventi di riqualificazione energetica su larga scala, realizzati mediante ingenti finanziamenti pubblici e innovative forme di partenariato con soggetti privati.

In questa trattazione ho deciso di analizzare le strategie di "adaptive reuse" e retrofit tecnologico adottate nel Regno Unito, in particolare a Londra. I principali programmi promossi nel Regno Unito - "Green Deal", "Retrofit for the Future" - non si configurano infatti come un semplice recepimento di orientamenti normativi e direttive europee, ma rappresentano piuttosto un adattamento delle stesse al contesto locale.
Casi studio significativi nella città di Londra sono quindi analizzati, discutendo le soluzioni di adaptive reuse spaziale, recladding, retrofit, e facadism.

Introduction

During the 20th century human settlements have shifted from sparse pattern to compact urban centres a change that has caused the vast transformation of the natural environment and consequently caused the current environmental problems.
The cities have been increasing their size with tremendous rates over the recent years and thus the impact that this has to the environment is beyond any other historic precedent. Although cities occupy just 2 % of the earth' s surface they consume most of the natural resources in order to sustain and produce huge amounts of waste being the major cause of earth pollution. It is now in question if the rapid growth of the urban centres as it has happened in the recent years can be sustained. They argue that it is of vital importance, in order to maintain and enhance the impact of the built environment to the natural environment, that the consumption of energy per person must be reduced.

There is an increasing concern on the understanding of the relationship between build and natural environment and the adverse impacts that human activity has on nature. Irrefutably the urban way of living offers many advantages to the quality of life to the modern man but these come hand in hand with environmental and social problems. Sustainability is about changing attitude and balancing the modern way of living with the renewable resources of the biosphere.

Sustainable development has been set as a fundamental goal in the agendas and strategies of UK government. By 2050, UK is committed to reducing carbon emissions by 80 per cent lower than the net baseline in the year 1990. In the UK, housing is responsible for 27 % of national carbon dioxide emissions and is amongt the least energy efficient in Europe[1].
As new-build housing only represents one per cent of the building stock each year (DCLG, 2006)[2], one of the ways to achieve this is by retrofitting the existing buildings as the built environment counts for the 45 % of the emissions and also the majority of the buildngs, around 80 %, that we are using today will still be in use in 2050. According to the English Housing Condition Survey 2012, England has the oldest housing stock in Europe with 21 % constructed prior to 1919[3]. This means that the building stock will have to adapt to the climate change.
The adaptive reuse and conservation of older buildings is a challenging subject, as there is the problem how to combine creativity and innovation with the eager to preserve the authenticity and the original fabric of the buildings.

The National Planning Policy Framework (NPPF) sets out the basic principles of the conservation policy that the UK government follows. There, it is encouraged the reuse of existing buildings in order to achieve a low carbon future and at the same time protect the heritage assets so that they can be preserved for the future. According to English Heritage reusing and conserving the historic environment serves sustainability in several ways, some of which are listed below and illustrated in the next chapters (English Heritage, 2012)[4]: waste saving, sense of place is further reinforced, limit the risk of destroying the fine grain in historic areas, historic buildings often have greater economic values than new ones, conservation and revival of older buildings leads to a growth of local economies and enhancement of local identity.

It is possible to achieve both comfortable living conditions and conservation of the building? Do conservation and sustainability form the two sides of the same coin?

At first glance someone might not be able to understand the connection of these two seemingly different fields, however the principles of sustainability are intertwined with the basic principles of conservation practices as conservation questions the need to add new stuff to the building stock that already exists in the built environment.

Sustainability is related to conservation in a broader ecological sense. It is often said by conservationists that the greenest building is the one that is already built, as this accounts for the massive amount of embodied energy that went into his construction.

There are two ways that buildings use energy, the most important is during its use, as "operational energy". Historic buildings are a reservoir of envrionmental and energy capital: historic buildings represent embodied environmental capital in the form of timber, stone, bricks, glass and metal. Research by the BRE in 2013 showed that a "typical" Victorian house contains the energy equivalent to 15,000 litres of petrol[5]. These materials are also irreplaceable and often represent craft skills that are no longer available.

Almost all types of historic buildings can be retrofitted to adapt to the modern standards of living and sustainable design. The aim of this dissertation is to examine how buildings can be upgraded through adaptive reuse techniques and retrofitting, to make them more environmentally friendly through sustanaible means. It will be investigated how the conservation of heritage buildings may contribute to a more sustainable urban environment. The role of building conservation has changed from preservation to being part of a broader strategy for urban regeneration and sustainability.

In this study I will highlight the ways in which older buildings can be enhanced and conserved in order to prolong their efficiency, reducing carbon dioxide emissions and using renewable sources of energy.
The importance is to understand the need of upgrading the existing building stock through sustainable adaptive reuse techniques; thus, detaching from a traditional concept of conservation/preservation.

In the first chapter of the research, I will describe the main directives applied in Europe and UK in terms of sustainability. In the second chapter the energetic trends and building stock in the UK are analysed, followed by a wide analysis on the UK building subdivision by the English Heritage and the need of detaching from the traditional approach of conservation.
In the fourth and fifth chapter, I will introduce the concept of adaptive reuse, analysing the different spatial and technological techniques through case studies in the city of London.
Finally, in the last chapter, two projects of adaptive reuse in the city of London are developed, clarifying the importance of upgrading the existing building stock through sustainability, an approach that should be implemented with a similar approach in other European countries, such as Italy.

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1. EU DIRECTIVES ON SUSTAINABILITY

The European policy context

At the European level, the main policy driver related to the energy use in buildings is the Energy Performance of Buildings Directive (EPBD, 2002/91/EC).
Implemented in 2002, the Directive has been recast in 2010 (EPDB recast, 2010/31 EU)[1] with more ambitious provisions. Through the EPBD introduction, requirements for certification, inspections, training or renovation are now imposed in Member states of the European Union, prior to which there were very few.
While all countries now have functional energy performance certification (EPC) schemes in place, five countries have not yet fully implemented the scheme for all requested types of buildings.
Only eleven countries currently have national EPC register databases while ten countries have databases at regional/local level or development plans underway.
Building energy performance needs to be significantly improved in order to reduce overall energy demand and, importantly, reduce carbon dioxide emissions in line with the cost-effective potential and Europe' s Green House Gas emissions objectives.
Energy security and climate change are driving a future that must show a dramatic improvement in the energy performance in Europe's buildings emissions in line with the cost-effective potential and Europe' s Green House Gas emissions objectives.
Energy security and climate change are driving a future that must show a dramatic improvement in the energy performance in Europe's buildings.
The 27 Member states have set an energy savings target of 20 % by 2020, mainly through energy efficiency measures. The Europeam Union has also committed to 80-95% GHG reduction by 2020, as part of its roadmap for moving to a competitive low-carbon economy in 2050. Buildings currently represent almost 40 % of total final energy consumption, and therefore, can make a crucial contribution to these targets.
In the Energy Efficiency Plan 2011, the European Commission states that the greatest energy saving potential lies in buildings. The minimum energy savings in buildings can generate a reduction of 60-80 Mtoe/a4 in final energy consumption by 2020, and make a considerable

contribution to the reduction of GHG emissions[2]. This will be achievable only if buildings are transformed through a comprehensive, rigorous and sustainable approach.

The European policy framework for buildings has been evolving since the early 1990s. A wide array of measures has been adopted across individual Member States to actively promote the better energy performance of buildings. After 2002, the issue gained strong momentum when the Directive on Energy Performance of Buildings (EPBD) [Directive 2002/91/EC] was adopted. The EPBD was recast in 2010 to make the goals more ambitious and to reinforce the implementation[3].

The European Union stretches over many different climate zones, landscapes and cultures. Some 501 million inhabitants spread over 27 countries reside in a wide array of building types with an equally wide range of thermal qualities, in a constantly expanding building stock.

Buildings consume about 40 % of total fine energy requirements in Europe, representing the largest factor, followed by transport with 33 %.

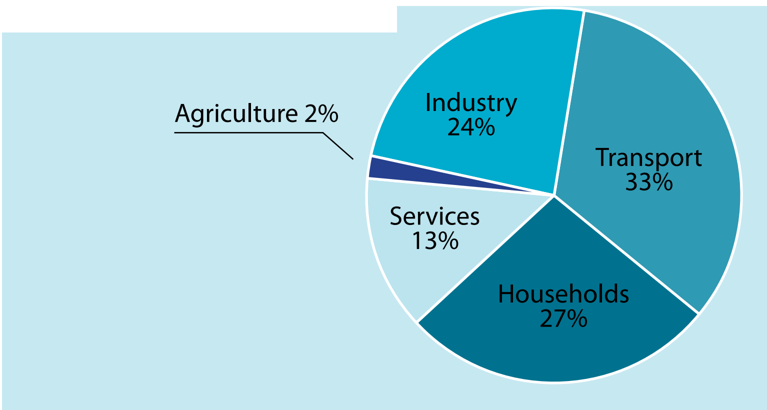
The high level of energy consumption and GHG emissions in buildings in Europe makes this is an obvious sector to target in order to determine the potential and improve energy performance. While there has already been significant effort to improve energy performance in buildings, considerable potential still remains, as was noted by the European Commission.

The justification for focusing on the energy efficiency in buildings can be summarised in the following arguments that relate to both the individual's point of view and the perspective of society as a whole:

- Security of energy supply;

Fig.1

"Final energy consume by sector in the EU, 2009: Buildings consume about 40 % of total energy of total final energy requirements in Europe. In the context of all the end-use sectors, buildings represent the largest sector, followed by transport with 33%."
Source: DG Ener



- Lower Green House Gas emissions, which means a major contribution to climate change strategies;

- Reduced energy costs for consumers, which can be important in avoiding "fuel poverty", where energy costs represent a disproportionate share of disposable income;

- Cheaper than investing in increased energy capacity;

- Improved comfort;

- Contribution to the rehabilitation of certain building types of the new member states of Central and Eastern Europe;

- A major contriubution to the objective of sustainable development, which is a formal commitment of European countries;

- Improving energy efficiency in buildings is important to the buildings energy service industries that are important employers in Europe.

One major challenge for European states is changing the mind-set concerning buildings. If the building sector is to significantly contribute to the 80-95 % Green House Gas reduction target for 2050, each building will have to demonstrate very low carbon emission levels and consume very low energy in a context of a decarbonised power sector. For most of Europe' s buildings, that probably means improving the current average energy consumption by a factor four or five and the installation of renewables[4].

1.1 EU BUILDING TYPOLOGY

Buildings in Europe vary remarkably in terms of their function type. They can be broadly divided into residential and non-residential sectors, where each sector alone consists of multiple types.

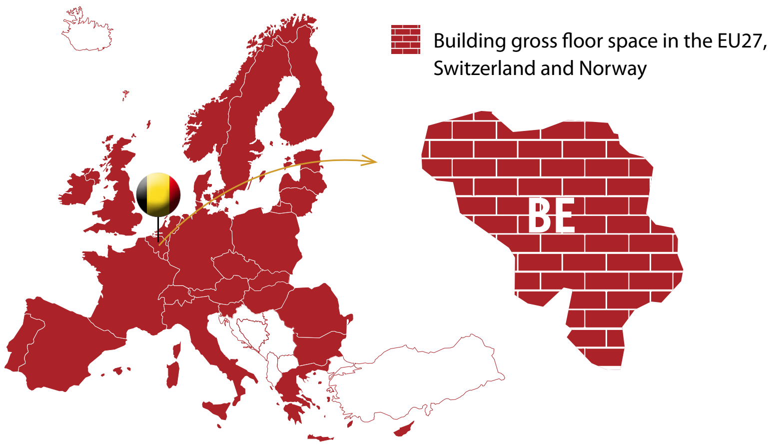
It is estimated that there are 25 billion m^2 of useful floor space, a figure that, is increasing at a rate of around 1 % per year. All EU buildings in terms of their gross floor space can be concentrated in a land area equivalent to that of Belgium (30,528 km^2). In comparison to China and USA, Europe has the "highest building density", followed by China and then US. Floor space trends can be linked to a number of factors, such as wealth condition, culture and land availability. These factors can explain the significant differences between Europe, China and US, where floor space per capita are around 48,81 and 26 m^2, respectively[5].

Improving the energy efficiency of our buildings, not only reduces energy consumption and energy bills, but also improves the aesthetics of the building, increases the value of the asset and provides healthier conditions for the occupants.

Fig.2

"Final energy consume by sector in the EU, 2009: Buildings consume about 40 % of total energy of total final energy requirements in Europe. In the context of all the end-use sectors, buildings represent the largest sector, followed by transport with 33%."

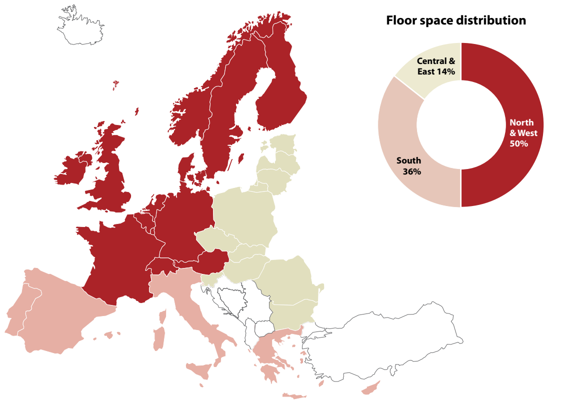
Source: DG Ener



	Population (2010)	Land area (km^2)	Building Floor Space
EU27	501 million	4,324,782	24 billion m^2
US	309 million	9,826,675	25 billion m^2
China	1338 million	9,598,080	35 billion m^2

European states can be divided into North and West, South, Central and East.

Half of the total estimated floor space is located in the North and West region while the remaining 36 and 14 % are contained in the South and Central and East regions, respectively.



North & West	AT, BE, CH, DE, DK, FI, FR, IE, LU, NL, NO, SE, UK	Population: 281 mil.
Central & East	BG, CZ, EE, HU, LT, LV, PL, RO, SI, SK	Population: 102 mil.
South	CY, GR, ES, IT, MT, PT	Population: 129 mil.

Fig.3

"Countries and regions considered herein with equivalent population and floor space figures"

Source: BPIE Survey

The five largest countries in population (France, Germany, Italy, Spain and UK) account for approximately 65 % of the total floor space[6].

Countries in the North and West regions have higher total floor area per person than in the South and East central regions. The countries of central and eastern Europe tend to have lower space standards in terms of dwellings with a floor space of around 25 m^2 in comparison to the Northern and Southern European countries, which have space standards typically of around 40 m^2 per person. On the other hand, non-residential floorspace per capita is nearly double in the North compared to other regions, which might suggest a link between non-residential floor space and economic wealth.

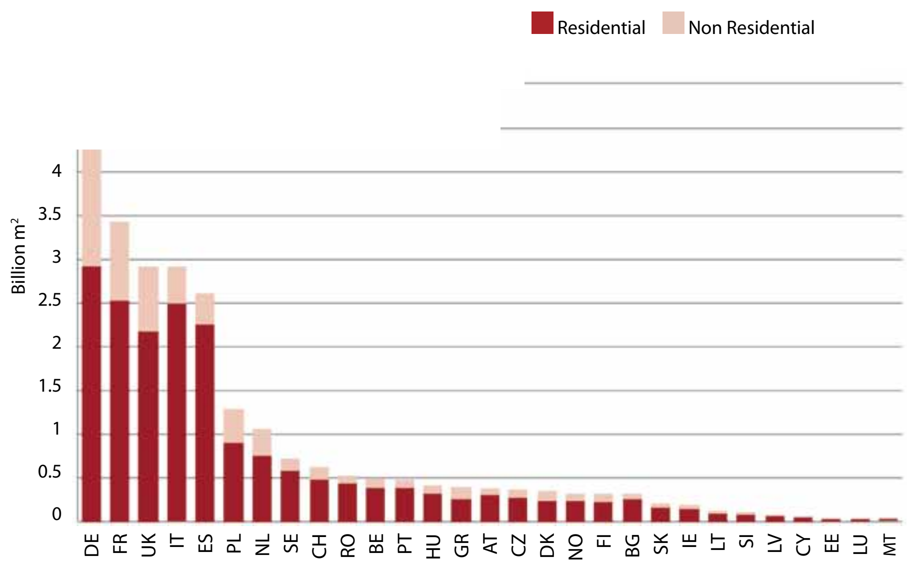


Fig.4

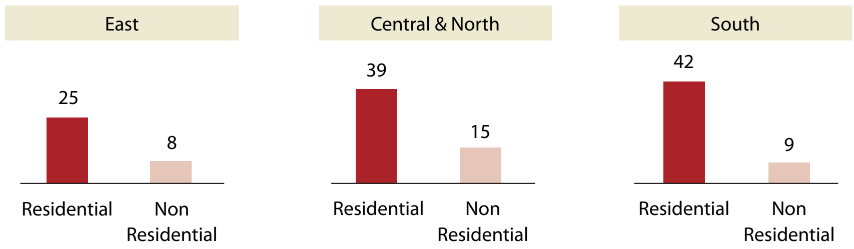
"Floor space distribution per country"

Source: BPIE Survey

Fig. 4.1

"Floor space distribution per country"

Source: BPIE Survey



The residential stock is the biggest segment with an EU floor space of 75% of the building stock. Within the residential sector, different types of single family houses and apartment blocks are found.

64 % of the residential building floor area is associated with single family houses and 36 % with apartments.

Fig. 5

"Residential floor space for the countries covered in the study"

Source: BPIE Survey

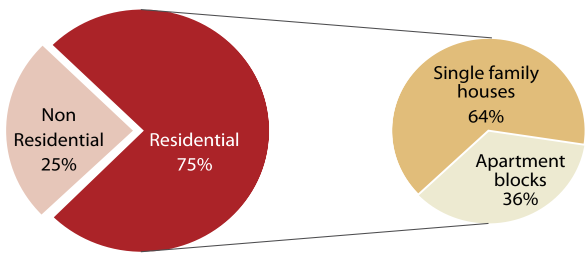
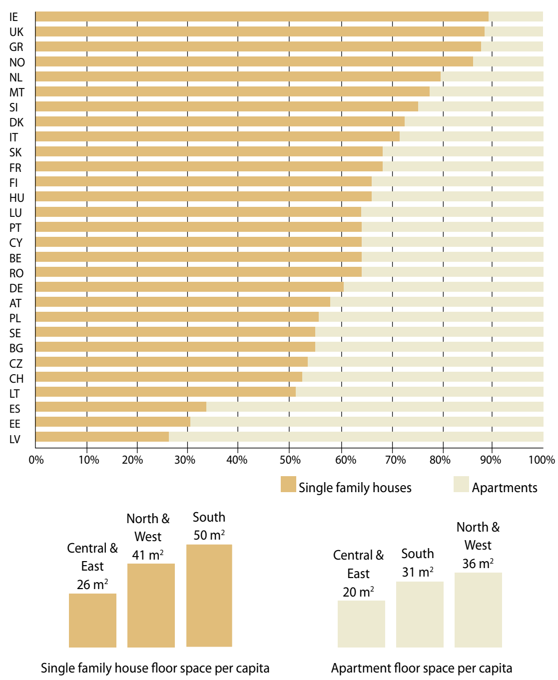


Fig. 6

"Single family and apartment buildings in Europe"

Source: BPIE Survey



NON-RESIDENTIAL BUILDINGS

The diversity in terms of typology within the non-residential sector is vast. Compared to the residential sector, this sector is more complex and heterogeneous. It includes types such as offices, shops, hospitals, hotels, restaurants, supermarkets, schools, universities and sports centres while in some cases multiple functions exist in the same building. Office buildings are the second biggest category with a floor space corresponding to ¼ of the total nonresidential floor space. Offices have similar heating and cooling conditions to residential buildings although they are of shorter use. Similar usage pattern as offices are found with educational buildings which count for less than 20% of the entire non-residential floor space[7].

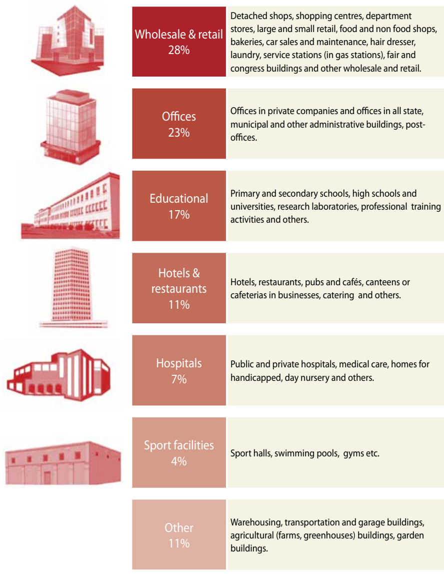


Fig. 7

"The non residential sector in Europe"

Source: BPIE Survey

Age of buildings

Buildings across Europe are also associated with different time periods dating even before the 1900s. Historical buildings certainly have a significant heritage value while construction techniques and building regulations such as building codes imposed at the design phase have a great influence on the energy performance of a building built in a specific period. in the residential sector, the age of a building is likely to be strongly linked to the level of energy use for the majority of buildings that have not undergone renovation to improve energy performance. Buildings have been classified by EU into three categories:

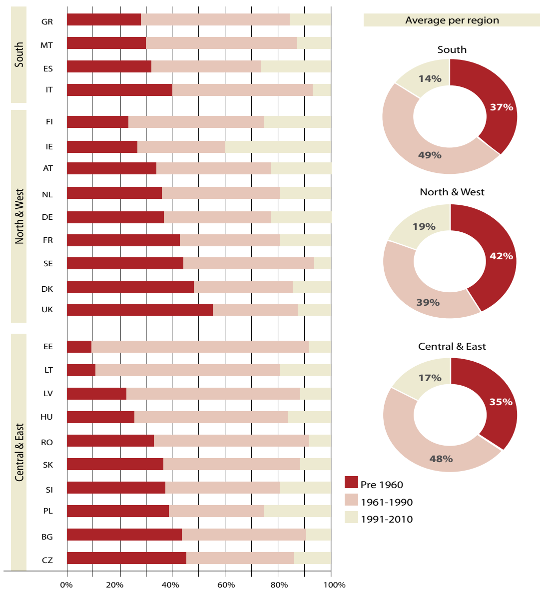
- old: typically representing buildings up to 1960
- modern: representing buildings from 1961 to 1990
- recent: buildings from 1991 to 2010

Figure 8 shows the share of residential floor space by age band. The countries with the larger components of older buildings are the UK, Denmark, Sweden France, Czech Republic, Bulgaria and Italy.

Fig. 8

"Age profile of residential floor space"

Source: BPIE Survey

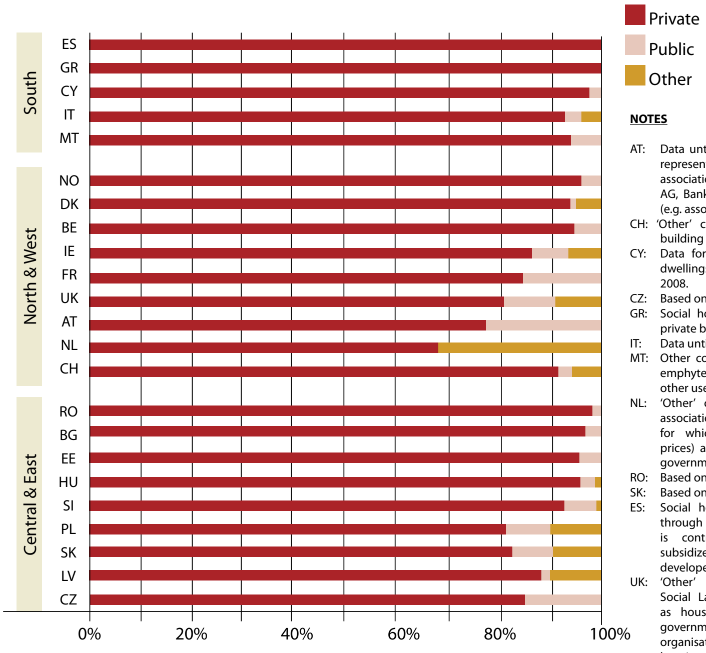


Ownership and tenure

The ownership of buildings have a bearing on the rate at which renovations are undertaken and the depth of the energy savings measures that may be included in renovation projects.
The public sector should be taking the lead in "deep renovations" and its portfolio of buildings provides many opportunities for economies of scale. Private owners can be more reluctant and require more encouragement in the early stage.
Across the 23 countries of EU, the largest share is held in private ownership while 20 % is alloacted to public ownership[8].
Figure 8 shows that only Austria has more than 20 % of residential dwellings held in public ownership.

Energy performance

It is widely recognised that the building sector is one of the key consumers of energy in Europe. Figure 9 shows the historical final energy consumption in buildings in EU since the 1990s. The consumption is made up of two main trends: a 50 % increase in electricity and gas use and a decrease in use of oil and solid fuels by 27 % and 75 % respectively.



NOTES

AT: Data until 2001. Mixed ownership is represented by non-profit building associations, other companies (e.g. AG, Bank, GmbH) and other owners (e.g. associations).
CH: 'Other' consists of members of a building cooperative and others
CY: Data for public and private sector dwellings constructed between 1998-2008.
CZ: Based on estimations.
GR: Social housing units are owned by private bodies
IT: Data until 2001
MT: Other consists of dwellings held by emphyteusis (notarial contract) and other used free of charge
NL: 'Other' consists of social housing associations owned by private bodies for which conditions (e.g. rental prices) are heavily regulated by the government.
RO: Based on 2006 estimations
SK: Based on 2001 data
ES: Social housing is mainly delivered through the private sector and is controlled through subsidies, subsidized loans and grants for both developers and buyers
UK: 'Other' consists of Registered Social Landlords (often referred to as housing associations) that are government-funded not-for-profit organisations that provide affordable housing.

Fig. 9

"FInal energy consumption in buildings in EU"

Source: BPIE Survey

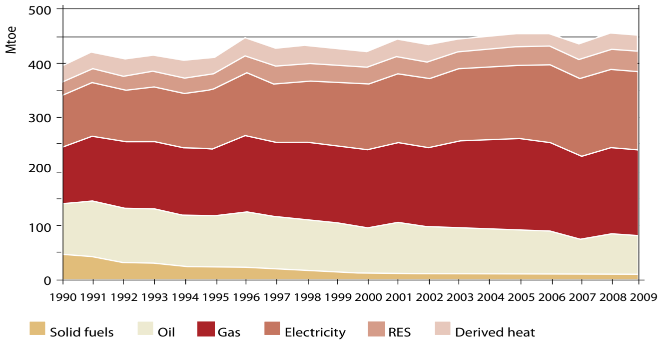
The energy use in buildings is a rising trend with an increase from around 400 Mtoe to 450 Mtoe over the last 20 years. This is likely to continue if insufficient action is taken to improve the performance of buildings.
In terms of Co^2 emissions, buildings are responsible for around 36 % in Europe. The average specific CO^2 emission in Europe is 54 $kgCo^2/m^2$ where the national values of $kgCo^2$ per floor space vary in the range from 5-120 $kgCo^2/m^2$ as shown in figure 9[9].

Residential buildings comprise the biggest segment of the EU' s building stock and are responsible for the majority of the sector' s energy consumption.
In 2009, European households were responsible for 68 % of the total final energy use in buildings. Energy in buildings is mainly consumed by heating, cooling, hot water, cooking and appliances, where the dominant energy end-use in homes is space heating.

Fig. 10

"Historical final energy consumption in the building sector since 1990s for the EU27, Switzerland and Norway"

Source: Eurostat database



Understanding energy use in the non-residential sector is complex for main uses such as lighting, ventilation, heating, cooling, refrigeration, that vary greatly from one building category to another one.

Basing on the EU data, it is estimated that the average specific energy consumption in the non-residential sector is 280 kWh/m2. This value is 40 % larger than the equivalent value for the residential sector[10].
Specific energy use for each EU state in non-residential buildings are shown below.

Fig. 11

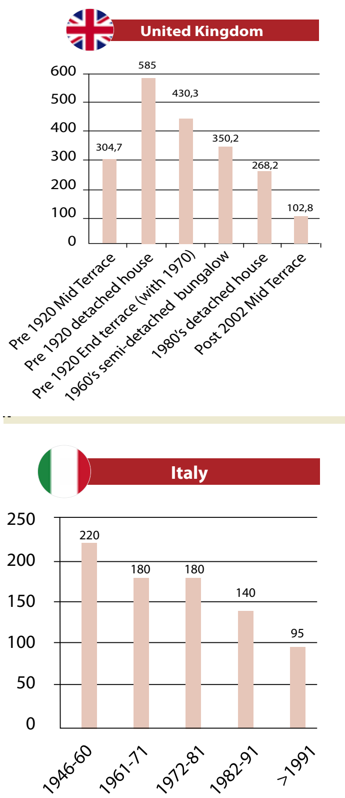
"Average heating consumption levels in terms of final energy use (kwh/(m2a) of single family homes by construction year in UK and Italy"

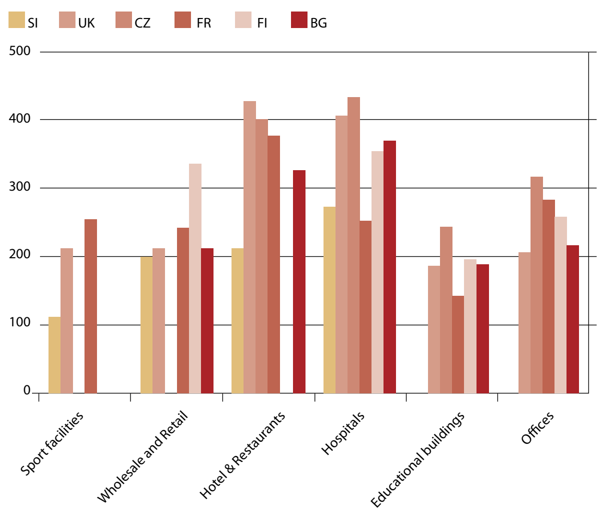
Source: BPIE Survey

Fig. 12 (right)

"Specific energy use in non-residential buildings"

Source: BPIE Survey





1.2 EUROPE LEGISLATIVE FRAMEWORK

Improving the energy performance of buildings is a key factor for UK, to achieve the EU Climate and Energy objectives, namely a 20 % reduction in the Green House Gas emissions by 2020 and a 20 % energy savings by 2020.
By reducing the energy consumption of the buildings, a direct reduction of the associated Green House Gas emissions will be obtained and a faster and cheaper implementation of renewable energy sources will be added.
To summarise, around 80 % of the total energy demand in the European Union is consumed by 20 % of the population. 50 % of the total carbon dioxide emissions is generated by the building sector of the most industrialised countries.

European directives

Directive 2002/91/EC

Directive 2002/91/EC of the European Parliament and Council on the Energy performance of buildings came into force on 4 January 2003. It was introduced after the Kyoto protocol and because the 160 million buildings in the EU use over 40 % of Europe's energy, producing over 40 % of its carbon emissions.
With the Kyoto protocol, Europe is committed to reducing the waste of energy and greenhouse gas emissions and to improving efficiency in the building sector, and the directive is intended to contribute to this aim.
The directive is divided into 17 articles. The main objective of the regulation is the improvement of the energy performance within a building, obtained by a methodology to calculate integrated energy performance of buildings, minimum energy requirements for new buildings, minimum enrgy requirements for large existing buildings being renovated, energy certification of buildings and regular inspection of boilers and of air conditioning systems.
It defines the following elements: buildings, energy performance of a building, energy performance certification of a building, Combine Heat and Power (CHP), air conditioning system, boiler, effective rate output and heat pump.
Member states are required to apply a methodology which calculates the energy performance of a building, according to its main characteristics and taking in consideration the norms applied in the specific Member States legislation[11].

The energy performance of a building shall be expressed in the most transparent way possible and may include a CO2 emission indicator.

Any member states shall also guarantee that the minimum energy performance requirements for buildings are properly set. In this case each member states is allowed to differentiate between new and existing buildings and to categorise buildings according to their use. The requirements need always to be updated.

Moreover, the concept of performance certificates is introduced. Whenever a building is constructed, member states shall ensure that an energy performance certificate is made available.

Regular inspections of boiler and of the air conditioning systems with an effective output of more than 12 kW must be done[12].

Directive 2010/31/EU

Directive 2010/31/EU is a revision of the previous adopted in 2002. A common general framework for a methodology to calculate the integrated performance of buildings, minimum energy requirements for new buildings and building units, minimum energy requirements for building undergoing major renovations, for all building elements when installed, retrofitted or replaced, energy certification of buildings, nearly zero-energy buildings have been introduced[13].

This directive encourages member states to set minimum performance standards that are challenging, but without being too costly.

Directive 2012/27/EU

Directive 2012/27/EU has been transposed into local law in each member states on the 5th June 2014, states that " a national indicative target for energy efficiency, based on the consumption of primary or final energy, on the primary or final energy, on the primary or final energy savings or on the energy intensity."[14] (Art.3), as well as "a long-term strategy to encourage investment in the renovation of residential and commercial buildings, both public and private" (Art.4).

The Directive also promotes information campaigns and trainings on energy efficiency and financial aspects[15].

1.3 APPLICATION OF EUROPEAN LAWS ON SUSTAINABILITY IN THE UK

Having seen, in the last chapter, the main European strategies, directives and objectives in terms of energy efficiency and environmental sustainability, with particular reference to the built heritage, and as a result of what has been said with respect to the British method of protection, restoration and enhancement of the architectural, artistic and cultural heritage, this work will be focusing on ways of interaction between these two topics, developed by the British government. The goal of this section is to trace and reconstruct the history of British policies regarding the issue of sustainability, analysing how UK relates to the European Union directives and strategies.

FIRST INITIATIVES ON SUSTAINABILITY IN THE UK

The UK has developed a set of measures to reduce CO_2 emissions already in the late '80s[16]: the aim was to quantify in monetary terms emissions stimulating the development and distribution of clean energy and improving energy efficiency.
The early interest of the English nation to the adoption of these types of policies perhaps originates from the awareness of being among the most responsible for the production of CO_2. In 1995, in fact, the United Kingdom was responsible for about 2% of global emissions of carbon dioxide, with emissions of less than 10 tons of carbon dioxide pro understand: even if that amount represented only a small percentage of the world total, it was still much higher than the global average (about twice)[17].
The first programs of the UK to the "Climate Change" were processed in 1994 and from now on periodically revised until 2000, the year that saw the publication of the "*Climate Change Programme*", a report in which the principles and priorities of action of the country were established, aimed at reducing CO2 emissions, in reference to international guidelines. According to analysis carried out in the same year, emissions were already fell compared to 1990, so this new program were united strategies past, which had led to such a reduction, with a new program that would lowered their influence on the world average by 2% to 1.6% by 2010.
The priority of the *Climate Change Programme* was to ensure that England reached the international target of reducing greenhouse gases emisssions by 12.5% compared to 1990 levels by the period 2008-12, certainly higher than the Kyoto target of 5 %. Another objective before 2010 was the reduction of 20 % from 1990 levels of carbon dioxide emissions caused by the domestic sector[18].

Next to this program was the "*White Paper on Energy: Our Energy fututre: creating a low carbon economy* ", published in February 2003, which for the first time in 20 years formalised an energy policy for the country. This paper stated that England's aim was to reduce the 60% of CO2 emissions by 2050, identifying as solution the use of a "cleaner, smarter energy".
UK wanted to establish a long-term program, designed to address the two main challenges of "Climate change" and the '"energy security". This program was based on four main pillars: environment, safety supply, competitive markets, social objectives; areas of energy policy established by various studies carried in the previous years as, for example, in "Performance and Innovation Unit's Energy Review", published in February 2002. The strategies for these four areas aimed at:

• leading the country toward a path of reduction of carbon dioxide, the main cause of global warming, by 60% by 2050, with real progress to be achieved already within 2020;

• maintain the reliability of energy supplies;

• promote competitive markets in the UK, contributing to the increase of sustainable economic growth, however, likely to improve the overall productivity of the country;

• ensure an adequate and affordable heating level to housing.[19]

After this White Paper, followed a series of further documents, including the "*Sustainable Energy Act*" in October 2003, which stands as the immediate precursor, and the "*The Energy Act*" of July 2004, which were endorsed earlier commitments, showing that the government was well determined to achieve their goals: in fact in all documents that followed the White Paper of 2003 these four strategies can be found. And the case of the Energy Review, revisions made in 2006 due to the rapid evolution of the world energy. That part confirmed the four usual subjects and continues with additional proposals and strategies falling into three groups:

• Energy saving: this issue is identified as the starting point for carbon reductions, thus becoming starting point for the reductions of carbon, thus becoming the main challenge for which they proposed the following actions: increase the information; raise national standards; make government possessions carbon neutral by 2012; developing a transport system more energy efficient;

• Clean energy: not just the economical measures adopted by UK could not lead to the energy reduction objective. For this reason, the government identified the use of clean energy as an additional need, achievable by: better and wider distribution of energy generators including heating with low emissions; use of Community systems including cogeneration; support for Carbon storage; development of alternative fuels for systems of transportation; use of renewables;

Energy Security Challenge: the challenge of reducing emissions is closely linked to security of energy supply. To achieve the latter, the government foresaw two main actions: achieve greater independence from the import of oil and gas, especially in light of global distribution of energy reserves and the growing of international demand; ensure that the market would offer considerable investments and the capacity of developing electric energy, encouraging affordable prices for families and businesses. Aim was the opening of new markets, working at international level to develop strong relationships with suppliers[20].

Always in the view of achieving the objectives before 2050, in May 2007 another *White Paper* on climate change and security was published. In this new document the proposed strategy imposed six parts: establishing an international framework in order to address the climate change; fix carbon targets legally binding for the whole UK economy; make further progress in achieving fully competitive and transparent international market; encourage better energy saving measures through disseminated information, incentives and regulations; support low carbon technologies thanks also to a collaboration within researchers, public-private, national and international. To achieve these objectives, the White Paper of 2007 proposed a series of concrete actions grouped into two main themes:

• conservation of energy, which had to be achieved in corporate and domestic sectors and transport. The introduction of the mandatory energy certification was of great importance in the business sector; the major innovations were: the need that the new buildings were designed as zero-carbon buildings; for the transport sector the introduction of a "*Low carbon transport innovation*" strategy;

• energy supply via the following: the introduction of biomass as an energy source; new measures for enhancing the production of energy, electricity and heat generation based on centralized systems; according to the "*Renewables Obligations*", confirms the production of 10 % of electrical energy by 2010 through renewable energy, and of 20 % be 2020; the introduction of the "*Renewable Transport Fuel Obligation Act*" in 2008-2009, which stipulated that biofuels would have to provide 5 % of the whole fuel quantity[21].

Finally, in 2008 the Climate Change Act was published, it enclosed all the decisions taken in the six previous years, and introduced, as first in the world, a long-term legally binding framework to address climate change dangers. This act has been proposed in parliament in November 2007 and signed into law in November 2008, and created a new approach for the management and response to changes in place by setting ambitious goals.
The principal regulations of this law were:

• legally binding targets for reducing emissions greenhouse gases by 34% by 2020 and by 80% by 2050 (always taking as a basis the values of 1990);

• a system for regular review of the emissions to be done every 5 years old, in order to control the effectiveness of strategies arranged for the finish line in 2050;

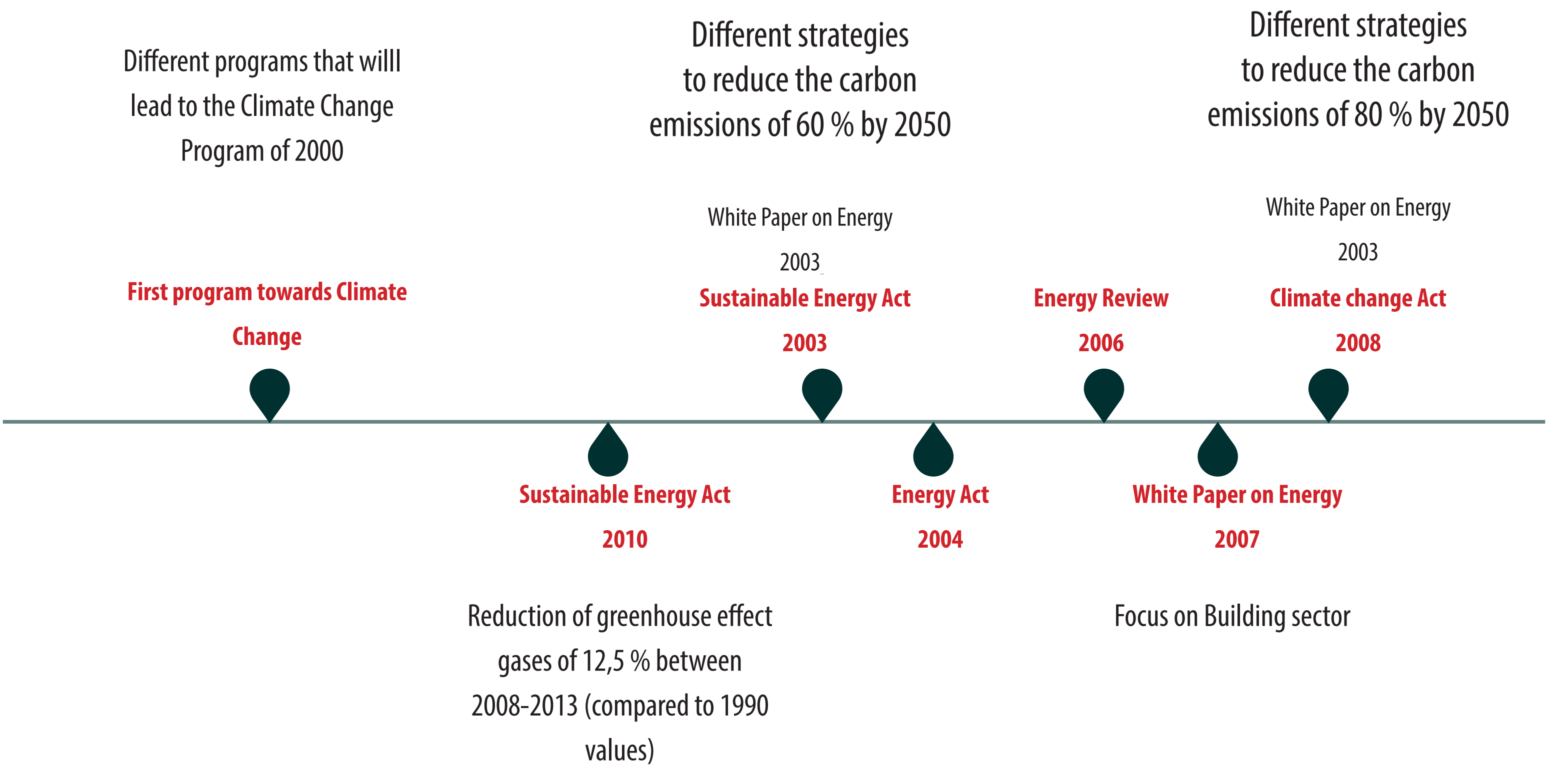
• creation of the "Committee on Climate Change," a new independent committee with the task of advising the government on the right balance between national action, international, and through annual reports, strategies and guidelines to be taken in order to achieve an effective energy saving and an optimal emission balance plan, providing monitoring tools towards the objectives of 2050;

• commitment for the government to draw up every five years a program, in which the risks for *Climate change* and its solutions are listed.

• obligation for the government to draw up guidelines for companies in order to reduce produced emissions;

• annual publications on energy efficiency and sustainability in government possessions[22].

Main sustainable policies in the UK



1.4 TRANSPOSITION OF SUSTAINABILITY LAWS IN THE UK

Once we have considered the first major UK directives, publications and laws on the theme of energy sustainability in the first decade of the twenty-first century, we will now focus our attention on the transposition of the three fundamental European directives in the UK. Directive 2002/91/EC was transposed by the British government with the "*British Law by the Housing Act* "of 2004 and "*Energy Performance of Building (England and Wales) Regulation* " of 2007 (SI 2007/91). Since 2007 until now, the Department for Communities and Local Governments (DCLG), the UK government department responsible for preparation of building regulations, has repeatedly revised the law on the energy performance of buildings (SI 2007/91), after the new demands made in European directives on performance energy, including the 2010/31 / EU and 2012/27 / EU. The current version is the SI 2012/3118, which came into force on 9 January 2013, which consists of 14 sections, each accompanied by an approval document, containing the requisite legal tools to meet the regulations. Very important, especially in our research, is the "Part L" of these regulations, as it deals with the conservation of fuel and energy in the building sector; also this part over the years has been subject to fundamental changes that are now listed. The version of 2002 included a division in L1 for housing and L2 for non-residential buildings: for the first calculating the standard energy performance, which was given by the "*Standard Assessment Procedures* "(SAP), for the second ones from a simplistic" elemental method", which provided that each architectural element should reach the minimum performance levels laid down in this part of the building code. The 2006 version has also introduced some fundamental changes in response to recommendations from the European Directive of 2002. One of these is that the current "*Approved Document: Conservation of fuel and power*" was divided into four parts, the division that shows the most attention has begun to turn towards the existing housing stock:

- Approved Document L1A New Dwellings (new homes);
- Approved Document L1B: Existing Dwellings (existing dwellings);
- Approved Document L2A New Buildings other than dwellings (New non-residential buildings);
- Approved Document L2B: Existing Buildings other than dwellings (Existing non-residential buildings).

Moreover, in this review two major energy calculation instruments have been introduced: the

"*National Calculation Methodology*" (NCM) and "*Simple Building Energy Model*" (SBEM), today used as the main calculation methods in building construction.
This document was subsequently renewed in 2010 and DCLG recently published the "2013 *Amendments to Approved Documents* ", the new regulations, in force from 6 April 2014, which take into account the recast of the regulation 2010/31 / EU, also introducing a new document "*Approved document 7* "relative to the types of constructions and materials.

We will now illustrate the specific content of the *Approved documents*, providing adequate and clear overview of the English which implement European directives and introducing most of the performance parameters and conditions design. The following description will be made only for the groups L2A and L2B, as they do not differ greatly from L1A and L1B, which can be considered, without making mistakes, as a subgroup of the first.
Starting from the *Approved Document* L2A - *New Buildings other than dwellings"*: this document, as mentioned above, relates to energy conservation in new non-residential buildings.
This category must meet five criteria, the first of which is closely related to the indicators of energy performance required by the Building Regulations 2010, while the other four, although often essential to achieve the first, are only a guide for the design of the building:

• Criterion 1: reach the BER. The intent of this criterion is to to limit CO2 emissions, achieving the optimum Building Emission Rate (BER), which must not be higher than the Target Emission Rate (TER), or the emissions of a theoretical building, having the same shapes and dimensions of the construction to realize. Calculations are performed using approved softwares, among which the most diffused is SBEM[23].
The BER is calculated by including the features of the building to be implemented in the software; emissions are then calculated following the methodology of national calculation introduced in 2006. Even to calculate the TER, this same methodology, which provides fixed values for each architectural element, is followed;

• Criterion 2: limits of flexibility in the design phase. This criterion is tense to impose limits on the design flexibility, to minimize heat losses through the building fabric, by setting minimum fixed building requirements (transmittance, permeability etc) for the control and efficiency HVAC, Heating, Ventilating and Air Conditioning;

• Criterion 3: limit the effects of solar gains during summer in order to reduce the energy consumption due to cooling systems;

• Criterion 4: get a supply of the building is consistent with the BER. To achieve this criterion should be that the buildings are designed and equipped in such a way that their performance is consistent with the BER; to do this it is necessary to check the absence of thermal bridges, leaks and air duct;

• Criterion 5: provisions for operations efficiency energy. They provide useful information to the construction and the management of the building according the previous criteria[24].

Speaking about the '*Approved Document L2B - Existing Buildings other than dwellings"*, which, as said, concerns the energy conservation in non-residential existing buildings, achievable through five key areas:

- construction of extensions;
- changes of use of the building and energy state;
- forecast or extension of control systems or service (Walls, windows, boilers, etc.);
- replacement or upgrading of heating elements (walls, doors, roofs, etc.);
- significant improvements.

These interventions are often linked together; for example, a new extension can make a change in the state of some elements, which in turn may require an appropriate control, or even lead to new construction of thermal elements. However, each new heating element, as well as even those recovered and preserved, must comply with the corresponding standard requirements (which are more stringent than those for new construction), properly tabulated in the document. Furthermore, proposals for work on existing buildings with a major surface 1000 m^2 may require "*consequential improvement*"[25] in order to make the construction more efficient, compensating for any increase in energy use caused by the work proposal[26].
Part L also provides recommendations in terms of *Energy Performance Certificates* (EPCs) and *Display Energy Certificate* (DEC): *The Building Regulation* perfectly follows the European directive in terms of thresholds for the production and for the visualization of certificates, which adopts the document containing the CIBSE TM47 reference model for the necessary

calculations[27].

In addition to these documents, specifically designed and targeted to the new construction sector and the housing stock, on the 30th April 2014 the British government published its "*National Energy Efficiency Action Plan* "(NEEAP). This plan was carried out pursuant to Article 24 of the European Energy Efficiency Directive 2012/27 / EU and it sets out how the UK government will conform to it, in view of the common goal of saving energy by 20% by the 2020. The document explains how the implementation of the directive will lead England to achieve the efficiency the energy potential economically viable for the country, potential "*Building on the UK's leadership on energy efficiency*"[28]. According to studies carried out in 2014[29], the final energy consumption in England already decreased by 13% compared to 2003, and the set target for 2020, referred to in Article 3 of Directive 2012/27 / EU, is a reduction in final energy consumption by 18%, corresponding to 20% of primary energy.

However, without going into detail on all the points of this plan, we would like to focus the attention on the most interested aspect on the topic, the *"Energy Efficiency in Buildings"*. The United Kingdom has, in fact, a wide range of policies that encourage high restructuring energy efficiency of the existing housing stock. In addition to these, the government is committed to introduce the strict requirements for new buildings to be *Zero Carbon Buildings*. The government will improve its policy "zero carbon homes" from 2016. As for the national plan "*Increasing the number of nearly zero energy buildings* ", published by the British government in September 2012, this sets the goal of having all new domestic construction as zero carbon by 2016, and the same ambition for non-residential buildings by 2019, and by 2018 for buildings of public authorities. To achieve these objectives the national strategy established two major actions, such as:

• reduction of energy demand in buildings, obtainable increasing the thermal efficiency through an enhanced and better insulation, encouraging consumers to use smart control systems; improving the energy efficiency of lighting and appliances and by encouraging better demand management;

• decarbonisation of heating and cooling reachable by promoting the transition from gas-fired boilers to alternative low-carbon systems, such as pumps heat and district heating[30].

Having said that, we focus now on what is the real novelty of the National energy efficiency action plan. Of great importance in this plan is in fact the strategy regarding refurbishing buildings, in accordance with Article 4 of Directive 2012/27/EU, which states, in Annex B of the plan, the portfolio of English policies, designed to stimulate investment in energy efficiency in interventions of building renovation, supported by an overview, that helps to understand the additional opportunities in refurbishment and retrofit in order to build a national building stock. Before analyzing this strategy, it is important to repeat what is required by the Article 4 of European Directive:

"Member States shall establish a long-term strategy for mobilizing investment in the renovation of the national park of residential and commercial buildings, both public and private. Such strategy includes:

a) an overview of the national building stock based on statistical sampling;

b) identification of effective methods of refurbishment in terms of costs, relevant to the type of building and climate zone;

c) policies and measures to stimulate deep and effective building renovations in terms of costs, including deep renovations in phases;

d) a forward-looking perspective to guide decisions of investment in individuals, in the building sector and in financial institutions;

e) an estimate based on evidence of the expected energy saving, and the benefits broadly.

A first version of the strategy is published by 30 April 2014 and updated every three years and submitted to the Commission within the framework of national action plans for energy efficiency[31].
The review of the housing stock of the country identifies the presence of a scenario mixed both for age and type of built.
However, this stock is extremely adaptable to changes and social models of work over time, which moved their demand to a different intended scope.

Starting from domestic existing buildings, the UK has about 27 million of houses, falling in different typologies, of which an important percentage was built before 1919, as demonstrated by following chart (Fig.1). Overall, more than three quarters of the entire housing stock was built before 1980. Together these are responsible for about 32% of UK end-use energy[32] and, in view of the estimates made, which establish that in 2050 over two-thirds of the houses will belong to that stock, for England interesting challenges and opportunities are setting[33].

These challenges are minor, if you think that the old houses do not have high levels of energy performance, often having no insulation, but mainly solid walls and thick, which must now reach the standards of modern insulation. As you can see from the chart (Fig.2) in England about half of the houses has a level of EPC equal to D, 25% situated in band E, F or G 6%, and only 18% is below the levels more or less good of A, B and C. The British government, already in the last 10-20 years, had however developed programs suitable for raising levels of insulation in the building stock: these ranging from providing mandatory or voluntary schemes, depending on the consumer demand, and the most famous is the Green Deal.

The latter consists of a policy launched by the *Department of Energy and Climate Change* in January 2013, allows a mechanism of funding prediction for interventions of energy savings in the residential sector. For the development of this policy a key role was played by the action of Green Building Council, a nonprofit organization active since 2007, which aims at improving the sustainability of the built environment, transforming the way in which it is designed, built and managed.
Their work is aimed primarily at residential buildings and not yet also the infrastructure that bind together the built environment.
The mission of the *Green Building Council* is to offer transparency and cohesion in a heterogeneous sector, bringing together all stakeholders involved in the planning, design and sustainable construction, influencing government policies and building a knowledge of green skills. On the occasion of the convening of this association, for the development of a government strategy on how to finance the retrofit energy in buildings, which occurred in 2009, *Green Building Council* has developed a report that has played a major role in the formulation of the *Green deal*[34].

Going back to the situation of the building stock in the reported English *national energy*

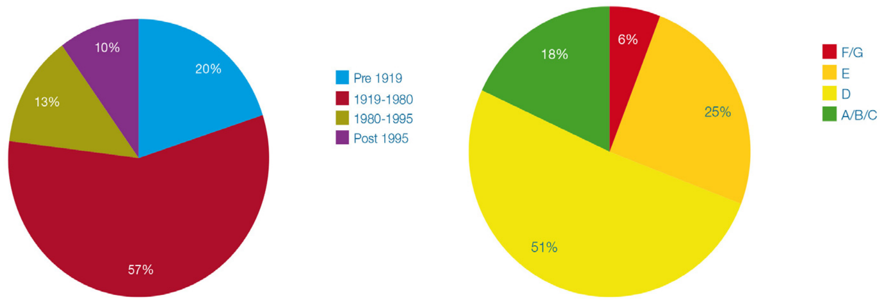


Fig. 13

"Age of non-residential buildings in the UK"(left) and "Energetic profile for non-residential buildings by sector in the UK" (right)

Source: National Energy

efficiency action plan in 2014: with respect to the situation of the housing stock of non-residential buildings, these are responsible for about 17% of total energy consumption of the country[35] and, as for the housing, these buildings are made from different types that vary by age and usage profiles: how can be seen from the graph (Fig.13), more than three quarters of these date back to before of 1985 and nearly one-third to before 1940. Also in this case the most of these structures presents very low standards of energetic performance and yet, according to the predictions made for 2050, half of them will still be in use[36]. The energy yield of these buildings varies greatly depending on the the sector to which they belong: depending on the function of each building there will be thermal requirements to be respected, that lead no doubt in different energy classes. It is clear, for example, that retail buildings present an energy class higher than a restaurant, having a simpler structure and easy to be isolated and not having to answer to the most demanding requirements a kitchen of a restaurant must have. However, the chart (Fig.13) provides a more or less overall situation of the various energy sectors.

Traced the scenario of the English building stock, in all developed governmental policies on this issue remains the continued division between residential and non,-division that is reflected also in terms of financing, to ensure a continuous investment for the restructuring of the housing stock. The next diagrams show how the national policies and incentives and of locally acting on the level of individual property for all the building renewal cycle: this frame of current policies represents a comprehensive package of measures aimed at overcoming the obstacles that arise in the course of refurbishment[37].

The strategies for the renovation of existing buildings reflect, however, as already established in the existing government strategy, in particular the "*Energy Efficiency Strategy*"[38], the *"Carbon Plan"*[39], and "*The Future of Heating*"[40].

However, although there are different policies for the two building types, the approach of these subjects on retrofit appears comprehensive, applying the same principles to both residential building, and non:

• make buildings more efficient in terms of heat thanks to an improvement of the insulation;

• improve the efficiency of heating systems, using more efficient boilers and moving to renewable energy systems;

• reduce the use of electricity, thanks to the improvement of control systems within the buildings[41];

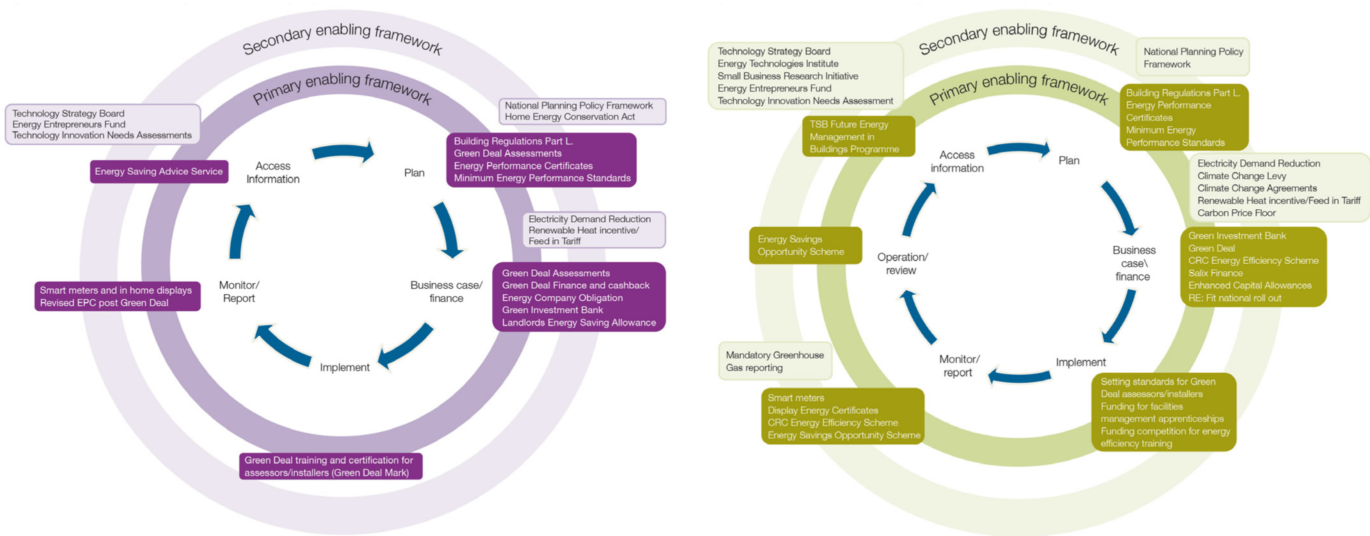
In energy efficiency policies established for the construction industry in this plan, then lie the ones that are already prescribed in the Part L of the Building Regulation, which set the minimum standards to be met for all the types of processing to be carried out. These energy standards have entered the UK guidelines already in 1970 and have been regularly enhanced to keep pace with the changes taking place.
It has already been explained the manner in which the Part L is divided according to the building category which is aimed; however, it was not told that, according to the strengthening of these documents, made under the new European directive, is to be expected an average reduction of CO2 emissions by 6% for new residential buildings, and of 9% for new non-residential buildings, with respect to the established values in the approved regulations of 2010.
These modifications are a further step that the English government wants to make towards the objective of low emission buildings, in particular on the energetic efficiency of the structure[42].

Moreover: in these strategies developed in the plan of 2014, it is included also what mentioned in the "*National Planning Policy Framework*"[43], published in 2012, which gives, as said in the previous paragraph, a framework of general policies, to which the local institutions have to conform; among the different topics there is also the transition towards a future with low carbon emissions. This plan establishes that local planning authorities actively support the improvements in energetic efficiency in the retrofit operations, following exactly the policy on "*Zero carbon buildings*", in case of planning any action of sustainability in construction[44].

Fig. 14

"Retrofit cycle for residential buildings and policies"(left) and "Retrofit cycle for non-residential buildings and policies" (right)

Source: National Energy Efficiency action plan



Another policy in place that flows into the national energy efficiency action plan, is that of "*The Energy Performance of Buildings Directive* "of 2002 which introduced the obligation for both categories of buildings, residential and non-, to have a energy certification in case of construction, sales and leasing.
The application of this Directive in England is exempted from the energy certification:

• buildings officially recognized and protected as part of the environment or because of their special architectural or historic value, or in accordance with the requirements of energy minimum that could cause unacceptable alter to their character or appearance;
• temporary buildings with a planned time of use of two years or less to it;
• residential buildings intended to be used less than four months a year;
• stand-alone buildings with a total useful floor area of less than 50%[45];

The regulations for improved Energy efficiency in the private rental sector is then established in the Energy Act of 2011 and echoed again in the version of 2014[46].There are other policies in place, included in the strategies of the plan of 2014 and which, however, they differ depending on whether buildings are residential or not.
As regards the former, we find:

• *Code for Sustainable Homes*, published by the British government in addition to *Building Regulation*, in 2007, and later revised in 2010. This code provides "single voluntary national standard "that can be followed in the design and in the construction of new sustainable homes: energy/CO_2, water, materials, surface water runoff, waste, pollution, health and well-being, management and ecology. A system 1 to 6 star is then used to assess the overall sustainability performance of a building by use of nine categories.
These standards are set, however, in addition to, or above, the minimum established by the Building Regulation, and the only cases in which are enforced are when local councils insert them as a requirement in their planning policies and when the "*affordable housing*" are funded by *Homes and Community Agency*[47].
According to studies carried out ad hoc, at the end of 2013 about 144,000 houses were built the way, that complies with these codes, with a prevalence of Category 3, corresponding to the current minimum level of energy efficiency provided in Part L of the Building Regulation[48].
However, standard provided by the above law will be replaced by zero carbon homes policy

that the government is developing and that will enter into force from 2016[49]:

• *Decent Homes Standards*, which establishes minimum requirements for the social housing;

• *The Housing Health and Safety Rating System*, a process assessment of the risks arising from the structural condition and energy efficiency of housing;

• *Smart electricity and gas meters*, a program introduced in 2010 which provides for the replacement of systems of smart control in homes, that can allow to control the energetic consumption.

About the existing policies about non-residential buildings established by this floor, we can find:

• *CRC Energy Efficiency Scheme*, introduced in April 2010, which requires consumers of large amounts of electric energy (banks and central governments, large companies, etc.) to purchase and surrender allowances to compensate for their emissions;

• *Climate Change Levy* (CCL), introduced in 2011, which taxes the provision of specific products, such as electricity, gas, fuel, for the commercial sector and business;

• *Government's Mandatory Greenhouse Gas (GHG) Reporting Scheme*, introduced in 2013, which makes it compulsory for companies and all listed companies to report, through the annual report, their energy consumption and emission levels;

• *Energy Savings Opportunity Scheme* (ESOS), introduced in June 2014 program that helps large companies and SMEs to cut their energy costs by providing recommendations tailored to improve their energy efficiency. Also the importance of this regulation is that it has introduced the new legal obligation for these to conduct energy audits that satisfy the requirements of Article 8 (4) and Annex VI of the European directive[50].

Directive 2002/91/CE

- British Law by the Housing Act 2004
- The Energy Performance of Building Regulation SI2007/91

Approved Documents of the Part L establish different energy requirements from: L1 Homes, L2 Non-residential buildings

Directive 2010/31/UE

- The Energy Performance of Building Regulation SI2012/3118

Approved Documents of the Part L establish different energy requirements from: L1A New Homes, L1B Existing Homes, L2A New buildings (non-residential), L2B Existing buildings (non-residential. Paragraphs from 3.7 to 3.14 focus on architectural heritage.

Locally listed buildings have to improve their energy performances without alterations ruining their aspect

Directive 2012/27/UE

- The Energy Performance of Building Regulation SI2014/80

National Energy Efficiency Action Plan

- Minimum energy perfomance requirements of the Approved documents part L
- Policies NPPF
- Energy Performance of Building regulation 2002 for energy certificate
- Different policies for housing sector and non-residential buildings

1.5 ROLE OF THE ENGLISH HERITAGE

What has been said so far relates to the strategies implemented by British government regarding the technological retrofit in existing housing, this chapter focuses on the measures to be taken for buildings recognized as architectural heritage, and thus placed under protection. Although Article 4 of the European Directive 2010/91/EU, "*Setting of minimum energy performance*" establishes that Member States may decide not to set or apply the energy requirements to "*buildings officially protected as part of a designated environment or because of their special architectural or historical value, to the extent that compliance with certain minimum energy performance requirements would unacceptably alter their character or appearance* "[51], this does not mean that any measures has not been taken yet or that do not exist any issued guidelines promoted by the government for these building categories.

Of great importance and usefulness of this is the work of *English Heritage*, which has pledged to provide, as early as 2004, guidelines to follow for sustainability in the buildiing stock.
Among these publications the most important are:

• *Building regulations and Historic Buildings* (March 2004);
• *Advice for domestic energy assessors* (July 2007);
• *Climate Change and the historic environment* (January 2008);
• *Energy conservation in traditional buildings* (Marzo 2008);
• *Energy Efficency and Historic Buildings* (EEHB), *Application of Part L of the Building Regulations to historic and traditionally constructed buildings.*

Moreover, the English Heritage has also published specific guides for operations to be performed on the different architectural elements, updated over the years in line with the change of the national and international language. These are:

• insulating pitched roofs at rafter level/warm roofs;
• insulating at ceiling level/cold roofs;
• insulating flat roofs;
• insulating thatched roofs;
• open fires chimneys and flues;
• insulating dormer windows;
• insulating timber-framed walls;

• draught-proofing windows and doors;
• secondary glazing for windows;
• insulation of suspended ground floors;
• insulating solid ground floors[52].

We will now focus our attention on one of the most recent and important methods applied by UK on energy efficiency and building preservation.
The *'Energy Efficiency and Historic Buildings* (EEHB), *Application of Part L of the Building Regulations to historic and traditionally constructed buildings*, was published in March 2011 and aims to prevent possible conflicts between the requirements of energy efficiency under Part L of the building regulations and the conservation of historic buildings.
Historical buildings, in fact, like other buildings of the existing building stock, can and must be subject to improvements, which, with a moderate cost, manage to improve their level of comfort for users, contributing also, and above all, to the reduction of greenhouse gas emissions.
Within the guide mentioned above, there are also different operations that should be performed in order to achieve an energy renewal in buildings that are, thanks to Article 4 before mentioned, exempt from meeting the minimum requirements of energy performance, as in building regulations. It should then be considered that this document serves as a guide of "second level" established by English Heritage to the understanding of the provisions in Building Regulations and in particular in the Approved Documents in paragraph 3.10, which should be considered for determining appropriate energy performance standards for jobs to be performed on historical buildings[53].

The *Building Regulations* in fact does not establish any general obligation for listed buildings and in part L, exactly from paragraph 3.7 to 3.14 of the *Approved Documents*, it is established that listed building, buildings within Conservation Areas and Scheduled Monuments are exempted from the requirements of energy efficiency of this part of the Regulation, to the extent that such requirements cause an unacceptable alter the character or appearance of such buildings (which among other things is also established within the NPPF)[54].
Moreover, always in these paragraphs of the document it is established that the following buildings are subject to special considerations pursuant to Part L:

• buildings of historical and architectural interest, designated as listed buildings in local development plans;

• buildings of historical and architectural sites within arches national, areas of outstanding natural beauty, registered parks, garden and battlefields, world heritage sites;

• buildings made in accordance with traditional construction methods with permeable fabric that absorbs and allows the evaporation of humidity, a feature that may conflict with modern materials and methods. This category includes all buildings built before 1919, and a significant percentage of those committed before 1945.

The objective for these buildings mentioned above should be to improve energy efficiency, as far as reasonably possible, without affecting the character of the building or increase the risk of deterioration[55].

For all types of constructions mentioned above paragraphs 3:10 states that it is right to consider the guides provided by *English Heritage* to determine appropriate energy performance standards for the works to be performed on these categories. It should be stressed that, according to what was said by these points, the exemption of those categories of buildings from compliance with requirements of energy efficiency is not unconditional: buildings should be updated in accordance with the energy efficiency requirements set out in *Approved Documents* L1B and L2B up to the point where the alterations would become unacceptable for their character and aspect[56] (the only buildings that are totally exempt from the fulfillment of the requirements Part L of the energy are the places of worship[57]). This definition thus it requires a great understanding of what is the character and appearance of a building, as well as high and effective assessment of the degree to which the changes will be unacceptable.
Of particular importance then it is what was stated in paragraph 3.12, establishing the special considerations for some "comprehensive treatments "[58] for which the requirements of energy efficiency can be more flexible. Such cases are:

• restoring the historic character of a building that has been the subject of a previous inadequate inalteration, by removing such changes where they restrict the ability of traditional construction;

• restoration of an old historic building in its original form, with the restoration of those lost elements important for its general character or for its structural function (for example, as a result of a fire, or to fill the void left in a row of terrace);

• plan provisions that let a historic building breathe, controlling the longtime potential problems of decay[59].

After talking about the *Building case*, we return now to the English Heritage guide. This underlines the importance of the understanding of a building in all its aspects, an operation that must be accomplished prior to the planning of any alteration. In fact it is essential to assess the elements that make up a building and its character as:

• external features, decorated surfaces, doors and windows;
• spaces and interior layout, the floor of a building is one of its the most important features that should be respected with all its internal partitions which should be left unaltered as possible;
• internal features, such as surfaces decorated in plaster, paneling, flooring, shutters, doors;
• details like cornices, moldings, and stucco walls;
• structure and other surviving technologies[60].

In addition, sets out principles which any operation must comply, and which are nothing less than congealed by all those European directives on the protection and restoration ie: conservative repairs, minimum intervention, compatibility, reversibility and authenticity[61].
Essential for the thermal upgrade of a building is then, primarily, understanding the performance of the building considered as an environmental system: ancient buildings, in fact, have always been made to mitigate the external thermal conditions, providing more favourable internal conditions, consisting by the outer envelope and subsequently by all internal partitions, such as fireplaces, hallways, cellars, etc. which together constitute an additional thermal mass, which mitigates heat losses and air infiltrations. Although such environmental performance are not comparable with those achieved with the use of modern materials and techniques, their contribution could be surprisingly effective for the thermal performance of the building[62].
To understand the energy performance of a building it is therefore necessary supporting evidence, not destructive, to establish subsequently the steps performed according to the

The most common tests are: test of air pressurization, infrared thermography, moisture measurement, transmittance investigations in situ, energy consumption monitoring, environmental data recording[63].

These analyzes are necessary because the traditional buildings are made with materials and systems that work differently from modern ones (Fig.15), and although both are capable of be highly efficient, the mixing of these could provide energy performance lower than that each would provide when used alone. Therefore, in the *Energy Efficiency and Historic Buildings* (EEHB) and *Application of Part L of the Building Regulations to historic and traditionally constructed buildings,* the English Heritage recommends all the steps required to repair and improve energy efficiency of each individual architectural element. tips that are also contained in the series of publications mentioned above, doing a special attention to the thermal isolation and hygrometric behaviour of each of these.

However, there are neutral operations, which would bring improvements for energy efficiency, such as: use of condensing boilers, counters, and all new smart control systems, highly energy efficient lighting, sources of microgeneration energy[64].

All these publications by *English Heritage* prove how important is the existing built heritage

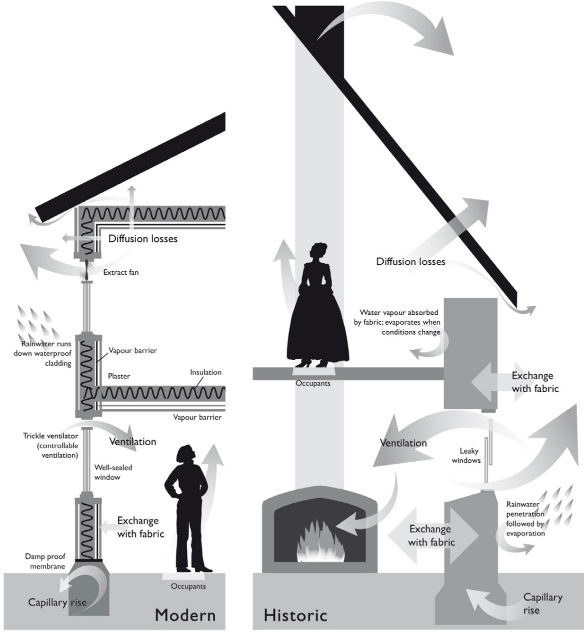


Fig. 15

"Differences between an historical building and a modern building"

Source: Energy Efficency and Historic Buildings (EEHB), Application of Part L of the Building Regulations to historic and traditionally constructed buildings.

in the UK. Current estimates tell that of all the buildings that will be in use in England in 2025, about 80% will belong to the historic building heritage, while this percentage will drop to 70% in 2050[65].
For this reason, the retrofit and adaptive reuse of the housing stock becomes a central policy of the government, which continues, together with other organizations, to develop reports, statistics, measures, guides, as well as financial incentives, in order to improve public approval.

Of great importance is also the *BREEAM, Building Research Establishment Environmental Assessment Method*, a protocol for building evaluation on a voluntary basis set in 1990 in the United Kingdom, with the aim to evaluate the environmental performance of buildings. The BRE is a founding member of *the Green Building Council* of the United Kingdom, and is also applied in other countries, as the Netherlands, Norway, Sweden, Spain, Germany.

This is the first and most widely used environmental assessment protocol in the world, setting the highest standard of green architecture, that made him the de facto evaluation criterion used to represent the environmental performance of a building. The judgment is given taking into consideration various environmental factors and getting a score (PASS, GOOD, VERY GOOD, EXCELLENT or OUTSTANDING), using recognized valuation methods and set according to predetermined benchmarks, to verify design, construction and use of the property. This Protocol, in fact, encourages designers, customers and other competent figures, to think of a design with low emissions carbon and low impact, minimizing the needs of energy by a building before considering energy efficiency and low-carbon technologies. The criteria cover several categories, from managing resources to ecology, and include aspects related to the use of energy and water, the internal environment (health and well-being), pollution, transport, materials, waste, ecology and management processes. BREEAM schemes available are:

• BREEAM Offices ;
• BREEAM School Buildings;
• BREEAM Healthcare Facilities;
• BREEAM Commercial Buildings;
• Bespoke BREEAM (for buildings not covered by the other schedules predetermined);
• BREEAM Residential Buildings;
• BREEAM International;

• BREEAM Data Centres;
• BREEAM Existing Buildings;
• BREEAM Industrial Buildings;
• EcoHomes (sustainable housing)
• Code for Sustainable Homes (Building Code eco).

In particular, the latter is used by almost all local planning authorities, operations in residential buildings and non, existing and new construction: "*People know and trust the BREEAM standard: if you get a BREEAM 'Excellent', for example, there is no doubt or argument about what you have achieved.*"[66]
This guide provides, in close connection with the Building Regulation, and with the NPPF, standards, requirements and good practices to follow the end of energy sustainability in construction, and in every single element, making a distinction between residential buildings and non.

Housing as a sustainable redevelopment tool

Of particular importance is also the theme of housing, which is at the center of British government policies onthe issue of environmental sustainability,
In British history this topic has always been protected: the British were the first to enter the building regulations to improve the condition of housing in the early years of the 800. To emphasize its importance in 2005 the *English Heritage* published "*Low demand housing and historic environment*", which has showed that repair and maintain a terrace house of the late Georgian age is cheaper than maintaining a new building by about 40-60%[67]. In 2003 a Research conducted by the team at *Heritage Counts*, comparing a terrace house with a newer building of 1980 said: "T*he research demonstrated that, contrary to earlier thinking, older housing actually costs less to maintain and occupy over the longterm life of the dwelling than more modern housing. Largely due to the quality and life-span of the materials used, the Victorian terrace house proved almost £1,000 per 100 m2 cheaper to maintain and inhabit on average each year."*

The research which we have just spoken about, have been moved by an sensitive issue that has involved, and still involves England: the housing shortage.

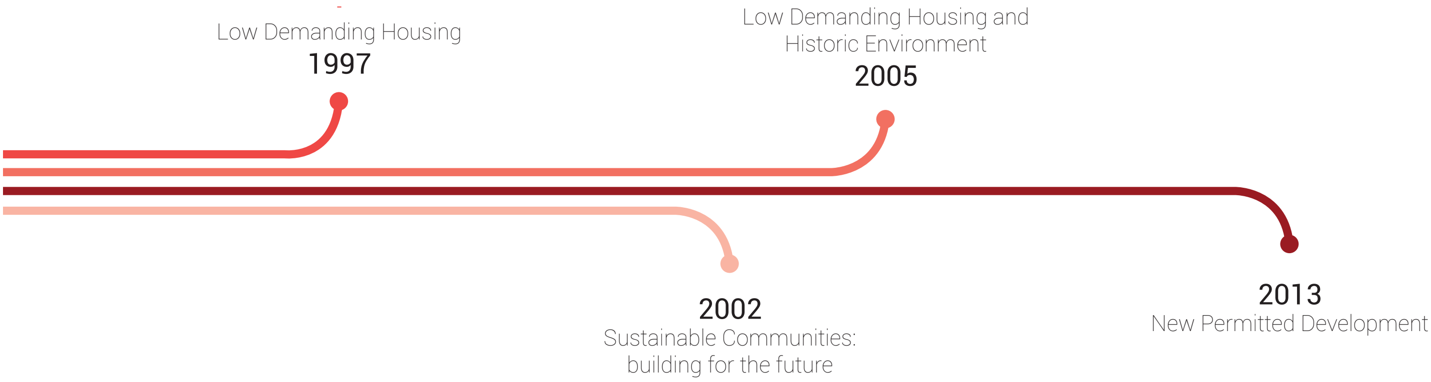
Already in the last years of the '900, around 1997, studies began to fight social exclusion and in particular to renew the neighborhoods and eliminate the so-called "no go areas ", a particular problem that has led to the phenomenon of "*Low-demand housing*"[68]. This latter problem, in particular, has led to further studies that have examined some issues, especially those related to the economy and sustainability. Studies done in the early years of the new millennium have revealed that about one million homes were abandoned and suffering from "Low-demand", so in 2002 the government announced measures to include this issue in the strategies of "*Sustainable Communities: Building for the future* ". This program established different actions, all designed to transform communities in the nation, reversing the legacy of neglect and under investment in the construction sector of the past: the main objective was to create a balanced and sustainable property market. Among these strategic actions large space has been left to the recovery and restoration of the present building stock and, where not possible, with its substitution with new build. In addition, the English Heritage decided to promote refurbishment and preservatoion of buildings with a historical value:

"*Houses are among our most important historic assets. Some 4.4 million houses representing 21% of the total stock were built before 1919. Nineteenth century terraced houses are a distinctive national building type [...]The majority do not receive any form of statutory protection, but by their very existence they give places a distinctive identity and character. The range and variability of terraced housing types and their relationship to the landscape often provides a strong local identity*"[69].

The reuse of old buildings, especially the terrace house is an eco-friendly solution, not only for the cost savings, as cited above, but also because most of these buildings are robust and highly adaptable.
In these urban regeneration policies entered a new law in May 2013, very important for the English towns and especially for the transformation of buildings, such as the case studies in the next chapters.
Due to a national shortage of accommodation, and always with the idea of renewal of the existing communities, a "*New permitted development* " was issued, whose most important aspect is to allow the change of use from office (Class B1) to residential (C3)[70] for 63 buildings remained empty for a period of at least 3 years, without having to request a "*planning permission*".

Following a consultation in 2011 the government approved a new amendment which, besides favoring National housing, could create new jobs in the construction industry and contribute to urban regeneration of many realities. Such permission will be applied for a trial period of three years (until 2016), after which it will decide whether to extend it or not. The change of use, while not requiring a planning permission, must still be subjected to an approval procedure local authorities, which must assess whether this change will cause serious problems or dangerous impacts, and only then to deny authorization. The change of intended use is not permitted, also, if:

• the building was used as office before May 2013;
• whether the use of a dwelling will be started after 30 May 2016;
• if the building is within the Listed Building or sceduled Monument (the change of intended use as a residence may be granted but it still requires a Listed building permission)[71].



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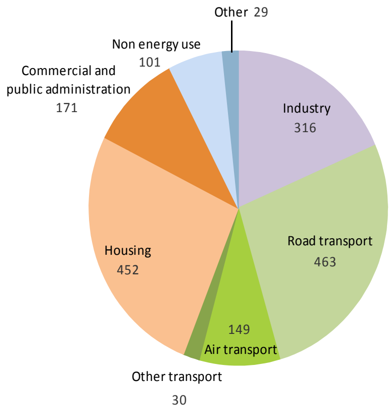
2. ANALYSIS OF THE BUILDING STOCK AND ENERGETIC TRENDS IN THE UK

The energy used in homes accounts for more than a quarter of energy use and carbon dioxide emissions in the United Kingdom.
Housing uses more energy than transport or industry (fig.16), therefore, it represents major opportunity to cut energy use and CO_2 emissions.
Much of the UK's housing was built before the links between energy use and climate change were understood. Much of it was also built when there were very different expectations of thermal comfort.
In 2008 Climate Change Act was introduced and requires: 34 % cut in 1990 greenhouse gas emissions by 2020, and at least 80 % cut in emissions by 2050.
It will be impossible for most of the states to meet the 2050 objective without changing the emission from homes. The Energy Act[1] in 2011 paved the way for the Green Deal[2], which was designed to improve energy efficiency in UK homes at no upfront cost to householders, at the same time as cutting carbon emissions and helping the vulnerable. The Green Deal also allows householders to pay for energy efficiency improvements through savings on their energy bills. Advisors and approved companies will be tasked with identifying improvements where savings are likely to be greater than the costs.
In terms of sustainability, the Green Deal is the most important institution in the UK and works with the ECO[3] (Energy Saving Programme), which will be funded by energy suppliers, and take the place of the old Carbon Emissions Reduction Target (CERT) and Community Energy Saving Programme (CESP). The ECO will provide extra assistance for vulnerable households in need of assistance.

Fig. 16

"Final Energy consumtpion by sector 2011"

Source: UK Housing Energy Fact File



2.1 ANALYSIS OF THE BUILDING STOCK IN THE UK

The UK housing stock is one of the oldest in Europe. It includes almost 13 million dwellings built before 1960, including 4.7 million built before 1919, which is the least energy-efficient housing type of all these Victorian homes have a staggering average mean energy use (heating and lighting) of 480 kWh/m^2/yr (emitting 4.5 t CO_2/yr)[4].
This is due to a better understanding of building physics through the years, the introduction of cavity wall construction (primarily implemented to prevent the passage of moisture into the interior of the building) and building regulations that are gradually becoming more stringent on the efficiency of building thermal envelopes.
The Victorian housing stock is certainly the most "energy consuming" of all housing stocks in

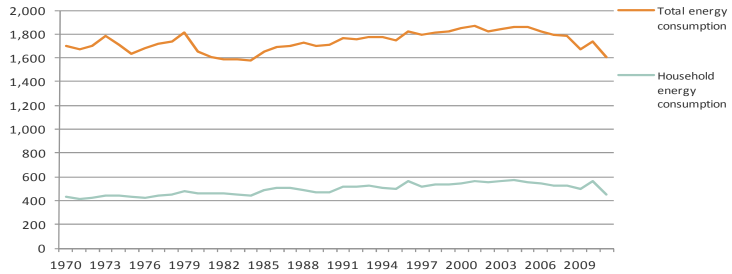
the UK.

Energy use in homes amounts to just under a third of total energy use in the UK, up from a quarter in 1970. The headline graph below shows that housing energy (the blue line) crept up gradually until 2004, fell by nearly a tenth to 2009, and then rose more than 12% in 2010 – largely because of the harsh winter weather. It fell back again by a staggering 20% in 2011. The orange line on the graph shows all energy used: transport, industry, public sector use and housing[5].

Fig. 17

"Final Energy use for housing and all sectors"

Source: UK Housing Energy Fact File



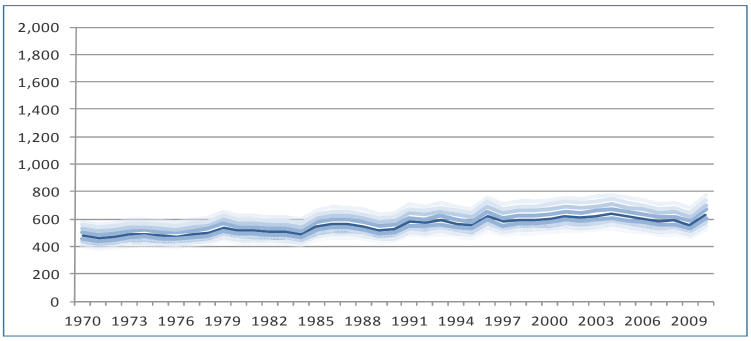
The graph below (according to the UK Energy statistics) shows the estimates for total household energy use in 2009 and 2010.

The graph below shows the modelled energy use for housing until 2010.

Fig. 18

"Modelled energy use for housing 1970-2010)"

Source: UK Housing Energy Fact File



2.2 ENERGETIC CONSUMPTIONS IN THE UK

Carbon dioxide emissions from housing have fallen since 1990, even including the cold winter of 2010. Today there are more UK homes than 40 years ago. 27 million today, compared to 19 million in 1970, and 23 million in 1990[6].
Overall there has been a broad downward trend in CO2 emissions from housing (see graph below). However, the trajectory has not been straight and, unsurprisingly, cold and prolonged winters like the harsh winter of 2010 lead to higher CO2 emissions.
Emissions from gas use have increased by a third since 1990, while emissions from solid fuels used for heating have fallen away from more than a tenth in 1990 to less than 2% of housing CO2 today. Carbon emissions from electricity, meanwhile, have fallen by nearly a fifth since 1990. Indeed, electricity's share of total household CO2 emissions fell from half in 1990, down to two-fifths in 2010.
Surprisingly, perhaps, CO2 emissions from oil use rose from 5 to 8 million tonnes during the period. As a fraction of total household CO2, they increased from 3 to 5%. This may reflect increased demand for heating in homes not served by gas, and particularly the neardoubling in take-up of oil-fired central heating since 1990[7].

Electricity generation in Britain has also changed considerably since 1970. The changes have come mainly as a result of different prices for the input fuels used in power generation, but also because of the availability of North Sea gas, electricity sector privatisation, growth in nuclear power, and regulations aimed at cutting emissions.
These changes alter the economics and the environmental impact of electricity use – in the home and beyond. Notably, coal has fallen steeply as an input into power generation.
Coal is a high carbon fuel, which leads to high emissions of CO2 per unit of electricity from a coal-fired power station. Burning coal also results in relatively high nitrous and sulphurous emissions. Nitrous oxide is a very potent greenhouse gas (300 times more potent than CO2), while sulphurous emissions have a cooling effect on the climate but they contribute to acid rain[8].

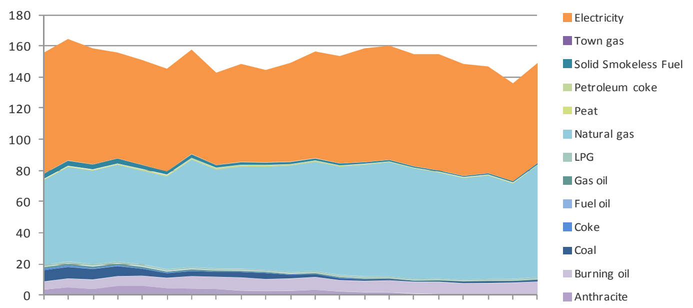


Fig. 19

"CO_2 emissions from housing energy (million tonnes)"

Source: UK Housing Energy Fact File

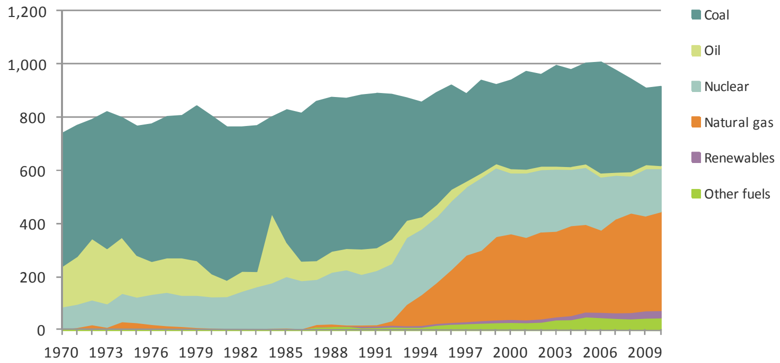
Modern coal-fired power stations are designed to remove most of these emissions from the flue gases before releasing into the atmosphere, and tightening environmental regulations mean that many of the older, less efficient power stations will close over the coming years. However, coal remains a more polluting fuel than gas.

Coal-fired power has been mainly displaced by electricity generated from natural gas and, to a lesser extent, by nuclear power. While two-thirds of the country's power came from coal in 1970, this has fallen to under a third today.

Fig. 20

"Energy content of fuel input for UK electricity generation (TWh)"

Source: UK Housing Energy Fact File



Oil has declined even more rapidly in the electricity generating mix: from just over a fifth of Britain's electricity to under 2% now. (There was a big increase in oil use for power generation during the miners' strike in 1984-5).

The share of electricity coming from nuclear power almost doubled over the period – from just over 10% in 1970 to just under 20% today. However, nuclear power peaked in 1998, when it generated towards a third of Britain's power, and the decline since then looks set to continue unless the nuclear power stations now reaching the end of their lives are replaced.

Natural gas was used to produce a tiny fraction of power in 1970. But today, mainly as a result of the 'dash for gas' in the 1990s, it generates nearly two fifths of the country's electricity.

The proportion of power coming from other sources (principally gas from coke ovens and blast furnaces, chemical and refuse waste, and renewables) has grown from almost nothing to nearly 10%[9].

Household spending on energy is directly affected by the price of different fuels. Fuel prices have changed significantly since the 1970s, even when nflation is removed from price figures, The real price of electricity has increased by almost a fifth since 1970, although this masks a more complex evolution. There was a steep price rise during the 1970s and early 80s, followed by a sustained downward trend until 2003, and then another steep rise from 2003 to 2009.
The pattern is linked to the prices of input fuels, and particularly the price of oil on international markets. It is no coincidence that the trend of electricity prices is similar to the trend for heating oil shown on the graph, although other factors also play a part.
The jump in real electricity prices from 2003 to 2009 is significant because electricity is three or four times more expensive per kWh than other forms of energy. The price of gas has also fluctuated over time in real terms, although less than heating oil and solid fuels[10].

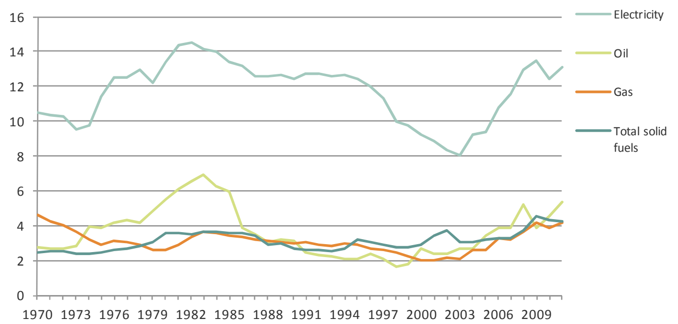


Fig. 21

"Average UK household fuel prices (p/kWh)"

Source: UK Housing Energy Fact File

Heating oil closed the period double the cost in real terms that it was in 1970. However, oil prices were volatile in the 1970s and 80s – when the price increased by more than 150%, and then slipped back to the original cost in real terms – and have also been volatile since 2007.
Gas prices were comparatively stable in real terms throughout the four decades in the graph. They finished the period about 10% lower than they were at the beginning.
The price of solid fuels, including coal, coke and breeze, rose gradually during the period, finishing 75% more expensive in real terms. (This is probably less significant than price changes for electricity and gas because far fewer homes now use solid fuel heating).
However, low-income households, who spend proportionately more of their incomes on energy, are hit much harder by energy cost rises. Their demand for energy tends to be more elastic than wealthier households, meaning that they tend to use less if prices rise.
In the long term, all households may act to reduce electricity use as a result of higher real costs of power. Savings could come from low energy lights and appliances, and possibly reduced use of conventional (resistance) electric heating[11].

However, low-income households, who spend proportionately more of their incomes on energy, are hit much harder by energy cost rises. Their demand for energy tends to be more elastic than wealthier households, meaning that they tend to use less if prices rise.
In the long term, all households may act to reduce electricity use as a result of higher real costs of power. Savings could come from low energy lights and appliances, and possibly reduced use of conventional (resistance) electric heating.

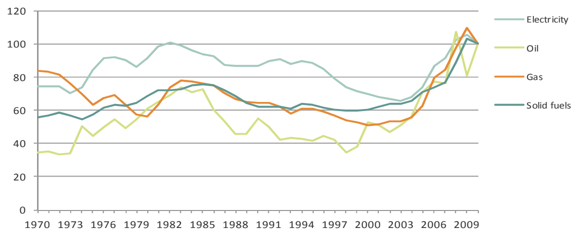
Indexed energy prices, with all fuels adjusted to a base of 100 for 2010, show similar trends. Generally, the prices of fuels rose from 1970 to the early 1980s, then the price of all fuels fell until around 2000, when they rose relatively steeply until 2010.

A household can be considered fuel poor if it would spend more than 10 % of its income on fuel to maintain comfortable conditions. This is usually defined as 21 degrees in the living room and 18 degrees in the other occupied rooms.
The emphasis is on heating, but the cost of hot water, lights, appliances and cooking are also included[12].
The graph below shows how fuel poverty has changed since 1970.

Fig. 22

"Average deflated UK household fuel price indices"

Source: UK Housing Energy Fact File

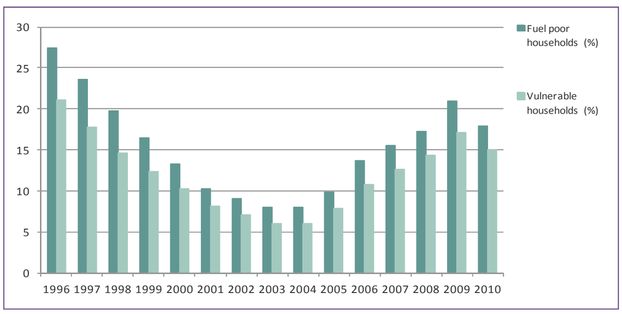


Fuel poverty has fallen significantly – from 6.5 million households in 1996 to 4.75 million in 2010, although it rose from 2005 to 2009, largely because of increasing fuel prices.
Households with elderly people, children and people with disabilities or long-term illness are known as 'vulnerable households'. These make up about 70% of households, and it is particularly important to ensure that these households do not fall into fuel poverty, which would make it hard for them to stay comfortable, and bring greater risk of illness[13].

Fig. 23

"UK fuel poverty"

Source: UK Housing Energy Fact File



With millennia of history, as we said, the UK's domestic built environment now reflects a rich range of diverse housing types, sizes and age. As of 2010, there were 26.59 million households in the UK, with 22.19 million in England and 1.32 million in Wales[14]. Figure 24 presents the segmentation of UK homes according to dwelling type and age over time.

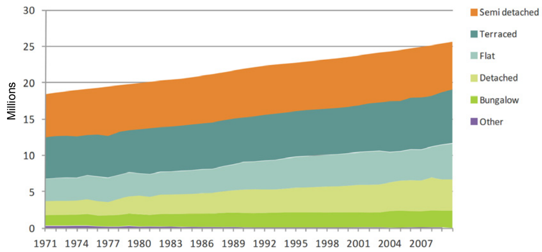


Fig. 24

"Housing stock distribution by type"

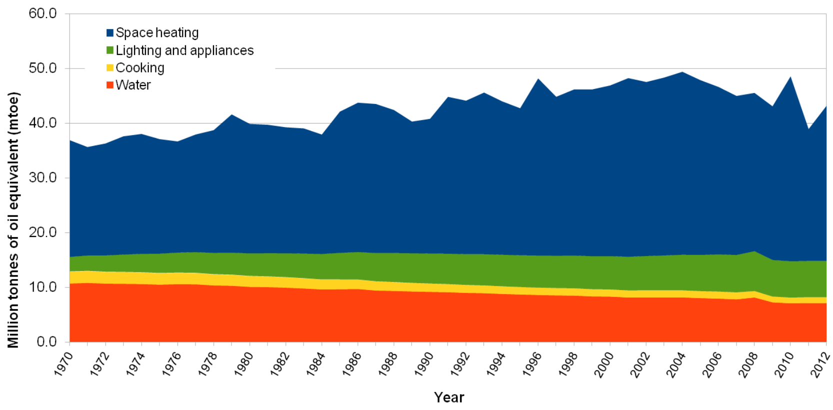
Source: UK Housing Energy Fact File

The building stock is also affected by a low demolition rate. As a result, the UK domestic built environment is composed of a mix of historical homes. Figure 21 highlight how the proportion of existing homes for all periods have stayed roughly the same, resulting in a varied housing stock[15]. A spike in the number of 1940s homes and a spike in the 1960 homes is due to the change in the housing survey that took place that year. While such a diverse building stock may be culturally rich, this heterogeneity between housing type, size, and age contributes to the complexity of the retrofit challenge. The result is that UK homes are some of the oldest and most energy inefficient stock in Europe[16]. This heterogeneity also conflates the application of technical retrofit solutions, since 'one size fits all' designs may not be appropriate, nor are they likely to meet the requirements of all the occupants. Examples of particularly difficult challenges are homes with solid walls, no loft space, or no ability to connect to a low cost fuel. Since these homes cannot accommodate 'standard' energy efficiency measures, they are defined as 'hard to treat' properties by the Energy Efficiency Partnership for Homes (EEPfH) Fuel Poverty working group. While the Office of National Statistics has no validated figures for hard to treat properties, an estimated 7m homes in the UK are of non-cavity wall construction[17].
From an energy and emissions perspective, the existing UK built environment accounts for approximately 50% of total UK energy demand, and 45% of its anthropogenic CO_2 emissions. Specifically for homes, the heating and moving of air and water, and the use of appliances in existing homes account for approximately 27% of all the anthropogenic carbon emissions in the UK, and an estimated 72% of household energy is used for space and water heating[18].

Fig. 25

"Domestic Energy consumption by end use 1970 to 2012"

Source: UK Housing Energy Fact File



It is, therefore, important to introduce the theme of adaptive reuse/retrofitting as an excellent opportunity to improve the energy performance of homes, meet its long-term emissions goals, and improve its spatial configuration.
Looking at the energy demand trend over time, Figure 25 compares the UK household energy consumption by end use from 1970 to 2012.
This Figure highlights the variability in space heating energy use, but overall the slow rate of change within the building stock as the profile within homes has remained fairly consistent, even though total energy consumption generally increased over time. Apart from space heating, the other substantial differences were a decreased use of energy for cooking followed by an increase in appliance and lighting energy use.

Retrofitting an existing building can oftentimes be more cost-effective than building a new facility. Since buildings consume a significant amount of energy particularly for heating and cooling, and because existing buildings comprise the largest segment of the built environment, it is important to adapt and retrofit buildings, not just for conserving energy but to create a high-performance building that will increase in value, last longer, and contribute to a better, healthier, more comfortable environment for people in which to live and work.

HOUSING IN LONDON

London's population is growing rapidly, reaching 8.3 million in 2012, and is expected to soon exceed its previous peak of 8.6 million. Average household size rose in the last decade as population growth outpaced growth in the number of households.
While London built fewer new homes in the last decade than in the 1960s and 1970, the housing stock grew faster due to fewer demolitions and more conversions. Most outer London homes were built in the 20th century, while homes in Inner London tend to be older, except for former docks and industrial areas where new building is concentrated. Flats comprise just over half of London's accommodation, compared to less 20 % in the rest of the country[19].

- The number of housing in London has grown rapidly in the last three decades, from 2.5 million in 1981 to 3.3 million in 2011.

- Outer London still accommodates the majority of London's households however, with 1.9 million in 2011 compared to 1.4 million in Inner London.

- While London built fewer new homes in the last decade than in the 1960s and 1970s, the housing stock grew faster due to fewer demolitions and conversions. While only 193,000 homes were built in London in the last decade, the net increase in the dwelling stock was greater, at around 270,000.

-Only around 5,000 homes a year are demolished in London, at which rate it would take 700 years to replace London's entire dwelling stock.

-Homes in Inner London tend to be older, except for former docks and industrial areas where new buildings is concentrated.

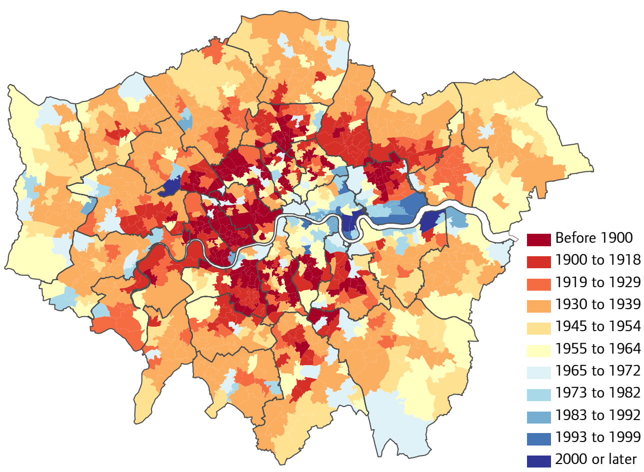


Fig. 26

"Period when houses were built in Greater London"

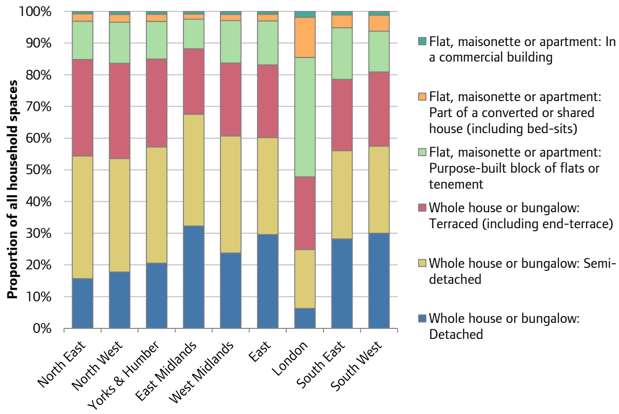
Source: Housing in London 2014

The average age of homes in London varies widely across the capital, from pre-1990 in much of the west inner city to post-2000 in Canary Wharf, Wembley and other pockets of new development. Houses comprise the great majority of accommodation in every region except London and across the country as a whole, but in London flats, or apartments account frjust over half of all accommodation, with detached or semidetached comprising 25 % to over half in every other region. London' s population was shrinking as recently as the 1970s, but since the 1980s has been growing increasingly rapidly, increasing by over 100,000 in each of the last four years. The direct cause of increased population growth is natural change, but migration has indirectly contributed by lowering the average age[20].

Fig. 27

"Accommodation type by region 2011"

Source: Housing in London 2014



London's population increased much faster than the number of households over the last decade, particularly in Outer London. Most parts of London saw substantial growth in population between 2001 and 2011, but just over half of Outer London's population growth was due to rising household size, while growth in Inner London was mostly due to a rising number of households. Between 2001 and 2011, London's population saw rapid growth among all age groups except those aged over 70.

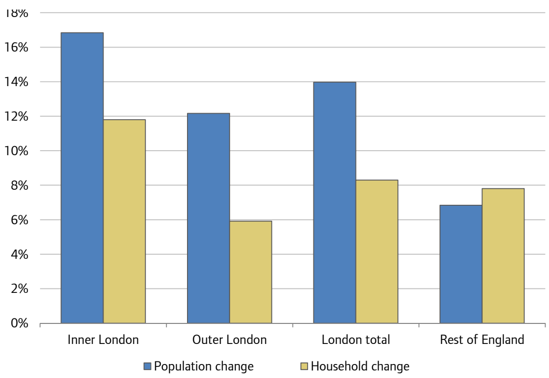
London attracts a large net inflow of people in their 20s from the rest of the UK, but sees a net outflow of people of every other age.

London saw faster economic growth than the rest of the UK both before and after the last recessions[21].

Fig. 28

"Change in population and number of households 2001-2011"

Source: Housing in London 2014



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[10] Department for Energy and Climate Change (2012), "*Annual Report on Fuel Poverty Statistics 2012*". London: DECC. http://www.decc.gov.uk/assets/decc/11/stats/fuel-poverty/5270-annualreport-fuel-poverty-stats-2012.pdf

[11] Ibidem.

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3. UK: FROM CONSERVATION TOWARDS SUSTAINABLE REUSE

Analysing policies and directives regarding English restoration and preservation of historical heritage it is necessary to identify and frame the central institution that regulates the management and operations of the adjoining conservation, protection and enhancement.

Before we go deep into the heart of the subject, it is important to explain the structure of the British government, being quite different from the Italian. There are, in fact, three different government departments: "Ministerial departments "," Non-ministerial departments "and" Agencies & Public bodies ". The first are 24 and dealing with issues that require direct political control, and are in fact driven by a minister government, usually a member of the Cabinet (often Secretary of State and member of the council of ministers) supported by a series of "junior ministers". The administrative management of the department is run by a senior official known as permanent secretary, while for the executive part come into play "Agencies & Public bodies". These organizations / executive institutions, in fact, have varying degrees of autonomy in carrying out functions, operating always, however, by reference to one or more specific government departments, which lay down the financing and policy, the action strategy of the institution, and they are the direct responsible for the actions before the parliament. Within these institutions they differ in the "not departmental public bodies" (NDPBs), known colloquially as "QUANGOs", "quasi-autonomous non-governmental organisations", dealing with managing funds for specific initiatives or services. The NDPBs are further divided into four types:

• executive, working for the government in specific areas;

• advisory bodies set up by groups that encourage Ministers of particular sectors;

• courts are part of the judicial system and hold the jurisdiction over a particular area of law;

• independent monitoring groups, responsible for the running of prisons and the treatment of detainees.

The "Non-ministerial departments", however, are 22 and dealing of matters for which the direct political control is deemed unnecessary or inadequate, and in fact they are not led by ministers but by high officials. In most cases, these departments have a control function and regulation[1].

MINISTERIAL DEPARTMENTS

They are 24 are and lead with the administration of matters that require direct political control and are led by a minister government.

They have administrative management power while the executive part is entrusted to the Public Agencies and bodies

NON MINISTERIAL DEPARTMENTS

They're 22 and dealing with matters where the direct political control is not necessary and they do not have ministries

AGENCIES & PUBLIC BODIES

Executive institutions with different degrees of autonomy in the performance of operational functions, which refer to specific government departments

Such as the Non Departmental Public Bodies or QUANGOs which deal with specific operational functions:

- executive: working for the government in specific domains
- advisory: advise ministers on particular sectors
- tribunals: hold the jurisdiction on specific parts of the right
- independent groups of monitoring

Returning to the subject of conservation and protection of heritage in England, to address this discipline are two main actors, first among them, is the Ministerial Department for Culture, Media and Sport (DCMS) as it is the responsible for promoting Britain as:
"... Creative and exciting place to live, visit and do business. We Promote and protect our cultural and artistic heritage and help businesses and communities to grow by investing in innovation and highlighting Britain as a fantastic place to visit." [5]
The topics it covers are in fact:
• art and culture;
• sports and leisure;
• media and communication;
• economy;
• equality, rights and citizenship.
This department was part of the former "*Department of national heritage*" (DHN) created on April 11, 1992 and subsequently renamed with the current title 14 July 1997.
Before descending into the specifics of the activities of the department for the conservation and protection of heritage, we have to speak about NDPBs, in particular on one that covers the

the second position in the management of the entire discipline, the "*English Heritage*".
This, officially known as "*Historic Buildings and Monuments Commission for England* "is defined not at all as "*the legal adviser to the Government on heritage historic* "[3] and is an "*executive non-departmental public body.* "
The Historic Buildings and Monuments Commission for England was set up under the "*National Heritage Act 1983*".[4]
However, the first move is aimed at heritage conservation was made with the ''*Ancient Monuments Act*" in 1882, and over the years subsequent systems have been developed increasingly sophisticated for the protection, as the introduction of "*listed building*" and "*conservation area*" in 1960, which I will discuss later. However, until the occasion of 1982 protection and conservation of monuments and old buildings or historical British belonged to the Ministry of Environment. in the early 80s the then Secretary of State for Environment, Michael Heseltine, advanced the proposal to entrust the responsibility of shareholders to a semi-autonomous agency or quango should have been in able to operate with greater efficiency and initiative, always remaining within the political and ministerial guidelines.
For this reason, the law of 1983 has established this new non-departmental public body that has assumed direct management sites and monuments, borne by the state in 1882, giving an increasing importance to the management of the historical English heritage. Following the approval of the act, the HBMC was renamed as English Heritage, name by which it is commonly known today.
Since 1983, it has incorporated other different agencies and archives thus becoming the lead agency in the field of heritage: in 1999 it merged with the "Royal Commission on the Historical Monuments of England" (RCHME) and with the "National Monuments Record"(NMR) thus combining the resources to identify and detection heritage and thus becoming one of the largest archives in the UK.

3. 1 SUBDIVISION OF BUILDING TYPES: DCMS ED ENGLISH HERITAGE

We will now introduce the main activities in the UK regarding building preservation: the objects of protection are those recorded in the official records but the classification of goods deserves special attention. A good place to start may well be the definition of what the British call "*Heritage assets*". This term, in fact, is used in the United Kingdom to describe a range of geographical components of the historical context that have been identified as having a degree of importance, as it deserves consideration in decision planning. Moreover, in England the term "*Cultural heritage*" is used to refer to the real estae: the only ones excluded are the moveable goods.

Among the components at Heritage assets we must then make a distinction between those included in the *Designated heritage assets*, and those not in the *designated heritage assets.* First, it is understand what is meant by the term "designated" in the UK, the process of giving some legal protection to buildings and other historical artifacts goes under the general heading of "*designation of heritage assets*". In short, the term is used to refer to the process of heritage protection, which then uses a range of different legislative instruments that have been developed in piecemeal fashion over the centuries. The "*Heritage Protection White Paper for the 21st Century* "published by DCMS in March 2007, describes the appointment as:
"*... The first step in an effective heritage protection system. it is a means of identifying aspects of our past Those That Are most important to us, and explaining why they are important. Effective anche designation is the basis for decisions about the way we manage change to the historic environment.*"
The same document summarizes what are the good categories, which can be designated and which are not.
In the Designated heritage assets come within: "*listed buildings*", "*Scheduled monuments*", "*conservation area*", "*historic wreck site,*" "*Historic landscape*", "*ancient battlefield*", "*parks and gardens"*, and "*World heritage site*".
A brief observation deserves to be made on the terminology worked to indicate the different actions of protection for each category: the buildings are classified (listed), planned ancient monuments (scheduled), preserved areas of interest (Canned), and recorded battlefields, gardens and parks (Registered).

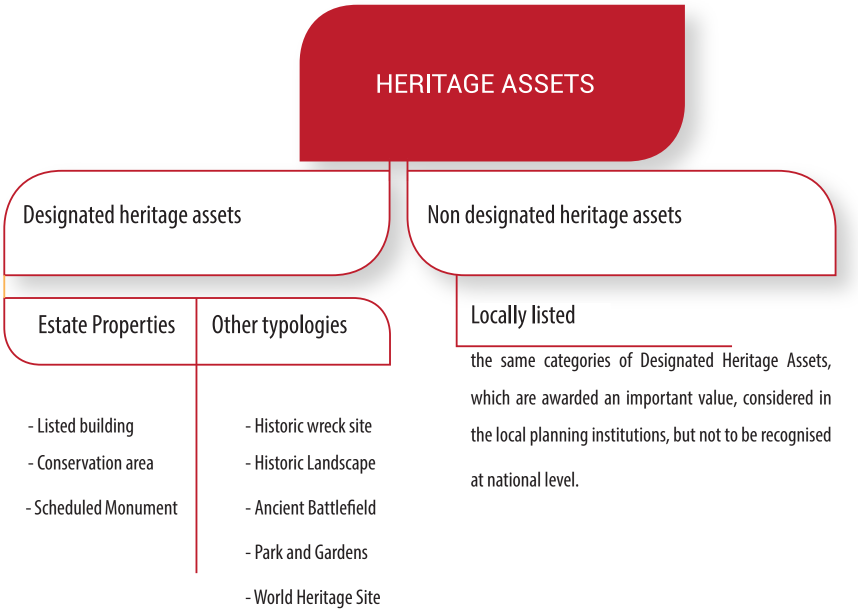
Considering just the building sector we will discuss in the next chapter the following:

• Listed building: building recognized and protected for its historical, architectural or cultural outstanding
• Conservation area: this description applies almost always to an area (usually urban or the nucleus of a village) considered worthy of conservation or enhancement due to its special architectural or historic interest.
• Scheduled monument: a site or a building of great archaeological or nationwide historical importance, which are given the protection against unauthorized changes.

Regarding instead the non-designated heritage assets, they are those buildings, monuments, sites, places, areas or landscapes that are awarded a level of importance, to deserve consideration in planning decisions, but which they are not formally designated as heritage assets. The designation and management of these assets is up to local authorities, that register them as "*locally listed*"[6].

The management of the nomination of these properties is distributed between DCMS and English Heritage. The DCMS is responsible for the identification and designation of *listed buildings* and *scheduled monuments,* while conservation area are often designated by local planning authorities, eventhough they have to report to the department. The English heritage, however, has the task of identifying and designating parks, gardens and places of battle, however, plays a very important role in the field of listed building, conservation area and scheduled monuments when he administers all designated national systems. If it is true, that the responsibility for the designations national rests with the Secretary of State of the DCMS, it is also true that this is bound to consider the advice from the English heritage, and there are really very few cases where these ones are taken into consideration[7].

Its main role is therefore to manage a large number (over 400) of historical and archaeological sites of the first floor, having direct ownership on some of these, while maintaining contact with the private owners of sites that are managed in terms of protection: then he deals with the conservation, registration, protection and enhancement of English, for the benefit of future generations, being not at all, the direct adviser of the Secretary of state on the above-mentioned policies. However according to the conditions of the DCMS expressed in the *Heritage Protection White Paper* for the 21st Century there is the will to transfer the legal responsibility for the nomination of goods from the state secretary to the English Heritage, in order to simplify the process of designation that often becomes very long and complex, because of its division between the decision-making role of the DCMS and the consultative one of the English heritage.



3.2 DCMS: LISTED BUILDINGS, CONSERVATION AREAS SCHEDULED MONUMENT

In this chapter we will explain the principal building typologies, mentioned above: listed buildings, scheduled monuments, historic wreck site and conservation area.
As already mentioned each of these groups is protected by a different legislative instrument, except for listed building and the conservation area which despite being enshrined in different periods both refer to the same act. In the next sub-paragraphs, these specific categories with the relevant legislative instruments will be explained.

Listed Buildings

Starting from the Listed buildings, these are buildings that are appointed because of their special architectural or historical interest, not by the entity of the entire building, but also for:

- any object or structure fixed to the building;
- any object or structure within the building curtilage which, even if not fixed to the building, is part of the earth from before 1 July 1948.

With the word "building" it is meant any structure or edification and any part of a building. The above definition is given in Section 1, Chapter 1 of the Planning (Listed Buildings/ Conservation Areas) Act 1990, the legislative regulation sanctioned on May 24 of 1990 in order to strengthen decrees concerning special controls on buildings and areas of special architectural or historic interest, that are not not listed buildings or conservation area[8].
The protection system of the listed building, in fact, has been in place since 1947, however, the concept of designating the buildings dates back to the second World War: the *Ancient Monuments Protection Act* 1882. They had identified a number of properties to be preserved, but as a result of the extensive damage caused by the bombings Germans during the Second World War there was the need to list and file the remaining buildings for their quality and architectural and historical importance. They were charged 300 members belonging to the *Royal Institute of British Architects* (RIBA) and *Society for the protection of Ancient Buildings* (SPAB) to draft the list of these buildings, under the supervision of the "*Inspectorate of Ancient Monuments"* and with funding from the Treasury Board.
This list was mainly conceived as a tool to determine which buildings were in need of protection and which of a reconstruction following the reported damage, with different degrees of importance (A, B, C)[9].

This designation system was later introduced and implemented as official instrument, immediately after the end of the War, with the *Town and Country Planning Act* of 1947, when dates back also the first list of listed buildings[10].
There are three different typologies of listed buildings:

- Grade I: all the buildings of exceptional interest, sometimes considered of international importance;
- Grade II *: buildings with particular importance, more than of special interest;
- Grade II: buildings with national importance and special interest.

According to the ''*Heritage at Risk Report* "drawn up by the "*English Heritage*" in June 2010, the listed building account for about 2% of the English building stock: in March 2010 there were approximately 374,000 classified buildings, and of these 92% were grade II, 5.5% grade II * and only 2.5% of grade I[11].
These buildings have to follow specific criteria:

• Architectural: buildings with special importance in the design, decoration and craftsmanship mastery; special interest can be found in those buildings which poses as a major national examples, and /or as particular building types or building techniques.

• Historic interest: buildings which illustrate important aspects of the social, economic, cultural or military value for the nation and/or have a strong connection with people, associations of national importance.

• Age and rarity: the older buildings are those found more likely in the lists of the listed building, however all buildings built before 1700 in which survives still a significant part of their original tissue are listed, as also the great majority of those built between 1770 and 1840. A more specific selection will be made for those buildings built after 1840 because of the significant number of surviving buildings, while for those built after 1945 there are more strict and accurate selection criteria.
Buildings with less than 30 years of life are rarely included in the list unless they have exceptional value, or are in danger condition. This time classification is only indicative, because different age and rarity of a building varies according to the building typology.

• Aesthetic quality: buildings with outstanding aesthetic value, which is intrinsic in its architecture, or have a visual appeal not too influential though they represent particular aspects of social history, economic and political, or when they have a significant innovative technology.

• Selectivity: in cases where a building is proposed for its architectural interest and there are, however, a large number of similar buildings, are designated only those that are the most attractive and significant type.

• National Interest: buildings with regional and national value or characteristics that are like archetypes of historic building stock.

• Shared value: buildings which, despite not having a strong value and/or interest, are part of an interesting and important architectural group.

• Condition: This requirement is not considered to be relevant during the designation[12].

Moreover, in addition to the "*Principles of Selection for Listed buildings",* the English Heritage drew up specific guides on each building typology, which serve as additional and accurate information on different building typologies, according to their style, and age.
Established the selection criteria for buildings, we must now understand the procedure that lies behind the designation. Firstly, it is important to say that any person can become part of this process, if the building is owned by him, or in the guise of counselor at the English Heritage, suggesting a building in need to be listed[13].
For external applicants the procedure must be carried out through filling out an application form in which the building is identified and explained in a documentation, why the building should be designated, thus motivating its historical and architectural interest. Once the form is received the English Heritage accomplishes the necessary research on the subject of evaluation and performs an inspection to determine the value; if the basis for the designation are good, a final recommendation is completed and sent to the DCMS, as as said, is the secretary of state that declares the final verdict[14].
Furthermore, the English Heritage is responsible to draw up each year a report in which are published the results of the heritage research, that highlight such buildings, which should be designated, or removed from the list, or part of the Heritage at Risk, those Listed buildings,

that are important historical sites and lie in a state of neglect and need an imminent intervention.
The results of these reports are sent to the DCMS which conducts the assessments, and are also available online for consultation by any user. As already stated, the English Heritage holds one or, probably, the greatest, archives in the United Kingdom, with the *Historic Environment Record (HER)*, the National Heritage List for England is a database of all designated sites by the government, including *Listed Buildings*, *Scheduled Monuments*, *Protected Wreck Sites*, *Registered Parks and Gardens*, *Registered Battlefields*, *World Heritage Sites*[15].

We also have to emphasize that the effect of such designation is not limited in helping to recognize and understand the interest of these buildings, but also to force local planning authorities to pay special attention during all stages and types of programming.
In order to to make changes to a building you need a particular permission, called *"Listed building consent"* and are regulated by the "*Planning (Listed Buildings and Conservation Areas) Act"* and by the "*National Planning Policy Framework (NPPF)*".
FInally, it should be emphasized that, for all grades of listed building the designation includes the entire building, external and internal, the objects attached to it, and often also those present in its curtilage; actions performed also on one of these parts without having obtaining prior consent, they are considered offense to the Article 9 of the "*Planning (Listed Buildings and Conservation Areas) Act".*

Conservation areas

As previously mentioned, the connotation of Conservation Area is applied to an area (usually urban or the core of a village) considered worthy of conservation or enhancement because of its architectural or historical interest.
This concept was introduced in 1967 thanks to the Civic Amenities Act: with the Town and Country Planning Act of 1947 the government aimed to protect of individual buildings, and afterwards decided to establish additional security constraints for regions of architectural and historical interest. This law came into force, because of a common and shared concern about the growth and requalification, which took place after the war[16].
This law was, however, replaced by the Planning (Listed Buildings and Conservation Areas) Act of 1990, which in the Section 69 states:

"...areas of special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance [...]"[17].

In this type of areas, therefore, the aim is to protect the quality and characteristics of the area as a whole, instead of the specific buildings: it is also true that within the Conservation Areas there are often listed building of different levels, which give a particular connotation to the whole architectural and historical area.
The attention is given to the sense of place created by the individual elements of the area. Therefore, while the importance of the listed building is established and recognized according to national criteria, the conservation areas are designated on the basis of local and regional authorities who are trying to support the peculiarity of a place[18].

Established as the general designation criteria of such areas, the English Heritage identifies these the main types:

• historical centers in the cities;
• fishing villages and mining;
• outskirts of the eighteenth and nineteenth centuries;
• model housing complexes;
• country house within historic parks;
• railway transport and immediate surroundings (eg. canal facing roads)[19]

Another question to answer is: how is life in a *conservation area*?

One answer is that certainly is a protected zone, and there are specific constraints on individual buildings: these are subject to special controls, called "*Article 4 Directions*"[20] restricting all those jobs that, in normal situations, may be carried out without the need for building permits. These general controls cannot be generalized but are cut and measured on each single area of the ordinary, because in each of these there are peculiar elements that need protection. A first evaluation serves to understand the place and the articulation of its character, but also constitutes, a starting point for the development of solid strategies for future planning decisions. Local authorities have to act with a holistic and precise approach. For this reason, section 69 of the *Planning (Listed Buildings and Conservation Areas) Act* states that the local planning authorities have the task to identify and nominate these conservation areas, and the duty to review "time to time" the conservation areas. However there is no indication of how much time should elapse between one revision and the next. Section 70 (8) of the document specifies that local authorities have to notify the Secretary of State and the *English Heritage*, should publish the decisions in the "*London Gazzette*" and, at least, on one local newspaper.

Furthermore, an active participation by citizens is encouraged by the *English Heritage*: this can only bring benefits in this development; in many cases to involve the citizens in an assessment of an area, the research is published and all the data found and processed on the town website, leaving a space to citizens for comments and suggestions.

As mentioned before, there are some specific inspections on conservation areas, according to Article 4. This belonging to the *General Permitted Development Order (GDPO*), gives local authorities the power of limiting the "*permitted development rights*"[22], where inadequate interventions could harm the area. These interventions include: actions carried out on the outside surface the building, as any change in the window frames, in roofs, gutters, downpipes, the coating material of the facades, and on green areas.

Furthermore, other restrictions and limitations existing in these areas are:

• Conservation area consent or a permit that is required if you want to demolish any building or "*unlisted*" building; in case we wanted to demolish a building belonging to the listed category is also necessary to get a "*listed building consent*".

• Any work to be done on the green and / or trees has to be notified to the municipality at least six weeks in advance.

•Extension works are allowed if they are integrated into the surrounding conservation area, and improve the quality of its architecture[23].

Scheduled monuments: ancient monuments and archeological areas act of 1979

The meaning scheduling is used as a sort of abbreviation to indicate the process by which sites and monuments of national importance are protected by the law and inserted in a "list" or, indeed, in a "schedule". That is why some buildings may have both designations.
However, as mentioned before, "scheduled monument" means an archaeological site or a historical building of national importance and protected against any unauthorized change to its surface and structure[24].

The first Act aiming to establish legal protection for older monuments was the *"Ancient Monuments Protection Act"* of 1882, by William Morris and the *Society for the Protection of Ancient Buildings (SPAB)* established in 1877, and included the "schedule" of 68 sites that were put under protection. However, this list focused only on monuments belonging to prehistoric times, with some of the most important sites in the country, in addition to those that were exposed to risk; with the '*'Ancient Monuments Protection Act*" of 1900 even monuments belonging to the medieval time were added to the list[25].
However, the current concept of scheduled monument was introduced by the"*Ancient Monuments and Archaeological Areas Act of 1979"*, the latest document after the five previous of 1882, 1900, 1910,1913 and 1931.
This document establishes its designation as the only legal form of protection and conservation specific to archaeological sites and describes a *"scheduled monument*", as:

• any building or structure, or excavation cave located above or below the surface of the earth and / or of the sea (in UK waters), or any building that includes its archeological finds.

• any site which includes any vehicle, vessel, aircraft or other mobile structure, or any portion of these[26].

If a monument belongs to a private owner, it will not change its property, but it can be preserved and, if necessary, open to the public.
Before any work is started, a *Scheduled Monuments Consent* is needed, and the DCMS will then decide about the state of progress for each building. To be recognised as "scheduled", a monument has to have *"non statutory criteria":*

- Rarity: monuments with special features and almost unique, or highly likely to be designated;

- Documentation: the greater the amount of information on the building, the greater the chance to understand its value;

- Value in the area: when a monument acquires a greater value being part of a geographical area or site;

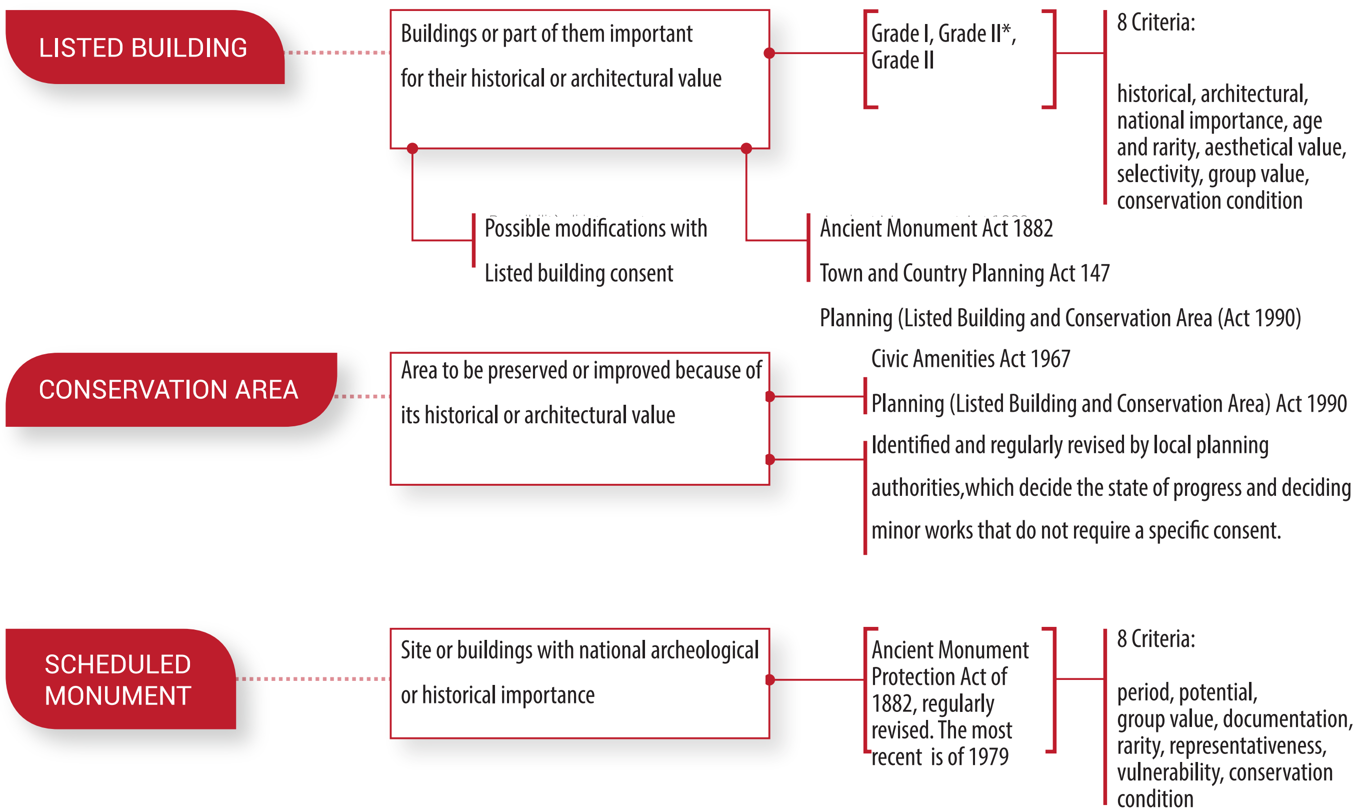
- Condition: the degree to which the remains of the monument are capable of transmitting the size, shape and function of the original appearance;

- Fragility / vulnerability: if there are threats to the site by natural agents, tourism or development, this may be designated in order to obtain protection;

- Representativeness: if the monument / site stands as representative of a certain category;

- Potential: the potential contribution that the monument / site can make to our knowledge.

Building typologies in UK preservation



3.3 THE ENGLISH HERITAGE: THE NHPP AND THE NPPF

The extraordinary collection of buildings and monuments now in the care of English Heritage began to be amassed in 1882. At that stage heritage was the responsibility of the Office of Works, the government department responsible for architecture and building. In 1913 an Act of Parliament was passed that gave the Office new powers. These were essentially to make a collection of all the greatest sites and buildings that told the story of Britain. At that stage these were regarded as being prehistoric and medieval remains - country houses and industrial sites were then not really seen as heritage.

By 1933 there were 273 sites in the collection of the English Heritage, including Stonehenge, Rievaulx Abbey, Carisbrooke Castle and Richborough Roman Fort. Preservation of these important places was, of course, the primary objective, but telling their stories was almost as important.

After the Second World War the Ministry of Works started to be interested in buildings other than castles, abbeys and manor houses. Its first industrial sites were acquired and in 1949 it acquired its first country house, Audley End in Essex. The Ministry had its sights set on a number of other big houses, but the Treasury was very nervous. The government felt it was one thing to take on old castles and abbeys, but quite another to look after, and maintain, huge roofed buildings full of works of art. After some debate it was decided that it would be financially more sustainable if the National Trust took on the country houses and that the Ministry of Works confined itself to the older monuments.

This ruling, though disappointing to the men at the Ministry, did not stop them collecting and huge numbers of historic sites, as windmills, iron works and Georgian villas were added to the collection. By 1970 the English part of the collection alone stood at 300 sites visited by more than 5.5m people; in 1983 what had effectively become the English national heritage collection was transferred to a new body set up by Mrs Thatcher's government. It was called the Historic Buildings and Monuments Commission. Its name was not thought to be very snappy by its first Chairman, Lord Montagu of Beaulieu, and so it was re-christened English Heritage. Under Lord Montagu's inspired leadership English Heritage did two jobs: it cared for the National Heritage Collection and it ran the national system of heritage protection, including listing buildings, dealing with planning issues and giving grants. On 1 April 2015 the old English Heritage separated into two parts: a charity that looks after the collections, and Historic England that champions the nation's wider heritage, running the listing system, dealing with planning matters and giving grants[27].

An important strategy developed by the English Heritage is the *National Heritage Protection Plan "(NHPP)*[28], which since 2011 until now sets priorities and give protection, trying to make the best use of national historical buildings.
The plan for the protection of national heritage was launched on 23 May 2011 by the Minister of Tourism and Heritage, RT. Hon John Penrose, establishing a precise system of preservation in the UK. In November 2011 the "*Localism Act*" was issued and in 2012 the "*National Planning Policy Framework"* came into power.
The aim of the "*Localism act*" of 2011 was to devolve more decision making powers from central government back into the hands of individuals, communities and councils. The act covers a wide range of issues related to local public services, with a particularly focus on the general power of competence, community rights, neighbourhood planning and housing. The key measures of the act were grouped under four main headings:

- new freedoms and flexibilities for local government
- new rights and powers for communities and individuals
- reform to make the planning system more democratic and more effective
- reform to ensure decisions about housing are taken locally.

Regarding the National Planning Policy Framework , it sets out the Government's planning policies for England and how these are expected to be applied. It also sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.
The purpose of this framework,which is controlled by the English Heritage, is to contribute to the achievement of sustainable development.
There are three dimensions to sustainable development: economic, social and environmental. These dimensions give rise to the need for the planning system to perform a number of roles:

- an economic role – contributing to building a strong, responsive and competitive economy, by ensuring that sufficient land of the right type is available in the right places and at the right time to support growth and innovation; and by identifying and coordinating development requirements, including the provision of infrastructure;

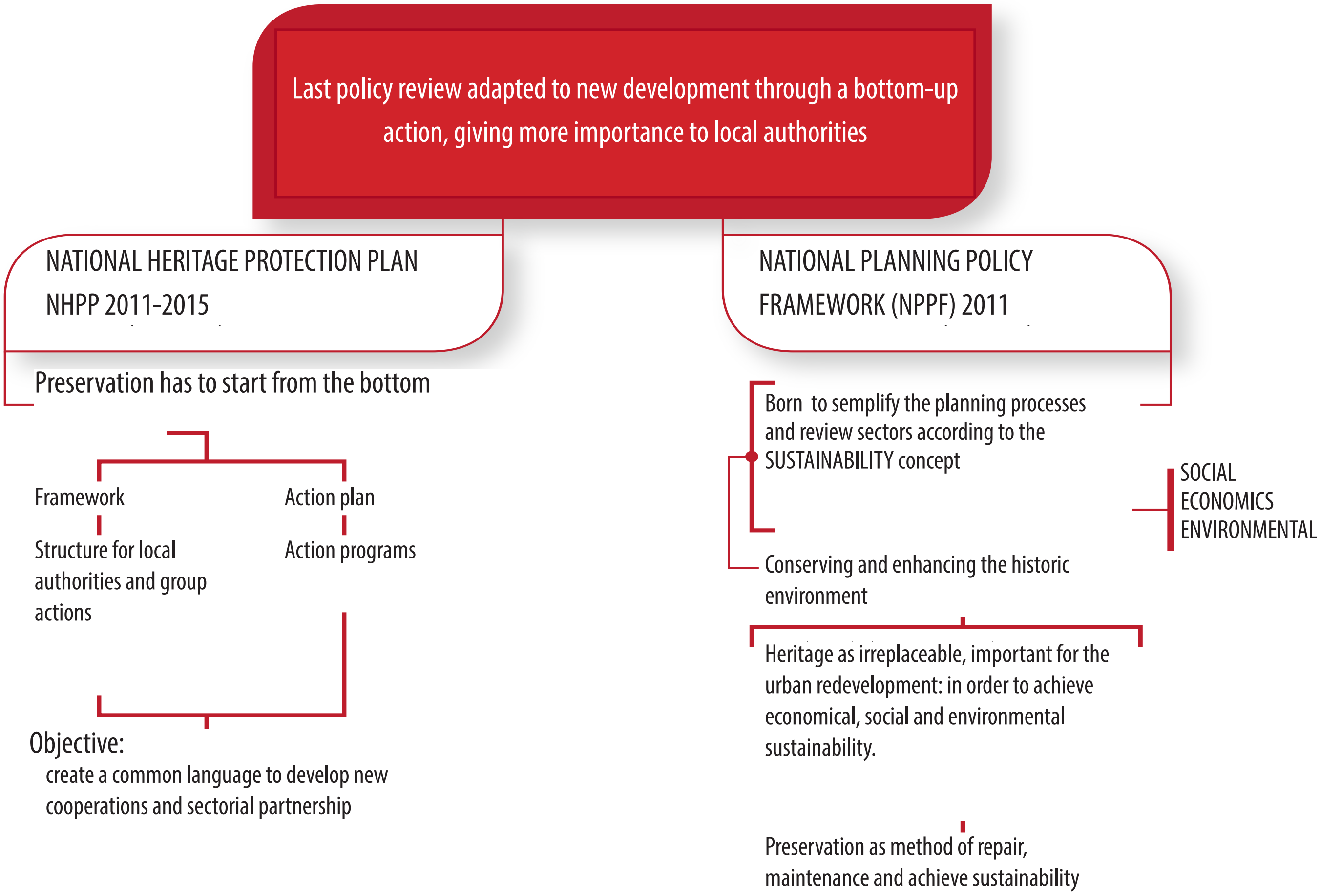
- a social role – supporting strong, vibrant and healthy communities, by providing the supply of housing required to meet the needs of present and future generations; and by creating a high quality built environment, with accessible local services that reflect the community's needs and support its health, social and cultural well-being;

- an environmental role – contributing to protecting and enhancing our natural, built and historic environment; and, as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate and adapt to climate change including moving to a low carbon economy.

Therefore, at the heart of the National Planning Policy Framework is a presumption in favour of sustainable development, which should be seen as a golden thread running through both plan-making and decision-taking[29].
For plan-making this means that:
- local planning authorities should positively seek opportunities to meet the development needs of their area;
- Local Plans should meet objectively assessed needs, with sufficient flexibility to adapt to rapid change, unless:
– any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole; or
– specific policies in this Framework indicate development should be
restricted.

For decision-taking this means:

- approving development proposals that accord with the development plan without delay; and where the development plan is absent, silent or relevant policies are out-of-date, granting permission unless:
– any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole; or
– specific policies in this Framework indicate development should be restricted.



Last policy review adapted to new development through a bottom-up action, giving more importance to local authorities
NATIONAL HERITAGE PROTECTION PLAN NHPP 2011-2015
Preservation has to start from the bottom
Framework
Action plan
Structure for local authorities and group actions
Action programs
Objective:
create a common language to develop new cooperations and sectorial partnership
NATIONAL PLANNING POLICY FRAMEWORK (NPPF) 2011
Born to semplify the planning processes and review sectors according to the SUSTAINABILITY concept
SOCIAL
ECONOMICS
ENVIRONMENTAL
Conserving and enhancing the historic environment
Heritage as irreplaceable, important for the urban redevelopment: in order to achieve economical, social and environmental sustainability.
Preservation as method of repair, maintenance and achieve sustainability

As we said in the previous chapters, it is through the planning system that most changes to buildings and land in the UK are carried out.
Changes are based on the principle of sustainable development, to be achieved in three specific areas: social, economic and environmental[30].
In the map in the next page, conservation areas are shown; if you want to alter or extend an existing building in a way that affects its character or appearance as a building of special architectural or historic interest, or even demolish it, it is necessary to apply for a listed building consent from the local planning authority[31].

A '*listed building*' is a building, object or structure that has been judged to be of national importance in terms of architectural or historic interest and included on a special register, called the List of Buildings of Special Architectural or Historic Interest.
Compiled by the Department for Culture, Media and Sports (DCMS), under the provisions of the Planning (Listed Buildings and Conservation Areas) Act 1990, the list includes a wide variety of structures, from castles and cathedrals to milestones and village pumps.
When a building is listed, it is listed in its entirety, which means that both the exterior and the interior are protected. In addition, any object or structure fixed to the building, and any object or structure within the curtilage of the building, which although not fixed to the building, forms part of the land and has done so since before 1 July 1948, are treated as part of the listed building.
Listed building control is a type of planning control, which protects buildings of special architectural or historical interest. These controls are in addition to any planning regulations which would normally apply. Listed building status can also result in the requirement for planning permission where it wouldn't ordinarily be required - for example, the erection of means of enclosure[32].
This special form of control is intended to prevent the unrestricted demolition, alteration or extension of a listed building without the express consent of the local planning authority or the Secretary of State.
The controls apply to any works for the demolition of a listed building, or for its alteration or extension, which is likely to affect its character as a building of special architectural or historical interest.
Types of building works which would normally require listed building consent include:

- demolition of a listed building
- alteration or extension of a listed building in any manner (including internal) which would affect its character as a building of special architectural or historic interest

It is important to note that the term 'listed building' includes:

- the building itself
- any object or structure fixed to it
- any object or structure that has been within the curtilage of the building since 1948

Planning permission may also be required for works involving the external alteration extension of the listed building, where works affect the character of the building. In this situation, the full application or householder application and listed building consent should be submitted.
In the UK buildings are listed to help protect the physical evidence of our past, including buildings, which are valued and protected as a central part of our cultural heritage and our sense of identity. Historic buildings also add to the quality of our lives, being an important aspect of the character and appearance of our towns, villages and countryside. The Department of Culture Media and Sport (DCMS) uses the following criteria to decide which buildings to include on the list of protected buildings:

- architectural interest: buildings of importance because of their design, decoration and craftsmanship
- historic interest: buildings which illustrate an aspect of the nation's social, economic, cultural or military history
- historic association: buildings that demonstrate close historical association with nationally important people or events
- group value: buildings that form part of an architectural ensemble, such as squares, terraces or model villages

In broad terms, buildings that are eligible for listed status are as follows:

- all buildings built before 1700 that survive in anything like their original condition
- most buildings of 1700-1840, although selection is necessary
- between 1840 and 1914 only buildings of definite quality and character; the selection is designed to include the major works of principal architects

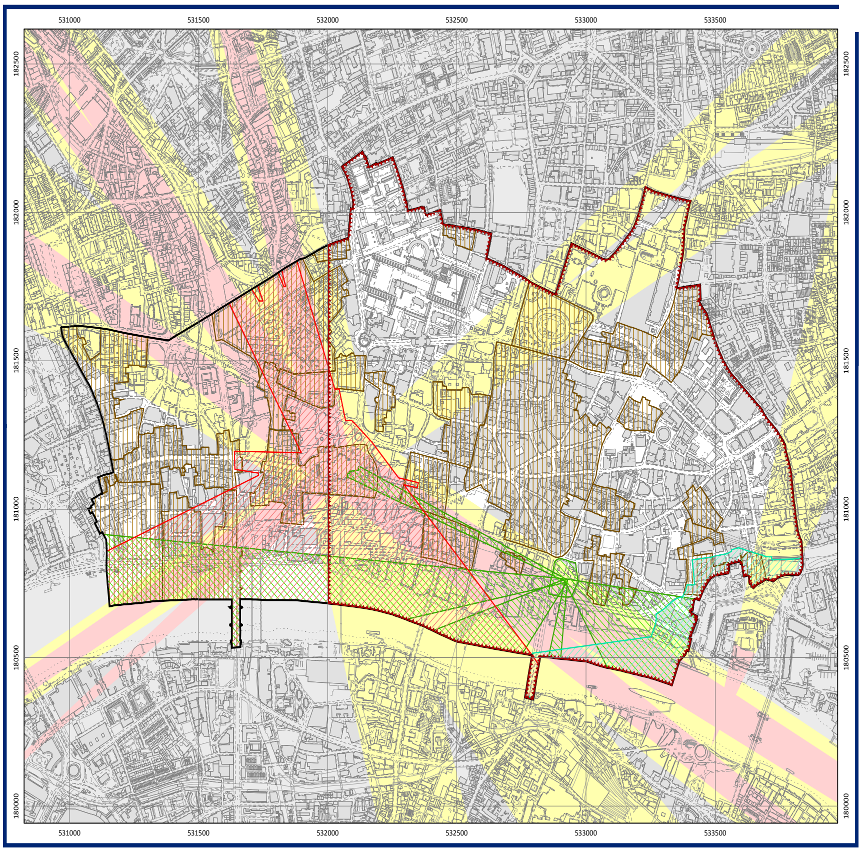
- between 1914 and 1939 selected buildings of high quality or historic interest
- a limited number of outstanding buildings after 1939, but at least ten years old, and usually more than 30 years old

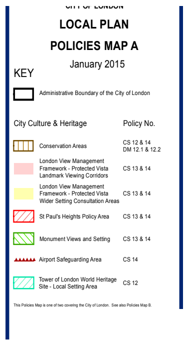
Listed buildings are classified into grades as follows:

- Grade I - buildings of exceptional interest (approximately 2 per cent of all listed buildings)
- Grade II* - particularly important and more than special interest (approximately four per cent)
- Grade II - buildings of special interest, warranting every effort being made to preserve them (94 per cent)[33]

There are 500,000 listed buildings in the UK, and between 1990 and 2000 there is an impressive increase in their number. In the maps on the next page, conservation areas are shown.

Differently from Italy, in UK it is a common practice to retain the facade of a building along the street, and demolish or modify the rear spaces behind. This phenomenon of "facadism", which will be discussed in the next chapter, is increasing in the latest years, and it permits the preservation of the historical facade of a historical building, while unrestrictedly alter its interiors.[34]

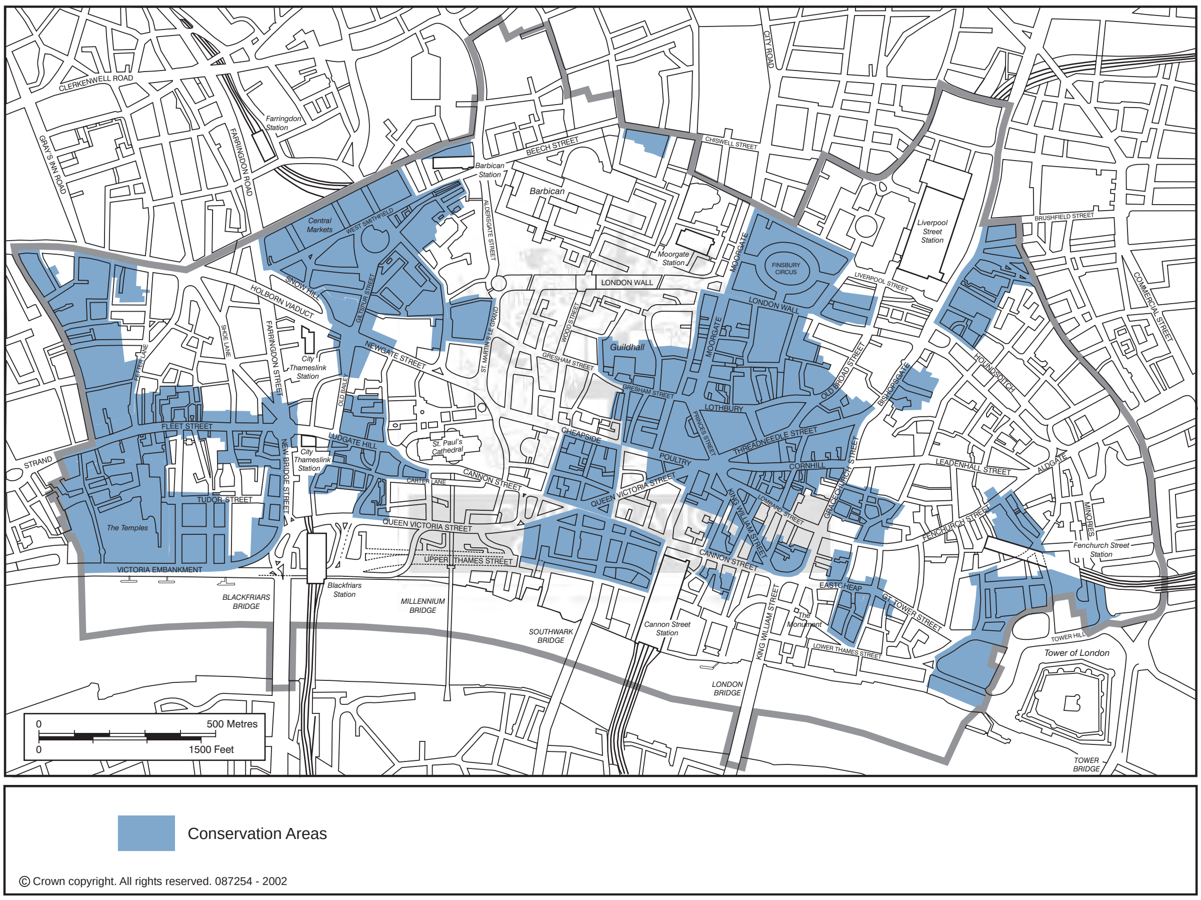




Figg. 29 and 30

"*Conservation areas and Views in London*"

Source: City of London, Department of the Built Environment



3.5 BRIEF HISTORY OF LONDON URBAN SPRAWL

Nowadays, the term London refers to its conurbation, better known as Greater London, that consists of 32 districts and the City of London. Historically, however, the name indicated only the square mile of the City, from which the city originated and developed; 1889-1965 identified the no longer existing Country of London. With the establishment of the new territorial unit of Greater London, the name London is expected to extend the current region. Yet London escapes the kind of classic European city, making it difficult to define, such as it is, or if it exists, its center.

The phenomenon has many faces, connected and distinct at the same time. For at least four hundred years, following the reconstruction after the fire of 1666, London had no boundaries or margins, so that the last vestiges of the only circle of city walls were removed one century later, due to the lack of invasions by foreign peoples. London has expanded and has grown from several villages in multi-cultural metropolis, without ever being a “città” in the classic sense of the term and the Renaissance, as it has happened in Paris, Rome or Amsterdam.

The urban plans that have followed over time, from that of Wren on, never plans for expansion or restructuring, the operations of mending parts of the urban fabric. London is no stranger to big gestures to Hausmann, and this stems from the very nature of the British people, that the Magna Charta on it is at the same time champion of individual freedoms and suspicious of any plan that tends to limit them.

London, as we see it today, is the result of temporary and continuous movement of a history of over two thousand years.

It will be the investigation of these aspects to guide us in this brief historical study of the origins and urban development of London.

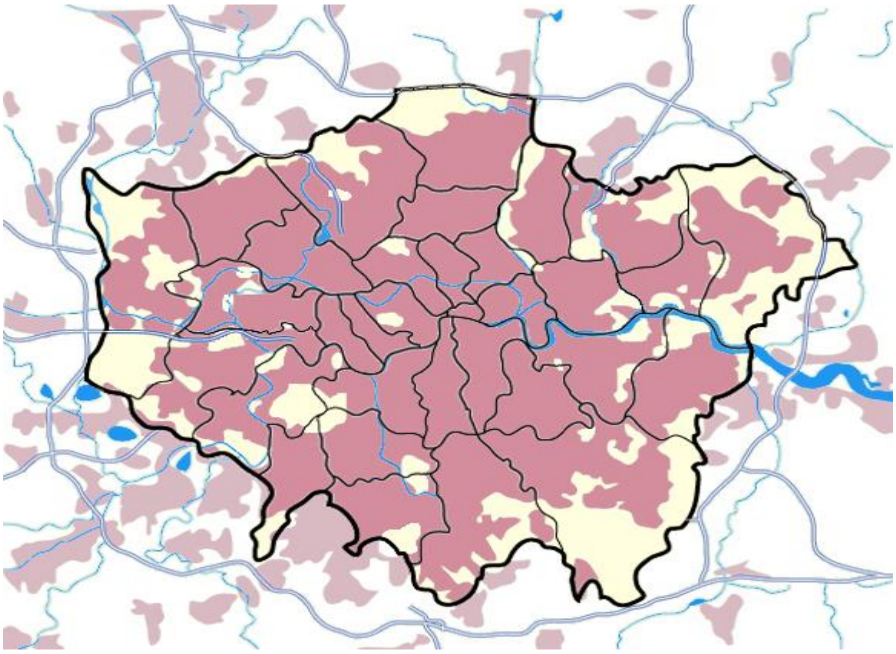


Fig. 31

"*Greater London territory"*

Source: Rasmussen S. E., Londra citta' unica

ORIGINS OF LONDON AND ROMAN AGE

Despite the existence of some legends on the foundation of London, there is no evidence of the existence of any form of settlement preceding that Roman. They were found remains of houses and tombs, but nothing that leaves imagine big city. So during prehistory London it was most likely a rural area with poor human settlements. Important findings, made in the bed of the River Thames near Chelsea, also suggest the importance of the area, where they were brought to light important urban ruins in Egham and Brentford, and a fortification to Uppall.

But there is no trace of Roman remains in the area of London, the current City of London.

The city founded by the Romans there remain many traces, which shows the presence of strong fortifications, but we do not know with accuracy the plant. Surely this faithfully modeled on the pattern of the Roman, with orthogonal streets, thistle maximus and decumanus maximus (parallel to the river bank).

A study at the University of Denver, has tried to reconstruct the plan of the Roman city.

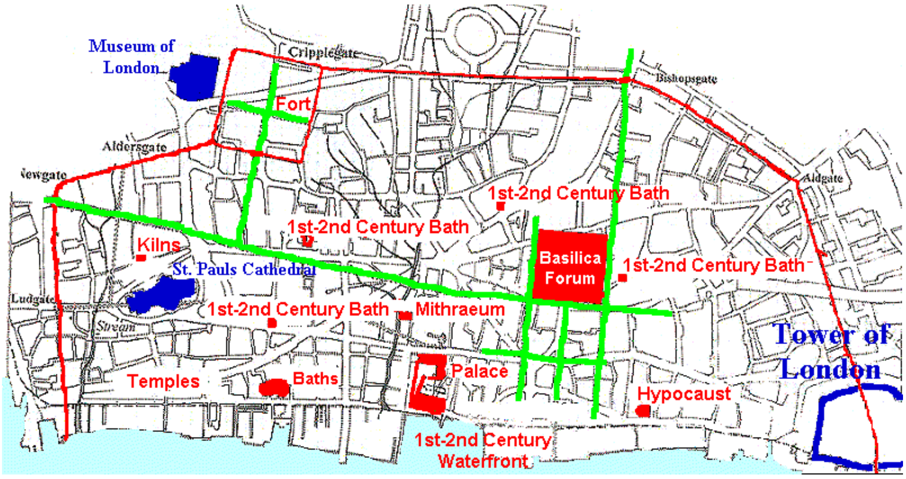
The Roman London occupied an area of about 140 hectares, with a population of about 50000 inhabitants[35]; it was not a city seat of government, while it probably was the current St. Albans (Verulamium), about twenty miles to the north, and London was perhaps originally the port.

The important element of the Roman settlement is the creation of large node communications:

Fig. 32

"*London in the Roman Age, red points important buildings of that time, blue significant landmarks of the city.*"

Source: www.globalreporting.org/GRIGuidelines/2002/gri_2002_guidelines.pdf



this determined the choice of the place of establishment, because the importance of London is mainly due to its position as a center of commercial activities. Then analysing the geographic location of the settlement, it has proved particularly favorable.

The clay of the Thames valley is bounded on the north and south by two hilly systems; that Southern, said Weald, was covered with impenetrable jungles, which extended also on the continent.

The Romans were able to make the territory exceptionally safe and peaceful, thanks to a system of strict laws and an excellent military organization. In order to make fast and easier the displacement of the troops, in case of need, were traced wide streets crossing forests, with forts to protect the key points, such as Watling Street, a major highway that went from Dover to the north-west across the city also Verulamium, a leading period. At Waitling Street crossed the Stane Street, which southwesterly continued north in what was later called Ermine Street, crossing the Thames on a fixed bridge, the only up to 1729, the London Bridge. The city of London was born at the northern end of the bridge, whose defense it was obviously necessary. They were then built defensive walls, within which developed the city[36].

MEDIEVAL LONDON

After the fall of the Western Roman Empire, the British Isles, abandoned by Roman legions, were easy prey for the invasions of Germanic tribes, in particular the Anglo-Saxons, coming from the east.

These territories resisted the Arab invasions of the seventh century, but found themselves on the edge of civilized world. The Life diminishes and in many cases is interrupted. Only later, after the 1000, in this area, which becomes modern Europe, formed a civil and economic life, and City return to grow; but here, unlike other areas of the Mediterranean, the crisis intermediate has created a rift between the two periods of development. The new city grows on trace of the old one, but with a social organization and different building, which instead they connect, without interruption, to the character of the scenario of the contemporary city.

What remains of the ancient city is a series of ruins, which are studied and visit, but not longer work as part of the odiern city[37].

In this rural society and self-sufficient, the city played a marginal role, not covering the function of administrative centers and only partly that of centers of production and exchange. But the physical structures of the Roman cities they are still standing, and become places of refuge; the large public buildings of antiquity - spas, theaters, amphitheatres - are turned into fortresses; the city walls are maintained in or are restricted to defend a part of limited city, linking the most importants cornerstones. We do not know for sure if London continued to live without interruptions throughout the Middle Ages; probably the city was abandoned for nearly a century and reduced to a mountain of ruins. By the sixth century it is instead proven that London was inhabited, with merchant features; Alfred the Great including the strategic importance of London, so as to make the fortified city that was to protect his kingdom to the south by the Danes. He was concerned so that the Roman walls were restored and expanded and then London was a fortress, while retaining its independence, it served the interests of the king[38].

A CITY WITHOUT A CENTRE

In the ninth century London was renamed Lundunaborg. The suffix Borg, who has come to indicate simply an agglomeration means -muro defense dirt or fortino. To bring about the town were, in fact, the walls, so expensive and precious that no one was never think of moving it.
Because of the narrow confines dictated by the walls, London began to develop so centrifugal, or by means of new settlements outside the walls, organized in communities with local government, without a driving force of expansion[39].
Sometimes the rulers lived in London for a short period, but there were never home fixed; Indeed, the City came later to be considered independent from the Crown. The seat of government was fixed at Westminster, who always had a strong bond with sovereigns.
As early as the ninth century there was a settlement at the south end of London Bridge, which constituted the fortification. This, the current Southwark, probably had no walls but stone ramparts of earth (in Scandinavian language "bulwark"), now completely disappeared.
It was a kind of secondary London, always connected with the life of the city, but built only in 1554. There the scum of the city took refuge, while the wealthy class went in search of fun.
Probably already in the Middle Ages the Danes, while not going into London, had a colony outside the walls, in the area where now stands the church of St. Clement Danes.
The Strand, a suburb of the aristocracy, has its origins in the thirteenth century, when Peter II Savoy (1203 - 1268), received the land from Henry III (1207 - 1272), built the Savoy Palace.
Well, In the Middle Ages we find a group of citizens gathered around the two cities official - and very different - of London and Westminster. It was possible to build safely. Also outside the walls, as the danger of war had diminished. The free expansion of the city, however, was opposed by the circuit of the convents and related properties. The Church was now joined in London and well established throughout the territory[40].
Only after the abolition of the monasteries by Henry VIII (1491-1547) urban sprawl, there was a mere extension of the City, which still preserves the medieval area; indeed, every village around the building crystallized to form a common, and practically went on with the same developing method.

LONDON AFTER THE NORMAN OCCUPANCY

At the dawn of the new millennium, the Danes ruled the whole England, having as a city. Main sort of capital, Winchester. Meanwhile, London had surprisingly maintained its total independence, self governing according to a kind of traditional right, never sanctioned, in fact, by any written document or grant real.

When William the Conqueror came to England in 1066, he found two distinct centers of very important, the real world of Westminster and the commercial London.

He could not get the better in a siege of a city as strong and united as London; he preferred to stop at the gates of the City, and wait for the fire to Southwark London, frightened and convinced by the Norman community to choose him as king.

Theoretically the kingdom was hereditary, but it was as if London, according to an unwritten law had the right to appoint the sovrans.

At the founding of the kingdom of England (14 October 1066) followed a solid organization kingdom, through a feudal system with a strict hierarchy, which does not leave too much power and territories too vast to various feudal Normans.

In London, however, William behaved differently: it was better to keep -Capiva good relationships with merchants, however, ready to switch to a strong manner in the event of conflicts. In their statute guaranteed all freedom desirable, but at the same time began to build, right on the edge of the city, the Tower, the royal fortress impregnable and menacing. His successors continued the construction and meanwhile were assuring, a constitution after another, their friendly intentions. This benevolence of the king was not free. The management of the kingdom was very expensive and certainly the king had not the means to bear the costs; therefore the granting privileges and favors was his tool to extort money from wealthy Londoners[41].

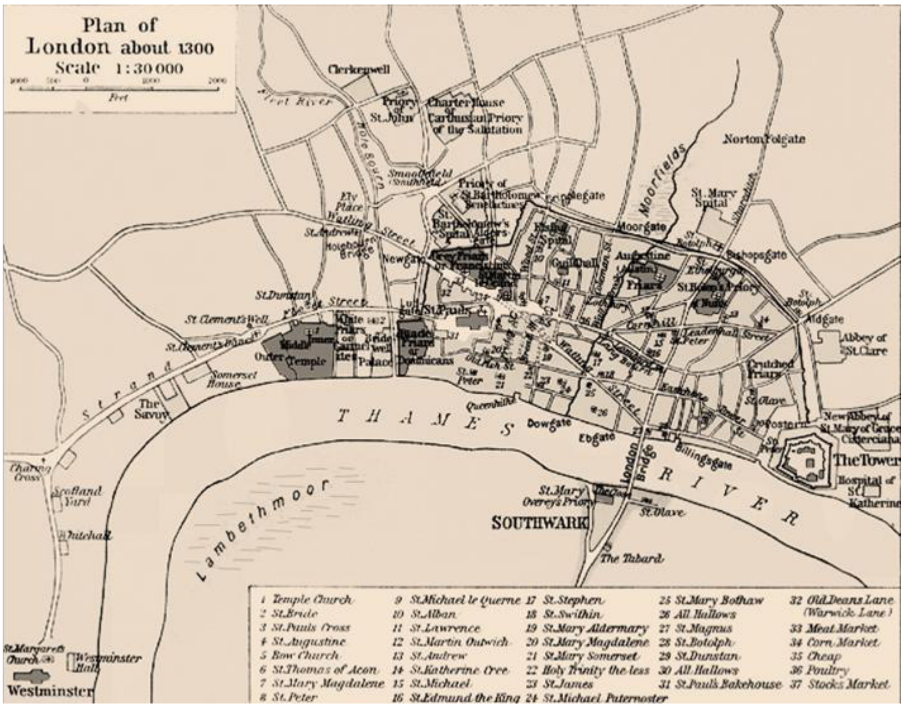
Even in the event of conflict, London could provide weapons to the king, troops and ships that he, alone, could not afford.

Soon the continued extortion attempts appeared to citizens deeply unfair. A solution to this problem could be the centralization of power in the hands of a single person; but when, at the end of the twelfth century, was made this effort, rose up the barons, too eager for power, which forced King John to sign in 1215, the Magna Charta. The ultimate solution to the conflict would be reached only after more than a century, when it was born the first form of British parliamentary system, which did not allow neither the king nor the great noble to have supremacy, solving problems through negotiations, in which also the municipalities took part.

Fig. 33

"*London plan in 1300"*

Source: http://mapco.net/london.htm



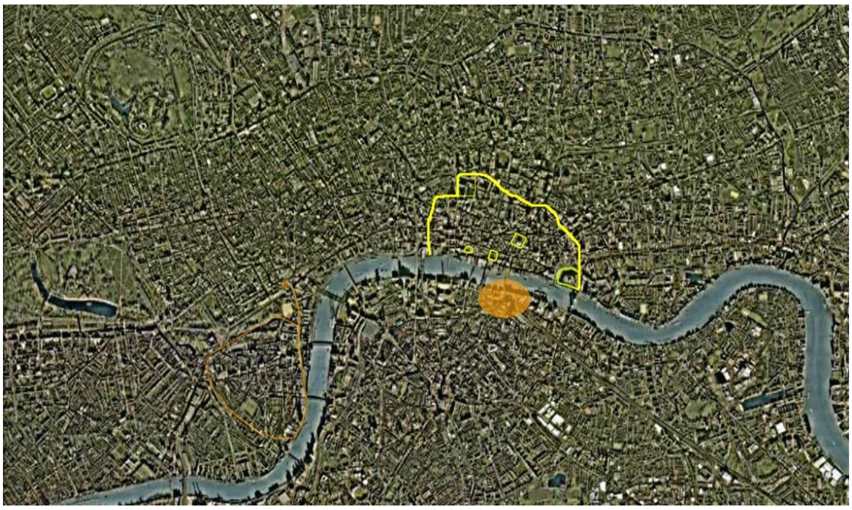
The above plan shows London in 1300, from the urban point of view, in the thirteenth century it witnessed a flowering of many small new urban centers, the result of the economic prosperity of the region and the increased exploitation agricultural areas.

In Europe in the second half of the thirteenth century start to shape the character of many metropolitan cities, including London. It is, ultimately, the expression of urban development ,agriculture and commerce which had affected all over Europe, and that will turn inexorably to the crisis in the mid 1300s[42].

Fig. 34

"*Expansion of the city in the 1300, in orange William I' s Tower"*

Source: www.globalreporting.org/GRIGuidelines/2002/gri_2002_guidelines.pdf



LONDON IN THE MODERN ERA

SEVENTEENTH CENTURY LONDON

At the beginning of 1600 the expansion of London had reached alarming proportions. The increase demographic of the last centuries and the increase of trade had poured into town a huge amount of people, all looking for alloggio25. The form such a small town had led to the development of vast neighborhoods outside the walls, often inhabited by foreigners and immigrants unpopular with locals and then looking for peripheral settlements, soon
They reached very poor and unsanitary living conditions.
In 1598 Stow John, in describing a district of London, this report mentions that in his say, he should go back to "not many years ago," and that clearly conditions marginalization in which they lived foreigners:
In Billingsgate Ward, there were fifty-one foreign families, and thirty of them lived the parish is St. Botolph, the most important buildings, where they paid twenty pounds a year for a house that is rented for the first four brands; closest to the river were more expensive.
They paid, and only thirty years ago there were more than three Dutch in the ward; at that time in that parish gathered for subsidies to the poor, seventy pounds a year; since the population has become so large, they could collect more than eleven pounds, since foreigners are not intended to cater to those needs as others do cittadini. In addition, the socio economic progress led to the formation of streams migration of impoverished artisans from City to the outer districts, leaving room for the new rich emerging class of merchants. The land value in the City was in fact increased and artisans, weakened by traders, abandoned shops. The City then became for mostly a residential and commercial, while the suburbs took on the guise of neighborhoods craft. Later there would have been another transformation: even buildings Residential merchants would move outside the walls, leaving only shops in the City and offices. The vast array of proletariat London was also increased by the mass of peasants, now unemployed due to the increasing exploitation of the estate, not for agriculture, but for the grazing more profitable[43].
A Shoreditch and Spitalfields settled that wave of migration that introduced silk weaving, Southwark settled hatters French and Flemish who could pull the beer from hop and Westminster and found Clerkenwell residence printers Dutch.
In the plant shown, it sees the development of London almost exclusively on the left bank Thames, with the Norman Tower and the only passage east of the River Thames in the center. To the west, after the bend in the river, the center of Westminster appears independent from London, with the Abbey and Whitehall.

Fig. 35

“*Map of John Norden of 1593”*

Source: www. http://mapco.net/london.htm

Around there are large green areas, as evidenced by the names of some churches, such as St. Martin in the fields.

The two centers are linked together by Strand (meaning shore), a curved road that follows the bend of the river. During the reign of Charles I (1625-1648), the aristocrats began to settle in the West End around the Strand and, thus constituting the backbone between the two centers, and populated first they settled the great noble estates.

The City, the residence of ancient families of merchants and traders, is marked by two main roads crossing, roughly parallel to the river Thames Street and, further north, Cheapside Poultry that, at the height of the building of the stock exchange, it is divided into Chill and Lombard Street.

The network of streets leading down to the river has its main axis in Old Street Fisch, who reaches the bridge. The streets are narrow and timber construction. As early as the sixteenth century overcrowding of the city was a matter of concern, both for reasons of hygiene that of security; Moreover a measure prohibiting Elizabethan building in wood and imposed stone, was completely rejected[44].

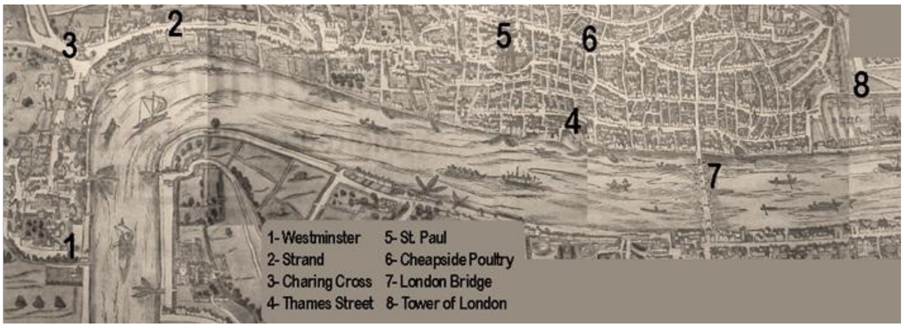


Fig. 36

"Major points in 1600 London"

Source: www. http://mapco.net/london.htm

Fig. 37

"Plan of 1553-1559"

Source: www. http://mapco.net/london.htm

INIGO JONES

The major protagonist of architecture and urbanism in London in the first half of the XVII century was undoubtedly Inigo Jones28. Upon returning from his travels in France and Italy, he is appointed in 1615 superintendent of royal factories at the court of James I. He arrived well in England a whole new way of designing, the rationalist rigor and the method of urban facade uniform, mainly from France, which create a clean break with the insular tradition and deriving from the language Palladian already containing the conditions of the English neoclassicism. During his tenure at the court of the king, took place the most interesting changes in urban design and architecture. The Banqueting House in Whitehall the opening of Lincoln's inn Fields, at the edge of the Strand, the first regular square architecture homogeneous, establish some standards profoundly innovative.

Fig. 38

"White Hall, Banqueting House, 1829"

Source: www. http://mapco.net/london.htm

Around 1620 the first urban housing development was started, this type of architecture will provide the design language, the one of Lincoln's inn Fields. The land on which it is built had been sold to the king to a private developer, Newton, who undertook to build thirty houses building around a rectangular area, a plaza with gardens and paths, designed by Inigo Jones, who actually takes the form of mixed space between the urban and the natural.
Despite the ban on building in London except on old foundations, Lord Bedford won in 1630 - upon payment - permission to build his huge property in Covent Garden[45].

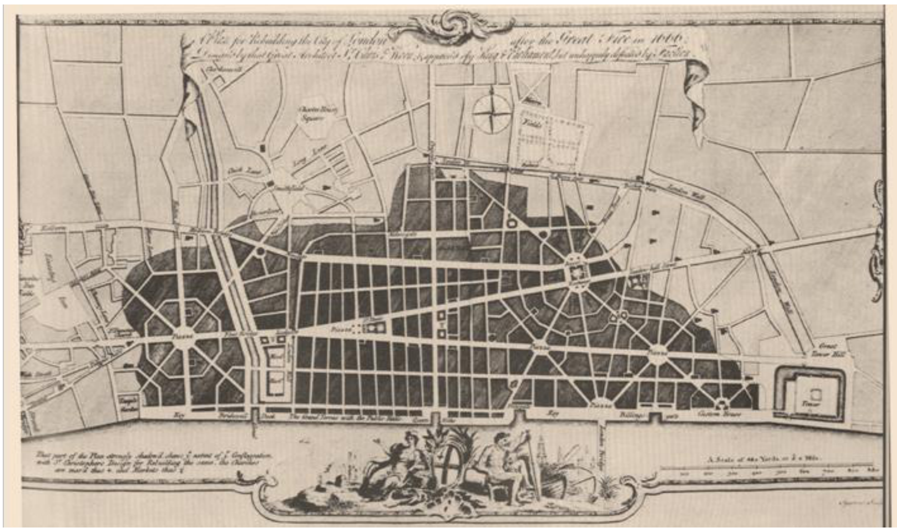
Such subdivisions with homes was continuous and very low, which in the seventeenth and seven hundred will inspire the construction of other squares in London, they were destined to social classes privileged; the oldest squares in the West End were reserved for the wealthy classes related to monarchy, because the nobility continued to reside in the country.
The central area of Covent Garden, a rectangle of 123 x 92 meters, was intended, in times later, to be a market of fruits and vegetables, thereby leading to a subsequent significant depreciation of housing.
Covent Garden is the first example of the population of the areas outside the centers of London or Westminster; This outlines a process of urbanization which, essentially, will not change until the Victorian age and that, in fact, is the foundation of a new city.
The area of the West End was composed of vast estates formed in the sixteenth century by the expropriation of Church property: those lands that in the Mediterranean countries were still in the hands of Church, in London were then owned by the crown and were assigned to landlords, who, once obtained a licence to inhabit the area, then leased the property (building lease), to entrepreneurs, who then could invest their capital[46].
Upon expiration of the concession for rent, land and houses returned to the landlord; the duration of the rent in Covent Garden was thirty years, but after the period ended, arriving at the end of eighteenth century, the period became of 99 years. Upon completion of the construction plan, the houses were leased and the manufacturer derived his profit.
The landlord acted as a de facto small sovereign in the territories entrusted to him; he needed immediate profits, but rather preferred to promote enhancement of land on a large scale basis. He had the power to impose the social, architectural and economic district, requiring, among other things, the names of the family in topography; also minutely it controlled throughout the process of realization and the step of maintenance, so that the neighborhood was not the victim of degradation.

After the Big Fire of London in 1666, Cristopher Wren introduced some urbanistic ideas seen from other European cities, where the main access to the city was through the doors and the bridge. Houses had to be rectangular and the streets perpendicular to each other.

Fig. 39

"Cristopher Wren' s proposal for London"

Source: www. http://mapco.net/london.htm



He proposed a series of large squares and regular, that would order a geometric system symmetrical.

In the next years John Evelyne proposed a series of squares that were regular and symmetric. Together with the plans proposed by Robert Hooke and Valentine Knight, none of them was approved. It was recognized that the streets were too narrow and therefore was available that they were more wide, both in accordance to the aesthetic of the time, both as a function of increasing traffic of carriages. It also provided that the houses were built of brick or stone and a wide riverside was proposed[47].

A plan for London was approved on 8th February 1667 and stated that taller houses could have been built along wider streets, older buildings would have been rebuilt in bricks or stone, giving to London the appearance of a rich and strong city.

Fig. 40

"Map of London in 1673, Richard Blome"

Source: www. http://mapco.net/london.htm

LONDON AND THE INDUSTRIAL REVOLUTION

London is the first major bourgese city, in which the urban form no longer depends on government interventio, but on a large number of small private projects; it was elegant and architecturally balanced (streets or squares surrounded by identical houses, with communal gardens in the middle), but the repetition of these incidents formed a giant and elusive periphery, that spread in all directions and gradually mingled with the countryside, without reaching a defined limit.
During the Industrial Revolution, London suffered the phenomenon of urbanization, namely the escape of large number of workers from the countryside to the city, living in suburbs, while the wealthy classes gradually abandoned the city centre.
In the 18th century London was the iggest city in the world with 2,5 million inhabitants, reaching 4 million inhabitants in 1901[48].

Fig. 41

"Map by R. Creighton: the West End is much more urbanised then the East End. "

Source: Print by J.& C. Walker of 1845

In 1805 Pall Mall was the first street illuminated by gas; in 1851 the first universal exhibition in Crystal Palace was opened,attracting tourists from all over the world. In 1836 the first railway line connecting London Bridge to Greenwich was built, giving birth to new suburbs and stations, as Islington, Paddington, Belgravia, Holborn, Finsbury, Shoreditch, Southwark and Lambeth.

Fig. 42

"New expansion areas in 1800"

Source: www. http://mapco.net/london.htm

THE TWENTIETH CENTURY AND THE MODERN ERA

In 1940 a report published by Minister Chamberlain described the disadvantages of demographic concentration and economy around large cities and decided to create the Town and country planning ministery, central body responsible of coordinating the planning activities. Three distinguished zones were determined: inner ring, suburban ring, green belt, outer ring.

- Internal, corresponding to the county of London and suburbs more compact, where lived about 5 million people over an area of 55,000 hectares; the density was considered excessive and was expected to decrease to 400 thousand inhabitants;
- the suburban area, where 3 million people were living on 58,000 hectares; the density was considered acceptable and the population would have to remain stationary;
- the outside area, including the green belt and the surrounding area up to 60-80 kilometers from the city center. Here all the expanding forces would take place, forming the new cities, the"New Towns".[49]

Fig. 43

"Abercombie Plan for London, 1944"

Source: www. http://mapco.net/london.htm

In 1946 the New Towns Committee came into power promoting 14 new cities, that had to be built close to larger cities.

After a first wave of hectic urban development, which took place in the late eighties, the imminence of the new millennium has brought an intense burst of real estate development, not very neat, but with the execution of certain operations located in different areas of the city, sometimes giving little attention to infrastructure projects.
Tony Blair, came to power in 1997, set itself, among other objectives, to inaugurate some important symbols for '2000, creating the so-called - "Cool Britannia".
The symbols of this London of the new millennium are four: the Tate Modern, the Millennium Wheel, better known as London Eye, the Millennium Bridge, and the Millennium Dome. The first proved to be a great success, as well as the second. The bridge, after an embarassing start , was then The Dome, however, was a very bad example of what can happen when politics starts to operate a commercial project.
The Millennium Dome, located on the Greenwich Peninsula, is a giant shell of carbon fiber; with a diameter of 365 meters, it is the largest indoor facility in the world. His problem is not the external structure, but a suitable internal destination.
In the later years its name was changed in 02, and converted into an arena of 26,000 seats.
From the second half of the nineties, London was subject to a general building boost, is the which we are witnessing still today. Blocks of ultramodern buildings have started to break the monotony of the traditional UK dwellings.
To the west of the city there are elegant and tidy villages of townhouses interrupted by bright building blocks, contrasting sharply with the surrounding area.
To the east, in the City, and in the Canary Wharf in the Docklands, towering skyscrapers are popping as missile on the launch pad.
To the northeast, in derelict areas, regeneration projects have assumed colossal dimensions, as in the case of Stratford City and the nearby Olympic Park, in the Lea Valley, to develop an ultramodern town among the ruins of a proletarian Victorian suburbs[50].

Fig. 44

"Symbols of London in 2000: Tate Modern, the MIllenium Dome, the London Eye, the Millenium Bridge"

Source: cronologia.leonardo.it/storia/mondiale/inghi000.htm

Fig. 45

"New expansion areas in 2010, black areas are the area with new projects of redevelopment."

Source: www. http://mapco.net/london.htm

THE 21ST CENTURY

London is now turning from the Victorian city, with some modern and some rare skyscraper, in a predominantly modern city, marked from the impression of tall skyscrapers which end up suffocating the few old surviving neighborhoods and eighteenth century churches.
In recent years, the process has accelerated exponentially; entire blocks of Victorian homes or buildings have been demolished after the war, revealing new perspectives that after a few months are reshaped by new structures.
The architectural development of the City reflects the change of the financial capital; from early symbol of the city St. Paul's church (1675), first skyscrapers have begun to break the rule: In the eighties, on the wings of Margaret Thacher politics, the City grew by horizontal remakes with the demolition of entire Victorian neighborhoods, accommodating American first big investment banks. Real estate development focused strongly on the River and the north bank of the Thames was invaded by a number of modern buildings of questionable taste, non-harmonic between them.
The new skyscraper Gherkin was symbol of the resurgence of the eastern suburb of the Docklands, a poor desolate neighborhood that in twenty years has increased its population from 10,000 to over 80000 people with the prospect of reaching the 100,000 inhabitants in 2012 and 200,000 in 2025: this is Canary Wharf, the small Manhattan, built from scratch in the eighties, and that could not adapt to the needs of modern times. Under the pressure of big American investment banks, which had set up their headquarters in London, buildings with wide meeting rooms were used in the Docklands. In 1980 the arrival of container ships and the growth of other ports such as Felixstowe, in Essex, decreed the death of the Docks. In 1981 the Thatcher government decreed the creation of the London Docksland Development Corporation with the purpose of reviving the area and with the objective of creating a financial center. The general project was given to the American architects Skidmore, Owings & Merrill. At the center, the number one in Canada Square, the tallest skyscraper in London, designed by 'architect Cesar Pelli, with around many other important buildings.
Unfortunately, when the Pharaonic complex was ready, in 1991, Britain had ended in the grip of one of the worst recessions in the postwar period and the great buildings of Canary Wharf were used.
The area surrounding the Millennium Dome will be the subject of a titanic project to relaunch the urban surroundings. Covering an area of 80 hectares will be built a mega mall and residential spaces, including a square, the Millennium Square.

London is the scene of an unparalleled building frenzy, using the best talent architecture and engineering of large multinational firms, this urban frenzy is also risking to explode, after a long housing boom of 14 years, during which a London prices continued to rise in all parts of the city. The economic boom and the arrival of waves of wealthy European triggered the so-called process of gentrification.

Since the mid-nineties, in the last years of the Conservative government of John Major and throughout the era of Blair, London has witnessed an unprecedented growth of prices. The city, which was emptied in the eighties, is back to fill up to the most secluded corners, fueling an immense pressure on property values, aided by a sustained and uninterrupted economic growth[51].

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4. INTRODUCTION TO ADAPTIVE REUSE

"More often than we like to admit, we are not engaged in changing the world to some determined end. We are adapting responding to outside forces beyond our control, seeking to survive, to preserve something, to maintain some desired level of performance."[1] (K.Lynch)

Adaptive reuse usually refers to the reuse of sites or buildings for purpose other than they were originally built or designed for. These new uses can offer economic, social and cultural benefits to their environments. As well, reuse is one approach to sustainability since it conserves original durable building materials. Adaptive reuse deals with issues of conservation and preservation of built heritage as well as strategies and policies. Once old structures become unsuitable for their functional and programmatic requirements, adaptive reuse becomes a sustainable option for reclamation of sites.

The urban areas that mostly became subjects to adaptive reuse in the process of development of the city in the 20th century included endless number of industrial sites and their buildings due to the fast development of industry and technology that forced the industrial processes to move further to the urban periphery away from the city center.

Therefore, in the context of urban development, adaptive reuse turns into an approach to urban renewal where historical industrial facilities being that have being abandoned and neglected remain the carriers of social meaning. Heritage buildings are physical repositories of collective memory embedded in the place, in the dilapidating structures and their materials, in the obsolete infrastructure and the abandoned open spaces once preserved and retrofitted. They represent social value that celebrates intangible cultural heritage embedded in the historical material of the built form.

New buildings can be quite easily built to be environmentally friendly, and as we saw, European legislation inexorably moves us in this direction. But in most countries, as UK, there is a large stock of buildings that are certainly not efficient to run nor necessarily comfortable to use. So their future must be to either demolish them or retrofit them. There are at least three valid reasons for refurbishment rather than demolition: the building may be an important historic building; it may be capable of refurbishment at lower cost than demolition and new build; or it may be considered that the environmental impact on the surrounding is less if its refurbished rather than demolished[2].

European cities celebrate their past by preserving significant buildings that mark their history. Building preservation can range from complete restoration to adaptive reuse (or retrofit).
While restoration is an expensive process of returning a building to its original condition, adaptive reuse is a more practical process of preserving part of a building's historical fabric, while updating it for modern uses.
Moreover, as we said in the previous chapters, awareness on climate change and the danger of consumption has raised in the past decade and with it a consciousness for sustainability.
A shift has occurred in the design world and more architects and designers are taking on projects with a green approach. With the majority of 200 million buildings in Europe not complying with building standards, 270 billion Euros are being lost on wasted energy, and with it 460 million tonnes of CO_2 leaked into the earths atmosphere.
To be able to achieve a reasonable target in the lowering of emissions a new mentality must be adopted.[3]

With the term "retrofit" or "adaptive reuse" we intend a wider concept of reusing buildings, meaning the process of modifying something, after it has been manufactured.
Today working with existing buildings, repairing and restoring them for continued use has become a creative and fascinating challenge within architecture.
The word "Adaptation" is derived from the latin "ad" (to) and "aptare" (fit). In this context it is taken to include any work to a building over and above maintenance to change its capacity, function or performance (as Appleby states it is "*any intervention to adjust, reuse or upgrade a building to suit new conditions or requirements*").[4] As regards existing buildings adaptation has traditionally come to have a narrower meaning that suggests mainly some form of change of use. The term has also been commonly used to describe improvement work such as adaptation to buildings for use by disabled or elderly people.
This means making changes to the systems inside the building or even the structure itself at some point after its initial construction.

Some "building adaptation" words can be used together, but there is a technical as well as semantic difference between these and other related general terms in building adaptation.
"Refurbishment" comes from the words "re", to do again, and "furbish", to polish or rub up. Thus, to refurbish something is to give it a facelift or a refit to enhance its appearance and function.[5]

It primarily involves extensive maintenance and repairs, as well as improvements to bring it up to a modern standard. At a basic level it implies that the work involved is mainly superficial or cosmetic. It usually refers to upgrading the aesthteic and functional performance of the building.
Rehabilitation, on the other hand, because of it obvious relevance to the word "habitation", is usually restricted to housing schemes. Like refurbishment, refurbishment may include an element of modernisation as well as some extension work.
Words, such as "recycling", "refit", "remodelling" are also sometimes used to describe major adaptations.

What has interested me most in this research is "*Retrofit*" a prominent theme in the last years. It can be defined as a broad way of adaptive reuse, a construction approach involving the action of introducing (retrofitting) new materials, products, and equipment into an existing building not just to reduce the use of energy of the building, but to improve it and extend its life not just through technological improvements.
Up to the late 1970s demolition was often the fate of redundant or obsolete buildings in British urban areas. The post-world war II recovery triggered a slow but inevitable rise in general prosperity and the boom in property up to that period. This in turn prompted rapid urban growth and redevelopment in both private and public sectors.

Moreover, adaptive reuse can be a more affordable technique to restoration, that preserves some of a building's historical elements, while converting many of its functions to accommodate contemporary tenants. This can take the form of an historical restored facade, for example, with a completely modern interior. While a preserved building evokes pride of countrymen and awe of tourists, adaptive reuse attracts new tenants to occupy classic buildings often located on prime real estate.
Even planning considerations for adaptation of a building are extensive and can take months or longer before construction can begin. "*Building from the shell of an older structure can be more costly than demolishing and building from scratch*".[6]
Many issues must be addressed when considering a building for retrofit and adaptive reuse projects. Agreements must be made with government and preservation foundations regarding which sections of the building a contractor is required to keep intact and what materials need to be reused. It must be determined whether the building is financially feasible for its intended

purposes. The architectural and structural integrity of the building must be maintained while modern features are added. Foundations must be inspected for settlement and for adequacy in carrying new load conditions. Building materials including soils must be tested for their structural properties. Temporary structures must be devised to stabilize the building and protect adjacent structures during renovation activities. Retrofitting modern plumbing, HVAC, and electrical and communications systems require delicate surgery to the existing skin and skeleton of the historical building. Meeting modern code requirements—such as fire safety, security, and handicapped accessibility—without detracting from the building's historical appearance is a major challenge. Archeological discoveries that often lay waiting beneath old buildings can delay the construction schedule significantly.
Removal and safe disposal of toxic materials is a strict requirement. All of these obstacles are best handled through careful planning among architects, engineers, and constructors before work on an adaptive reuse project begins.

"*As an alternative to our ever-increasing throw away society, renovation and adaptive reuse are significant ways in which to breathe new life into our communities.*
They will, however, almost always be accompanied with challenges of higher costs..." (Bonsall, 2004).[7]

Of course, financial analysis should be first priority for an adaptive reuse project. All challenges mentioned in the introduction have costs associated with them; therefore it is necessary to conduct a complete financial analysis to determine if adaptive reuse of a building is affordable. A financial feasibility study should be conducted well before pre-construction begins. The study should include the building's worth prior to restoration, estimated cost of all construction related materials and processes, and anticipated value of the building after it is restored. Finally, the feasibility study itself is an additional cost item not part of new building projects.
Moreover, with most construction projects, the contractor is obligated to evaluate on-site conditions.
An adaptive reuse project site survey is a little different. The existing building must be completely evaluated to determine whether the building has sufficient structural integrity to withstand the proposed restoration. Deterioration of the original structure can be severe enough to prevent reuse. Site survey information can have a significant impact on project

budget. For example, asbestos and lead paint discovered in a site survey of London's Tate Modern Museum, led to twenty percent of the overall construction budget dedicated to removal of toxic materials. ("*Old Buildings, New Uses",* 2004)[8].
Since most reuse projects are unique, evaluating each building's potential to be upgraded to current safety codes is required. Costs of upgrading a building to meet code can be expensive enough to affect the building's feasibility for reuse. Evaluating a building through site surveys may require removing part of the building in order to investigate how much restoration will be required, a process which inevitably increases expenses.

It is also important to say that a successful retrofit project can offer growth and also bring heritage tourism to its city and new life to its neighborhood.[9]

The particularity of our times must be considered in the same way as is historic context; we must project it into the future so that it will be able to add new components to the historic fabric.
In recent years our urban contexts suffered a great deal of damage because of misguided guidelines that refer to "the architecture of our time". While it's obvious that our opinions of the art and architecture of the past are unavoidably influenced by our concern about the present, we should try to set aside for awhile our obsession with applying "the architecture of our time" and appreciate historic sites as living entities that can grow and adapt without losing the character that makes them worthy of conservation and that can offer models for contemporary construction (Semes, 2009)[10].

Retrofitting is regarded as an essential strategy of cultural heritage in current preservation theory and practice. "Since prehistoric times, there has been modification of buildings to adapt to changing demands; however, it is only recently that different strategies towards adaptive reuse have been developed"(Cantacuzino, 1975)[11].
We can identify three main strategies for retrofitting: technological, spatial/typological and on the cladding. The last one involves an intervention focused on the external part of the building.
In the next chapter we will focus on the integration of retrofitting methods on some case studies in the city of London. These case studies exhibit a clear and visible dialogue between old and new architecture, and have been chosen to describe the reuse and repair of London older buildings in the last few years.

As we said earlier, in the last years the subject of retrofit technology, and more generally of the design and construction of energy efficient buildings, saw in Europe a gradual transition from experimental interventions aimed at identifying the best strategies applicable in different national contexts - often involving not only the architectural and technological, but also the funding mechanisms and policies of intervention in the relationship between public and private - to a stage where the focus is primarily on the "quantitative" results in terms of energy reduction and environmental impacts, and therefore the ability to check and verify these results in the different phases of the construction process. After ten years since the 2002/91/EC Directive on the energy performance of buildings, a general framework at the European level began to take place, for increased awareness on issues related to energy efficiency and, more generally, environmental sustainability, which improves the quality involved in the entire building process. On the one hand, in fact, the major bioclimatic design "topics" are largely acquired in the design practice to become in some cases founding assumptions of a valid architectural "concept", and on the other hand, technological innovation has been oriented on the development of products and systems with high levels of performance in relation to major energy parameters, often combined with ecological characteristics and low impact of products and production processes.
Sustainability involves the entire life cycle aiming to reduce consumption of resources and energy, and emissions of pollutants, with particular attention to the durability, disposal methods and potentials for recycling. It also involves an economical, social and environmental.

I decided to focus on the UK, since 'the importance given to the "energy and sustainability issue" has allowed a programmatic capacity, design and technical (and legislation) to start the most ambitious programs that aim to the so-called "large-scale retrofit", or large-scale sustainable redevelopment realized through substantial public funding and innovative partnerships with private entities.
In the past twenty years Italy, instead, has paid off the delay in efficient conversion policy making, importing inappropriate methods.
Today a greater awareness (cultural and technological) can operate a critical reading of the examples of Northern Europe, settings and programmatic intervention strategies with the objective of re-interpreting and chenaging towards an energy efficient "architecture reuse" in the Mediterranean area. Italy in fact, compared to other European countries, seems to have partly filled the gap in regulatory terms in the field of energy performance of buildings and

sustainable design, through the gradual improvement of requirements for retrofit interventions and methods for verifying the energy performance, converged recently in the ITHACA Protocol of 2011 for the evaluation of energy and environmental sustainability of buildings in the residential and tertiary sectors. While having almost overcome the significant loopholes that have characterized the last two decades, Italy has different gaps between the different regions, especially between the North (starting with the Autonomous Province of Trento and Bolzano and Lombardy) and the South, where they proceed with effort to imopse the minimum requirements for sustainable interventions.

On the other hand, the main programs promoted in the UK - "*Green Deal*", "*Retrofit for the Future*" - do not constitute a simple transposition of regulatory guidelines and European directives, but rather represent an adaptation of the same to the local context. These are devices that allow you to direct operational funding in Europe and to give benefit to the entire industry (companies, lenders, designers and end-users), making it self-sufficient in the future thanks to the benefits of the consolidation of a virtuous connection between public sector co and private entities. The strategies that can be transferred by the British cases are however beyond regulatory issues and concern the design approach to common problems, especially in the context of large cities, such as retrofitting of buildings within town centers and restricted areas, in which type-morphological elements are preserved in the energy redevelopment without giving up'.

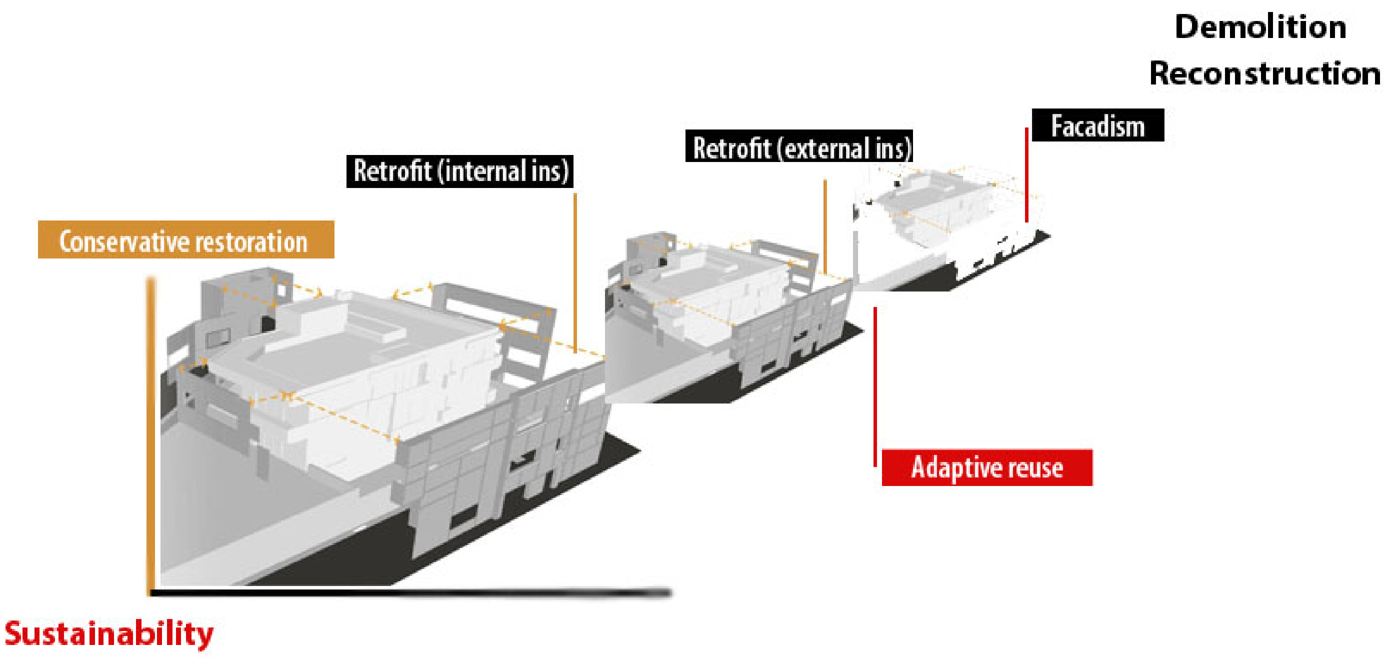
As in the next case studies, adjustment of **performance** (Princedale Road Davis and Partners), or ***conversion*** of large often poor quality residential complexes built after the war, are examples of retrofit or adaptive reuse strategies, where spatial and morphological reconfiguration of the buildings, the redesign of the public spaces from the perspective of functional equipment take place together with a technological intervention. The study cases in London can be an important reference for an approach to a sustainable urban regeneration and redevelopment. The first case studies introduce major Retrofit interventions in London city centre, where retrofit interventions include wider adaptive reuse techniques, and ***spatial reconfiguration,*** as for example, in the redevelopment of the *St. Martins School of Arts*, in *Billingsgate Market,* and in the project developed during my course work on *Jamestownroad*.
The next ones include major interventions on the ***cladding*** of the building, as in *Guy's Hospital* and in the project developed with Ben Adams Architects, at *24 King William Street* (London).

The other case studies include the above techniques , focusing mainly on modern ***technological*** interventions on the building, as in Undercliff road.

In the graphic below I summarised different phases of intervention on a heritage building: there is a wide separation between the conservative restoration of a building and its demolition and reconstruction. There are possible strategies that can be applied that fit in the middle between the two, in order:

- an internal retrofit on its envelope;
- an external retrofit intervention on its surface;
- adaptive reuse, which fits in the middle between the external retrofit and the practice of facadism;
- facadism

These techniques will be explained in the following chapters.



4.1 ADAPTIVE REUSE

"An old building is not an obstacle but instead a foundation for a continued action. Designing with them is an exhilarating enterprise; adding to them, grafting, inserting, knitting new pieces into the existing building fabric is endlessly stimulating".[12]
Francoise Astorg Bollack

Architecture is subject to aging just like human beings. Buildings need to evolve to suit the needs of the people managing and living in them. Not just the technological improvements, but their functional requirements cause interventions and changes to existing buildings.
The changes beyond their facade can have numerous reasons and advantages which make this form of design economically and functionally viable.
The vital aim is that the historic environment is a wealth which should be preserved, but can integrate cultural and economic value to new design inserted in it. Respectively, the integration of the new design within the historic facade will become a crucial part of the buildings and contribute to the functionality of the space.
This new form of design is becoming progressively influential as the society is becoming, as we said, more informative of environmental issues. If historic buildings are not preserved right, they can turn into ruins. The neglectful demolition of buildings which are no longer intact as they were not preserved on time is now being perceived as ecological waste and also as the destruction of the identity of that space (J.Cramer, 2010)[13].
The methods used to preserve historic buildings are taking a new turn in design going beyond common restoration. These methods are now being applied to existing buildings to make them more functional and give a new design to it rather than demolishing the whole structure.
These methods, which will be illustrated in this chapter with some case studies, have been given names of insertions, weaving, parasites, juxtaposition and wrapping (Francoise A. Bollack 2014)[14].

The case studies discussed in the chapter exhibit a clear and visible dialogue between new and old architecture. They are individual buildings with fused-together parts; my aim was to address why this form of design is becoming steadily popular and what are the numerous advantages and reasons for this design being considered more economical than new construction. In the UK interventions behind historic facades are therefore becoming more and more common; and they can be the best solution for economic and ecological reasons, being a creative form of design providing functionality and sustainability.

Why should we build new designs behind historic facades and reuse historic buildings?

In order to understand the benefits of creating new design behind historic facades, we need to understand that buildings are not structured to deliver the growing needs of the population when the design of the building is made in a particular period of time, the time is made keeping in mind the needs of the people for that time period and not for the future. As the time passes, if changes are not made within the building to improve functionality, it will gradually become vacant. These vacant buildings are demolished more frequently and it is harder to justify the restoration of a non-functional building than one which is in use. These buildings offer no economic benefit to the society and come with legal liabilites, decisions such as alterations and benefits have to be made (Dedek, 2014)[15].

Many buildings which we are using today and are fully functional did not initially have electrictiy, central heating or air-conditioning. These buildings had to be retrofitted with new facilities in order to make them fit for habitation.

Old buildings have many problems such as no fire escape routes, disability access, and inefficient consumers of energy and get more affected by hurricanes and earthquakes and other natural cause. The life of existing buildings can be extended by altering them to address the problems mentioned above (Bloszies, 2013)[16].

Reasons for construction behind historic facades

The appeal of renowned buildings

Many historic places influence the architecture and interior design fields as they show us the staggering statements, and the complex details of the lifestyles of the past generations. It is these buildings and architecture that give a sense of identification to a place. These factors make this form of architecture more justifiable as it works around the historic facades, keeping the sense of identification while improving the fuctionality of the space according to the needs necessary.

There are many organizations, such as commercial buildings, banks, and other institutions, whom often opt to work from these prestigious sophisticated historic buildings. These organizations will often pay a substantial amount of money to purchase or lease these buildings. By constructing a modern, more functional accommodation behind a renowned

facade will therefore add to the importance of a building.
The restored, prestigious facade will display the status demanded by the user, at the same time the new constructed accommodation within the facade will cater for the modern and productive working environment required (Highfield, 2001)[17].
Moreover, in the Town and Country Planning Acts, for any construction work is required a planning permission; however, it also states that carrying out any work within the interior for improvement, maintenance and any other alteration, where the exterior look of the building is not getting affected, does not involve construction and thus it does demand planning permission.
This comes in useful to give an interior a modern look with increased functionality, whilst the exterior still reflects the prestigious looking facade which is in demand.

The option of available facade

WIth the development in commercial and industrial field, combined with requirement for a better, modern interior environment, have added up to numerous amount of buildings becoming vacant, pleonastic and outdated. This, in turn, have provided an opulence amount of buildings which are suitable for redesigning.
As we said, there is a growing importance of building adaptation and retrofit in the UK, adding up to half of the construction industry.
According to Goodier and Gibb, new build comprises 54 % of the building sector in the UK, while construction refurbishment and repair 46 %[18].

Arguments against alterations in existing and historic buildings

"Ever since the preservation movement started in the 1960s in the UK, designers and architects have encouraged the retention of buildings through alterations, refurbishments and restorations. In recent times, the re-use and re-cycle of entire buildings has become popular and has been recognized as a sustainable approach to modern development. This allows complete functionality of the space and an economic benefit to the society. UK has adopted policies which state that the reuse of existing buildings is mandatory or encouraged highly" [19](C. Bloszies, 2013)

This view is not shared by all. These architectural interventions are torn between two opinions of the oppositional mind-sets. This section will go through the views and arguments expressed by those who believe facade retention is the way forward for architectural conservation, supported by architects who believe that designing within historic buildings is when a designer can be the most creative. This view is opposed by some conservationists who are against facade retention schemes or any alterations to historic buildings for that matter, supported by architects who believe that working within such schemes limit their creativity[20] (Highfield, 2011).

Much controversy has been caused among architects, who believe that a building's integrity gets lost under the so called creative changes. Some conservationists argue that if a historic building is worth retaining, it should be retained in its original form, in its entirety and to alter and conceal a new design behind historic facade is a deceitful unacceptable approach. Concealing new accommodation behind historic facade is a very false solution. This is what has been named the purist view of conservationists. These purists believe that not only the exterior but what lies in the interior should also be restored. As the interior should be related to the exterior facade, in terms of architectural design and historic significance. For example, a Victorian facade should only function to enclose the rooms, it was originally designed to enclose, and not be altered into a modern open planned accommodation for offices under the retention policies and schemes.[21]

Some conservationists have a more realistic view where they believe that if a building is to be preserved,some loss to the integrity of the facade is unavoidable. This view is shared by the majority of the conservationists, from which only a few keep the purist view. Unless a historic building is wanted to be kept purely as a museum piece, some damage to the facade is inevitable.

It has been said that to truly preserve a structure it needs to adapt to become more like the functional buildings in order to fulfil viable purposes[22] (Highfield, 2011).
This argument is supported by architects who find the very suggestion of designing behind historic facade a constraint on their creative liberty [23] (Cramer and Breitling, 2009). Not many architects have this view and are embracing facade retention. This view of limited creativity is based upon the fact that facade retention comes with many technical problems for builders which require innovative solutions and highly specialised technical expertise outside the architectural construction field of new buildings.
Of course, a big problem faced with facade retention is the cost. To retrofit an efficient solution considers new technologies and therefore becomes expensive, but is beneficial longlasting.

Arguments for alterations in existing and historic buildings

Many architects from the 1960s proved that it is possible to alter a building without demolishing its integrity and giving it a new function.
Some are Carlo Scarpa, Massimo Carmassi, Aurelio Galfetti and Karljosef Schattner. Scarpa had always been interested in renovations and conversions and attracted many eyes with his projects of facade retention. His style was tagged as natural with elegant combinations with elegant combinations of materials. His use of materials inspired a great number of architects, as Herzog de Meuron, David Chipperfield, Malcolm Fraser and many others.

4.2 FACADISM

Facadism is a practice of "inauthentic" conservation which enables the regeneration of listed urban areas whilst preserving the character of the streetscape and keeping the surrounding architecture inuniform. It is noted however, heritage groups and conservationists argue that the movement turns beautiful historical buildings into characterless fakes. This somewhat architectural and yet philosophical movement of Facadism first hit the design arena in the mid 1980's. Surfacing in Britain and spread throughout Western Europe, this method of construction was a contemporary spin off of urban redevelopment following great financial investment. This is considered as an intrusive regeneration method, practicing the renovationof old buildings, leaving the facade intact while demolishing and rebuilding a new interior behind. 'Facadism' literally meaning frontage/face, hence changing only the innards is of French origin.

It was not until the 1970's when Britain made an attempt to conserve architecture; despite William Morris helping to establish the SPAB (The Society for theProtection of Ancient Buildings) in 1877 promoting the idea for the preservation of ancient structures. As stated by Burke "Until recent years conservation was scarcely recognised as a subject for national government policy. Buildings and ground layout from the past survived fortuitously, largely on their own merits, and chiefly because they could continue to serve useful purposes."[24]
This was an attitude favoured by many.

Facadism in its most commonly understood sense involves retaining the facade of a (usually historic) building that is deemed to have some architectural or other cultural value and building afresh behind it. The term may also be used to refer to the rebuilding of an historic facade with new materials, possibly in an altered form that meets current floor-to-floor height requirements, or, in the case of a new building, the construction of a facade in a style (usually historical) which fits in with the prevailing style of its surroundings, but bears little or no relation to the spaces behind[24].

So much for definitions. But what then is the problem? Is it really necessary for the facade of a building to reflect what is going on behind? Equally, where it is not possible to retain a building in its entirety, and the loss of at least its interior is unavoidable, why shouldn't the exterior be saved? On one level, after all, retaining an historic facade seems sensible, as it retains fabric of public or cultural value and allows the developer white paper, or something like it, to develop private space that meets his own immediate requirements. The controversy arises of course, from the lack of relationship between interior and exterior. This may be thought to highlight the loss of purpose of the historic building, to draw attention to its essential redundancy. But the problem goes deeper than that. At its heart it is about rationality.

Rationality has been a powerful thread in 20th century architectural thinking and has strong antecedents, in a philosophical sense, in the 19th century.
A rational relationship is expected between all parts of a building. Buildings should be designed from the inside out; form should follow function; the exterior should be a logical expression and extension of the interior.
On this view, buildings are indivisible totalities; the spaces behind the facade belong to the facade, windows serve interior spaces, and doors lead to entrance halls and circulation arteries like staircases and passages. The facade is the outward expression of the anatomy and organisation of the building[25].
At its most extreme, there is in this view a quasi-religious quest for revealed truth. Engineers, once content with hiding their lights under bushels are now often among the most evangelical proponents of rationalism: Tower Bridge, for example, has the structural simplicity of a Meccano set, so why turn it into a stone-clad gothic fantasy? By logical extension we arrive at the view that truthfulness and rationality lead of themselves to beauty. Thus Virginia Woolf on Docklands warehouses:

"The aptness of everything to its purpose, the forethought and readiness which have provided for every process, come, as if by the back door, to provide that element of beauty which nobody in the docks has ever given half a second of thought to. The warehouse is perfectly fit to be a warehouse, the crane to be a crane. Hence beauty begins to steal in."

What the rational view considers to be unacceptable is what Hogarth, in his "Analysis of Beauty", called 'leading the eye a wanton chase'. He was referring to the winding paths and serpentine lakes of the 18th century English garden, where the picturesqueness and irregularity of the garden form seem at odds with the classical angularity of the house.

Facadism is about leading the eye a chase, wanton or not. Certainly, it creates a tension between what is perceived and what is real. Yes, an unavoidable sense of absurdity creeps in when a facade is left adrift, shored up by scaffolding, awaiting a new building behind it; and yes, the eye, attuned to expect some relationship between fenestration and interior space, is

is disturbed when fluorescent lights reveal an historic facade to be fronting nothing more than vast open-plan offices.
Facadism does offend against the purely rational. It involves deliberate obfuscation. At its most basic level, facadism is not really truthful.

Do we care? Possibly, if architects are rationalists and utilitarians. But if less stress is placed on the holy grail of architectural integrity, if buildings are seen partly as theatre and sculpture – and some of the severest mid-20th century architecture is best appreciated as sculpture – then facadism may make more sense. We may begin to think of rigid integrity as constricting, suffocating, injecting a morality which is alien to the English temperament. Robert Byron, reviewing the modernist MARS exhibition at the New Burlington Galleries in 1938, said that 'over-emphasis on functionalism threatened to swamp the whole architectural idiom'. In a similiar vein, Jonathan Meades, writing recently about Brighton (UK), noted:

"Fashions in building design are as ephemeral as fashions in thought or polity. What, astonishingly, has not proved ephemeral is the conviction that architecture must be plodding, earnest, serious, morally-rooted. Brighton has suffered as much as anywhere from the puritanically wrong idea that buildings should work, that they should primarily be functional. Successive generations of Brightonian aesthetic midgets have spent more than a century and a half not learning from the Pavilion's geometric delinquency and from the Regency's propensity for legerdemain that building can and should be theatrical, exhibitionistic, illusionistic, lighthearted, camp, edgy. Build thus – as Frank Gehry and Piers Gough propose to – and the gap between the physical and the ideal is closed."[26]

As Robert Bargery states, in the English context, pragmatism is always likely to come out on top. To take a dogmatic, absolutist approach – either a strictly rational one that demands an unwavering relationship in architecture between interior and exterior, or a conservationist-based one that regards facadism as an unacceptable bastardisation of historic buildings – is bound to lead to its own absurdities. Facadism is, after all, an inherent muddle. Given this, the terminology itself is a little suspect. The 'ism' suffix suggests a coherent philosophy; accordingly, it used to be reserved for religions, political movements and universal themes – matters of some consequence. Putting 'ism' after facade has given the whole question a supposed importance out of all proportion to its real weight. In fact, there is nothing very systematic or coherent about it. In England it has simply been, on the whole, a pragmatic response to circumstances.

Taking the Georgian age, in some ways this was the apogee of expressive architecture: Palladianism, in principle, perfectly embodies a logical relationship between interior and exterior. But even so, the Georgians often placed great emphasis on the facade, sometimes neglecting the structure of the building as a whole (a particular gripe of Pevsner's). They were perfectly comfortable with facadism; Jones and Nash were exponents. It was relatively common practice to regularise a facade to correspond to the vogue for classical proportions and harmony, with the result that quite a few apparently Georgian houses are in fact much older. Medieval and Tudor timber frames are masked by beautifully-proportioned brick fronts, but the classical proportions on show are not systematically carried through to the inside. This is facadism as makeover. The facade is a mask, an exercise in superficial dissembling. And the practice has carried on more or less ever since.

So facadism has a long and impressive background. And what is often overlooked is that it is a facet of many wholly new designs. Deception is part of the architect's art. Look at the pinnacle of British architectural achievement by Britain's greatest architect, Sir Christopher Wren. St Paul's Cathedral is in part an exercise in facadist deception. The flying buttresses that support the building are masked by a parapet wall above the aisles. This offended Banister Fletcher. The 12th edition of his History of Architecture, dating from 1945, goes so far as to suggest modifying St Paul's in order to correct the solecism. The recommended solution is to punch holes in the parapet wall to reveal the buttresses, which merely confirms that rationalism and extremism are often comfortable bedfellows[27].

What about 21st-century architecture?

Its practitioners are often among those most censorious of facadism, but their moral outrage comes dangerously close to hypocrisy: in much contemporary architecture, facadism, or what amounts to facadism, is effectively introduced from the outset. Ever since the invention of the curtain wall, a good deal of new-build involves the hanging of prefabricated facade panels off a standard steel frame holding up a standard floor plate. As a result, what is nowadays built behind a facade is almost inevitably at loggerheads with the facade.

It is at loggerheads structurally, for example where reinforced concrete supports masonry. It is at loggerheads spatially, for example where an open-plan layout is set behind a facade of hole-in-the-wall windows that imply a cellular organisation of space. And it is at loggerheads formally, because the roof is often not regarded as an integral part of the building and additional floors are built within mansards that bear no relation to the facade.

This practice of tacking a front onto large floor plans is effectively built-in facadism. The facade is essentially a separate, freestanding element that is developed in isolation, or theoretically could be. Its organic connection with the interior is limited; when the steel frame of the building is erected, it is anyone's guess what prefabricated panels will be added. They could be classical in detail, as at Juxon House near St Paul's, or they could be beautifully-detailed glass, as at the new Bowring Building next to the Tower of London. So facadism, in all but name, is ingrained in modern architectural thinking. This radically diminishes the force of the modernisers' argument against retaining historic facades; doing so, after all, is simply a modified form of conventional architectural practice[28].

Built-in facadism has become more common as historicism has spread, in reaction to the mid20th century lack of architectural ornament. Most contemporary classical buildings are exercises in this kind of facadism, because so few clients – and next to no commercial clients – want a building that is classical through and through. If they want a classical facade, they almost certainly do not want the space inside to correspond to it. What is left is instant facadism, where the richly modelled, articulated facade bears almost no relationship to the large, open-plan floors behind them. But it also needs to be borne in mind that what began life as strictly rational designs have also generally been diluted over time. Buildings are living organisms. Insides are hacked about, rooms divided, partitions installed, uses changed. Retention of the facade by itself is no more than the reductio ad absurdum of this continuum, the final divorce of front and insides. It is often only the last step in a breach that has been developing for years, or even decades, often pretty much since the building was built. Façadism is hardly ever, in other words, the sullying of a perfect relationship.
Looking at facadism pragmatically, as a response to conditions, is also helpful in addressing current concerns about sustainability and environmental protection. These lie at the heart of contemporary ethical dilemmas, more so than questions of aesthetics or architectural integrity.

Therefore, demolition is wasteful. English Heritage has estimated that demolition and construction account for almost a quarter of total annual waste produced in the United Kingdom. Largely because of the quality and lifespan of the materials used, a Victorian house is almost £1.00 per square foot cheaper to maintain and occupy each year than a house built in the 1980s[29].

Existing buildings, including their facades, represent an investment of capital and energy. Given this, it may well be that a high-quality stone facade is worth keeping: it is durable, it improves with age, it requires little maintenance. Replacing it with a new facade may add to the developer's short-term costs but is likely to increase the lifetime costs of the building.

If facadism is acceptable in principle and is not inadmissible on moral or ethical grounds, what key practical considerations should apply, since clearly not every facade, or even most facades, will be kept? Pragmatism suggests that each case should be judged on its merits.

The first consideration is quality. In simple terms, the best facades should be retained, even if their relationship to the interior has lessened over time and the facade is the chief element of the historic building to survive. The Coutts development at the west end of the Strand, where Gibberd in the 1970s retained the Nash facades, is a an example of a 20th century architect sensitively acknowledging the high-quality legacy of a forebear, as is Michael Hopkins's work at Bracken House in the City of London. If facades are especially valued for cultural, aesthetic, or even sentimental reasons, there ought to be space in our thinking to retain them. A listed building should not be de-listed solely on the grounds that its interior has been lost[30].
It is true, of course, that some retained facades are so distinctly ordinary that one is left wondering what pass we have reached, that we could not have designed something better. Often, of course, we could have, but unadventurous planners have prevented its expression, as for example in Fenchurch Street in London, where Richard Rogers' sparkling Lloyd's Register of Shipping languishes absurdly behind a bland retained facade, denied a relationship with the street. Just a few yards away, Rogers has successfully incorporated the facade of Edwin Cooper's Lloyd's building into his own 'Hi-Tech' Lloyd's building, but here the retained facade is subordinate, as it should be. Or as it should be, at least, when the new architecture is of such high quality.

Whenever we see a building demolished, we expect something worse to replace it, and with some justification. Facadism may stifle architectural opportunities, but the onus must be on architects to provide, consistently and reliably, buildings that are rich enough to engage the senses and repay repeated attention, in the way that all good art does. The poor quality of much modern design provides the oxygen that sustains facadism, and for that architects have only themselves to blame.

Until a richer architectural vocabulary is developed, facadism will continue to be used as a lazy way out. And indeed there can be a good deal of laziness in facadism, particularly the kind that preserves mediocre facades. For the developer, it may be an easy escape from controversy, an act of vacuous piety designed to absolve him from the sin of demolishing a good building that should have been saved in toto. This was particularly true in the interwar years. Since then, the laziness has more often come in not thinking hard enough about a building and relapsing into a soft option. Is the existing structure behind the facade really too dilapidated to save? The answer is no, almost never. Is it acceptable for planning authorities to pretend that the old building is still there and at the same time rake in higher business rates they get from larger buildings with higher rateable values? Again, probably not. Facadism that simply gives aggressively commercial development a sheen of respectability or allows planners to deceive themselves that they are preserving heritage is often the product of lazy, complacent thinking, and it is no bad thing to be jolted out of it.

Once architectural quality is dealt with, a second practical consideration is contextual value. Some facades may have no especial intrinsic merit but may contribute significantly to a townscape or streetscape. This is most often true of classical facades, simply because the canons of classical architecture respond to hierarchies in public space. Thus the giant order was not as a rule approved for domestic buildings; but if a domestic building was on a public square, such as the Place Vendôme in Paris, the public function of the building took precedence. In other words, the building is seen primarily as a composition whose public face derives from its context. Some facades do indeed have a public role that is more important than their private role as an envelope to the building behind. Indeed, so much have facades been seen historically as part of the public sphere[31].

A third consideration is retention of architectural unity. There are certain contexts that are so powerful that if new development were permitted, facadism would be not only justifiable but the only sane option. It would be impossible to take one element out of the facade of Bedford Square in London or the Royal Crescent in Bath, for example, without wrecking the composition; and so if development were undertaken in either place, it would be conceivable to do so only behind the retained facade of one or more units. This sort of facadism is unlikely to be controversial, and was commonly practised after wartime bomb damage.

What emerges from all this is that facadism is not for idealists and arch-rationalists. But offending against idealism and rationalism is no great hardship, given our national predilection for pragmatism. And if for some reason we wish to avoid facadism, it is by no means a corollary that facades should be demolished. After all, another way around the problem – a way of protecting architectural integrity, indeed – is to retain at least a room depth behind the facade, so that windows continue to relate to room spaces. This would mean adding a new building to a cut-down old building rather than trying to relate the new building to a facade alone; it would avoid the continuous open offices with regimented fluorescent lighting that are seen at dusk behind a long facade, where previously there were cross-walls with parapets above the roof line, chimneys and a cellular structure expressed through a subtle vertical rhythm in the facade.

And if the facade really is all that can stay, we might insist on the new building being properly related to and integrated with the retained facade, correctly-placed cross-walls included. Façadism works least well when windows evidently lead through to nothing, when their lack of relationship to anything behind them is betrayed by mirror glass, or blanked-out windows, or even a view of the sky. It is an unhappy compromise, but perhaps in future we should seek to avoid it by keeping more, not less, of the historic building.

In this study, as seen on the graphic in the introduction to adaptive reuse techniques, facadism precedes the action of reconstruction or demolition of a building.

Arguments in favour of Facadism

In this part I will illustrate Facadism emphasising the positive points of this redevelopment method. Facadism has its advantages, which are argued by Pro-Facadist groups, namely property developers.

One thought is that Facadism is a poor excuse for preservation; there are also social, religious, historical and physical perspectives to be considered.

Facadism allows buildings to be revamped even in listed or historical areas, maintaining the exterior streetscape during renovation and saving the character of the build. This process not only retains history and heritage whilst putting the building to modern use, it also has a sustainable aspect; using the original building materials as opposed to starting from scratch. These points defend the argument put forward by property developers and those who believe Facadism is a positive way to redevelop our inner city and suburban areas. It is true that Facadism allows property development in grade II listed areas as the fascia and cityscape remains in its original form. It is put forward that Facadism is a saviour to the buildings heritage and historical value, especially in the event of the structure becoming beyond economical repair or structurally unsafe. It is noted however, sometimes where possible, some of the interior features such as ceiling roses, coving, flooring and other items of historical interest can be salvaged and reused too.

Although it is the heritage aspect which is regarded as the most important, other arguments are put forward in defence for Facadism. It was stated by the Prince of Wales that "There is nothing 'fake' about building in an established tradition or trying to revive one."[32] Which confirms to property developers that what they are doing is beneficial to the public; This point is backed up by legislation in the form of the DDA Act 1995 (revised in 2005) Part B - Fire Safety and means of escape and Part M – Disabled Access of the Building Regulations, which states that the building has to be adaptable in order to accommodate people with all disabilities and be wheelchair friendly[33].

The quotations found below, taken from an online discussion forum praise Facadism[34]. People believe that it is an ideal compromise for Facadism to take place as it ensures that the building works to a maximum potential whist the frontage takes on the role of preservation:

"I think Facadism is great, I don't care much about the inside of a building since I'm hardly ever going to go inside."
A rather narrow minded but honest statement which to a degree has a point in the way that it is highly unlikely everyone will visit the insides of every regenerated building. Therefore they are probably unaware of what lies behind the façade anyway.
"I pretty much agree. Overall good but if the interior can be kept as well; even better." [35]

This quote expresses an open mind, it agrees with Facadism on the whole, but believes that the interior would be a bonus, not a necessity.
An attitude adopted by most who favour Facadism, question the integrity behind the reasons for redevelopment. As long as the development work is done in good taste with high quality finishes and respect to the building, they say it does not really matter if the interior is ancient or modern. Not only does Facadism provide a small percentage of good environmental practice, but it is a very subjective, cost effective, popular method of urban renewal. It provides better solutions to more unused historical sites of dilapidated shells in high density locations; whilst erecting substitute cities in the inner suburbs.

"In relation to the use of non sustainable natural resources, the prevention of the complete demolition of historic buildings, by the retention or rebuilding of their facades utilising as much as possible of the original fabric, can be seen as a valuable act of conservation."[36]
Statistically, the construction industry accounts for 87% of greenhouse gases therefore, in order to reduce this; developers are attempting to make buildings more flexible and adaptable by using an abundance of natural materials. More serious problems would arise with regards to global issues, such as global warming reaching a new time high; should we have to build out into rural areas in order to accommodate for today's business needs.
Facadism offers the capabilities of a new build to an old build without having to design or redesign the frontage. It is a much easier way of incorporating and accommodating modern technologies, such as air conditioning and computer suites as well as providing a more beneficial use of space.

Arguments against Facadism

In this section I will analyse the negative attitude and look into the reasons why some members of the public including conservationists, heritage groups and anti-facadists believe that the following disadvantages represent the movement in a negative light.

According to some, when the movement is put into practice, the background history and original character of the building are forever lost. One belief is that older buildings should be handled with more care and respect for sentiment, instead of just tampering with it for quick cheap money-making schemes.

Conversationalists say that developers use facadism as a poor excuse for preservation, which can also be regarded as another form of vandalism. Some extremists would go as far to say the historical landmarks are becoming fakes and nondescript in result.[37]

It appears to be under estimated just how strongly and passionately people feel internationally about Facadism, especially today. It is true that many do not really care, just as long as the building looks nice and serves a purpose; however, many believe that there is no justification for Facadism to continue. Should such drastic attitudes be adopted...? Disappointment is often felt by conservationists, who believe that the public and visitors travelling worldwide to examine these 'theme park cities' will be amazed at the accurate detail of stonework and style of the original façade but once inside, they will be disappointed with the cheaply refurbished interior, magnolia plasterboard walls, nylon carpets and plywood doors as opposed to the grand staircases, detailed plasterwork and original flooring. "Facadism just turns our cities into fake, theme park cities. They look the part...but scratch the surface and its just sawdust and plasterboard....no substance!", "It is important that the built fabric behind the facades of many listed buildings is of equal significance architecturally and historically to exterior fabric."[38]

Other disadvantages of Facadism include the change in the buildings proportions. When building onto a facade there are numerous design limitations encountered, such as ceiling heights, window locations, door sizes, rooflines and geometrical concepts, which may cause problems for the purpose of the extension. Additional problems arise when the interior differs greatly to the exterior[39].

Preservationists acknowledge what developers are saying about the global issues involved with the expansion and building of new cities, and respond by saying that new builds are be an inappropriate approach to conservation".[40] Anti-Facadists ask the reasons why the money put into these projects cannot be used to restore the whole building and adapt it in a way, which does not compromise the buildings creativity.

Many online discussion forums have been launched, where people express their thoughts, feelings and opinions on the subject. Here is a poll along with some quotes taken from the online discussion on the famous design blog consulted above[41]:

"I think it's bad....I would much rather the interiors of older buildings to be restored a long with the Facade."

"Buildings are three dimensional, if they were to have one dimension they would be in a book or magazine and not on our streets"

Many negative comments about Facadism say is that it is true older buildings contain a surprising level of beauty with regards to interior characteristics; most of which would have taken years to create and put into place. As a result, it is devastating to see them torn down in a matter of minutes. Urban planners and property developers should really consider this more and aim to stop opting for the cheapest methods of regeneration and respect culture.

Original fireplaces, flooring and stain glass windows along with the plasterwork and staircases are irreplaceable. They tell a story which dates back to the day of its erection which makes the buildings innards and shell just as important and valuable as the front elevation.

Times are changing as are lifestyles and working environments; therefore some alterations need to be made to buildings to ensure they can cater for their new purpose. So why can't developers see what they are destroying…? Preservationists feel that architects and interior designers should step back and just take a look at these interiors in order to reach a more appropriate, suitable method to make these structures ideal.

"The problem I have with Facadism is that you are destroying the history of the building....yes the outer shell remains, but buildings are more than just an outer shell.[42]

Any city can construct buildings with an old fashioned outer facade and a modern interior. What makes the UK different is that our buildings have the Exterior, Interior and History to go with them.

An extremely passionate speech which condemns Facadism and its values. Also a very true statement; the UK does offer the whole package and day by day we are disposing or our heritage brick by brick. It is fair to say that modern builds can be constructed in the Victorian or Edwardian style but they will never ever be the real deal.

Finally, façaderetention has rescued many buildings from the threat of demolition, decay or collapse. However, realising that this option of development comes with major penalties; environmentally, financially and socially, despite it being the less popular attitude of the two. It is believed Facadism is a positive construction method so long as the original façade is restored to the highest standards with the utmost respect. Demolition of original interiors should be handled with as little disruption and waste as possible. Facadism is, therefore, an important concept in the context of urban change and economicregeneration in historic areas. One of the most significant points we saw is that it allows greater flexibility in sympathetically incorporating new accommodation within traditional settings of high visual quality than does the conservation of existing fabric. The table below shows main facadism typologies and the next pictures significant examples of facade retention in London.

Fig.46

"Table showing the most common facadism typologies"

Source: D. Highfield, *"The construction of new buildings behind historic facades"*

table 1. ARCHITECTURE OF COMPROMISE: FACADISM TYPOLOGY

COLLAGE

Retains a piece or pieces of a facade during demolition and incorporates elements into new construction.

effect: decorative

SHEET

Retains the exterior facade wall and incorporates the facade into new construction, resulting in the appearance that the facade hangs like wallpaper on the new building.

effect: decorative

ILLUSION1020(+)

Preserves 10-20 feet of the building in order to give an illusion of some depth and is abutted by new construction. (+) indicates that only the exterior facade wall has been retained, but that a 10-20 foot setback has been constructed at the back of the facade, resulting in the appearance that 10-20' feet of the original building has been preserved.

effect: streetscape

ILLUSION2040(+)

Preserves 20-40 feet of the building in order to give an illusion of some depth and is abutted by new construction. (+) indicates that only the exterior facade wall has been retained, but that a 20-40 foot setback has been constructed at the back of the facade, resulting in the appearance that 20-40' feet of the original building has been preserved.

effect: streetscape

SCOOP

Preserves two, three, or all historic facades and the interior is "scooped out" with new construction behind the facade(s). It may read as a whole building or as if the facades have been grafted onto the new building.

effect: "preservation"

INCORPORATION

Over 40 feet of the historic building is incorporated into the interior of new construction. The type of incorporation can vary: the historic building is gutted and the interiors reconfigured, or the interior is retained. While most of the historic materal may be preserved, many incorporations read as a stage set. gutted and the interiors reconfigured or the floors may be retained.

effect: "preservation"

Figg. 47-48 *"A new-build block of student flats behind a retained Victorian facade on* ***Gun Street, London.****"* Source: Oliver Wainwright Photography

The new block of flats is inserted behind the facade with no retention.

Figg. 49-50

"The original building is the Mallett, Porter and Dowd Ltd Building on ***Caledonian Road*** *in the London Bourough of Islington. It features in Pevsner's Buidings of England (p.698 London 4: North 1998 ed.) and dates from 1874. It 's now a façade retention of a historic warehouse with a carbuncular twist. It seems the monumental masonry façade did not work with the horizontal and vertical cell module of optimised student housing. Thus the new façade is set behind the retained façade to allow it to take the most economical form, ignoring the existing facade. The historic facade is propped a few feet off an econo-curtain wall. This nasty detail gives a new meaning to "shadow gap" – more emphasis on shadow, less emphasis on gap. It is not clear which rooms if any align with the warehouse windows. The inmates living behind the massive masonry ruin will acutely feel the heritage of the retained wall, but it is not clear they will be able to see out. Perhaps the architects were influenced by the historic Pentonville Prison down the road."*

Source: Kieran Long

Figg. 51-52

*"The skyscraper is called **Altolusso,** and situated in Cardiff. Historically, the site had been used for the production and storage of coal gas since 1837; when the Cardiff Gas Light and Coke Co established their facilities in Bute Terrace (formerly known as Whitmore Lane). The majority of the buildings remaining on site that were demolished in order for the scheme to proceed dated from the 1890s with some minor additions and modifications during the 1960s and 1990s Situated on the site of the former New College, the property retains the Victorian façade of the college for the first two floors.The façade is not listed, but was retained at the request of Cardiff Council during the planning application. It had fallen into a poor state of repair by 2003, and modifications had been made over the years (such as a driveway leading through to the rear buildings). Extensive renovation and reconstruction of the façade was carried out using stone blocks from some of the rear buildings that were demolished. The façade forms part of the three-storey main foyer with a glass atrium roof. The design of the building forms a three-leaf clover with three sweeping curvaceous wings emerging from a central service and access core.*

The design intended not just to enhance the appeal of the development, but it was necessary to retain a high level of flatness and smoothness through the selection and application of the building's acrylic-based render to provide the building with durability and resilience against harsh weather conditions."

Source: skyscrapernews.com

Figg. 53

*"The first building on the left shows a new accommodation solution for students, inserted on an older facade in **Lancaster.**"*

Source: lancasterguardian.co.uk

Figg. 54-55 (below)

"Student housing behind a neoclassical facade, a turret was removed over the years and now hosts King' s college campus."

Source:skyscrapernews.com

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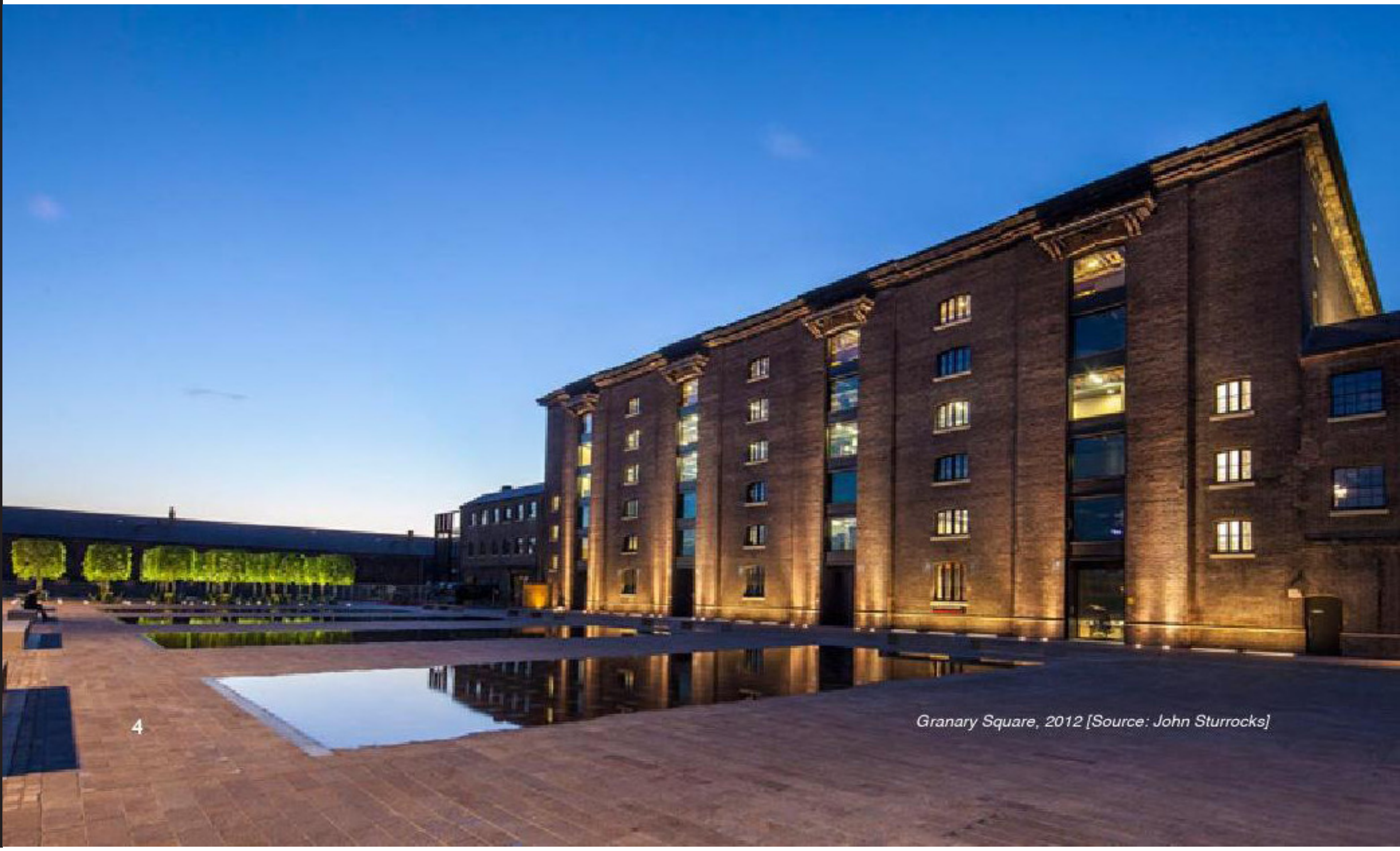
Fig. 56 *"The Granary Basin 1851, Kings Cross, by Lewis Cubitt"*   Source: Camden Local Studies and Archive Center

Fig. 57 *"The Granary Square 2012"*   Source: John Sturrocks



Adaptive Reuse

5.1.1 Central St. Martins College of Arts and Design

Date: *2011*

Architect: *Stanton Williams*

Conservation architects: *Richard Griffiths*

Stanton Williams' design for the new campus unites the college activities's under one roof for the first time. It provdes Central Saint Martin' s with a substantial new building, connected at its southern end to the Granary building, at the heart of the 67 acre redevelopment of King's Cross by developer Argent. The design combines the 19th century Grade II listed Granary building and transit sheds with a 200 m long new shed building that uses industrial materials and creates full of natural light. An internal street draws daylight in and acts as a central circulation spine with suspended walkways, cafes, film, graphic and light projections. The spaces are designed to be flexible and 'raw'.

This is the first case study to be investigated; This is an exemplary project as it demonstrates how a large historic building can be transformed into a triumphant public space and still uphold sustainable values. The grand development consist of a gallery, multi functional workshops, studios, a library, archive, lecture halls, student theatres, rehearsal spaces, reception, staff rooms, social spaces indoors and out, a public theatre with a separate entrance including an internal street in the heart of both new and old buildings[1] .

What is most interesting about this site is its location and the atmosphere that accompanies it. In the heart of London surrounded by the buzz of the new Kings cross and St. Pancras stations but also tranquillity offered by the canal and vast open spaces that surround the building. This building is not only striking inside but also it its carefully designed surroundings, which play a big part of its character.

The Granary Building is one of six Grade II classified buildings; it forms the heart of the complex, which was built in 1851 by Lewis Cubitt to store sacks of Lincolnshire grain. The complex consisted of the "*Granary Building, the Eastern and Western Transit Sheds, the Assembly Shed and the East and West Granary Offices*" these buildings formed a fundamental part of the British trade in the midst of the Victorian boom, receiving grain from Lincolnshire, fish from Aberdeen and Grimsby, potatoes from East Anglia and coal from Yorkshire, giving this site a remarkable industrial heritage. The Granary building which now holds the principle division of the UAL campus was designed by Architect Lewis Cubitt who additionally designed Kings cross Station. It was originally built as a warehouse to house the grain for the British trade industry; from here the grain would be shipped on to railway wagons and boats that would travel down the canal arriving at bakeries across the city. "*The building contains a series of trap doors, chutes and loading points which allowed the efficient transfer of goods between wagons, canal boats and horse and cart.*" [2]

The new building is connected to the existing granary building; it is two thirds of the campus. Two, four storey buildings have been built replacing but mimicking the existing assembly sheds by keeping with their scale. An internal street unifies both new studio buildings and a series of bridges adorns the street and creates accessibility from one building to the other. *"The design aims to maximize the connections between departments within the building, with student and material movement".*

The internal streets have been tailored to suit a big art college, adequately large and flexible enough to hold fashion shows, exhibitions and socialising spaces. The studio spaces are not designated to a particular discipline allowing students from different departments to mix, socialise and inspire eachother.[3]

Fig. 58

"Masterplan for the redevelopment of King' s Cross St. Pancras"

Soruce: www.kingscross.co.uk

Fig. 59 *"View of King's Cross St. Pancras area"* Source: Stanton Williams Website

Fig. 60 *"View of King's Cross Station and Granary"* Source: Stanton Williams Website

The main aim of the project was to break down design barriers, to create a new type of dynamic so you get disciplines working together. Dissolving the asylum mentality that exists in art education. *"Although an incredible building on the outside the insides have been left bear, so the students can impose their own artistic identities "It wasn't about the building making a statement. It needed to leave space for the people inside it to make the statement."* Quotes Stanton Architects. *"The structure introduces a strong contemporary intevention that celebrates the juxtaposition of old and new in its detailing".* [4]

Built at the height of the Victorian railway development, the Granary is part of a collection of industrial buildings designed in conjunction with the King' s cross station and Regent' s Canal as an interchange for the transport of goods between canal, road and rail. As we said, it was designed by Lewis Cubitt in 1851 and built in 1852, the building was intended as a grain store to receive and process Lincolnshire grain, unloaded from railway wagons onto canal boats for distribution to London' s bakeries. Also part of Cubitt' s design are two low and long transit sheds that flank the Granary, running 180 m northwards to the end of the site. In line with the southern elevation of the Granary, the combined effect is an industrial take on the palace facade. After the rise and fall of the Industrial Revolution, as coal distribution lessened and transport by road became more common, the Goods Yard slumped and sunk into neglect, and was eventually abandoned. *"The thirties, the war, air raids, and the optimism of the 1948 nationalisation of the railways are all embedded in its 70-year decline"*[5]. In 1985, the Greater London Council published its first Draft Action Area Plan for the railway lands, by which time the area had become so degraded it was London' s lowest rent area for commercial leasing, infamous for drugs, prostitution, and crime. Several improvement schemes were put forward in the following years, variously denied or approved and stymied, before the vast site was amalgamated by its two owners DHL and LCR in 2000. An early masterplan by Foster and Partners was scrapped following *"financial and logistical difficulties"*[6].

Fig. 61 *"View of the old Granary, outside and main hall"* Source: Camden Local Studies and Archive center

Fig. 62 *"View of the terrace up the shed"* Source: Stanton Williams Website

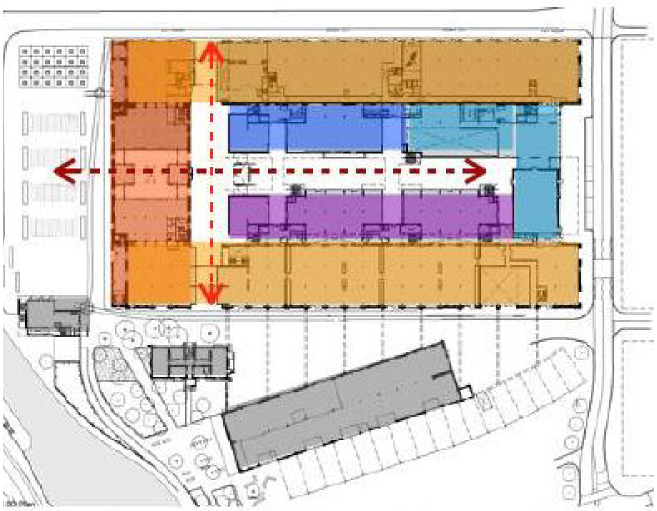
Fig. 63 *"View of the new granary"* Source: Stanton Williams Website

Finally, developers Argent worked in consultation with the Kings Cross Partnership, CABE, English Heritage, GLA and local stakeholders to reevaluate the site' s needs and potential. It took five years of work before outline planning was approved in 2006. The Argent masterplan was approved in n2008, including the conversion of the Grade II listed Granary building to a new library and campus for Central Saint Martins College.

The new building, designed by Stanton Williams with Richard Griffiths Architects as conservation architects, opened in 2011 with a mixtureof anticipation under scrutiny as the pioneer development within the King's Cross development area.

Cubitt' s granary was built to be as robust as its austere facade suggests, with brick construction, wrought-iron Doric columns, and hardy 300 mm deep timber beams. Of course, it had to be strong to withstand the daily pressures and loads imposed by the storage and processing of grain. The exterior brick walls taper from 1 mm thick at the base to 600 mm at the top, and each structural system is indipendent, meaning sections of timber floor could be removed without adversely affecting the columns, which were not fixed to beams, but held together by gravity.[7]
Fortunately this structure was sturdy enough to cope with library shelves now slotted between columns.

Historic analysis helped determined the original colour of the structure, reinstated with new, rusty red paint adorning all wrought iron in the Granary, and shot-blasted, raw timber. Issues with low floor to ceiling heights were mitigated by the exclusion of additional ceiling finishes below this timber structure, and instead a new raised floor plenum hides services, allowing this historic structural pattern to stay visible.
The intimate scale of the library floors is at odds with the vast space that vaults between the historic brick building and the patently contemporary concrete frame the steel and glass gateway, giving access to an internal "street" where the steel frame is supported on a new transit shed floor slab, allowing for an expansive, column free space 110



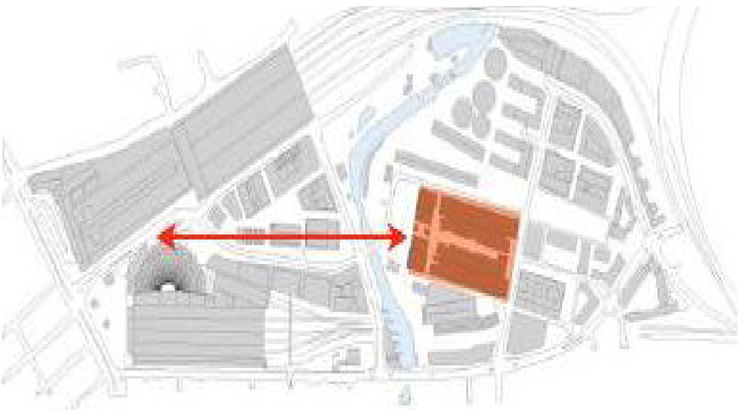
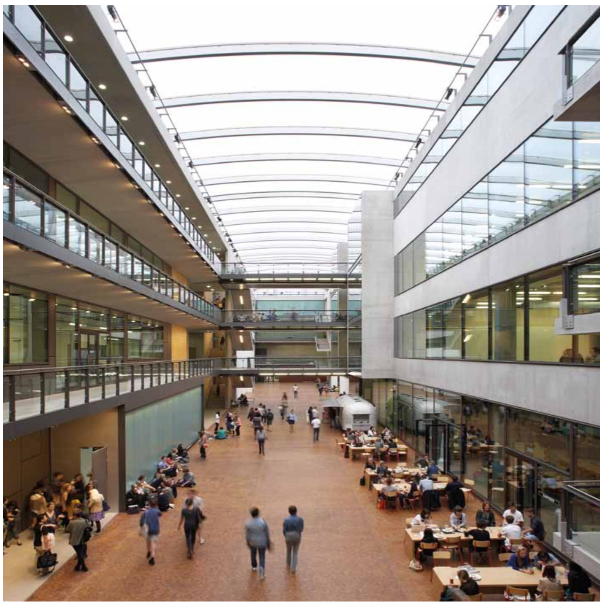


Fig. 64 (left) *"Granary and transit shell in orange and yellow, new build (blue offices), aqua (theatres) and purple (studios)"* Source: Dezeen

Fig. 65 (right) *"Site plan diagram: King' s Cross: the Granary and Transit sheds in the context of Argent' s masterplan, with their main axis of connection between King' s Cross and Saint Pancras Stations."* Source: Stanton Williams website

Fig. 66 *"The Granary: ground floor. Red-wrought iron columns, raw timber, and a new glazed stairwell punched thtough the building"* S: S. Williams

Fig. 67 *"Campus entrance. Giant concrete planes support a floating steel-framed glass box"* S: S. Williams



long, 12 meters wide, and 20 m high. Despite this powerful scale, the building's structure was allegedly basic and inexpensive. "*This is Stanton Williams on war rations, with standard steel sections and no spatial extrusions".*[8]

The historical importance of the Granary' s rear facade is paid due respect, with a triple height atrium revealing the full height of the building. Remnants of the building' s former life is preserved in the paintwork, signage and patchwork brick, with many original openings retained. Yet the facade is not totally sacred, playing an essential part in holding up the huge solid roof suspended precariously between old and new buildngs, with its reverential glazed perimeter. The solid part of the roof has steel beams at 4.6 m centres supported at one end by the new studio building. Steel T-beams rest on a horizontal steel parallel flange channel carved into the Granary brickwork, and the glass perimeter is recessed into the Granary brickwork to provide a waterproof seal. *"This key detail where the new glass/steel meets the old listed fabric is designed to minimise intervention into the listed structure with vertical and horizontal cuts into the brickwork."*[9] A somewhat more obvious insertion, the vertical shaft cut through the Granary wall for the new glazed lift is a significant intervention, without detracting from industrial language of the building. It serves in fact to help marry the bald brick facade with Stanton Williams' steel and glass aethetic. This material juxtaposition is most clearly visible at the Eastern transit sheds, where many of the blind brick arches were punched through to create new windows allowing a new and crucial visual and physical connection through the site. The walls were not structurally sound to achieve a clean break, and tie bars had t o be inserted into the masonry while curved steel was inserted to support the sawn brick at the arches. The removed bricks were reused on site and brickwork joints were repaired using original lime mortars.[10]

The new structure after the adaptive reuse is functional and minimal, while the interventions to the existing structure sought to preserve and highlight what was so seminal throughout the building's history.

Fig. 68 *"Internal street with "semipublic" ground floor, and studios and offices stacked on either side. PTFE skylight and cubic timber floor."* S: S. Williams

Industrial buildings in the 19th century had little need for the kind of abundant natural light so highly valued today. The Granary had meagre windows punched through the facade to provide symmetry, affording little daylight to the library, and timber doors large enough to holst goods to and from the basin below. Stanton Williams have exploited these vertical apertures, inserting enlarged glazing "*which maintains the integrity of the unbroken openings and rhytmically punctuates the building' s main facade*",[11] taking care to maintain the doors now placed inside adjacent to the windows.

A compromise was made between historical honesty and environmental needs, with a new, rectangular, steel-framed atrium punched through the granary from roof to ground floor, allowing light to filter through all six storeys. Fire separated with layers of glass between floors, this atrium had the added benefit of allowing additional parts of the original steel structure - metal rods running across the building - to be made visible for the first time. The new addition by the architects, occupying the space between the East and West transit sheds, has no such problems with light. *"Hemmed in by the listed train sheds on the east and west, the buildings appears very dense. Yet each space is flooded with light"*[12], thanks in large part to the ETFE rood crowning the internal "street", and the extensive glazing and skylights in each studio space.

As part of its holistic environmental strategy to reduce energy consumption set out in the KXC Environmental Sustainability Strategy, the building works on a CHP (combined heat and power) system, to be shared across the King' s cross site. Cycle storage has been house in the orignal stables, housed in the undercroft below the Eastern Transit Shed, complete with showers. No heating is used in the vast internal "street", and photovoltaic panels have been placed on the southern facing pitches of the Transit shed roof to power Granary Square. Overall, the project achieved a BREEAM "Very good", with carbon emissions 48% lower than its original energy strategy.

Fig. 69 *"The library in the Granary wuth exposed timber ceiling structure and doors"* S: S. Williams

Fig. 70 *"CSM studio-workshops with A-frame exposed timber framing"* S: S. Williams

Fig. 71 *"Granary rear facade, witht glazed lift and triple height atrium"* S: S. Williams

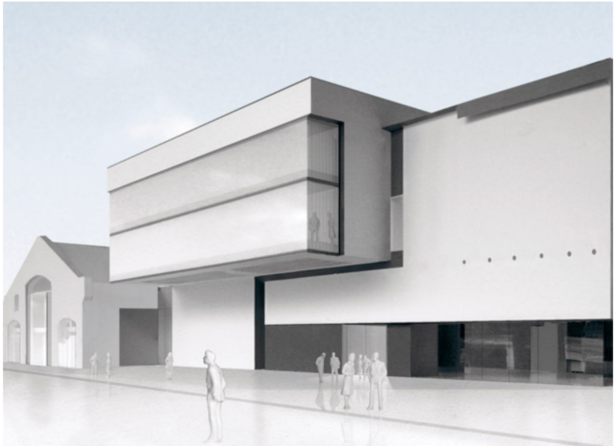


Fig. 72 *"Sketch of the facade"* S: S. Williams

Fig. 73 *"Atrium glazing inside the campus"* S: S. Williams

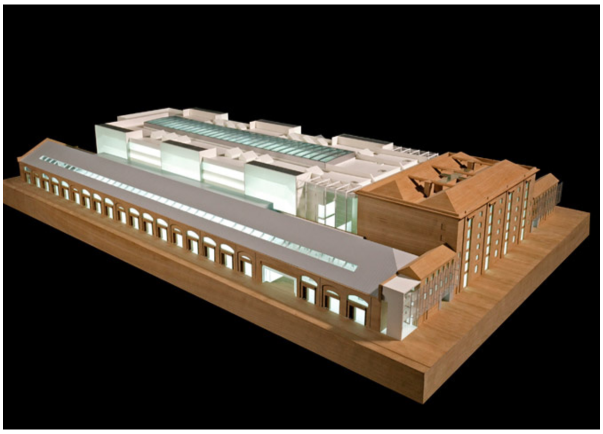


Fig. 74 *"Model of the project. Significant is the retaining of the arches along the shed."* S: S. Williams

Flanked by elegantly simple Transit sheds, the tall, proud Granary, with its patina of age lending a dark air to the already austere design, formed a sort of classical industrial palace facade, a symbol of its power and strength in its prime. As much as possible, the original industrial aesthetic has been preserved trough the retention of key historic markers, including the arches along the shed, the symmetrical facade, and remnants of indutrial mechanisms, such as pulleys, hoists, tracks and turbines. *"The way we refurbished the old buildings is to keep as many of the pulley systems, harnesses and winches as we could. When you walk through the builiding, you will be able to understand how it was used in 1851."*[13]

Without attempting imitation, Stanton Williams' insertion is boldly contemporary, using cutting edge technology, materials and forms to unite the building with a compatible language. *"Progressing through the circulation spaces that connect the function, the architect frames the old building against the skin of the new intervention, providing a tapestry of uncompromising, scarred brick and iron Victoriana agains crisp and powerful concrete, steel and glass."*[14] The new, cubic mass of Stanton WIlliams' insertion is only visible from the north elevation, where the translucent screen of the theatre forms a geometric play with the angled Transit sheds. Internally Stanton Williams have taken the programmatic requirements (4,000 students, 1,000 staff, in a flexible environment under one unique roof) and translated these needs into an internal fitout that allows ultimate malleability and control by its users. Fixtures and finishes are pared back, suc as plywood studio walls that can be taken down and moved, with electrical outputs to suit every configuration feasible. Raw concrete floors and exposed services complete the look. The pared-back aesthetic is perhaps also influenced by heavy budget cuts, as much as the university' s need for a space that is not precious, and can be rough-handled.

Paul Williams, architect, says *"It' s still a big warehouse, really. We' ve pulled back to allow students and staff to stamp their own identity on the building. So it' s a little raw. We think it' s up to the various departments here to test the potential of the building. It' s utterly unresolved in that sense."*[14] Funding cuts also meant the architects relinquished control of the furnishings, a hotchpotch of pieces from their former campuses scattered around Soho, adding to the theme of a warehouse in which the pieces inside can be thrown around at whim. Perhaps the architects made up for these austerity measures with the grand internal street, all glazed finishes, magnificent transparent roof and a floor paved with 1.3 million timber cubes, their own version of the yellow brick road.

We also have to add that the choice of location was fundamental; in architecture, location is key in forming identity and reputation. Central St. Martin's is renowned for birthing success and creativity; over the years it has evolved into one of London 's most iconic design schools. Their main campus had been situated on London's Charing Cross Road since 1913. With such a prestigious title and heritage, their new location had to live up to the name.

Paul Williams affirms that *"The layers of history that are left behind; a fantastic raw material that you've got to work with. A development no longer looks like its arrived out of space. What these buildings, places, individual features, turn tables, name plates and all these little features hundreds of them; they root Kings Cross in its place".*[15]

Director of Stanton Architects Paul William talks about the precautions of dealing with a Grade II listed building.

Understanding the complications of dealing with a historic building is critical. There needs to be a respect for the building and supportive appreciation of its preservation.

Design vs Preservation may become a reoccurring issue for an architect when designing. Successfully preserving the building whilst integrating new elements of design is, therefore, the key to successfully complete an adaptive reuse project.

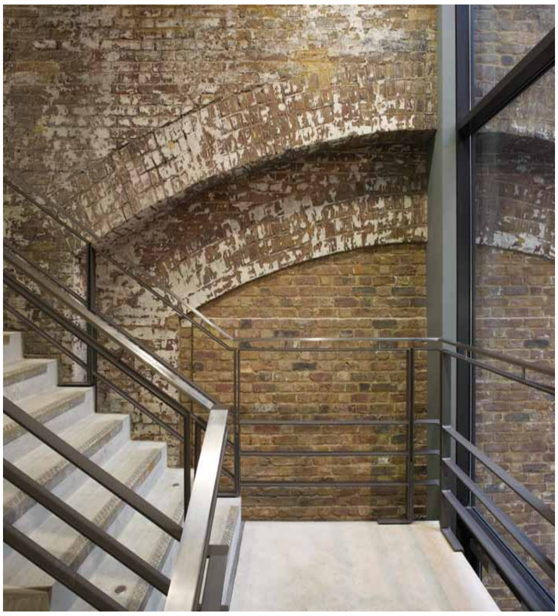


Fig. 75 *"Brick walls with scraped-back paint; raw concrete, slick steel detailing, and expanses of glass"* S: S. Williams

Fig. 76 *"The concrete and translucent glass theatre cube between brick transit sheds"* S: S. Williams

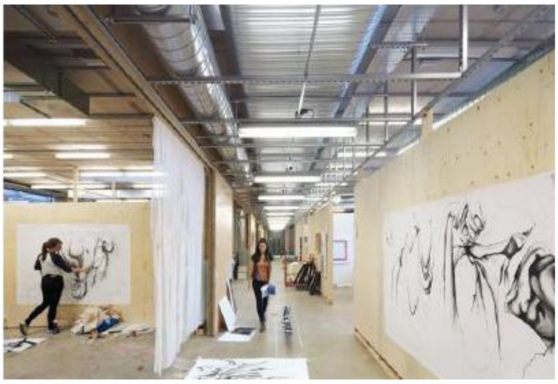


Fig. 77 *"Workspace: flexible, with exposed ceiling services and moveable plywood panels"* S: S. Williams

Fig. 78 *"Western Transit shed: office tenancy"* S: S. Williams

Fig. 79 *"View of the exterior with the retained arches"* S: S. Williams

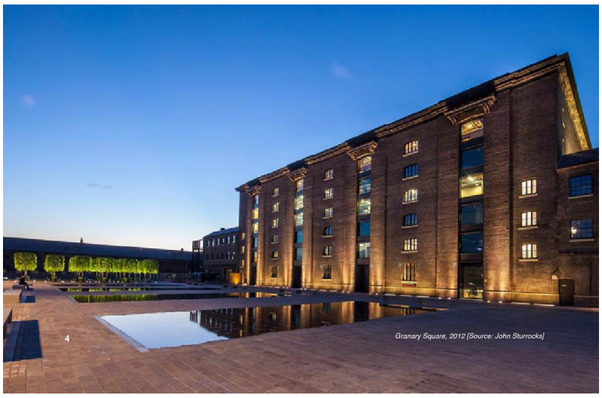


Fig. 80 *"View of the main entrance after the adaptive reuse intervention"* S: S. Williams

Finally, the most appropriate typology to describe the spatial organisation of the building is the shopping centre. All the programme is contained in a closed envelope, mostly inward looking. The size, approximately 180 meters long and 100 meters wide, on four levels, is comparable to that of the facilities of Euston Station, the British Museum, th Brunswick. It is a strategically situated in the middle of the largest urban redevelopment area in Europe.

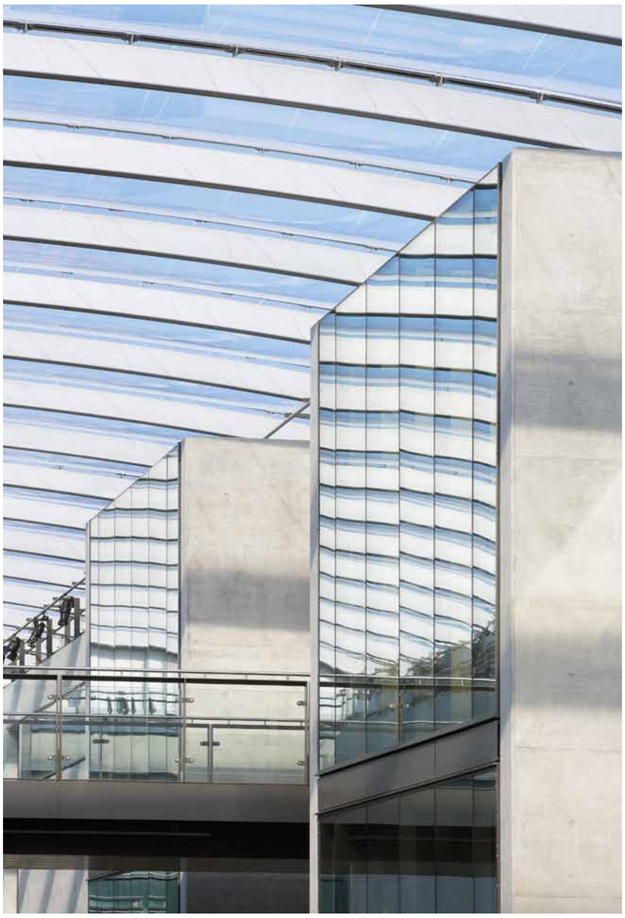
Large circulation areas distribute the activities, with a central atrium offering an architectural surprise. Transparencies and seethroughs, almost shopping windows, enhance the feeling of an ongoing general activity throughout the building.

Through the exposed concrete and use of "naked" materials" , the atmosphere is almost severe.

The synergy of architecture and living matter is well balanced.

The definition of the space is suspended between the generic and specific. Vast areas of the building remain flexible and easy to appropriate by teaching activities and temporary exhibitions, while maintaining their identity.

On the other hand, other volumes have been invested in quite a condensed manner, especially the workshops. Stanton Williams and Richard Griffiths architects have managed the delicate balance between preserving old and celebrating the new seemingly without compromise to either. The greatest compromise has bee made in the budget, with the architects relinquishing ultimate control to the contractors, which has translated to a simpler building, a further distillation of the architects' original ideas, albeit in a way that seems to work well for students and staff, and incidental visitors.



Figg. 81-82(above)

"Inside view of the atrium and external facade " S: S.Willams website

Fig. 83 (left)

"View of the stairs in the atrium" S: S.Willams website

Fig. 84 (below)

"Long Section through the building" S: S.Williams website

Key
1. Existing Granary listed brickwork wall
2. Primary structural back to back to back PFCs, MIO finish.
3. Secondary structural tee, MIO finish, with ss CHS bracing
4. Stainless steel spider / horseshoe bracket
5. Double glazed units.
6. Fritted DGU, silicone jointed.
7. Twin RSAs resin anchored into recess cut into existing heritage wall.
8. Insulated single ply gutter.
9. Rigidal Ziplok aluminium standing seam roof.
10. Glulam beam.
11. Internal plywood lining (Class 1 SSF)
12. Reclaimed brickwork.
13. Existing listed brickwork wall.
14. Refurbished steel 'runway' beam
15. Insulated RC coffered slab with powerfloat concrete finish.
16. DGU.
17. Thermal break.

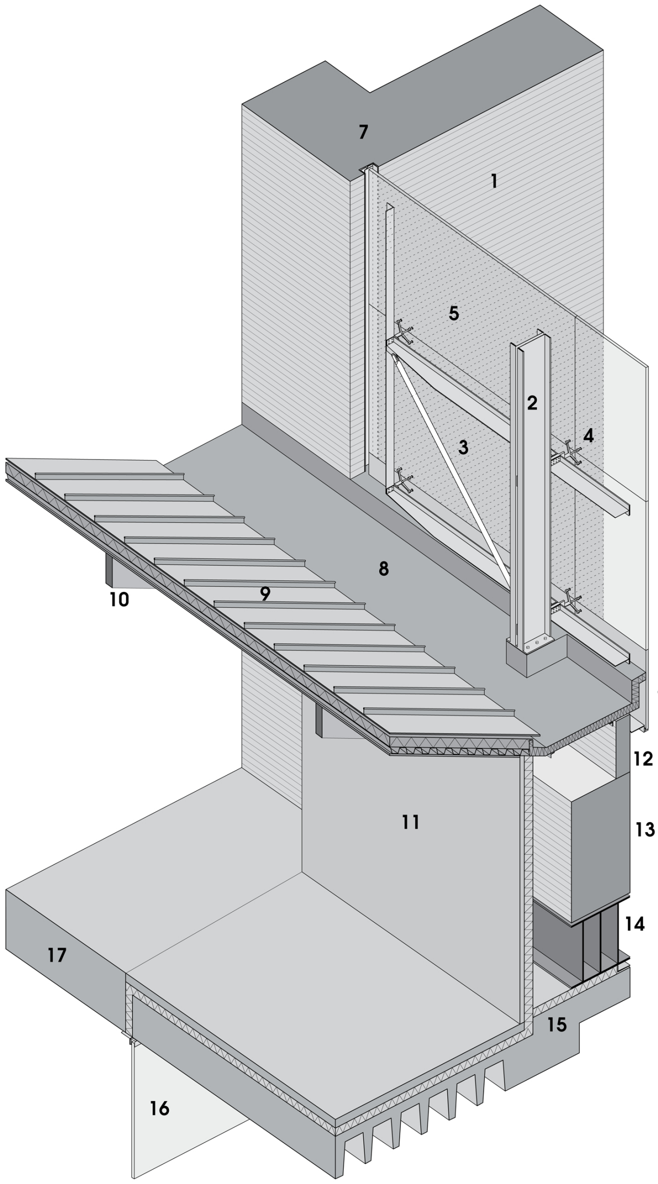
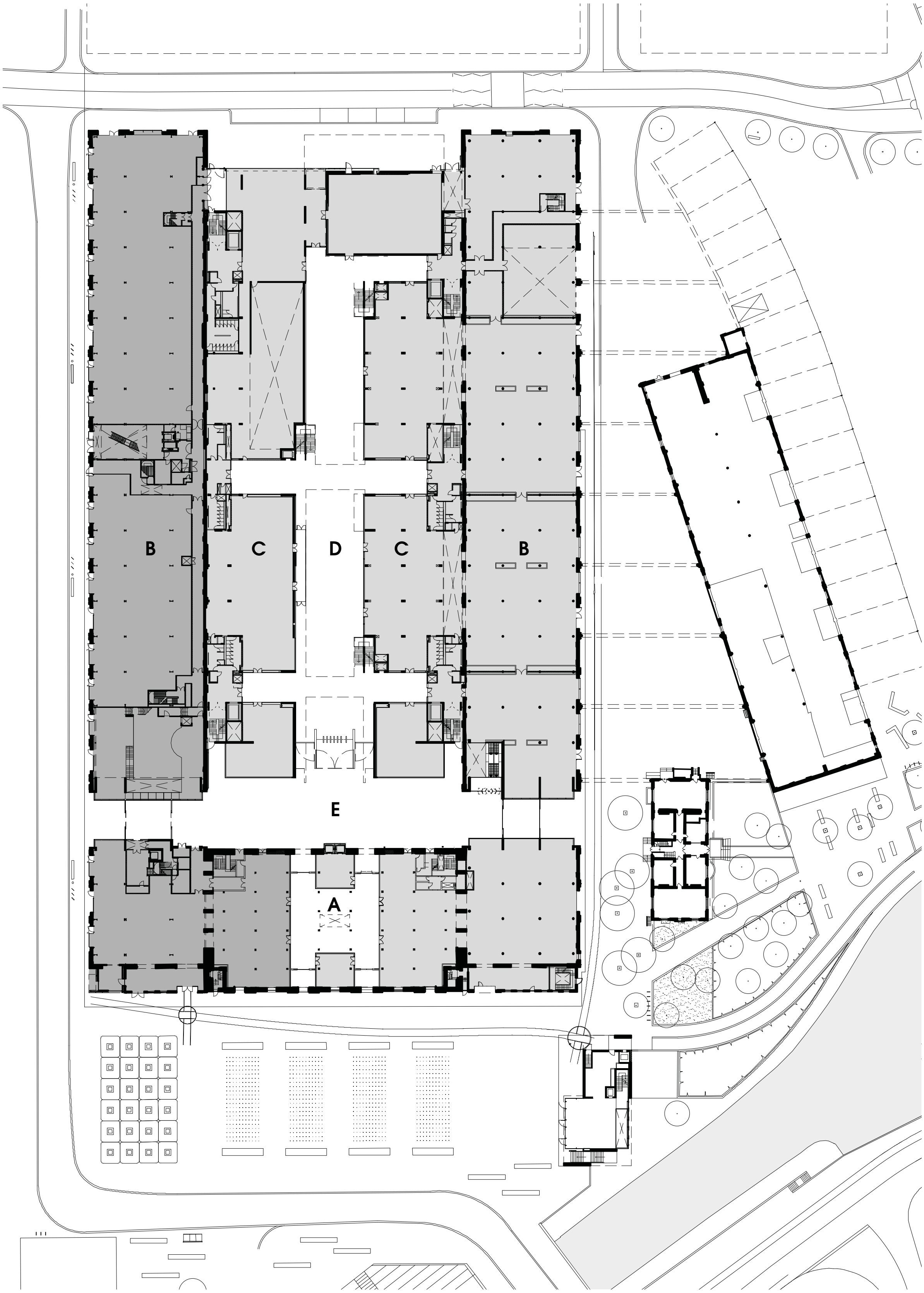


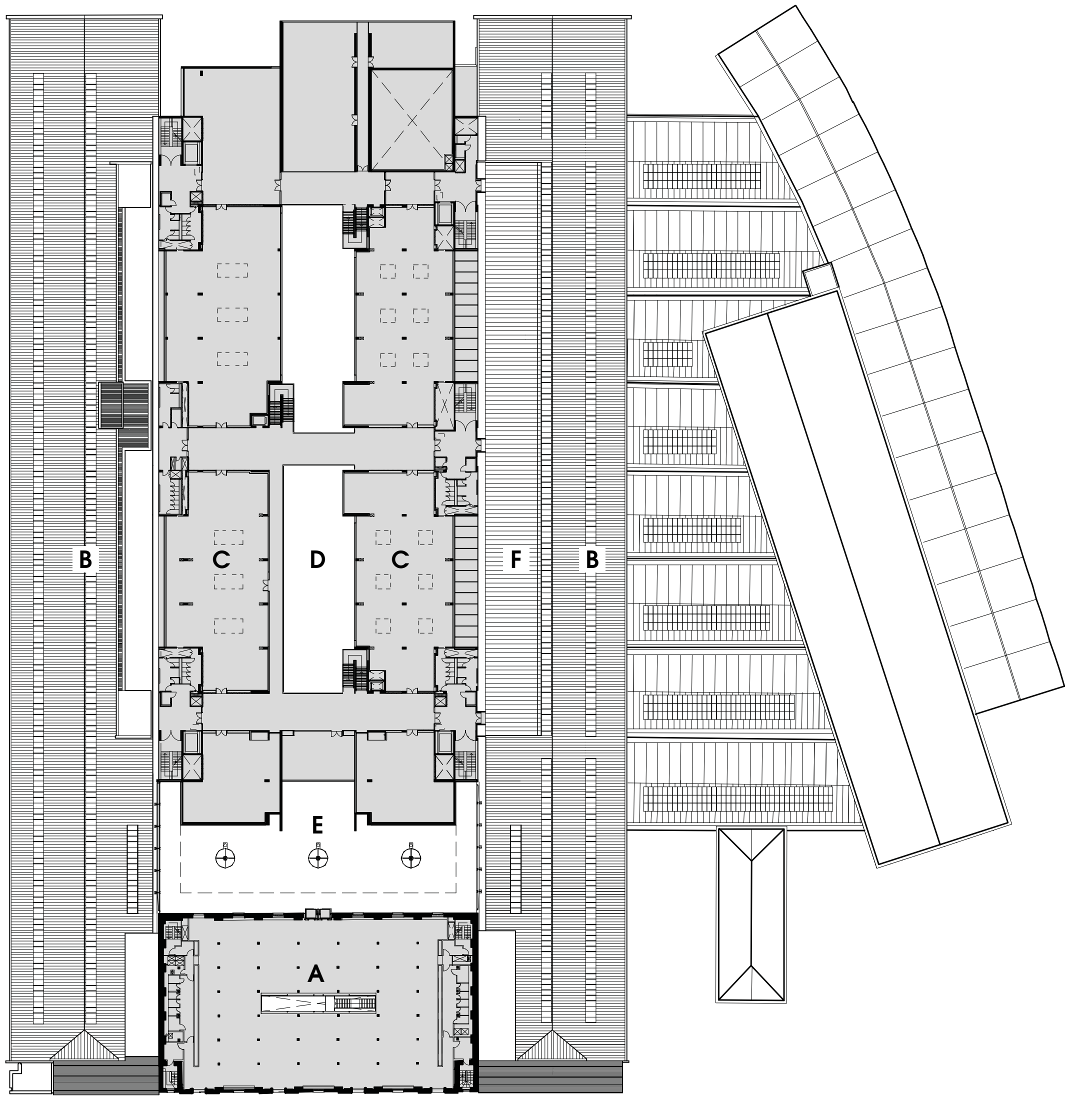
Fig. 85 (right)

"Detail of Junction of the Granary, East-west Ling glazing and Transit shed"

Source: S. Williams website



▢	CSM	**A**	Granary Building	**D**	Central Street
▢	Argent	**B**	Transit Sheds	**E**	East-West link (public access)
▢	Canal	**C**	Studio Buildings	**F**	Terrace



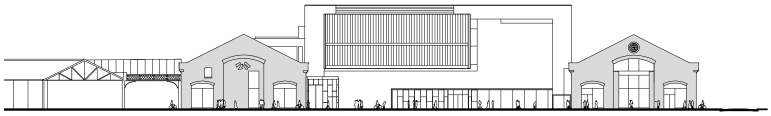
CSM
Argent

A Granary Building
B Transit Sheds
C Studio Buildings
D Central Street
E East-West link (public access)
F Terrace

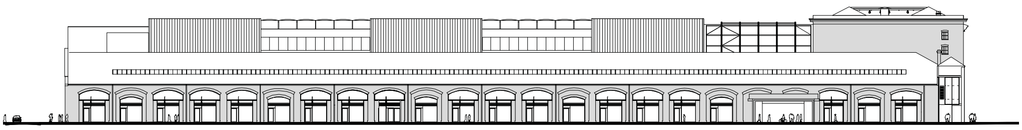
Fig. 86 (left) - 87 (above)

"Plan of the buildings"

Source: S. Williams website

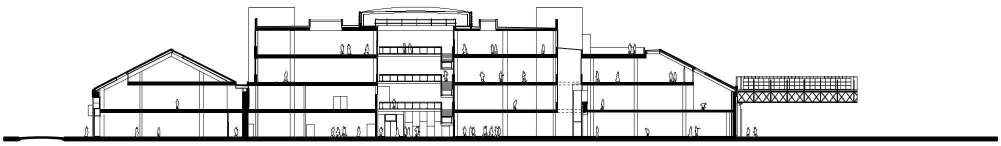


UAL North Elevation

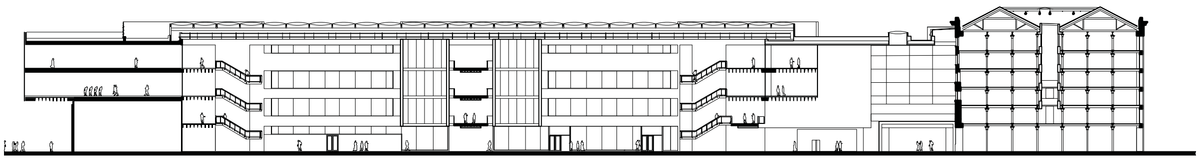


UAL West Elevation

UAL East Elevation



UAL Short Section



1. University of the Arts London
2. Cubitt Square
3. Cubitt Park
4. 1 Handyside Street
5. Granary Square
6. New bridge over Regent's Canal
7. Goods Way
8. Pancras Square
9. St Pancras International
10. New bridge over Regent's Canal
11. Granary building
12. Transit sheds
13. Studio buildings
14. Central street
15. East-west link (public access)
16. Terrace

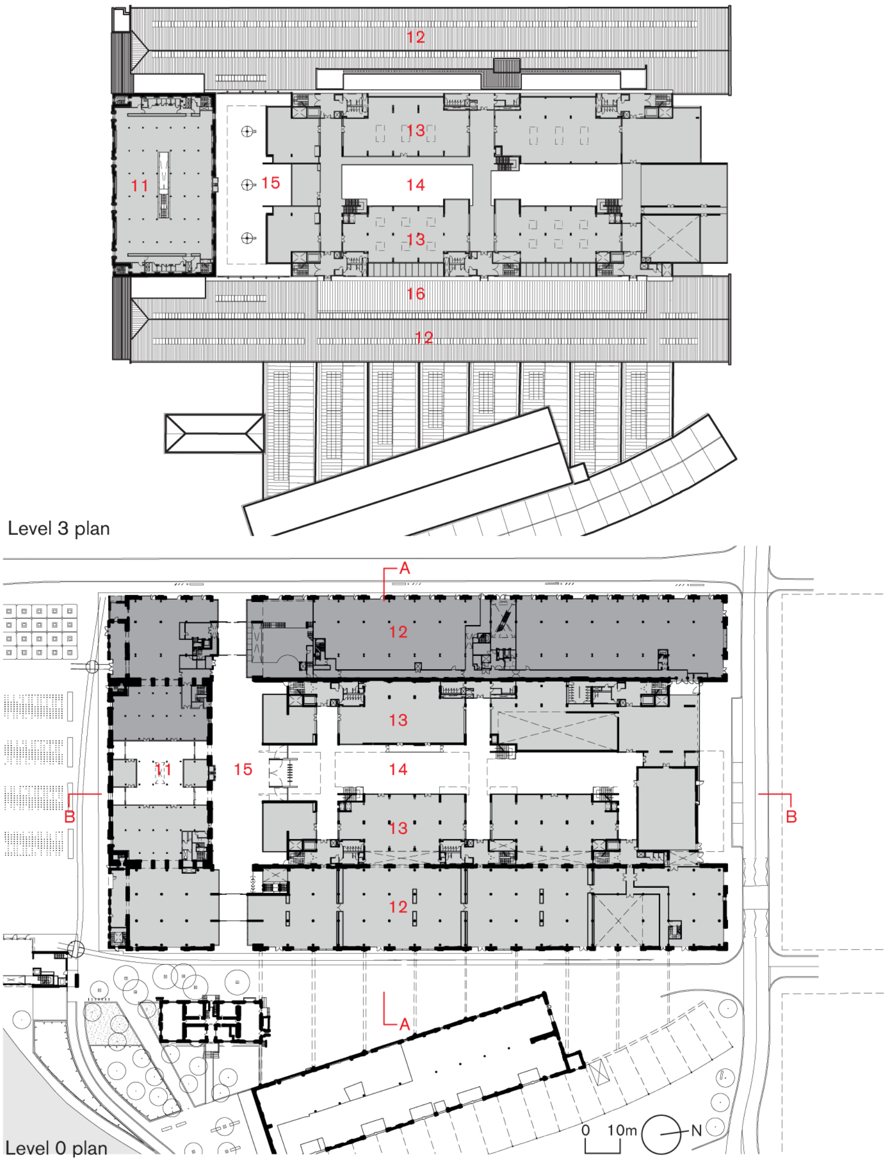


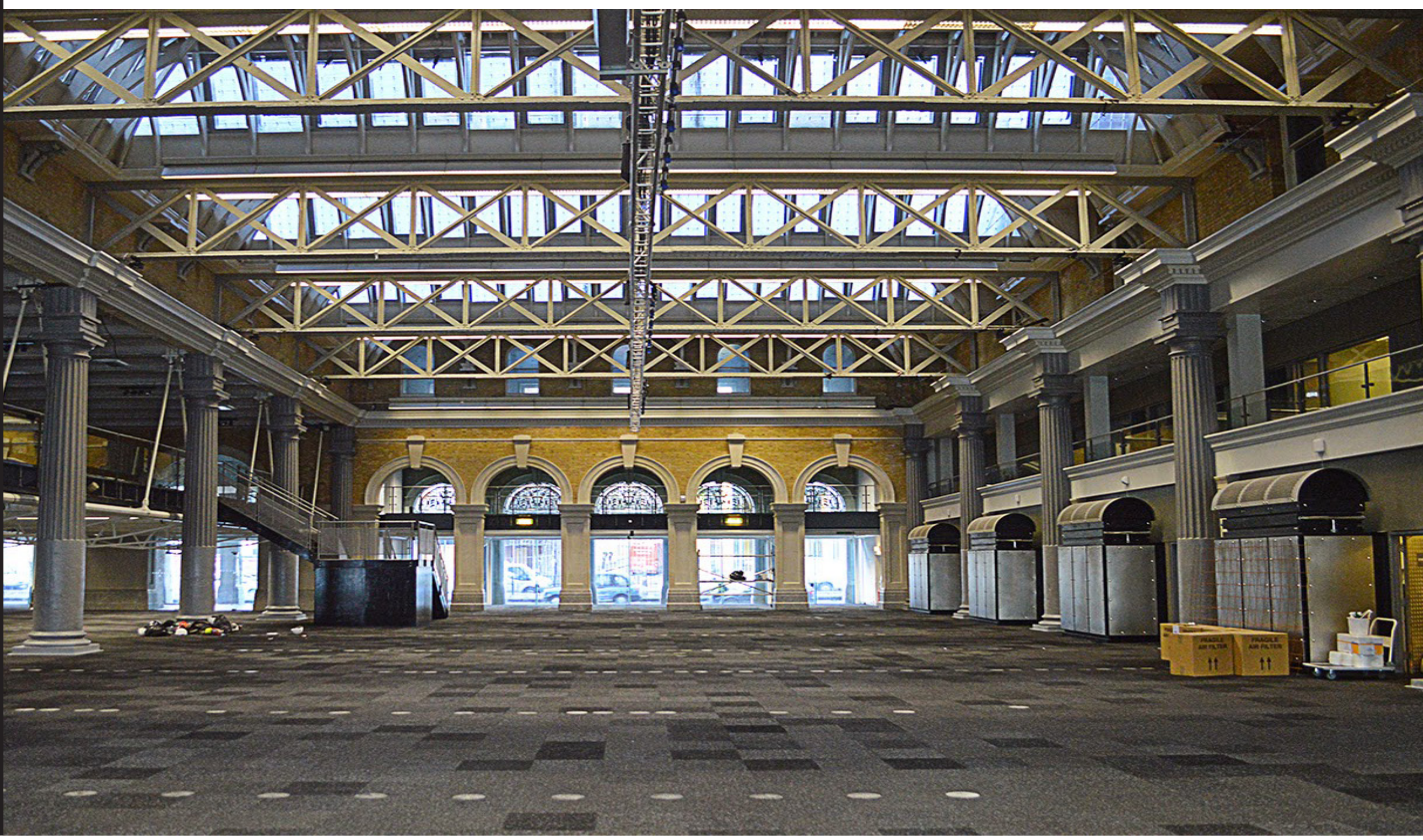
Fig. 88-89 (left and above)

"Elevations and sections on the left and plan level 0 and level 3 above"

Source: S. Williams website

Fig. 90 *"Facade facing south of Billingsgate Market"* Source: www.rsh-p.com

Fig. 91 *"Main hall of the building"* Source: www.rsh-p.com



Billingsgate Market, London

5.1.2 Billingsgate market, London

Date: *1985-1988*

Architect: *Richard Rogers Partnership*

The second case study to be investigated is the Billingsgate Market Refurbishment by Richard Rogers Partnership.

Having just completed the Loyd's of London building, Richard Rogers architects found that the attitude in construction had changed, with a strong emphasis on conservation and a predilection on the part of the planners for contextual, often Post modernist, designs were new buildings were concerned. The practice however strongly favoured the retention of historic buildings of quality and agreed to advise the conservation group SAVE on its campaign to preserve the redundant Billingsgate fishmarket, owned by the City (which proposed to demolish it for redevelopment).

In the event, the market was retained and acquired by a major bank for conversion as a financial-services building. The client sought a large area of open dealing floor space – to which the Victorian structure was ideally suited. Externally, the aim was to restore lost details and to clean and repair, but to add nothing new. Inside, some changes were needed, chiefly to open up and use the huge basement vaults which entirely lacked natural light. The main floor of the market was, however, uncompromised by the addition of the new galleries, lightweight and structurally independent of the existing building. One of the most striking internal spaces is the former 'haddock gallery', which was left intact and converted for office use. Close attention was paid to detailing to ensure an immaculate junction between old and new. Rogers commented on the scheme: *'We sought harmony of modern with old in a single building.'* [16] Sited quite close to Lloyd's of London, Billingsgate h as come to epitomize Rogers' views on urbanism.

Billingsgate Fish Market, in east London, is the United Kingdom's largest fish market. It takes its name from Billingsgate, a ward in the south-east corner of the city of London, where the riverside market was originally established. In its original location in the 19th century, the market was the largest fish market in the world.[17]

Billingsgate Wharf, close to Lower Thames Street, became the centre for a fish market during the 16th and 17th centuries, but did not become formally established until an Act of Parliament in 1699.[18]

In 1850, the market to Horace Jones, consisted only of shed buildings, The open space on the north of the well-remembered Billingsgate Dock was dotted with low booths and sheds, with a range of wooden houses with a piazza in front on the west, which served the salesmen and

fishmongers as shelter, and for the purposes of carrying on their trade." In that year the market was rebuilt to a design by J.B. Bunning, the city architect.
Bunning's buildings was soon found to be insufficient for the increased trade, and in 1872 the Corporation obtained an Act to rebuild and enlarge the market, which was done to plans by Bunning's successor as City architect Sir Horace Jones. The new site covered almost twice the area of the old, incorporating Billingsgate Stairs and Wharf and Darkhouse Lane. Work began in 1874, and the new market was opened by the Lord Mayor on 20 July 1877. The new buildings, Italianate in style, had on their long frontages towards Thames Street the river, a pedimented centre and continuous arcade, flanked at each end by a pavilion tavern. The general market, on a level with Thames Street, had an area of about 30,000 square feet, and was covered with louvre glass roofs, 43 feet (13 m) high at the ridge. A gallery 30 feet (9.1 m) wide was allocated to the sale of dried fish, while the basement, served as a market shellfish.
The opening of the railways changed the nature of the trade, and by the late nineteenth century most of the fish arrived at the market via the Great Eastern Railway.
The infamously coarse language of London fishmongers made "Billingsgate" a byword for crude or vulgar language.
In 1982 the fish market was relocated to a new 13-acre (53,000 sq m) building complex on the Isle of Dogs, close to Canary Wharf. The freehold owner of the site is the London Borough of Tower Hamlets, but the City of London Corporation still runs the market.[19]

Most important, the Billingsgate refurbishment project is the first High-Tech refurbishment, being not merely an extension to an historic urban building, but a total adaptation of an old structure. It triggered a fertile combination of avant-garde engineering and conservation techniques that has led, for example, to some of the Norman Foster's best designs: the Sackler Galleries at the Royal Academy in London, the renovated Reichstag in Berlin, and the Great Court in the

Fig. 92

"View of BIllingsgate from the river Thames"

Source: www.rsh-p.com

Britain' s heritage, demonstrated the practicality of reuse, with new offices on an adjacent parking lot. The building was subsequently listed; since demolition had effectively been ruled out, the City looked for a buyer. Citybank, a major American bank seeking electronic dealing floor space in London, acquired the market, seeing its open floor space as ideal for their requirements.

The Victorian market consisted of a ground floor-trading area (surrounded by cellular offices on three sides and open to an impressive timber, iron and glass roof); a gallery (the Haddock Gallery) extending above this principal space at second floor level in a north-south direction; and a brick-vaulted basement supporting the superstructure and itself resting on a 3 meter thick concrete floor slab. The retention of the main internal space, (a condition of planning consent for conversion), was entirely compatible with the needs of the new users.

A massive upgrading of services was, however, required to support both a permanent workforce of over 500 and a large amount of electronic equipment.

Billingsgate had suffered from years of neglect and maintenance. Many original features had been lost and others had deteriorated badly. The timber roof structure needed a major overhaul, with the replacement of rotten parts. Lead coverings were replaced in the traditional manner. Externally, the market was faithfully restored to its 1877 state.

Renaissance facades revealed qualities that had been largely ignored.

Inside, the approach was to combine restoration with new interventions.[20]

Lighting was a fundamental issue, both aesthetically and functionally. Conventional glass in the roof and that of the Haddock Gallery was replaced by prismatic glazing units which excluded direct sunlight andglaer and filtered in a steady north light.

A frameless, glazed wall - using 25 mm - thick glass to ensure soundproofing - was set back beyond the street elevation and provided further natural light and a sense of contact wih the outside world. Artificial lighting for the new dealing floor was provided using fluorescent linear up- and downlights, supplying ideal conditions for screenwork which also highlighted the historic structure.

The major intervention into the old building was the construction of a mezzanine floor of lightweight reinforced concrete, suspended from the Haddock Gallery, to provide extra accommodation. The floor of the Haddock Gallery itself was structurally reinforced to permit heavier loads. New floors were introduced into the perimeter wings, reused as cellular management offices and meeting rooms. A reinforced concretefloor slab, 250 mm thick, was laid over the brick vaults to transfer loads from the new superstructure to the existing substructure.

At basement level, extensive alterations - including the additionof intermediate floors across part of the space - provided for the insertion of services. Full-air conditioning was installed, with air-handling on the main floor level conducted through a raised floor into specially designed perimeter units. The high servicing requirements of the refurbished building necessitated the construction of an additional plant room under the river bank for water storage tanks.

The other famous building for London' s history, the Lloyd' building, was completed while the Billingsgate project was under way. The Lloyd' s building was essentially a modern market hall.[21]

Here, Rogers provided an essential continuity of use while giving the listed building an assured future life.

The scheme challenged preconceptions, then widespread in Britain, that new work in a historic buiulding must be "in keeping" with surrounding buildings. Roger's radical approach maintained a clear distinction between old and new work and the elegance of latter demonstrated respect for the dignity of the existing fabric.[22]

Fig. 93

"The original open air Billingsgate Fish Market in the early 19th century. Boats delivered fish to this small inlet of the Thames and business was conducted on the quayside."

Source: Microcosm of London (1808)

Fig. 94

"Bilingsgate former premises in the City of London in 1876"

Source: Billingsgate website

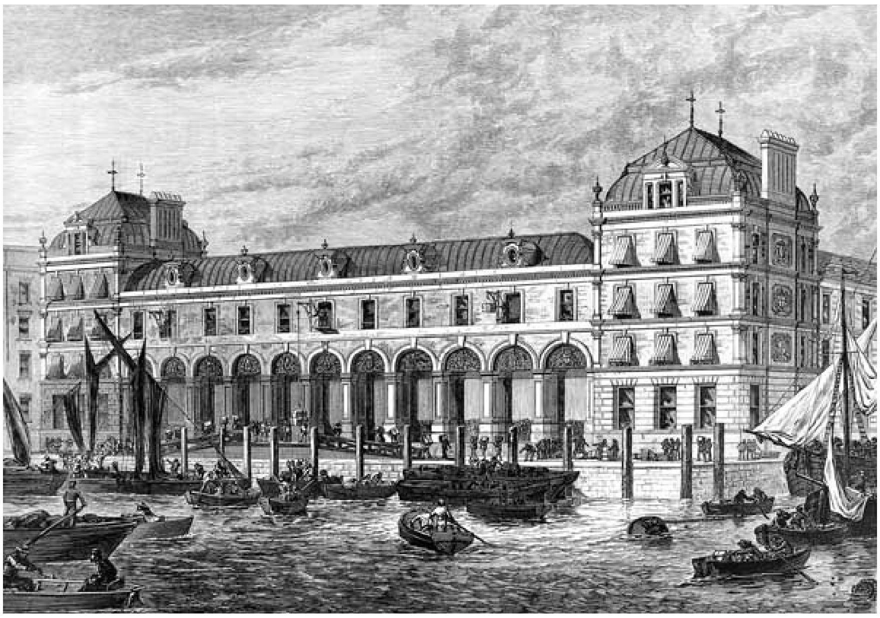


Fig. 95

"The interior of Old billingsgate Market in 1876"

Source: The Illustrated London News

Fig. 96

"Billingsgate former premises in 2006"

Source: Billingsgate website

Fig. 97

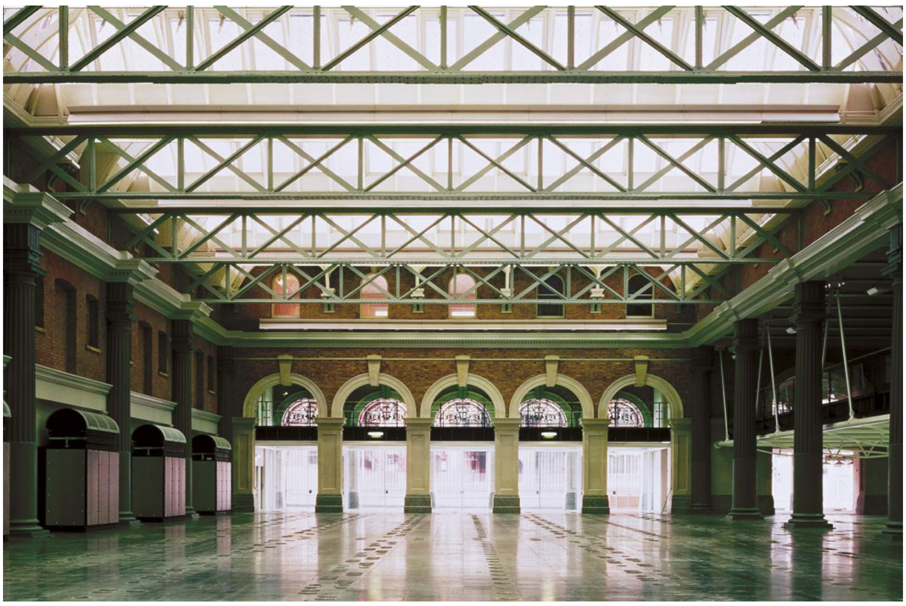
"Billingsgate seen from the Thames"

Source: Billingsgate website

Fig. 98

"View of the Grand Hall"

Source: Billingsgate website



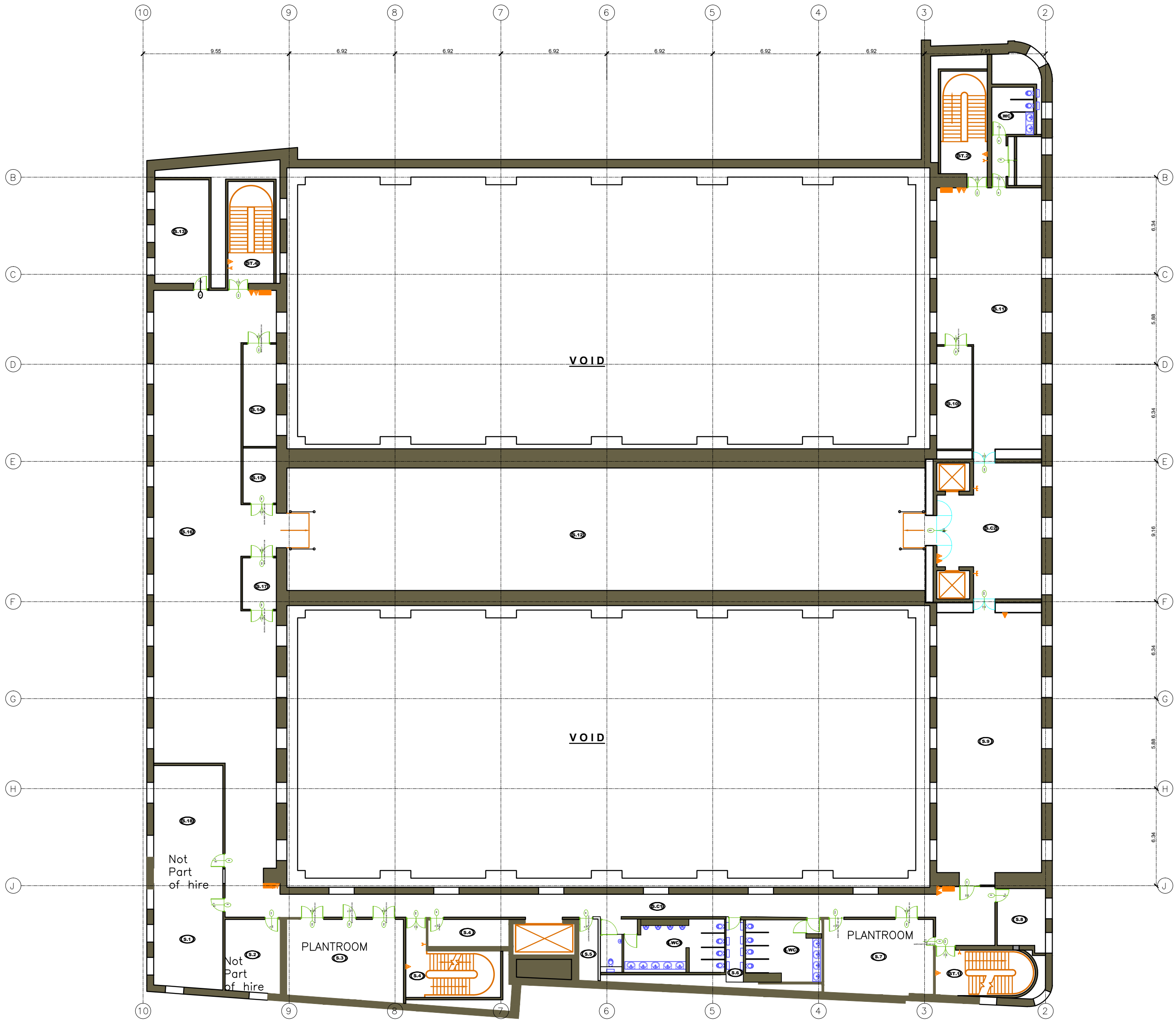


Fig. 99

"Plan of the Gallery - Billingsgate" Source: Old Billingsgate website

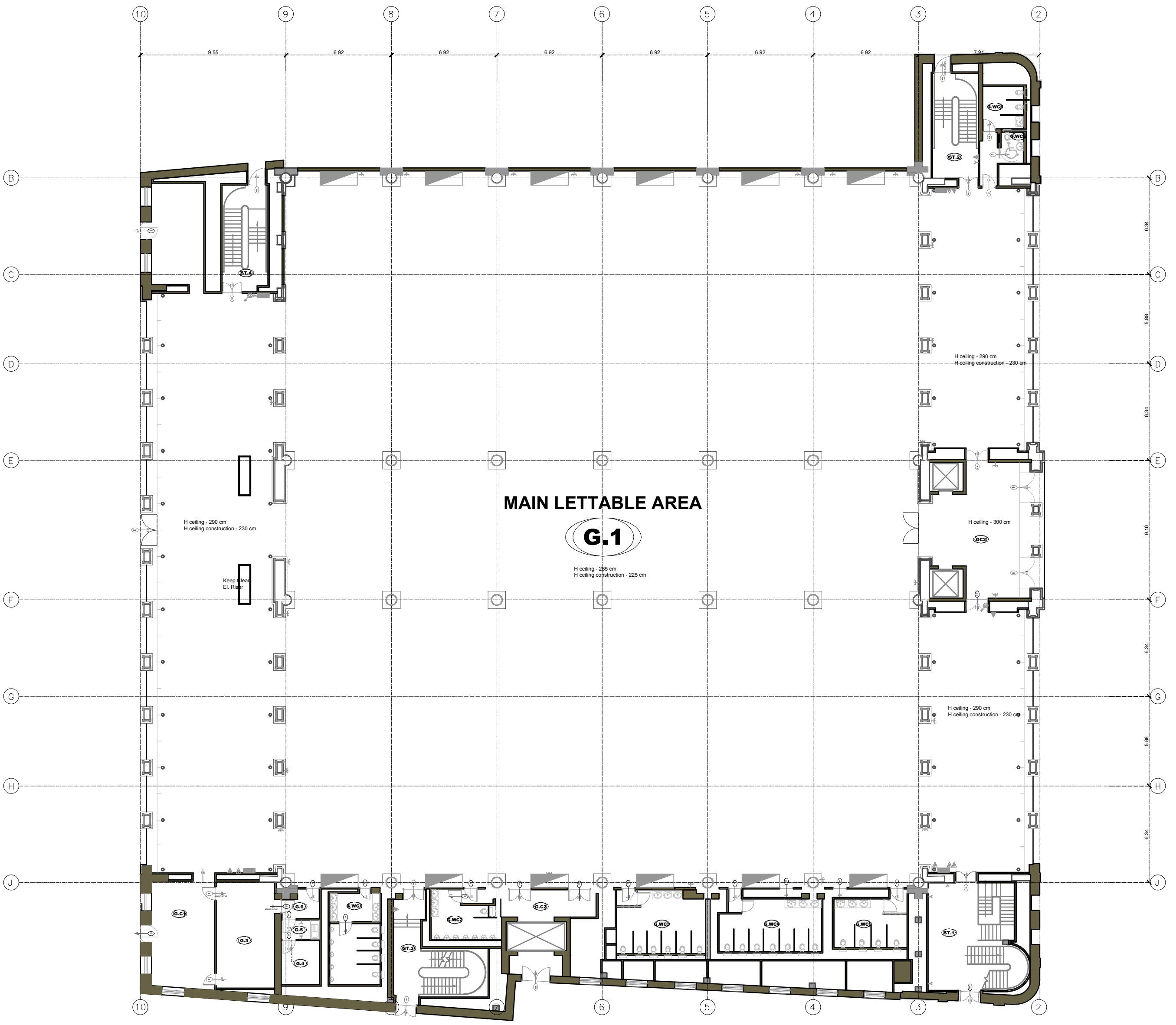


Fig. 100

"Plan of the Grand Hall - Billingsgate" Source: Old Billingsgate website

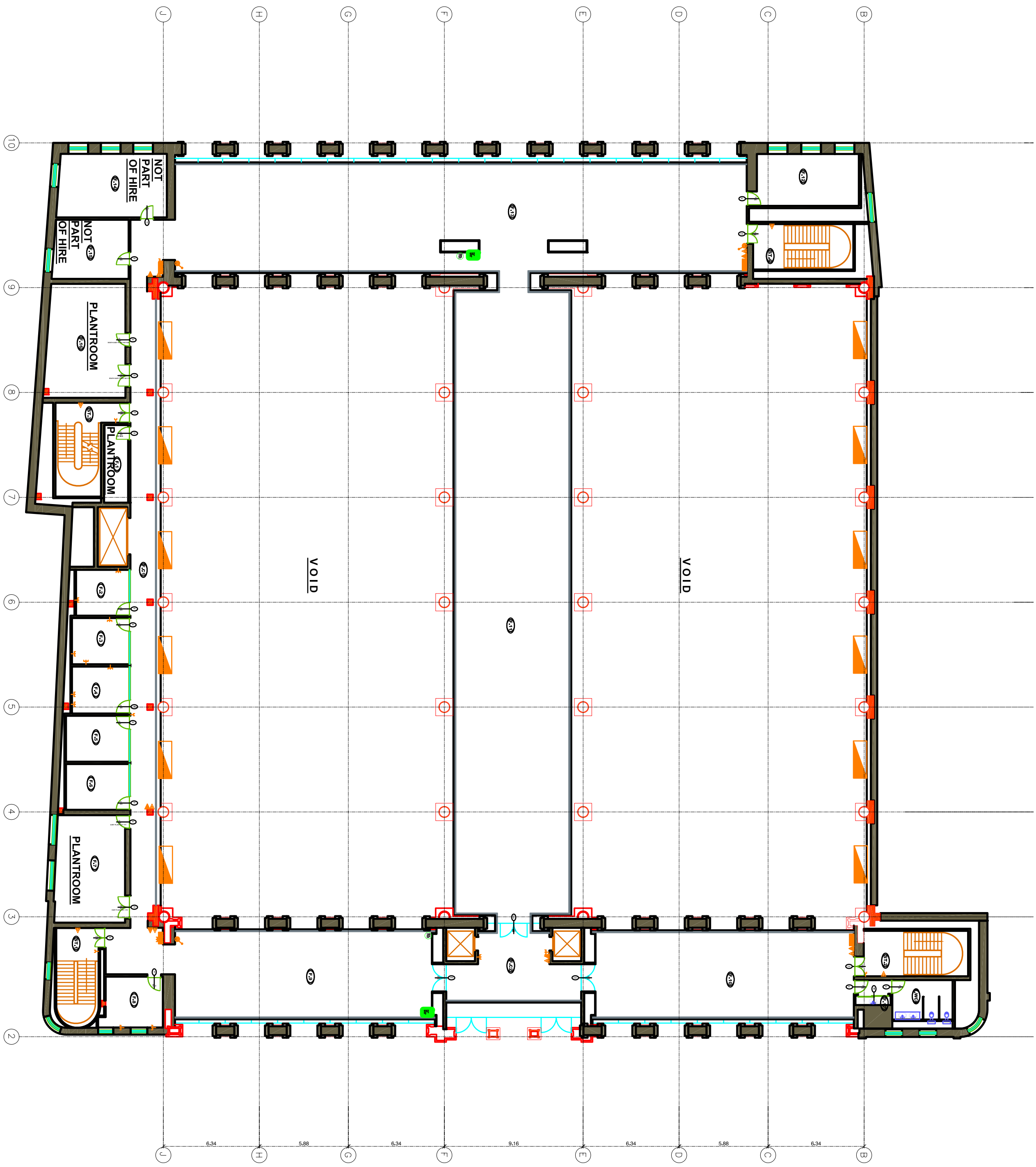


Fig. 101

“Plan of the Mezzanine- Billingsgate” Source: Old Billingsgate website

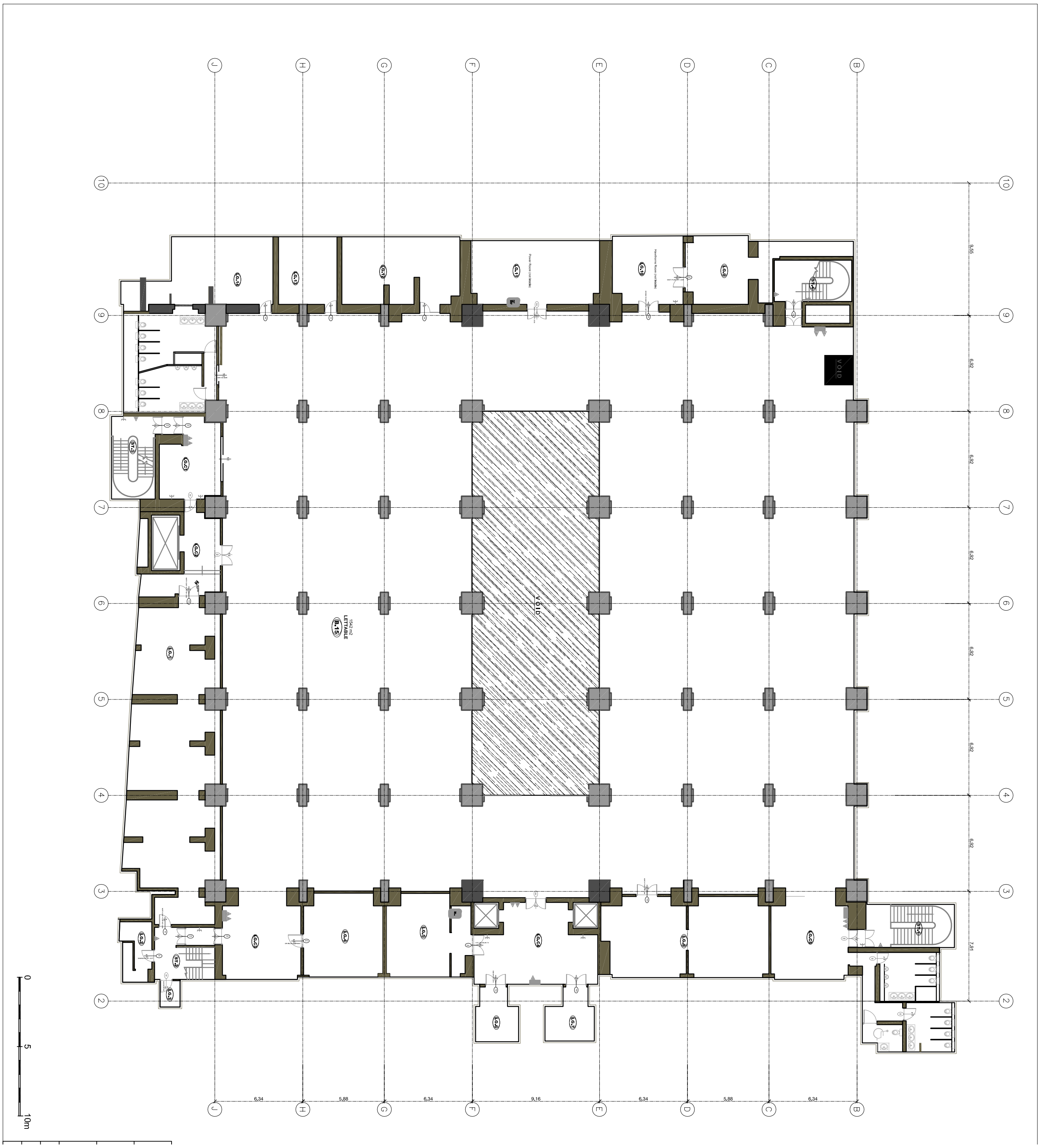


Fig. 102

"Plan of the Vault - Billingsgate" Source: Old Billingsgate website

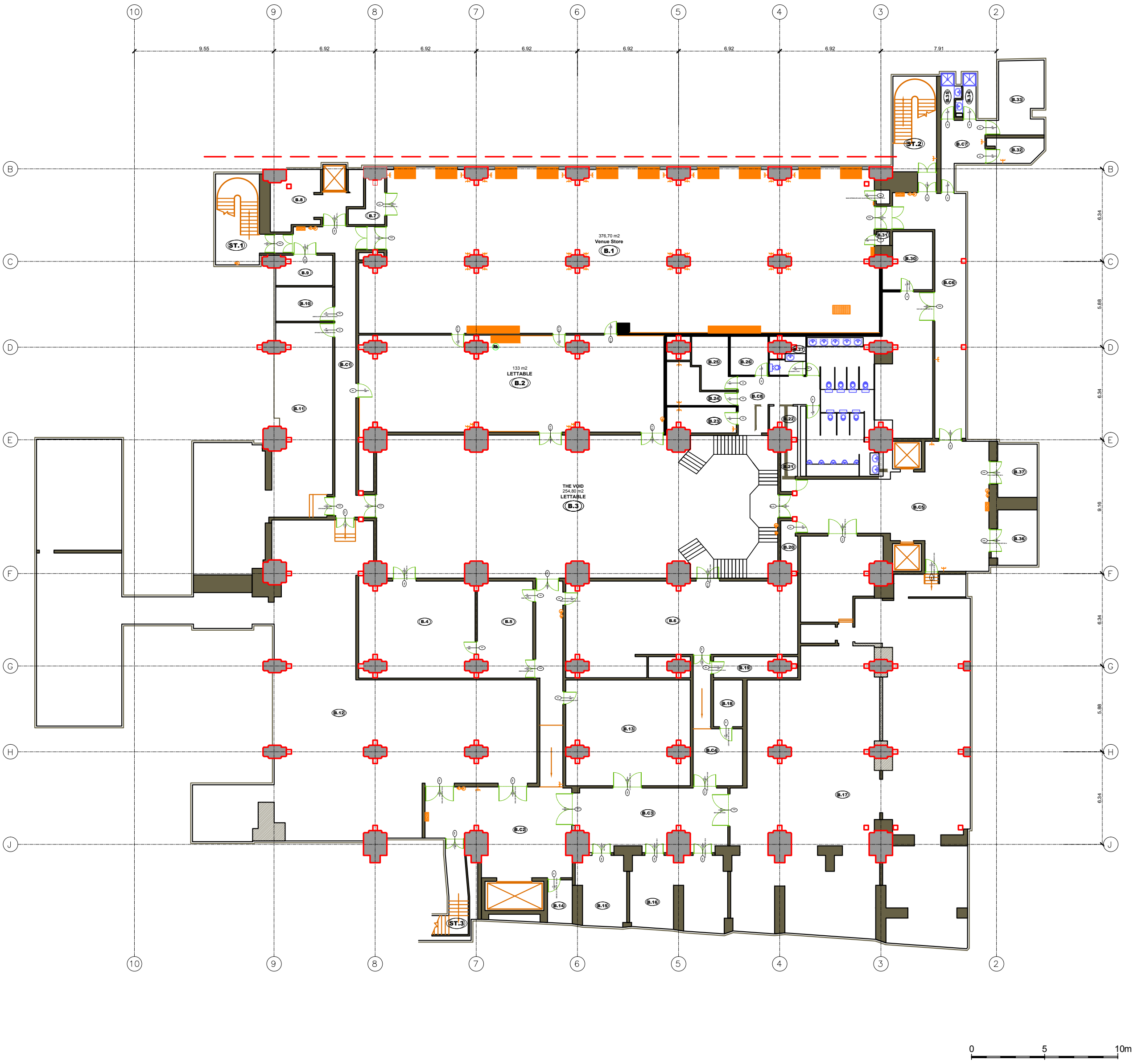


Fig. 103

"Plan of the Well" Source: Billingsgate website

Fig. 104 (top left and right)

"Views of the Grand Hall"

Fig.105 (below)

"View of the Vaults (left below) and Gallery (right below)"

Source: Billingsgate website

Fig.106 *"View of Guy's Tower after the refurbishment with the Shard at the back"* Source: Peynore&Prasad website

Fig. 107 *"View from the top of Guy' s Tower with the terrace on the roof"* Source: Peynore&Prasad website

Guy's Tower, London

5.2 Recladding

5.2.1 Guy' s Tower, London

Date: *2008*

Architect: *Penoyre&Prasad*

According to the recent LSE report High Rise Hope, there are 3,500 tower blocks in the UK housing around 800,000 people. With most of these built during the 1950s and 1960s post-war boom years, a high proportion are in urgent need of renovation, with a poorly performing building envelope making them highly energy-inefficient at a time of escalating fuel poverty.
In the last 10 years London has witnessed an unprecedented spate of high rise development. London currently has nine buildings under construction that will be over 100 metres (328 ft) tall upon completion. Of the nine, Renzo Piano's Shard (London Bridge) is the tallest at 310m (1,017 ft). The next tallest is the Pinnacle which – at 288m – will dominate the skyscraper cluster in the City of London.
The boom in London of skyscraper development has predominantly occurred after the terroristic attacks in the United States. Significant new additions appeared in two main areas – Canary Wharf and Bishopsgate in the City. It also mirrors the economic boom of the early 21st Century. The UK was experiencing a longer period of economic growth, than at any time over the previous 100 years. London was becoming the world's pre-eminent financial centre, and needed buildings to reflect its new image. Skyscrapers have long been associated with the financial services industry, and of course as a demonstration of wealth.
But some of the older towers, as the concrete tower of Guy' s Hospital in London Borough of Southwark are good retrofit candidates due to their structural vulnerability to cold and damp. Many of these towers have heat loss problems and should be retrofitted. If a tower block is in good condition and has been well maintained and hasn't been insulated, it will have heat loss problems and should be retrofitted[23].

At 143 metres, one of the tallest hospital towers in the world has been re-clad to solve constructional problems typical in commercial as well as civic buildings of the late sixties and early seventies. As well as optimising energy efficiency and lowering running costs, the solution proposed by Penoyre & Prasad with Arup has given this iconic building a distinct new profile befitting the national significance of the NHS and symbolises a resurgent London neighbourhood. The brief asked for innovative quality and cost effective solutions to address the structural, fenestration and energy issues of the Tower, restore it to its former glory and make it fit for purpose for the next 30 years[24].

Although described as Guy's Tower, the building is in fact two separate towers joined by a link structure. The taller 34 storey Communications Tower has been highly insulated and clad

Since its opening in 1974, Guy's Tower has cast its distinctive outline on the London skyline. The building is a product of its age, with a brutally modernist aesthetic at odds with some of the more graceful, expressive high-rise edifices that have sprung up in the capital in more recent years.

Guy's Tower was designed by Watkins Gray Architects in the late 1960s. For 16 years, it was officially the tallest hospital building in the world, before the 145m O'Quinn Medical Tower in Houston. Both were subsequently topped by the Hong Kong Sanitorium & Hospital (or Li Shu Pui Building) at 148.5m. However, with the recent addition of a 14m light sculpture on its roof as part of the renovation described in this book, Guy's Tower is now 148.65m tall, and has regained its crown by just 150mm.

In fact, Guy's Tower is made up of two towers joined by a small bridge link spanning each floor. The main tower (or User Tower) is the shorter and larger of the two – a series of stacked 1,200m2 floor plates used for research and clinical accommodation.

The taller, slimmer 34-storey service tower (or Communications Tower) rises to 143m in height, housing some working space, but is largely taken up by lifts, stairs, service ducts and boiler flues. At the top, there's a chamfered roof and the cantilevered prow, which houses a lecture theatre.

Three decades of intensive use, harsh UK weather and environmental exposure had clearly damaged the exterior.

Guy's Tower was not only looking old but also sizeable cracks, gaps and stains were starting to appear.

Although described in the singular as Guy's Tower, the structure actually consists of two towers constructed between 1968 and 1974 – the rather prosaically named User Tower and Communications Tower.

These are connected at each level by narrow glazed links, which are in essence little more than short corridors.

While the Communications Tower took care of the unglamorous essentials like lifts, stairs, boiler flues and ventilation shafts, the User Tower was designed to house most of the hospital's departments, operating theatres and other functions.

Over the years, the wards were moved out and King's College London's research laboratories moved in. The various floors continue to serve as out-patient areas, conference and teaching facilities and are home to most of the King's College London Dental Institute. Diagnostic functions and operating theatres are to be found on the lower levels.[25]

Each of the two towers was designed differently to signify its original internal organisation and use. So the Communications Tower has a vertical emphasis that is reinforced by the profiled reinforced concrete walls. This emphasis is broken at the top of the tower by the horizontal banding on the north-east corner from floors 18–28. Right at the top, the tower has an exaggerated profile that resembles an 'underbite' where the lecture theatre projects, creating a viewing terrace above.

The User Tower, by contrast, is all about the horizontal. It is designed as a deliberate series of horizontal bands, with each a floor of accommodation accessed from the Communications Tower. A series of pre-cast concrete balconies further emphasise the horizontal theme, while also providing some shade from the sun.

The result is a functional vertical access tower that is used to serve a series of floors, almost like filing cabinet drawers.[26]

To emphasise the different elements of the tower, a palette of various concrete finishes was used. These ranged from the profiled concrete for the vertical walls of the Communications

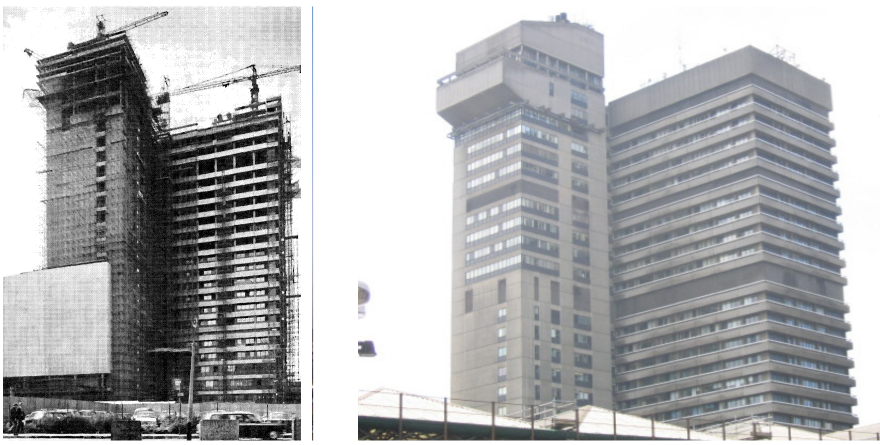


Fig. 108

"General view of the construction in September 1970 (left). First printed in "The Structural Engineer", vol.49, January 1971. On the right, view of the construction before refurbishment"

Source: Book "Guy's Tower 40 years on"

of the Communications Tower, to the finer, jet-washed precast panels used for the horizontal balconies of the User Tower.

Both buildings featured a lightweight concrete, with lytag aggregate in place of traditional stone aggregate. This greatly reduced the weight of the structures and improved their fire resistance.

The User tower is designed as a deliberate series of horizontal bands. The Communications Tower has a vertical emphasis, reinforced by the profiled concrete walls.
The feasibility study carried out in 2008 revealed markedly different areas and levels of decay in the two towers.
The Communications Tower was in a particularly poor state, with widespread, serious damage. Substantial areas of concrete had already been carefully removed by the inspection team. This worrying level of deterioration was in part due to the process of carbonation, which had caused corrosion of the reinforcing steel in areas that weren't covered by sufficient concrete. This damage needed to be repaired urgently, and new protective cladding installed to halt any further degradation to the steel.[27]
The Communications Tower windows were also in a bad way, their plastic-coated steel frames corroded in many areas. It was difficult to tell what the condition of the concealed parts was like, but in all likelihood, they were probably even worse. So for safety reasons, all these windows would need to be replaced.

Fig. 109 (left)
"Guy' s tower in 1974"
Fig. 110 (right)
"Link bridge between the two towers"

For the most part, the User Tower wasn't so badly affected. Many of the concrete panels used to clad the building had been pre-cast in a higher strength concrete with galvanized reinforcement, and there was little damage to be found.
However, panels on the balconies were stained and discoloured and would need specialist cleaning to get them back to something like their original appearance.
There was also some damage to wall, columns and balcony slabs inside the line of the pre-cast panels, where cracks had started to appear.
While the windows of the User Tower were generally holding up, their finishes were not what they used to be. What's more, glazed units in a number of places had failed and were starting to mist up – double glazing is expected to last up to 35 years, so the situation was only likely to get worse. While the balconies had provided the windows with a certain amount of shelter from sun and rain, this wasn't enough for the long-term.
In both towers, the existing concrete façade and old windows were thermally inefficient, letting out the heat and letting in the cold. This meant that the building's energy consumption was much higher than it should have been. In fact, tests revealed that the windows' thermal performance fell dramatically short of current standards, let alone being able to meet the demands of the coming decades, when the government is expected to set increasingly stringent carbon targets[28].
As well as addressing the major structural problems outlined above, it was found that the User Tower balconies required new handrails, the roof finishes of the Communications Tower needed replacing, and the cleaning cradles didn't work properly or cover the full extent of the building.
This was also a once-in-a-generation chance to improve the Tower's appearance, to give it a much-needed facelift, as well as fixing nearly 40 years worth of environmental damage. Whichever way you looked at it, the extent of the refurbishment was substantial, but a variety of approaches were possible.
Consequently, Penoyre & Prasad and Arup came up with a range of different options to repair and revitalise Guy's Tower, from minimal to highly ambitious. Guy's and St Thomas' NHS Foundation Trust chose an option that best balanced long-term performance with available budget – re-cladding the entire Communications Tower, and Link Bridge, plus cleaning and repairing concrete on the balconies and overcladding the façade of the User Tower[29].
But even this was far from a simple, minor refurbishment. It involved a massive and challenging installation of 8,000m2 of of aluminium cladding panels all the way up the Communications

of aluminium cladding panels all the way up the Communications Tower. Plus a further 12,000m2 of glazing units to be installed on all levels of the User Tower. In total, 34,500m2 of concrete was to be cleaned and extensive specialist high-altitude repairs carried out.[30]

The decision to reclad Guy's Tower was driven by purely practical issues. However, providing a solution also offered an opportunity to address aesthetic issues. It was a way to emphasise the landmark qualities of the existing building, while making it far more environmentally friendly

Fig. 111 (right)
"Base of the tower from Great Maze Pond, the only point where the façade touches the ground and *connects with public space."*

FIg.112 (below)
"The roof needed renewing and redundant services removed"

Source: Book "Guy' s Tower 40 years on"

Fig. 113 (top left)
"Staining on the concrete from the boiler flues"

Fig.114 (top right)
"Ribbed concrete walls and steel windows on the Communications Tower. Steel windows had corroded and the glazed units had started to fail"

Fig.115 (left)

"*"Ribbed concrete facade of the Communications Tower"*

Source: Book "Guy' s Tower 40 years on"

and thermally efficient.
Architecturally speaking, the driving idea was to reinforce the key approach of the original design, a composition of two towers, one with clearly expressed horizontal floorplates, the other with a vertical emphasis and a flourish on top: two complementary elements connected by a visually transparent link bridge.
Cladding materials were carefully chosen to heighten the contrast and physical relationship of the two towers.
These featured a family of metallic anodised aluminium finishes. Accordingly, a bespoke, folded-aluminium profile in a graphite anodised finish was specially designed for the Communications Tower walls to cover the existing profiled concrete. This intriguing, folded 'origami' profile has an almost sculpted quality, so seen from distance on a cloudy London day it gives the Tower a solid hewn feel, almost as if it has been carved out of rock.
On brighter days, there would be surprising plays of light as some of the facets are angled towards the sky. Meanwhile, the windows and curtain walling were to be finished in a contrasting, pale umber anodised finish.[31]
For the replacement windows, high-performance, double-glazed units were specified. The new windows were to have solar-selective glass to control the balance between solar gain in summer (which affects the amount of cooling needed) and high levels of natural light.
The approach to the User Tower was quite different. Here, the plan was to clean and seal the existing pre-cast concrete balconies, revealing the 'white' cement and aggregate used in the original construction.
This would lend a lighter, brighter finish, and accentuate the horizontal lines of the structure. The existing windows were to be replaced with a new façade placed in front of the existing columns. This would allow the new cladding to be installed before the old windows were removed (thus minimising disruption) and provide the Trust with 48m2 of additional floor space per floor once the old façade was removed.
At the lower floors of the User Tower along Great Maze Pond, the same profiled cladding from the Communications Tower was to be used, but this time in a perforated version in the lighter tonal finish to match structure. The existing windows were to be replaced with a new façade placed in front of the existing columns. This would allow the new cladding to be installed before the old windows were removed (thus minimising disruption) and provide the Trust with 48m2 of additional floor space per floor once the old façade was removed[32].

At the lower floors of the User Tower along Great Maze Pond, the same profiled cladding from the Communications Tower was to be used, but this time in a perforated version in the lighter tonal finish to match the rest of the User Tower.

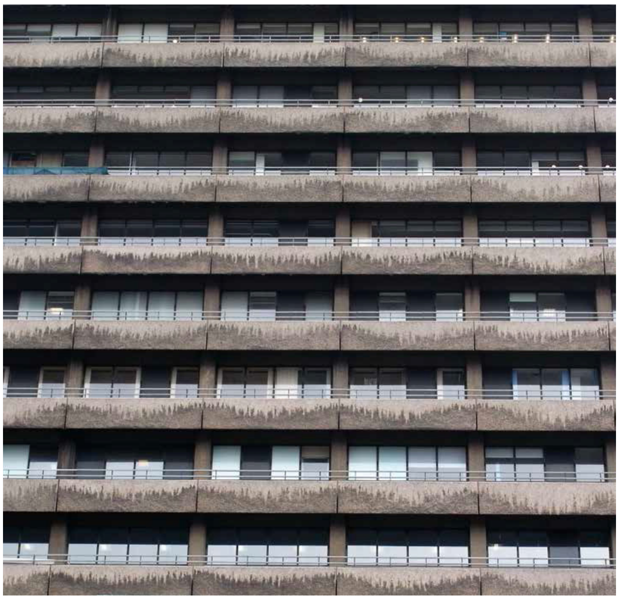
To further accentuate the separation of the towers, the link bridge was to be reclad in a fully glazed façade, which would also improve the views from the tower across the city to the north and south as you pass from one tower to the other.

The thermal performance through the new facade was fundamental to the design. Arup's building physics experts had significant involvement during the planning stages, working closely with the team to model the effects of various proposed cladding solutions. The modelling first focused on establishing a baseline, before looking at the relative impacts of alternative façade solutions[33].

The initial model was based on the existing building, calibrated to take into account the number of occupants, lighting, equipment loads and measured energy consumption. As well as the building in its entirety, selected rooms were also modelled to establish the impacts of differences in location, orientation, use and occupancy.[34]

Fig. 116 (below)

"Typical User Tower balconies with discoloured concrete and thermally inefficient concrete façade." Source: Book "Guy' s Tower 40 years on"



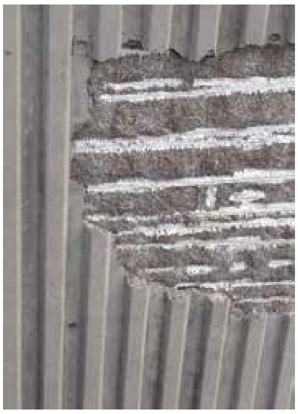


Fig. 117 (left)

"Spallling concrete to areas of the Communications Tower façade."

Source: Book "Guy' s Tower 40 years on"

Fig. 118 (below)

"Existing steel windows had corroded and the glazed units had started to fail"

Source: Book "Guy' s Tower 40 years on"

Fig. 119 (right)

"Early visualisation to study the new cladding solutions"

Source: Book "Guy' s Tower 40 years on"

Fig. 120

"User Tower cladding"

Source: Book "Guy' s Tower 40 years on"

The building accommodates a range of different clinical and research uses, with different requirements for thermal comfort, making it difficult to pin down an optimum solution. This meant looking at the building as a whole, and checking exactly how each façade system works. If you were to change the glass type, for instance, you would have to consider how that simple decision might impact the rest of the building.

For the Communications Tower, it was clear that a lightweight rain screen over insulation, together with high-performing replacement windows, offered the most balanced solution for all the internal functions.[35]

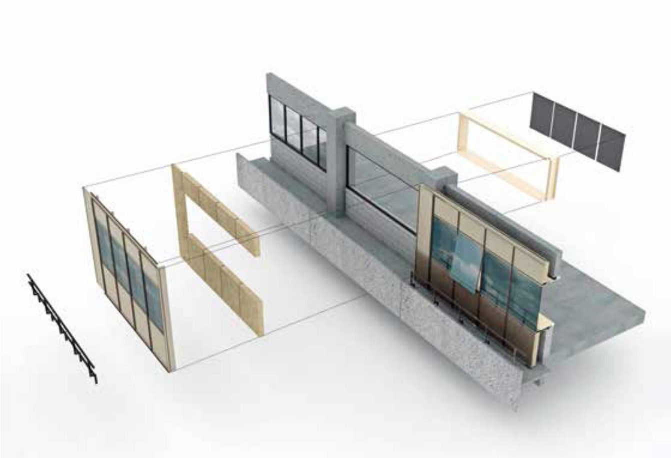
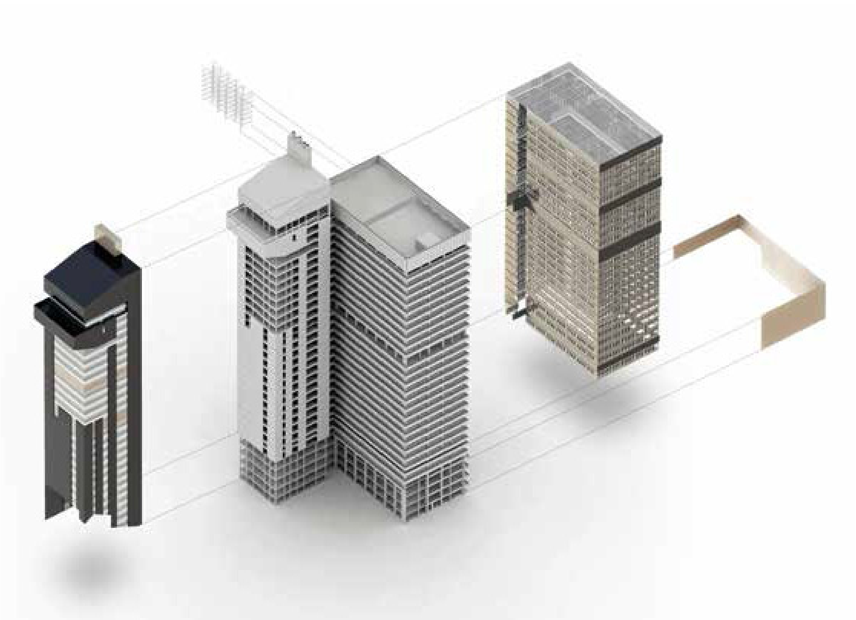


Fig. 121 (left)

"Cladding assembles for the User Tower"
Source: Book "Guy' s Tower 40 years on"

Fig. 122 (below)

"Exploded diagram showing the main components of the refurbishment."
Source: Book "Guy' s Tower 40 years on"



For the User Tower, several alternative approaches were modelled, to try and establish the best way forward bearing in mind the various internal functions. The preferred approach was to install the new cladding just in front of the existing façade and slightly back from the perimeter balcony fronts.

The design of the new façade incorporates additional insulation up to 180mm thick over the existing solid wall areas, significantly increasing the thermal performance of the façade. This was combined with orientation specific low G-value double-glazed windows, to reduce solar gain; low-emission glass where needed, to reduce heat loss; and improved sealing of the façade.[36]

It was also important that the refurbishment provided much better operational energy efficiency, and in turn, carbon improvement.

As well as establishing the thermal performance of the cladding materials, a lifecycle impact assessment of the façade refurbishment options was also carried out to assess the environmental implications of a variety of cladding types.

Operational carbon saving was then offset against the carbon of the materials used in the façade refurbishment to calculate the carbon 'payback' of the building. This exercise revealed that the carbon used in the materials should be paid back in just 12.5 years – less than half the minimum life of the façade. During a 30-year lifecycle, over 8,000 tonnes of CO2 would be saved through the improved thermal performance.

Finding ways to make Guy's Tower more thermally efficient was high on the agenda from the start of the refurbishment programme.[37]

The project was limited to the external façade and did not include the Tower's building services. On this basis, the Arup building services team estimated that the project could only influence 18.5% of total energy consumption.

The design of the new façade was started before the 2010 update of Part L of the Building Regulations was released, covering rules on thermal performance of buildings. However, it was always part of the plan to comply with or better the official targets. The Communications Tower has been clad in a fold-stiffened aluminium rain screen, which incorporates 180mm-thick additional insulation, significantly decreasing the U-values of the envelope, which overall averaged 4 W/m^2K. The User Tower uses curtain walling for which Part L demands a thermal transmittance (U value) of less than 2.1 W/m^2K. The design actually achieves an impressive U value of 1.4 W/m^2K. Other energy-efficient measures included reduced thermal transmittance, orientation-specific low G-value glazing, to reduce solar gain; low-emissivity glass to reduce heat loss; and improved sealing of the façade, to reduce gains and losses via infiltration.[38]

The additional efficiency of the windows also helps reduce glare and heat gain, particularly on the south and west sides of the building, where previously staff and patients often required significant cooling to remain comfortable.

The design of the façade has been carefully considered so that low carbon ventilation strategies, such as natural and mixed-mode ventilation, can be brought into play in the years to come. Using this information, the study concluded that a brand new hospital might typically have an embodied carbon of 490 kgCO2/m2 of operational floor area. So constructing a new building with the same floor area and functionality as Guy's Tower would have an impact of 28,100 tonnes of CO2.

It's plain to see that refurbishing the façade and extending the life of the existing buildings by at least another 30 years, with a carbon spend of just 105 kgCO2/m2 of floor area, is a far more environmentally friendly option. In absolute terms, 18,300 tonnes of carbon has been saved. The refurbishment will also bring significant operational energy efficiency to the building by reducing its energy consumption and, as a result, lower its overall carbon footprint.

Guy's Tower can be seen from many parts of London; the re-cladding works were also designed to emphasise the landmark qualities of the existing building, but at the same time reduce the visual bulk of the Tower as a single mass, and to make it appear as two separate, but complementary elements. The form and composition of the Communications Tower was also reviewed, and adjustments made to reinforce its vertical appearance.[39]

The choice of cladding materials heightens the contrast between the two towers. The materials are a family of metallic anodised aluminium finishes that complement the retained (and cleaned) concrete balconies of the User Tower. They also create changing patterns and light effects as the sunlight moves across them throughout the day.

For the rain screen cladding of the Communications Tower, Penoyre & Prasad designed a bespoke folded aluminium profile in a dark anodised finish. The pattern is mirrored every other floor level to provide a vertical emphasis. This folded 'origami' profile is intended to have an almost sculptural quality. Particular attention was paid to the corners and window reveal junctions. The corners return on a straight profile and the window reveals are returned in the profiled aluminium. When viewed from distance the cladding gives the Tower a solid hewn feel, as if it has been carved out of rock.[40]

Fig. 123

"The folded panels of the facade"

Fig 124

"Perforated panels at the base of the User Tower"

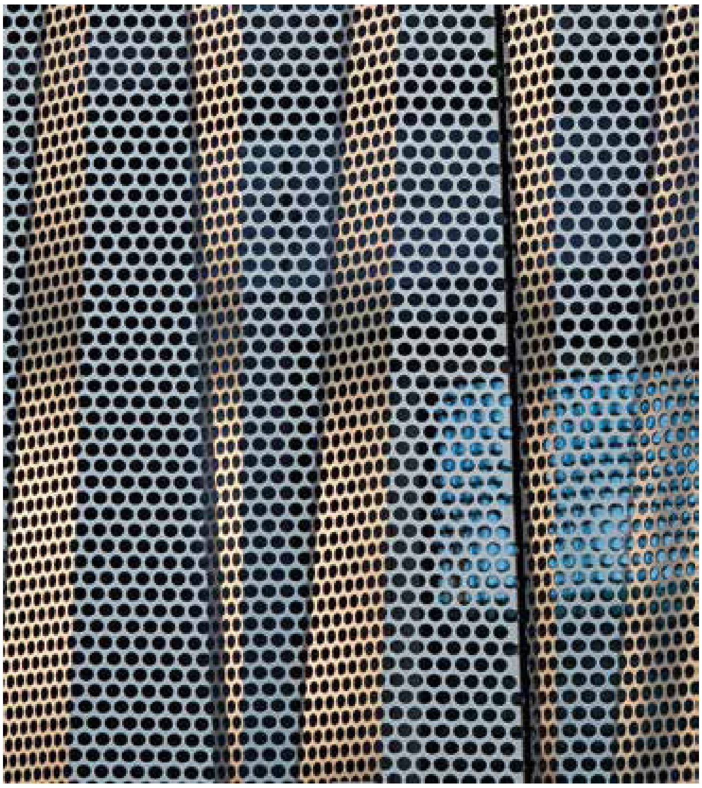


Fig. 125

"Individual folded panels on the Communications Tower combine to create a feeling of solid hewn rock"

Source: Book "Guy' s Tower 40 years on"

Fig. 126

"Perforated cladding facing the public space on Great Maze Pond."

Fig. 127

"View of the refurbished building with the variation in the colour of the cladding due to the changing light throughout the day and year."

Source: Book "Guy' s Tower 40 years on"

5.2.2 24 King William Street, London

Own developed project **with Ben Adams Architects, London**

View chapter 6 for drawings

Figg. 128-129 *"View of 24 King William Street and of the recladding solution"*

5.3 Technological Retrofit

INTRODUCTION TO MAIN STRATEGIES

Adaptive reuse is fundamental in upgrading the performance of a building, not just through spatial modifications but also through technological interventions (technological retrofit).
This chapter focuses on summarising the main strategies required on an elemental basis of retrofit intervention, with the scope of improving energy efficiency of a dwelling.
The main priority is to conserve energy before generating it by: insulating the building to the highest possible standard, making it airtight and ensure suitable levels of ventilation.
Install an efficient heating system that is sized correctly to match the anticipated space and domestic hot water demands. Where possible, install solar collectors to provide a proportion of the hot water required. Consider other renewable water and space heating systems; and renewable electrical power systems.
Fully comprehending how the existing building works is key to a successful energy efficient refurbishment.
It is essential to understand how the building performs thermally. Understanding and quantifying energy usage, heat loss and air permeabillity will be critical in identifying performance targets and eventually measuring the degree of success realised through refurbishment. Assessing thermal performance will include: thermal modelling, air tightness testing, thermal imaging, meter readings will show exactly how much energy is currently consumed, understanding occupant behaviour will also identify how the energy is being consumed. How does the building deal with rising damp and water penetration, if the house depends on an absorption and evaporation cycle, where walls become wet and then dry out, or if the house is of a more modern construction that forms a barrier against moisture through using impermeable materials. If the building is in a particularly exposed location, if it is subject to wind and driving rain. If the house is old, it will show particular defects, that will guide the designer to address the particular issues that are unique to the house.
Retrofit, as we saw in the previous chapter on Recladding, can alter the appearance of the building to some degree. Especially when involved with historically important buildings.

THERMAL BRIDGING IN RETROFIT

A comprehensive thermal insulation retrofit should create a continuous insulated envelope around the living accommodation and, ideally, avoid any residual thermal bridging of the structure. The extent of residual thermal bridging will vary depending on the insulation strategy selected and is generally the result of structural elements breaching the insulation zone.

Thermal bridges occur where localised building fabric elements are less well insulated than the surrounding areas and therefore allow a greater rate of heat loss. This can lead to lowered temperatures either on the internal surface or within the structure, with the subsequent risk of condensation and mould growth as well as the penalty on energy efficiency. When working with existing buildings, the total elimination of thermal bridging is not always practical or even possible without extreme intervention.[41]

Even with externally applied insulation, thermal bridges typically remain where existing load-bearing structures meet the ground below, for example, at external walls, party walls and chimney breasts or at load-bearing internal partitions.

With internally applied insulation, thermal bridges at the external wall junctions can be avoided but the party wall, chimney and internal partition bridges are comparable. In addition, further thermal continuity complications often occur where extensions meet the main external wall structures, both horizontally and vertically. Party wall and internal partition abutments are more difficult to treat with internal wall insulation installations, particularly around entrance hallways, for example, where corridor widths are narrow. Finally, internal floor structures typically bear onto the external load-bearing walls and thus penetrate the thermal layer – this is arguably the area of most concern with internal wall insulation because of potential moisture build-up in the joist ends.[42]

At roof level, a typical problem area is the transition between loft insulation and external insulation at the wall plate.

This can be addressed by a limited amount of internal insulation at ceiling level or, preferably, by replacing the roof covering and insulating over the top of the existing roof structure.

Other difficult areas include abutments between solid-walled properties and extension roofs, and roof struts and chimney breasts, which penetrate the insulation plane.

AIR LEAKAGE IN RETROFIT

In construction, the term “air tightness” refers to a building’s capacity to prevent air leaking from its fabric (ie walls, floors, ceilings, doors and windows) through unintended paths. All inhabited spaces need to be ventilated with fresh air in order to maintain good air quality. However, poorly sealed building fabric can be a major source of heat loss and occupant discomfort.

Air leakage occurs through a significant number of routes, as illustrated in the figure.Those highlighted in orange are unintended leakage paths, as distinct from intended ventilation paths, which might include permanent wall vents, window trickle vents, mechanical extract fans and passive vent ducts. Airtight construction therefore aims to eliminate unwanted air leakage so that the ventilation design strategy is optimised. This is summed up by the phrase “Build Tight, Ventilate Right”.

It is very important in low energy retrofits to retain the heat contained within the internal air as any escaping warmed air is replaced by cold from outside, causing draughts and discomfort. As this replacement air then needs to be heated, it compromises the efficiency of the heating system and wastes energy. At the same time, it is essential to refresh the indoor air to remove pollutants (such as water vapour from cooking), supply fresh air for the occupants and provide a means of cooling in summer. The most advanced energy efficiency solutions are even able to recover the heat from this extracted air, but for such systems to work effectively the building envelope needs to be very airtight. Airtight construction methods are also important in retrofit to avoid thermal bypass (where air is able to circulate around joints in the insulation due to poor installation) and mitigate the risk of interstitial condensation. Techniques might include the use of taped membrane or sheet materials, parging coats and proprietary grommets and seals around service penetrations.[43]

Fig. 130

“Apron insulation extends the heat loss path at the junction of the external walls with the foundations”

Source: ECD Archtiects

The air tightness of a building is tested through the blower door method in accordance with industry standard methodologies (ATTMA Test Standard 1) and is measured either as air permeability in m3/hr/m2 at 50 Pa pressure or in air changes per hour at 50 Pa pressure (h–1) depending on the assessment procedure selected. The result should be taken as the average of the pressurised and depressurised results to reflect real pressure conditions. Good practice air permeability is considered to be around 5 m3/hr/ m2 at 50 Pa (compared with the 2010 Building Regulations minimum for new buildings of 10 m3/hr/m2 at 50 Pa) while heat recovery ventilation is only considered effective below an air permeability of 3.0 m3/hr/m2 at 50 Pa Air tightness tests should be carried out at key intermediate moments in the retrofit strategy, not just left until practical completion as it will not be possible to carry out remedial work without major disruption to the completed installations. The programme of the retrofit works should take account of the need for air tightness testing, for example, upon completion of the air barrier including all service penetrations and fenestration installations but prior to internal finishes being applied.[44]

Therefore:

• Air leakage is a major cause of energy loss, typically around 20% in older houses, from space heating. In modern houses, where heat loss is less through other means, ventilation counts for a higher proportion - estimated at between 35 - 40%.

• Older houses tend to be more airtight than more modern houses - this might be because of the less precise nature of modern workmanship and materials assembly.

• Air leakage is the uncontrolled movement of air in to and out of a building which is not for the specific and planned purpose of exhausting stale air or bringing in fresh air.

• Air leakage is measured as the rate of leakage per m2 of external envelope per hour at an artificial pressure differential through the envelope of 50 Pa. i.e. x m3/hr/m2@50Pa

• The Building Regulations 2006 standard is 10 m3/hr/m2

• EST 'Good Practice' air permeability is 5m3/h/m2. 'Best practice' is 3m3/h/m2 (based on CIBSE Tm23 2000).

Fig. 131

"Blower door tests involve connecting a fan to a suitable aperture in the building envelope and pressurising it over a range of pressure differences"

Source: ECD Archtiects

Fig. 132

"Localised testing can be carried out using a smoke pencil to determine the sources of air leakage"

Source: ECD Archtiects

• The AECB Gold Standard is 0.75m3/h/m2@50Pa.

• In a recent survey of 100 new houses, none achieved a best practice standard and around a third failed to achieve the Building Regs. standard. Less than 20% achieved the good practice standard of 7 m3/hr/m2

• Ensuring airtightness is achieved through careful implementation of strategy throughout the design and construction phases.[45]

- Air barriers must be impermeable to air, continuous, durable and accessible.
Internal air barriers need to be airtight; External air barriers need to be wind-tight.
Air barriers can be vapour open but require careful specification of adjoining construction and insulation materials.
Having made the building airtight, mechanical ventilation is essential.

- Laps in membranes should be rigorously sealed. Run a layer of double sided tape between the membranes at the overlap and run a tape over the leading edge of the outer sheet. Ensure that laps are positioned over a supporting area eg studs that can be battened for added security.[45]

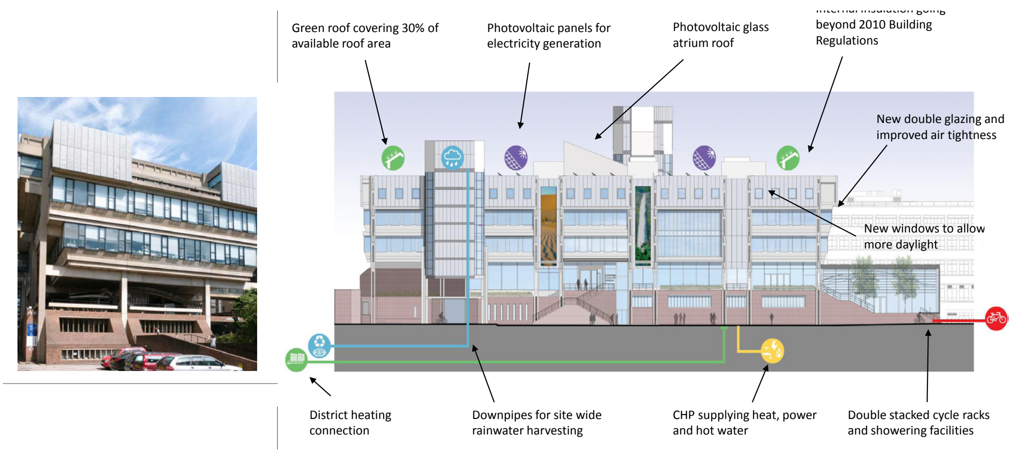


Fig. 133

"Retrofit strategies applied on the ARUP building (University of Cambridge), designed in late 1960s and undertaken a major retrofit intervention in 2013" Source: M. Dowson, A. Poole, "Domestic UK retrofit challenge"

Special wind and airtight membranes are available complete with adhesives, adhesive tapes and service penetration seals.

- When installing / reinstalling a window/door frame, ensure that the gaps around the frame are sealed. Gunned in compatible sealant is suitable for small joints, not forgetting joint cleaning and priming to ensure a good bond, but where the openings are larger, use a pre-compressed flexible expanding foam strip. Ensure that the airtight membrane meets and overlaps the seal to maintain the airtight layer overall. Do not use foaming gap-filling adhesives, they shrink and break the seal after the tests are complete.

- Use compatible gunned in sealant to seal joints between door / window frames and the surrounding wall externally. Internally, apply sealant to gaps between the wall reveals / window boards and the window / door units.

- Draughtstrip existing windows and external doors. (Do not draughtstrip to kitchens and bathrooms unless extract ventilation is provided.) Use synthetic rubber or elastomeric tubular seals. Use brush seals with sash windows.

- Draughtstrip the loft hatch. Ironmongery should be specified to ensure seals are compressed.

- Seal holes around services passing through the external wall including water, drainage, gas pipes, boiler flues and electrical cables. (Ensure that the sealant around boiler flues is heat resistant)

- Seal holes around service pipes passing through suspended timber floors.

- Seal holes around light fittings and pull cords in the ceiling. If the light fitting is not airtight then install an airtight box over the light fitting in the ceiling void. Choose airtight light fittings.

- Block up redundant fireplaces and insert vent. Cap the chimney.
Make sure the blocking up material is thermally insulating to reduce excessive heat losses.[46]

- Drylining is notoriously air leaky, consider parge coating the wall for airtightness before drylining. When drylining directly to an external wall, apply a continuous perimeter of adhesive. Ensure the joints between boards are sealed.

- Lay room-conditioned hardboard over existing square-edged floor boards. Seal the perimeter.

- Seal the joint between the ceiling and the external wall. Seal the joint between drylining and skirting board

FABRIC MOISTURE IN RETROFIT

The air inside buildings is generally warmer and more humid than external air with the result that any air leaking through the fabric carries a lot of moisture with it. There is a considerable risk that this moisture will then condense on colder surfaces towards the outside of the building envelope.

This is known as interstitial condensation. In retrofit scenarios, it is therefore usually a better solution to place the insulation on the outside of the existing fabric. Provided a vapour permeable weatherproof finish is applied externally, there should be very little risk of interstitial condensation. However, for heritage reasons, there will inevitably be many occasions where external solutions are simply not going to be permissible. In those circumstances, airtight linings are crucial as the internal surface of the external masonry will now be cold, providing ideal conditions for interstitial condensation and potential mould growth.

A further concern when internally insulating solid masonry walls is the potential buildup of moisture levels within the element from external conditions ie precipitation.[47]

Masonry walls are prone to absorb rainfall falling on exposed facades but this is usually mitigated by the drying effect of heat loss and the vapour permeable nature of lime mortar masonry. However, when this drying capability is removed by insulation and vapour/air barriers, a potential risk exists whereby moisture continues to build in the exposed wall over time until reaching the point where the inside surface of the masonry can be permanently saturated. The risk to the structures lies not only in mould growth on the inside surface or rot in timbers located in this position but also in causing a sheer split in the masonry due to freeze/thaw actions. Solutions to address this in exposed regions or where absorbent materials are prevalent include the use of vapour permeable silicate coatings externally to reduce the absorption of rainwater and the use of "intelligent" membranes, which allow moisture diffusion in both directions as conditions demand.

As much as 800 gr of water per sq meter per day can enter a structure through a 1mm per 1m gap.

INSULATION TECHNIQUES IN RETROFIT

FLOOR INSULATION

Insulating the ground floor is one of the most disruptive of all retrofit measures, often requiring removal of all internal fittings, furniture and finishes from the area being insulated. Floor structures are referred to as being suspended or solid. Suspended floors are typically very poor thermally, constructed of timber joists spanning between load-bearing walls (or bearing on secondary dwarf walls) supporting timber floorboards, which might be tongued and grooved or simply butted together.

The sub-floor void should be cross-ventilated via vents in the external walls and thus cold air can readily circulate through gaps in the construction. Solid floors are typically constructed of concrete, which might bear directly onto the ground or be supported via concrete beams with infill blocks. It is common practice to top the structural layer with a screed of 50–75 mm thickness.[48]

Timber floors should be checked for structural soundness and the presence of wet or dry rot before proceeding to retrofit any insulation. Insulation can be fitted between and above the existing joists, using rigid insulation boards, mineral wool batts or even loosely laid cellulose but care should be taken not to block cross-ventilation through the sub-floor void. Non-rigid insulations will require some form of support between joists such as wire netting stapled over and between joists or lapped breather membrane laid to form trays between joists. The latter helps to reduce air movement around the insulation from the sub-floor void and is essential for poured insulations. Rigid boards, such as polyurethane, can be supported on battens fixed beneath or at the base of each joist. These boards should ideally be slightly undersized so that foamed polyurethane can be applied around each junction. In all cases, care should be taken to insulate between all perimeter joists and the external walls, if necessary moving the last joist inboard to allow sufficient room.

Thermal performance can be enhanced by the addition of a further layer of rigid insulation across the timbers to reduce the thermal bridging effect of the joists – a structural layer of 12 mm plywood may be required as extra support with some forms of rigid insulation. The insulation will have to be protected by a chipboard or plywood deck, which, if taped appropriately, can also form the airtight barrier (in this case, the tapes may need the additional protection of a layer of hardboard). Alternatively, a continuous airtight membrane system could be applied beneath the deck layer.

Solid floors, where sound, should be insulated with high-performance rigid insulation above the existing concrete or screed in the form of a "floating" floor. Laying a continuous damp-proof membrane beneath the insulation is advisable, taking care to overlap with any damp-proof course (DPC) in the external walls. The insulation may be supplied pre-bonded to a chipboard deck or may require a separate deck to be laid.[49]

Considerations for the airtight barrier are consistent with those for suspended floors.

Whether in an existing solid or a suspended floor situation, the impact of additional layers of insulation on other existing features should be thoroughly considered before proceeding with this measure. Examples would include the reduction in room, cill, door opening and switch heights, the need to undercut door leafs and the decrease in riser height at the bottom step of any stair.

The most common methods are:

1. Upgrading an existing slab

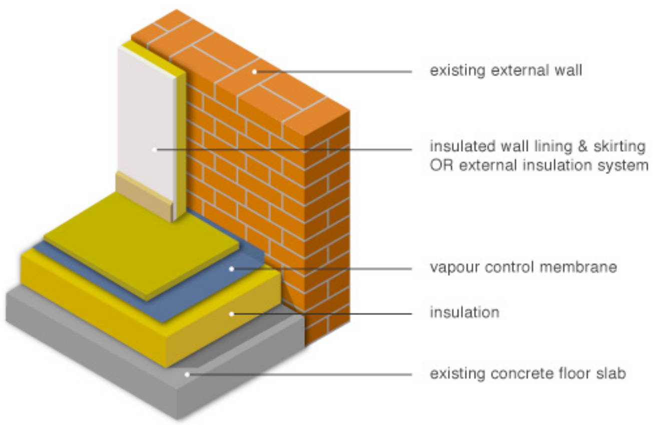


Fig. 134

"Upgrading an existing slab solution"

Source: S. Burton, "Sustainable retrofitting of commercial buildings"

The easiest way of improving thermal performance, adding an insulation and a new floor deck on top of the existing floor.[50]

2. New slab - insulation above slab

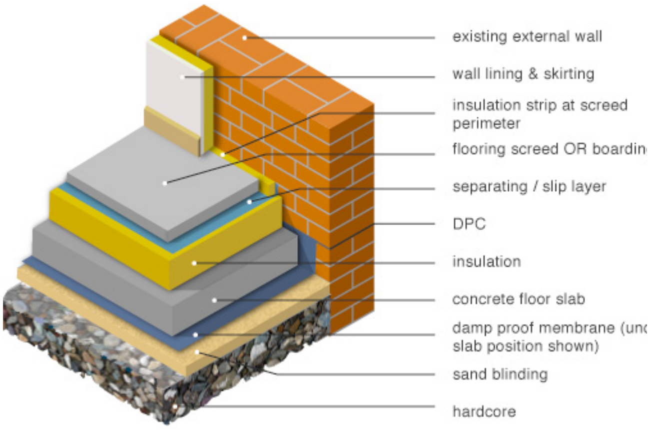


Fig. 135

"New slab - insulation above slab solution"

Source: S. Burton, "Sustainable retrofitting of commercial buildings"

The floor finish over the insulation can be either screed or boarding. It is argued that a screed finish is more durable and can offer a modicum of thermal mass otherwise absent. Board finishes, on the other hand, can be quickly installed and provide a quicker thermal response time. Ensure that the damp proof membrane (either above or below the slab) provides continuity with the damp proof course in the surrounding walls.
Insulation above the slab increases the heating response time. Temperatures will increase more quickly when the heating system is switched on in comparison with below slab insulation.
The insulation zone can be used to run services and underfloor heating.[51]

3. New slab - insulation below slab

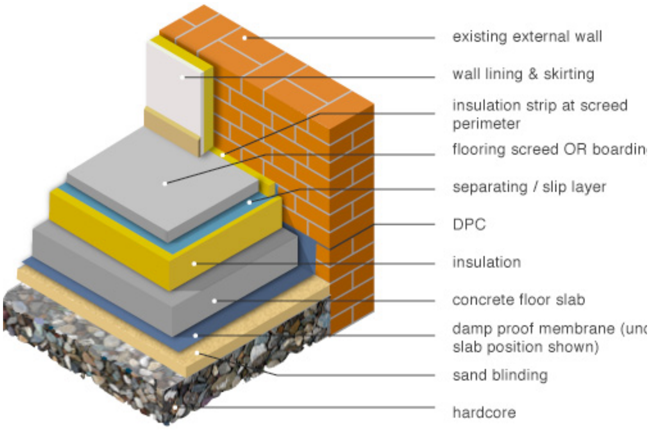


Fig. 136

"New slab - insulation below slab solution"

Source: S. Burton, "Sustainable retrofitting of commercial buildings"

It provides thermal mass, particularly useful in southward facing rooms and helps maintain steady temperatures; moreover, the thickness of insulation is less restricted than for an above-slab condition.
Point loading is less of an issue where the load is spread over the slab.

4. Suspended timber floor

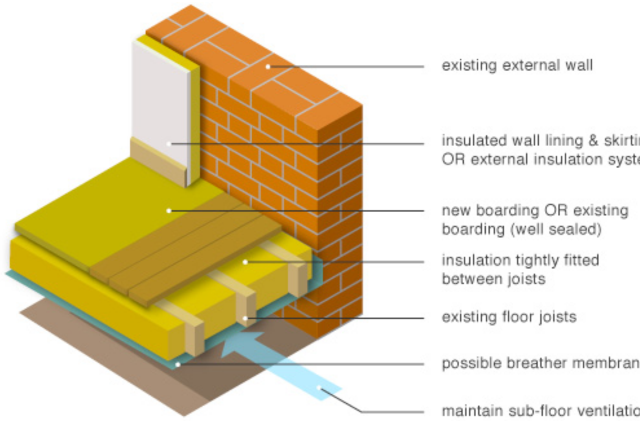


Fig. 137

"Suspended timber floor solution"

Source: S. Burton, "Sustainable retrofitting of commercial buildings"

Suspended timber ground floors can be easily upgraded. A range of insulation materials can be fitted between the joists to make a quick and efficient contribution to reducing overall heat loss.
- Rigid slabs can be friction fitted from above against nailed timber bearings to the sides of the joists;
- Insulation quilts can be installed upon mesh or netting to suspend between or fixed to the underside of the joists.
- Blown insulation needs to be contained by mesh or boarding beneath the joists.

• One of the most important issues with timber floors, is their propensity for air leakage. Where old floorboards are relayed or new ones installed, careful attention is needed to ensure that all joints between boards are adequately sealed.
• Insulation should be taken right up to the edge of the floor and any space close to the outside wall filled with insulation to avoid any gaps. Insulate between the last joist and the wall.
• Ensure that there are no gaps between the insulation and the u/s of the floor.
• Insulate hot water pipes.
• Provide a flexible sealant between the skirting and the floor finish to limit air leakage.

• Where polystyrene insulation is specified, ensure that it does not come into contact with PVC cabling.
• Maintain sub-floor ventilation
• One of the problems of providing continuous ventilation to the underside of the floor, is that it can greatly restrict the efficiency of the insulation, particularly loose-fill and mineral fibre. One consideration might be to attach a breather membrane to the underside of the floor joists.[52]

WALL INSULATION

CAVITY WALL INSULATION

Cavity wall insulation (CWI) is a common form of retrofit whereby insulation is injected into the void between inner and outer leafs of masonry walls, a form of construction typical since 1920. The Government estimates that around 18.6 million homes in Great Britain have cavity walls of which only 10.3 million have been insulated. When improving cavity insulation the main considerations are:
• avoiding gaps between injection points where thermal bypass can occur
• avoiding moisture ingress across leafs in regions with high exposure
• avoiding damage to any materials within the cavity through inappropriate specification.
Materials suitable for insulating cavities include the following:
• polystyrene beads
• mineral wool (glass or rock wool fibres)
• urea formaldehyde foam
• urethane foam.
Most systems can be used throughout the UK – mineral fibre and expanded polystyrene bead CWI have British Board of Agrément (BBA) certificates for use in all areas but urea formaldehyde foam has a British Standards Institution (BSI) certificate with certain restrictions in severe weather zones, including coastal areas. Problems with rain penetration are rare, especially if walls are rendered, and warranties are available for most systems from the Cavity Insulation Guarantee Agency (CIGA).[53]

EXTERNAL WALL INSULATION

External wall insulation (EWI) comprises an insulation layer fixed to the outside of an external wall, using a combination of mechanical fixings and adhesive depending on the material used, with a protective render or cladding finish. It is suitable for solid wall, non-traditional and cavity wall properties and offers several advantages, as well as the improvement of energy efficiency standards:

• The work is done externally so there is very little disruption and no loss of living space.

• The system will protect the property and the results can improve the appearance of the building through a range of external finishes.

• Condensation risk is managed to the outside of the home and there should be little thermal bridging if the insulation layer is continuous.

• It needs little maintenance while, internally, no redecoration is needed.

Proprietary insulation systems use a variety of rigid insulation types depending on the characteristics needed, such as mineral wool batts, expanded or extruded polystyrene and phenolic foam boards. Key selection considerations are: fire resistance; thermal performance (ie thickness); weight and cost. Adhesive is applied to the back of boards to create a continuous combed surface suitable for bedding and adjusting the boards – it is important that due care is given to the avoidance of any gaps behind the boards which could lead to thermal bypass. A parging coat may be applied prior to fixing the insulation to smooth out any surface irregularities and act as the air tightness barrier. Proprietary insulation anchors, sleeved in plastic, are then used to mechanically secure the boards.

Finishes fall into two categories: wet render systems (either thicker cement mineral renders or thinner synthetic renders); or rainscreen systems (comprising panels or boards on a carrier system of either timber battens or aluminium rails). Wet render systems are typically built up using mesh and base coats, before the final throughcoloured top coat. Where a brick appearance is required, 20 mm thick brick slips may be adhered directly onto the insulation or, alternatively, a two-coat render build-up is used to achieve the same appearance. Rainscreen carrier systems may reduce the thermal performance of the insulation, particularly where metal brackets are used.[54]

While EWI may at first appear to be the least disruptive solid wall insulation solution, there are a number of constraints to overcome. Typical cases include:

• eaves, soffits and verges, particularly where the proposed insulation thickness exceeds the existing projection. Care must be taken to achieve thermal continuity with the roof insulation

• junctions with windows where, if possible, consideration should be given to overlapping the window frame to further improve energy efficiency of these elements. Window cills will most likely need to be extended also. If at all feasible, window replacement should take place concurrently with EWI as the replacement windows can then be integrated into the plane of the insulation to reduce thermal bridging at the edges.

INTERNAL WALL INSULATION

Internal wall insulation (IWI) comprises an insulation layer fixed to the inside of an external wall, using a combination of mechanical fixings and adhesive depending on the material used, with a decorative plasterboard finish. It is suitable for solid wall, non-traditional and cavity wall properties and might be selected over EWI for a number of key reasons, as well as in the improvement of energy efficiency standards:

- The work is done internally so there is no impact on planning policy, although Listed Buildings may need specific permission.
- It can be installed in one room at a time so disruption is minimised.
- Installers will not need to use scaffolding.

IWI systems use a variety of insulation types depending on the characteristics needed:

- EPS-backed thermal laminate boards
- phenolic foam-backed thermal laminate boards
- foil-backed polyisocyanurate boards plus dry-lined service zone
- aerogel lining boards
- insulated stud mineral wool systems
- wood fibre lining boards
- rigid "wool" boards
- anti-mould growth linings.[55]

The greatest concern with internal wall insulation is the control of moisture. Water vapour can pass through the wall build-up by both diffusion through the insulation layer but far more significantly by air movement through gaps in the system between insulation boards. It is therefore vital to introduce a continuous vapour barrier to prevent moisture meeting the cold inner surfaces. By separating the insulation, vapour control layer and plasterboard, greater control over continuity can be achieved compared with a thermal laminate board solution and electrical services need not penetrate the vapour control barrier.

LOFT (CEILING) INSULATION

Ventilated loft spaces are a common feature in the UK housing stock. A significant proportion of a building's heat loss is through the roof, yet this is relatively easy to address through insulation laid between and above the ceiling joists. The Government estimates that only around 12.9 million homes in Great Britain, or around 55% of the total homes with lofts, have been insulated with more than 125 mm of insulation. When improving loft insulation the main considerations are:
• avoiding thermal bypass and crushing of the insulation
• maintaining cross-ventilation
• reducing air leakage from the rooms below.

Thermal bypass can occur at the eaves, where air circulates under the perimeter of the insulation, or between layers of quilt where they are lifted by obstructions such as services or roof structures. Furthermore, the effectiveness of loft insulation is greatly reduced if heavy items are placed on top, crushing the air pockets between fibres.

This can be avoided by constructing a decked platform above the proposed insulation level. Measures to address these concerns might include the use of eaves trays, careful cutting of mineral wool around obstructions or relocating services inside the thermal envelope. For trussed rafter roofs or other complex structures, blown loft insulation should be considered as this could more readily fill inaccessible pockets.[56]

Fig. 138

"Well insulated loft space, showing both retrofitted eaves ventilation trays and a vent tile above well fitted mineral wool batts"

Source: ECD architects

To avoid condensation on the underside of roofing felts, ventilation must be maintained across the roof space, typically from eaves to eaves. It can be avoided by carefully fixing insulated boards or proprietary retrofit eaves vents between the rafters above the wall plate to contain any insulation and maintain a clear air passage of minimum 50 mm. The wall plate may require chamfering to assist this operation.

Alternatively, new tile vent terminals can introduce cross-ventilation above the level of the proposed top-up insulation.

Finally consideration should be given to reducing air leakage from ceiling penetrations such as light fittings, cabling and loft hatches as part of an overall air tightness improvement strategy for any retrofit. If ceilings cannot be replaced, all cable penetrations should be sealed with proprietary tapes or grommets on the warm side – over-boarding with another layer of plasterboard will then be required to conceal these measures. If head heights permit and the level of disruption is acceptable, consideration should be given to replacing plasterboard ceilings with a taped 18 mm oriented strand board (OSB) lining to create an airtight barrier and a void for all service runs.

This void can be then faced with a second plasterboard layer. Conventional loft hatches are poor both in terms of thermal continuity and air tightness. Consideration should be given to replace them with more robust, higher performance proprietary types or even relocating access to a gable end outside of the thermal and airtight envelopes.[57]

PITCHED ROOF INSULATION

In roof configurations where the internal ceiling line follows the pitch of a roof, thermal insulation upgrades have to be added at rafter level. Such a "room-in-theroof" arrangement may already exist or arise as a result of a loft conversion to create additional habitable space. When improving pitched roof insulation the main considerations are:

• adding insulation in a practical manner while eliminating any thermal bridging of the roof structure
• maintaining cross-ventilation behind the roof finish, where the construction cannot be made vapour permeable
• achieving an improvement in air tightness while working around existing framing members.

Pitched roofs can be upgraded by adding rigid insulation boards or batts between the existing rafters but it is unlikely that this will be sufficient to meet best practice standards. Insulation will therefore need to be added either above or below the rafter zone as a continuous layer. Decisions to be made include:

• whether the existing roof finish layer is to be replaced or retained, ie the slates, tiles or metal
• whether it is more practical to insulate above or below the roof structure
• how to overlap the insulation (and air barrier) with any EWI or IWI and maintain thermal continuity.

If the roof finish is being replaced, and there are no planning constraints on doing so, the best practice approach is to insulate above the existing rafters. Consideration should be given to using vapour permeable rigid insulation boards, such as wood fibre, to allow the release of any moisture present in the roof structure. Battens and counter battens can be fixed through the insulation to ventilate the space under the roof finish. A continuous vapour check will be required on the inside surface, which also forms the air tightness barrier. Mineral wool quilt can be used in the same situation in conjunction with a secondary roof structure, for example, engineered timber I-beams.[58]

FLAT ROOF INSULATION

Upgrading flat roofs can be relatively straightforward to achieve. The main considerations are:
• increasing the thermal performance, or U-value, of the roof build-up
• maintaining the waterproof membrane
• avoiding thermal bridging at the junction with the wall insulation.
Flat roofs are insulated by adding rigid insulation boards above the existing structure. Decisions to be made include:
• whether to remove or retain the existing waterproof layer
• whether to choose a warm or inverted roof solution
• how to overlap with any EWI and maintain continuity.
Warm roofs are preferred. As with inverted roofs, there is a tendency for cold rainwater to percolate between the insulation to the waterproof layer. However, inverted roofs have the advantage that the roof membrane is protected. Typically, additional roof timbers are required to carry an extended eaves and fascia to accommodate the EWI.[59]

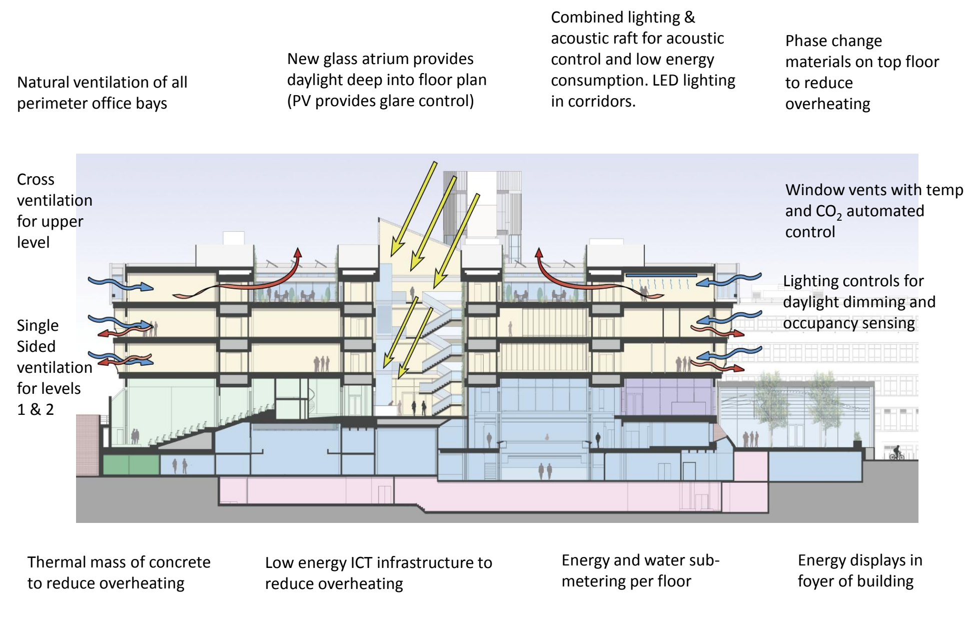


Fig. 139

"Additonal retrofit strategies on ventilation and light applied on the Arup building of 1970"

Source: M. Dowson, A. Poole, "Domestic UK retrofit challenge"

WINDOWS

Upgrading poorly performing windows is an important part of improving the building fabric. They can be a major source of heat loss from both conduction and air leakage, while the cold surface they present to the interior of a room is a contributor to downdraughts and prone to condensation. When improving windows, the main considerations are:

• increasing the thermal performance, or U-value, of the glazing and/or the frame
• reducing unwanted air infiltration around the frames and opening lights
• reducing thermal bridging at the window reveals
• supporting the ventilation strategy, whether that be maintaining an existing approach or accommodating a new one.

There are three retrofit strategies for windows, the selection of which may depend on planning or financial constraints:
• upgrading the existing window system or adding secondary glazing
• independently replacing the windows
• replacing the windows concurrently with IWI or EWI measures.[60]

Where windows are to be retained, it is possible to achieve energy efficiency improvements by installing higher specification glass and draught-stripping around opening lights and frames. It is important to establish whether any frames to be retained can accommodate thicker glazing units, for example, when improving from single to double or even triple-glazing. In Listed Buildings or within Conservation Areas, there may be restrictions on alterations to the appearance of existing windows.
Other strategies could be the replacement of single-glazing with slimline double-glazing or vacuum glass.
As an alternative to changing the existing glazing it may be possible to apply an additional low emissivity film layer to the inside face, or to supplement the retained windows with secondary glazing.[61]

EXTERNAL DOORS

As with windows, upgrading doors to improve thermal performance and air tightness should form part of any comprehensive retrofit strategy. Doors are also defined as controlled fittings in the Building Regulations, but only where door and frame are being replaced simultaneously. The limiting factor for replacement is defined by the maximum permitted U-value of 1.8 W/m^2K for the whole door. Therefore, when improving entrance doors, the main considerations are:

- increasing the thermal performance, or U-value, of the door and the frame
- reducing unwanted air infiltration around the frames and the door leaf
- reducing thermal bridging at the door reveals
- accounting for functional aspects such as security and post delivery.

There are three retrofit strategies for doors, the selection of which may depend on planning constraints, budget or opportunity:

- upgrading the existing door leaf
- independently replacing the door and frame
- replacing the door concurrently with IWI or EWI measures.[62]

If the door structure allows, it may be possible to refurbish panels in an existing door leaf to introduce insulation in the form of polystyrene, polyurethane or even vacuum-insulated panel (VIP) cores. New panelling could be retrofitted outside the existing stiles, mullions and rails to create a new appearance. Draught stripping should be applied at the same time to reduce unwanted air leakage.

New doors can be obtained that achieve as high a thermal performance as windows at a U-value of 0.8 W/m^2K, incorporating triple-glazed lights, pre-insulated cores and double seals. Unlike windows, doors should usually be fitted by screw-fixing directly into the adjacent opening jambs in order to be able to cope with the additional stresses created when opening heavy doors.[63]

FITTINGS

As well as the controlled fittings, additional measures may be considered to further reduce heat loss or reduce solar gains. Thermally insulating window hangings are available to retain additional heat within the room at night, for example. Solar control measures include: external blinds, retractable louvres, external shutters, brise-soleil.[64]

Fig. 140 *"Court Farm road: view of the facade (top left), interior (top right) and solar panel solution (below)"* Source: ECD architects

Technological Retrofit

5.3.1 Midterrace House, 1930s South London

Date: *2010*

Architect: *ECD Architects*

The aim of the project was to establish the most effective overall package of retrofit measures on a typical UK midterrace Victorian house, necessary to achieve a 80% reduction in CO2 emissions.

225 Court Farm Road was built in the 1930's as part of a large estate development. The external walls are of cavity wall facing brick construction and the original dwelling included suspended timber floors and pitched tiled roofs but no bathroom.

Later improvements saw the inclusion of a first floor shower room, the replacement of open fires with a central heating system of gas combination boiler with radiators and the addition of a single-storey rear extension comprising a third bedroom and ensuite bathroom.

Fabric improvements over time have seen the addition of double glazing (though of poor quality) and 100mm loft insulation to the pitched roof, though the flat roofed extension included only 25 mm mineral wool insulation. A solid concrete floor replaced the timber in the kitchen and the strip out works found that the original water supply was via lead piping and an asbestos tank, with no stop-cock found on the premises. Further asbestos was found in the soffit boards.

Initial design proposals investigated the potential for a loft conversion at the property but this was eventually ruled out due to a lack of headroom. There is an imperative to enlarge the first floor shower room and further space is required for hot water storage and electrical equipment (inverters, dataloggers etc).[65]

PERFORMANCE PRIOR TO RETROFIT

• The existing house had a SAP rating of 60, well above the national average of 48 and therefore presenting a significant challenge to achieve the 80% reductions.

• An initial 'base case' airtightness test was executed with which to compare the completed scheme and to highlight existing leakage points that need mitigation. The test revealed a surprising 9.16 m3/hr/m2 @ 50 pascals, which is better than current building regulation requirements. The windows were the source of the worst infiltration with poor seals leaking air badly, followed by incoming services penetrations and the loft access hatch.

• According to PHPP software, specific primary energy use (heating, DHW + auxilliary electricity) at the existing property is estimated to have been 414 kWh/m2/yr with CO2 emissions rated at at 100 kg/m2/yr and space heating demand rated at 223 kWh/m2/yr.[66]

RETROFIT PRIORITIES

- Obtain an overall 80% reduction in energy use, employing the most straightforward of improvements.
- Minimise heat losses from the building fabric
- Install an easily replicable, efficient form of space and water heating
- Reduce the energy requirements for lighting
- Utilise the most appropriate renewable forms of micro-generation

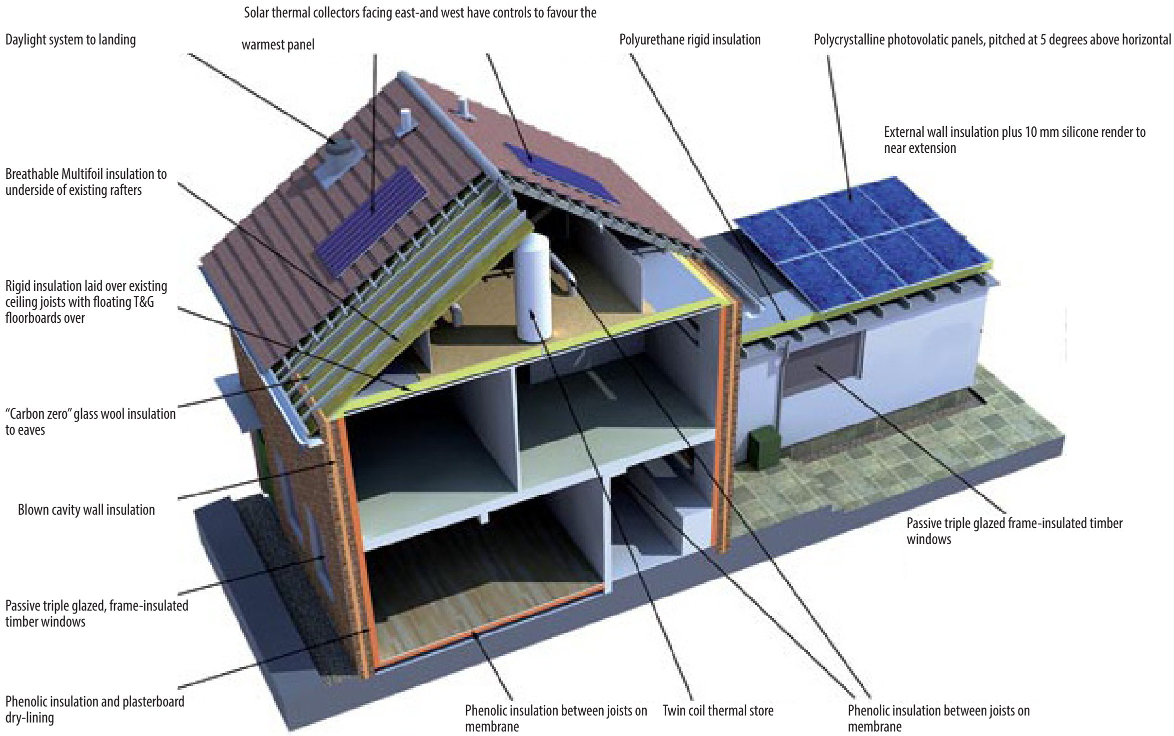


Fig. 141 *"Main solutions applied during Court farm road retrofit"* Source: ECD architects

REDUCING HEATLOSS

· Suspended timber floor – 0.2 W/m2K
· External walls – 0.15 W/m2K
· Pitched or flat roofs – 0.1 W/m2K

FLOORS AND WALLS

• In the choice of insulation material, thermal performance and ease of installation has been favoured over embodied energy and material source considerations, although minimal GWP and ZODP credentials were pre-requisites.

• Phenolic foam insulation offers the best performance of any readily available panel and therefore has less impact on internal room dimensions where dry-lining is concerned – an important consideration for Hyde. Kingspan's Kooltherm phenolic range was therefore selected for both suspended floors and external walls. For the main body of the house, insulation-backed K17 plasterboard dry-lining panels were specified, whilst for the rear extension external K5 wallboards with a silicone render finish provides the best solution.

ROOFS

• For the pitched roof element, a number of other factors came into play rather then straightforward thermal performance.
The loft is to be used for locating plant such as the proposed thermal store and mechanical ventilation unit, therefore access and available headroom were important factors, as was the poor condition of the existing roofing felt.
-Simultaneously, architects were concerned about achieving good airtightness when recessed light fittings were introduced to the ceiling below.
A combination of insulation products were therefore selected – the first one laid on an airtight vapour barrier over the existing ceiling joists, and the second multi-foil lining the existing rafters and party walls. The rigid boards are laid to the depth of an existing central bearer (170mm), thus allowing a floating floor deck to pass freely across the loft area.

• For the rear extension roof Kingspan Thermapitch rigid polyurethane boards (220mm) were preferred, in conjunction with Knauf Carbon Zero glasswool in the eaves location.[67]

WINDOWS

• The existing double-glazed windows were shown to be the weakest building element during the airtightness test: they will be replaced with aluminium-clad Passive windows, which are triple-glazed with warm edge spacers and composite insulated timber frames, achieving an overall Uw-value of 0.7 W/m2K.

• Front and rear doors will also be replaced with insulated replacements with a Uw-value of 1.0 W/m2K.[68]

HEATING

VENTILATION AND HEAT RECOVERY

To provide controlled ventilation, a 275 mechanical ventilation system is being retrofitted into the property. Mounted on the party wall in the loft space, the unit will extract air from the kitchen and bathrooms, reclaiming around 90% of the heat to pre-warm incoming fresh air which is then supplied to the living and bedrooms. In summer mode, a bypass extracts the air direct to outside

SPACE HEATING

With the above measures in place, the space heating requirements at the property are estimated to reduce from 17,238 kWh/yr to 2,410 kWh/yr – a drop of over 86%. With such low levels of heating required, tenant fuel bills will be significantly reduced. Capital cost, ease of retrofitting and ongoing maintenance requirements therefore become the most important driver in the choice of fuel source.

SYSTEMS CONSIDERED BUT REJECTED

• **Ground source heat pumps**: are relatively expensive to install and need to be located in a substantial, and preferably sound-proofed, cupboard. Furthermore, to operate efficiently they work best in conjunction with an underfloor heating system, which in itself has inherent problems in a retrofit situation.

• **Underfloor heating**: The feasibility for underfloor heating was explored by ECD and Mears and found to be technically possible but only with a reduction in underfloor insulation levels and an increase in installation time and cost. When further confronted with a solid concrete floor in the kitchen, the concept was rejected in favour of a conventional wet radiator system.

• **Heat pumps**: Heat pumps require electricity to operate, which in the UK is particularly carbon intensive – more than twice the kgCO2/kWh than mains gas. Therefore to produce carbon reductions in comparison with an efficient gas condensing boiler, heat pumps need to achieve a Coefficient of Performance greater than 2.5 measured across the whole year – the recent trials at the Barratt EcoSmart show properties recorded a CoP of 2.6. Air source heat pumps are unlikely to improve upon these results at present and would also require underfloor heating.

• **Biomass boiler**: A biomass boiler was also ruled out by Hyde as it was thought to place an undue burden on the tenant to source and store a supply of wood pellets, and would again require additional plant space.[69]

DOMESTIC HOT WATER

The gas condensing boiler will also supply hot water to the property but will be supplemented by solar thermal collectors located on the pitched roof. The system is to be installed with a twin-coil thermal store located in the loft space. Two flat plate collectors mounted either side of the ridge will face east and west but will be controlled intelligently to favour the better performing panel as the sun tracks around the house to the south. It is hoped that 50-60% of the tenant's hot water needs will be met by this system. All connecting pipework between boiler and thermal store will be well insulated to prevent heat transfer to the internal environment.

LIGHTING

Unlike typical low energy lighting solutions, the use of compact fluorescents is avoided in favour of the latest in LED technology. Unlike CFLs, LED lamps contain no contaminants such as mercury or phosphor and can be safely disposed of or recycled. Although they are much more expensive currently, they can last up to 20 years rdeucing the energy impact on the environment.[70]

WATER EFFICIENCY

• Though driven primarily by low-carbon targets, the project offered an opportunity to incorporate other sustainable refurbishment measures. Water conservation measures are also a key interest for Hyde and the two bathrooms will subsequently be fitted with Flushwise (2.6l/4.0l dual-flush) wc's, aerated basin taps, Mira Eco shower handsets and a low volume bath.

An alternative way of harvesting rainwater

• The project team did not consider conventional rainwater harvesting, stored underground and pumped up to a header tank, to be viable for a stand-alone property - primarily in terms of the installation and maintenance costs but also in terms of energy and carbon savings.

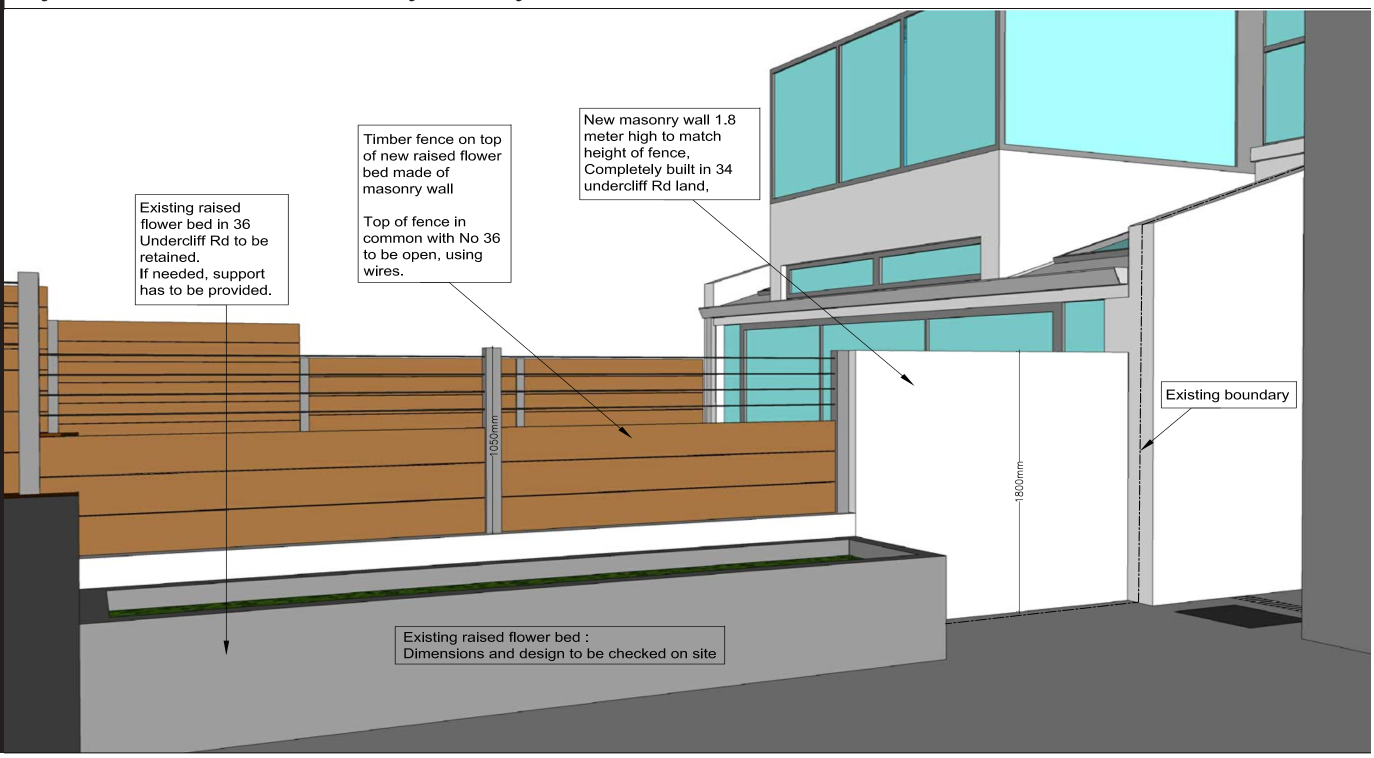
A recent study by the Centre for Alternative Technology (CAT) has proven that the embodied energy consumed in the manufacture of buried tank systems is never paid back through its life by the savings made from utilising rainwater.[71]

However, similar Retrofit projetcs in UK have experience of installing simple gravity-fed harvesting systems and have designed a proposal based around a filtered 318 litre tank located in the void above the stairs. The tank is fed directly from an external downpipe, requires no pumps and therefore requires no parasitic electricity and next to no maintenance. Parity Projects' calculations indicate that virtually all of the water required for flushing could be supplied from the annual average rainfall locally. A meter on the back-up supply will determine actual annual mains water consumption.

Undercliff Road, London

Figg. 142-143 *"View of the facade (left) and of the rear elevation (right)"* Source: Love architecture Ltd.

Fig. 144 *"Model of the rear elevation with some strategies used during retrofit"* Source: Love architecture Ltd.



4.4.2 Terraced House - Undercliff Road

Strategies applied on a semi-terraced house in collaboration with Love architecture Ltd.

1. Existing and new roof insulation upgraded to building regs standard
2. Existing front and rear walls lined with plasterboard on insulation on timber battens. Cavity between insulation and brickwork vented top and bottom by standard weep vents inserted into 'perp' joints in brickwork at approx 900mm centres to avoid condensation.
3. Existing and new suspended timber floor insulated to building regs standards.
4. Whole house SAP calculation required as the proposed extensions could not satisfy the Area Weighted U-value calculations.
5. Existing timber sash windows to street facade repalced with new timber double glazed with u-value 1.6
6. Rear elevation new aluminium windows and doors with U-value 1.5
7. Thermal store in large cupboard on top floor with controls located adjacent.
8. New wood burning timber stove conforming to DEFRA standard for smokeless zone feeding thermal store. Cleints wanted a built in wall fire but no products on the market which conform to DEFRA standard for smokeless zones.
9. Solar panels with glycol on west facing elevation of dormer feeding thermal store.
10. Heat build up in glazed clothes drying room on rear elevation collected by heat exchangers at high level and feeding thermal store by hot water.
11. Gas boiler in front bathroom (only location that could accommodate the flue) feeding thermal store as back up.
12. Underfloor central heating on all floors fed from lower, cooler section of thermal store.
13. Hot water supply from top section of thermal store.
14. Low energy lights throughout house.

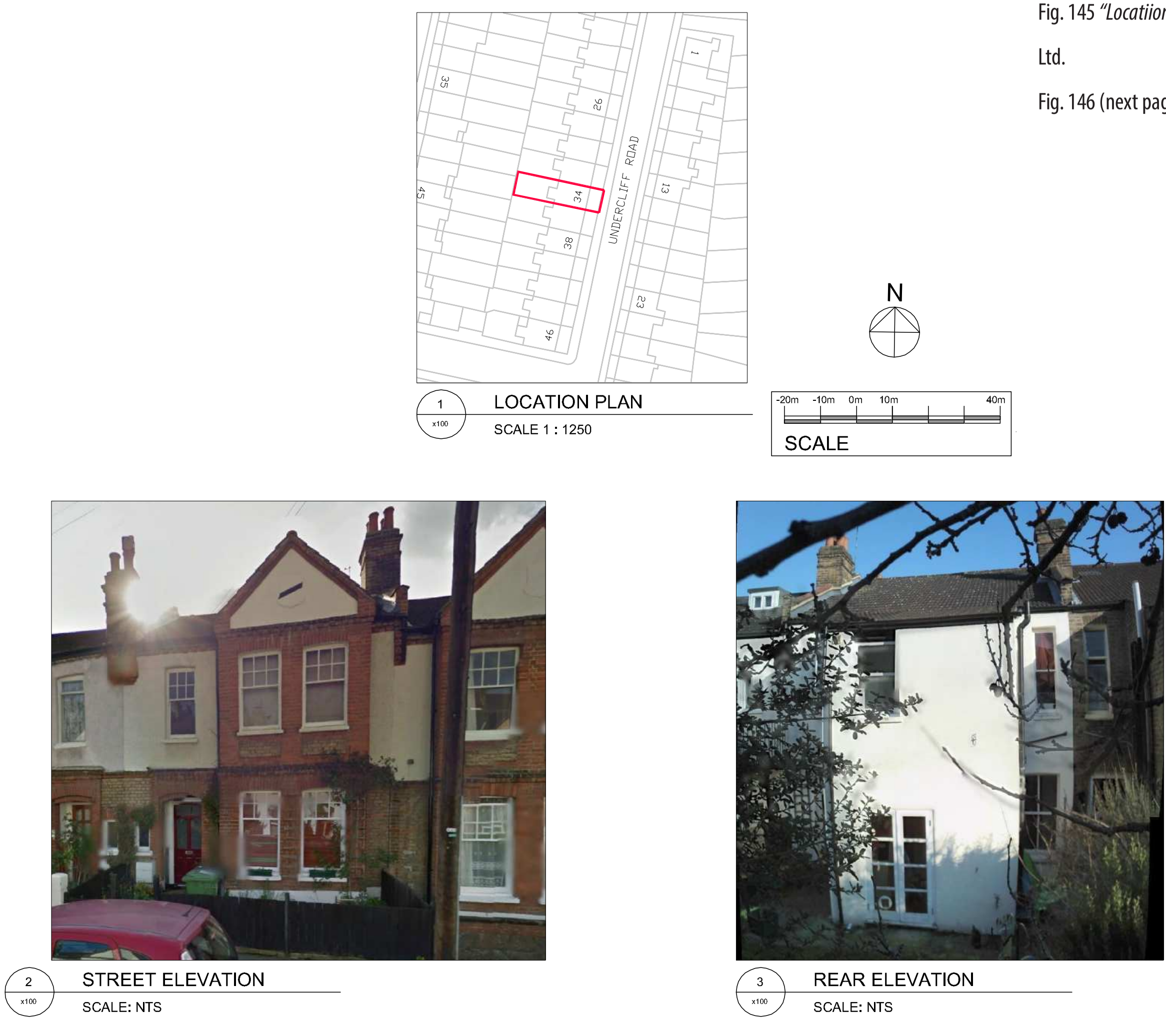
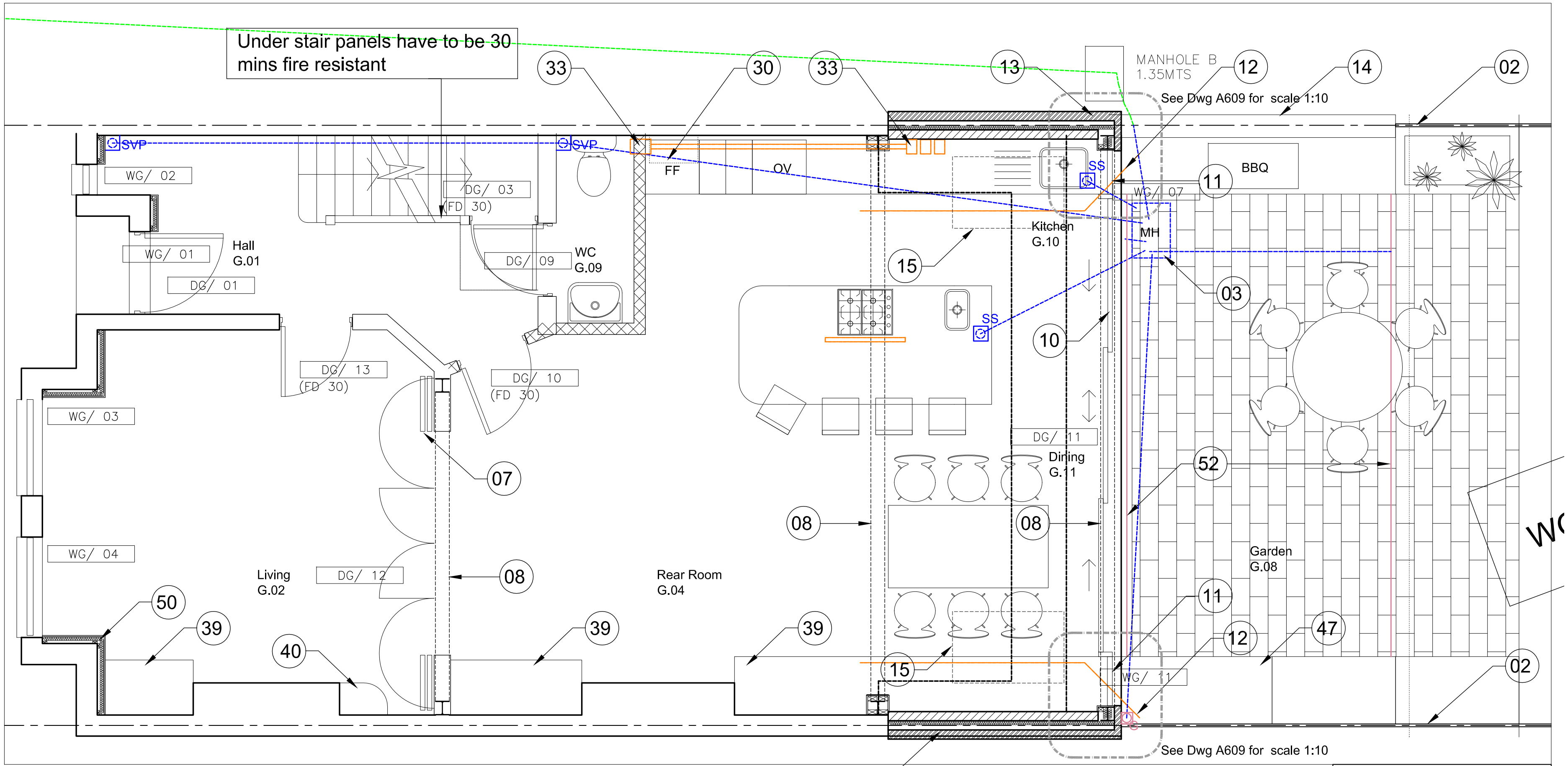


Fig. 145 *"Locatiion plan of 34 Undercliff Road, London)"* Source: Love architecture Ltd.

Fig. 146 (next page) *"Ground floor plan as proposed"* Source: Love architecture Ltd.



1 A300 GRD FLOOR AS PROPOSED

SCALE 1 : 50

13

For Construction References see Schedule of Works: A913

0 1m 2m SCALE

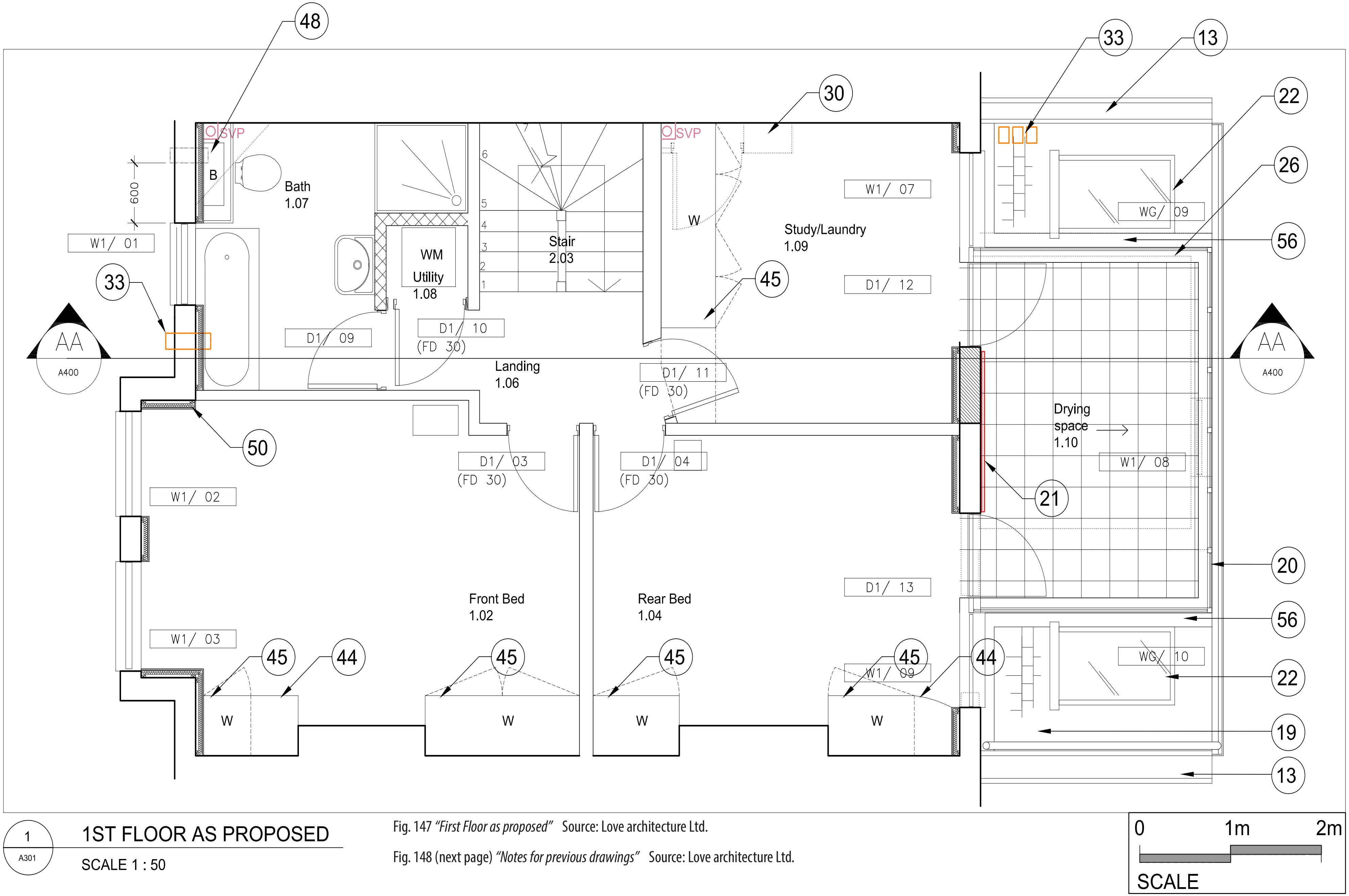


Fig. 147 *"First Floor as proposed"* Source: Love architecture Ltd.

Fig. 148 (next page) *"Notes for previous drawings"* Source: Love architecture Ltd.

NOTES

For Construction refs see Schedule of Works A913

01. Boundary
02. Existing timber fence
03. Manholes
04. Existing Thames Water drain
05. Existing tile roof
06. Existing fireplace & chimney
07. New opening with folding doors - see 2.2.2.3, 4.2.2 and 4.2.6.1
08. New beam over - see 3.2.3, 3.10.3 & 3.11.3
09. Island - see 7.10.5
10. Sliding glass panel - see 4.10.6
11. Fixed glass panel - see 4.10.5
12. Ventilation below floor - see 3.10.5
13. New party wall straddling boundary - see 3.10.4
14. New garden wall height existing fence
15. Line of glass roof over
16. 150 mm ventilation air gap
17. Drainage channel - see 5.21.1
18. Tile hung wall - see 3.22.4.2
19. Tiled roof to match existing
20. Obscured glazed drying enclosure - see 4.21
21. Pipes to collect solar gain
22. Rooflight - see Section 4
23. Hot water storage - see 5.26
24. Line of sloping glass roof beyond
25. Louvres to vent solar gain
26. Line of existing rear extension
27. Flat roof finished in roofing felt - see 3.22.6.2
28. New stair to loft - see 4.24.3
29. Fire protected stairwell - see 4.24.1
30. Existing chimney demolished
31. Stepped DPC
32. Roof vent - see 3.22.6.2
33. Extract vent - see Sect 6
34. Suspended timber floor insulated -see 3.1.5
35. Fire resistant door
36. Removable box on wheels - see sect 7
37. Openable base to under stair area - see sect 7
38. Fixed cover plate - see sect 7
39. Cupboard - see sect 7
40. Shelf - see sect 7
41. Existing coving
42. Desk - see sect 7
43. Existing picture rail
44. Bookshelf - see sect 7
45. Wardrobe with rail or sliding shelves inside - see sect 7
46. Fireplace - see 3.2.4
47. Logs storage - see sect 7
48. New Boiler - see 5.18.6
49. Filing cabinet - see sect 7
50. Internal insulation - see 4.1.4
51. Cantilivered slab to SE spec - see 3.10.5
52. Linear drain - see 3.8.2.3
53. New RW gully - see 3.8.2.2
54. Timber dwarf wall finsihed render - see 3.21.4
55. Replacement timber windows - see 4.2.5
56. Lead flashing forming gutter - see 4.10.5.3
57. UPVC Gutter - see 5.8.2
58. Access panel to under roof storage

NOTES

For Construction refs see Schedule of Works A913

01. Boundary
02. Existing timber fence
03. Manholes
04. Existing Thames Water drain
05. Existing tile roof
06. Existing fireplace & chimney
07. New opening with folding doors - see 2.2.2.3, 4.2.2 and 4.2.6.1
08. New beam over - see 3.2.3, 3.10.3 & 3.11.3
09. Island - see 7.10.5
10. Sliding glass panel - see 4.10.6
11. Fixed glass panel - see 4.10.5
12. Ventilation below floor - see 3.10.5
13. New party wall straddling boundary - see 3.10.4
14. New garden wall height existing fence
15. Line of glass roof over
16. 150 mm ventilation air gap
17. Drainage channel - see 5.21.1
18. Tile hung wall - see 3.22.4.2
19. Tiled roof to match existing
20. Obscured glazed drying enclosure - see 4.21
21. Pipes to collect solar gain
22. Rooflight - see Section 4
23. Hot water storage - see 5.26
24. Line of sloping glass roof beyond
25. Louvres to vent solar gain
26. Line of existing rear extension
27. Flat roof finished in roofing felt - see 3.22.6.2
28. New stair to loft - see 4.24.3
29. Fire protected stairwell - see 4.24.1
30. Existing chimney demolished
31. Stepped DPC
32. Roof vent - see 3.22.6.2
33. Extract vent - see Sect 6
34. Suspended timber floor insulated -see 3.1.5
35. Fire resistant door
36. Removable box on wheels - see sect 7
37. Openable base to under stair area - see sect 7
38. Fixed cover plate - see sect 7
39. Cupboard - see sect 7
40. Shelf - see sect 7
41. Existing coving
42. Desk - see sect 7
43. Existing picture rail
44. Bookshelf - see sect 7
45. Wardrobe with rail or sliding shelves inside - see sect 7
46. Fireplace - see 3.2.4
47. Logs storage - see sect 7
48. New Boiler - see 5.18.6
49. Filing cabinet - see sect 7
50. Internal insulation - see 4.1.4
51. Cantilivered slab to SE spec - see 3.10.5
52. Linear drain - see 3.8.2.3
53. New RW gully - see 3.8.2.2
54. Timber dwarf wall finsihed render - see 3.21.4
55. Replacement timber windows - see 4.2.5
56. Lead flashing forming gutter - see 4.10.5.3

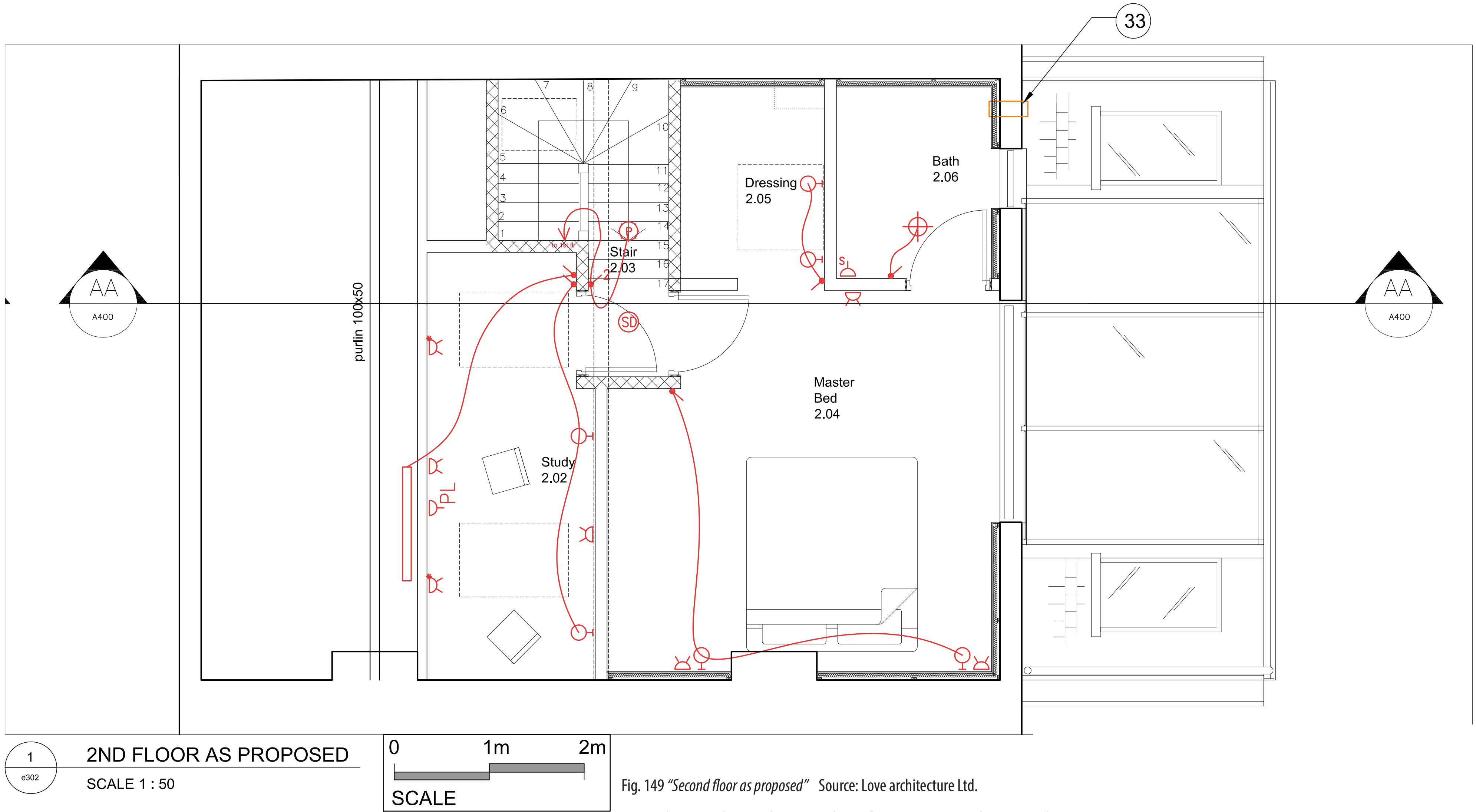
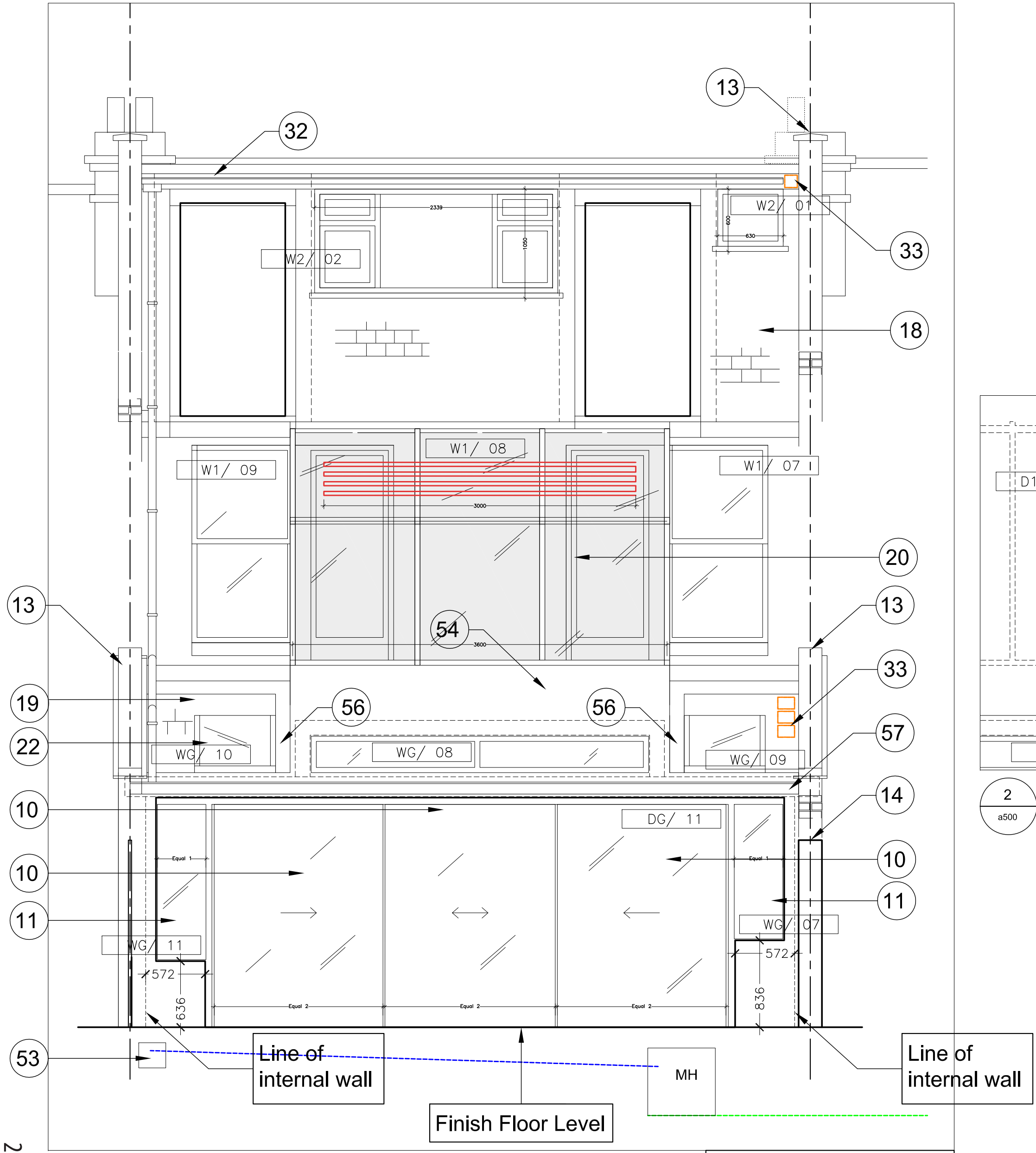


Fig. 149 *"Second floor as proposed"* Source: Love architecture Ltd.

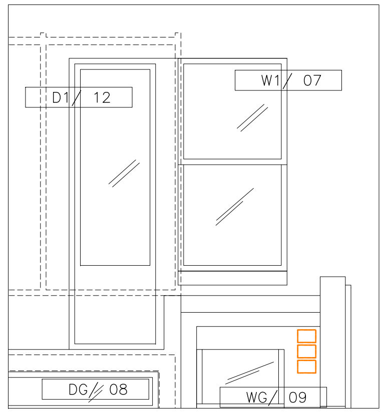
Fig.150 (next page) *"Rear elevation with retrofit"* Source: Love architecture Ltd.

NOTES
For Construction refs see Schedule of Works A913
01. Boundary
02. Existing timber fence



1 a500 REAR ELEV AS PROPOSED

SCALE 1 : 50



2 a500 REAR ELEV AS PROP (behind Greenhouse)

SCALE 1 : 50

02. Existing timber fence
03. Manholes
04. Existing Thames Water drain
05. Existing tile roof
06. Existing fireplace & chimney
07. New opening with folding doors - see 2.2.2.3, 4.2.2 and 4.2.6.1
08. New beam over - see 3.2.3, 3.10.3 & 3.11.3
09. Island - see 7.10.5
10. Sliding glass panel - see 4.10.6
11. Fixed glass panel - see 4.10.5
12. Ventilation below floor - see 3.10.5
13. New party wall straddling boundary - see 3.10.4
14. New garden wall height existing fence
15. Line of glass roof over
16. 150 mm ventilation air gap
17. Drainage channel - see 5.21.1
18. Tile hung wall - see 3.22.4.2
19. Tiled roof to match existing
20. Obscured glazed drying enclosure - see 4.21
21. Pipes to collect solar gain supported by munson brackets
22. Rooflight - see Section 4
23. Hot water storage - see 5.26
24. Line of sloping glass roof beyond
25. Louvres to vent solar gain
26. Line of existing rear extension
27. Flat roof finished in roofing felt - see 3.22.6.2
28. New stair to loft - see 4.24.3
29. Fire protected stairwell - see 4.24.1
30. Existing chimney demolished
31. Solar Panel
32. Roof vent - see 3.22.6.2
33. Extract vent - see Sect 6
34. Suspended timber floor insulated -see 3.1.5
35. Fire resistant door
36. Removable box on wheels - see sect 7
37. Openable base to under stair area - see sect 7
38. Fixed cover plate - see sect 7
39. Cupboard - see sect 7
40. Shelf - see sect 7
41. Existing coving
42. Desk - see sect 7
43. Existing picture rail
44. Bookshelf - see sect 7
45. Wardrobe with rail or sliding shelves inside - see sect 7
46. Fireplace - see 3.2.4
47. Logs storage - see sect 7
48. New Boiler - see 5.18.6
49. Filing cabinet - see sect 7
50. Internal insulation - see 4.1.4
51.
52. Linear drain - see 3.8.2.3
53. New RW gully - see 3.8.2.2
54. Timber dwarf wall finsihed render - see 3.21.4
55. Replacement timber windows - see 4.2.5
56. Lead flashing forming gutter - see 4.10.5.3
57. UPVC Gutter - see 5.8.2

For Construction References see Schedule of Works: A9

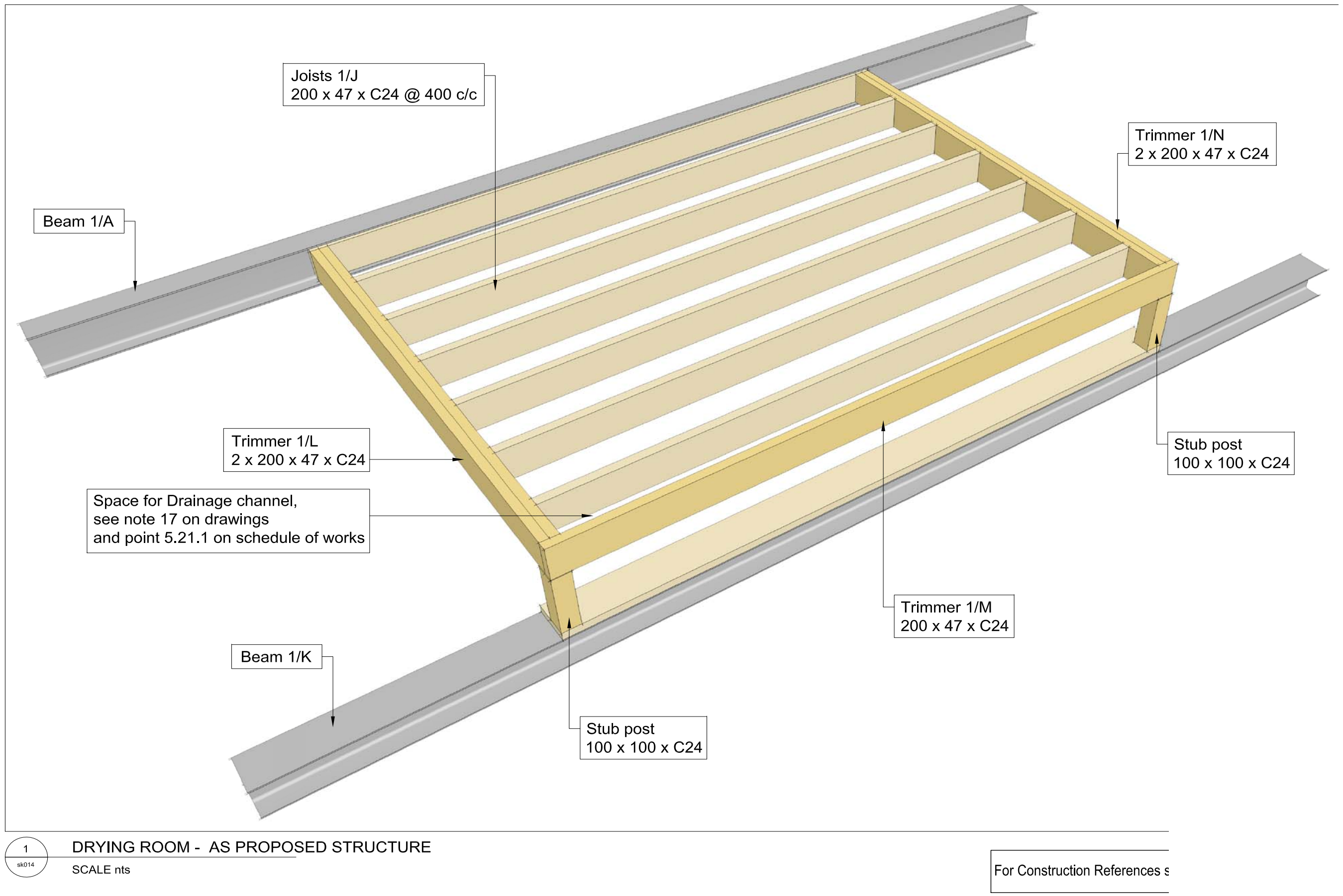
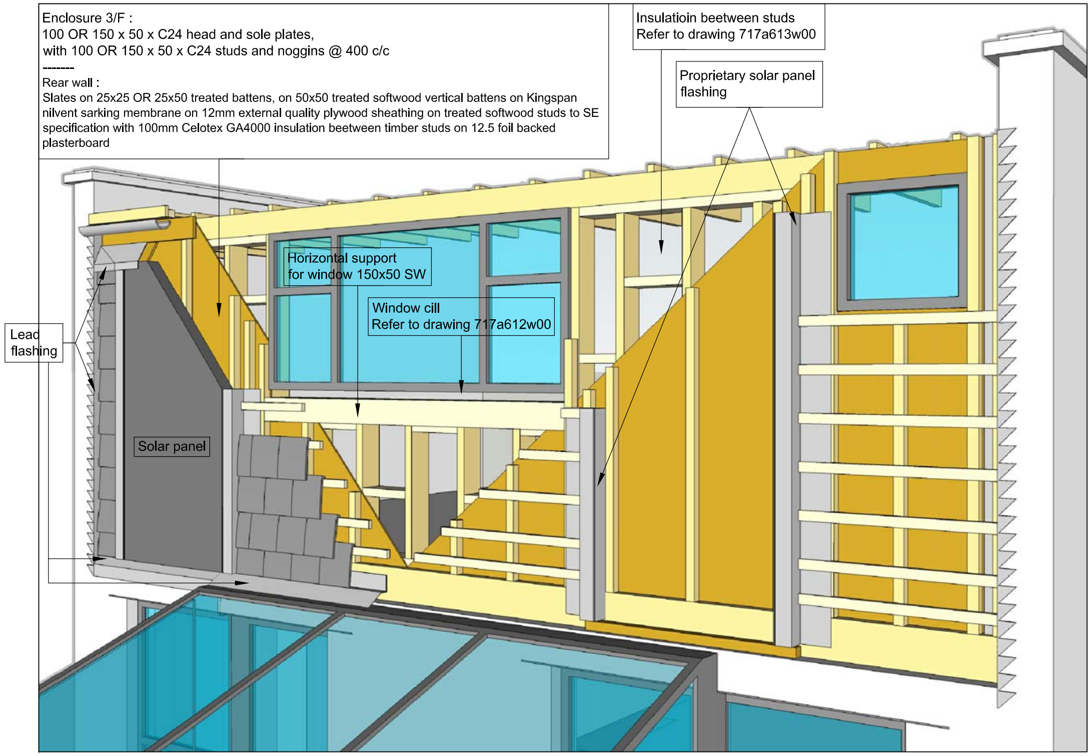


Fig. 151 *"Drying room as proposed structure"* Source: Love architecture Ltd.

Fig.152 (next page) *"Roof elevation details, after returbishment"* Source: Love architecture Ltd.

For Construction References see Schedule of Works: A913

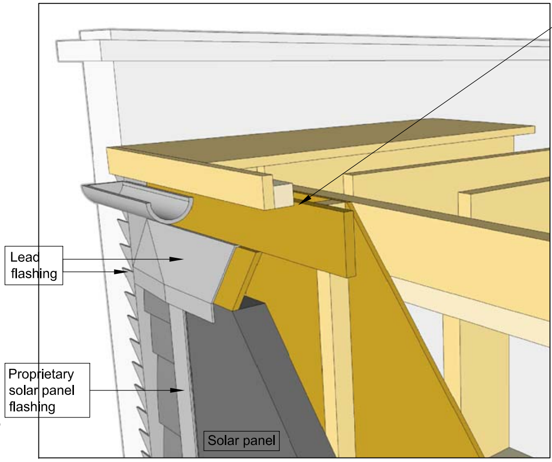


1 SK016 BIRD'S EYE, Rear elevation - Dormer As Proposed

NTS

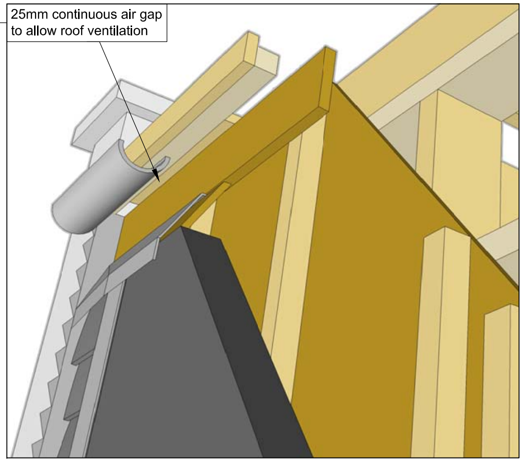
2 SK016 BIRD'S EYE, Rear elevation - Roof As Proposed

NTS



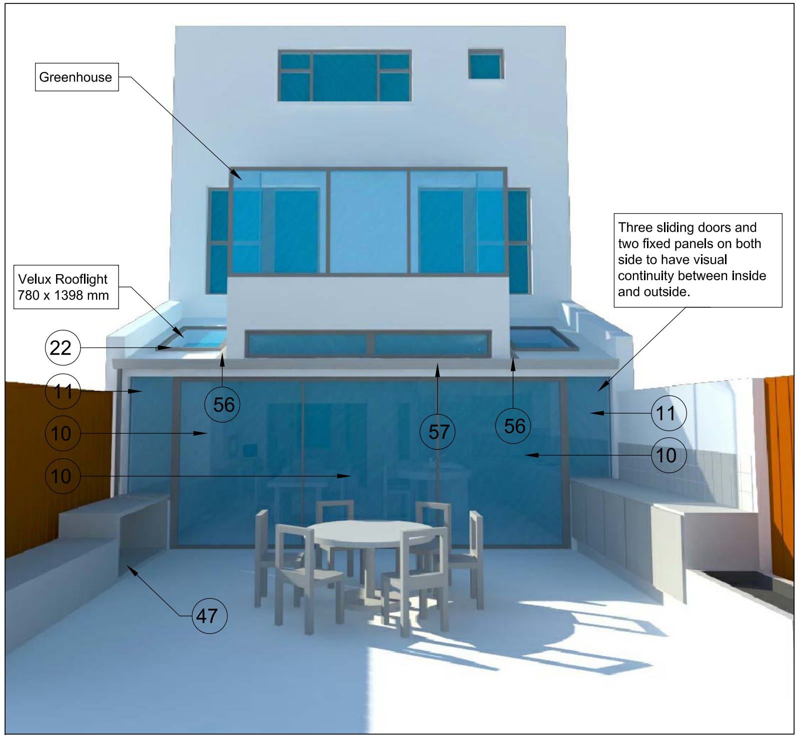
3 SK016 DETAIL 1, Rear elevation - Roof As Proposed

NTS

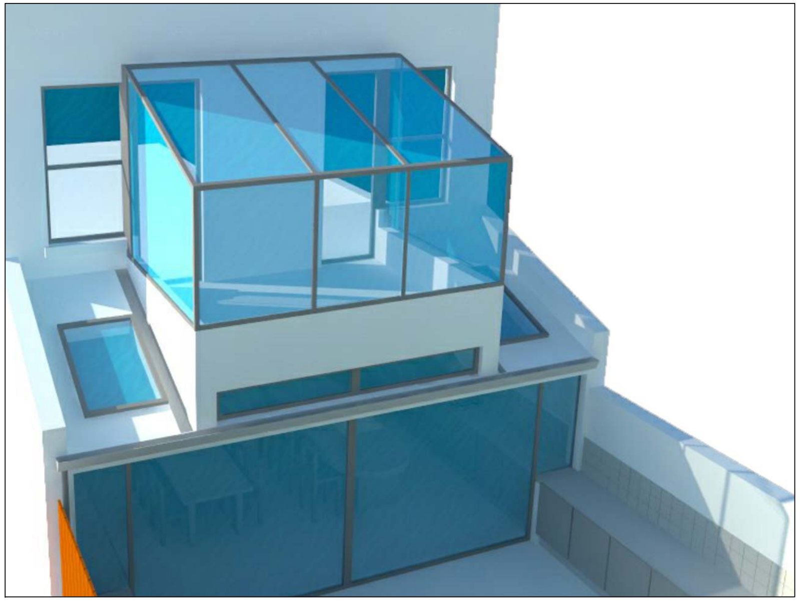


4 SK016 DETAIL 2, Rear elevation - Roof As Proposed

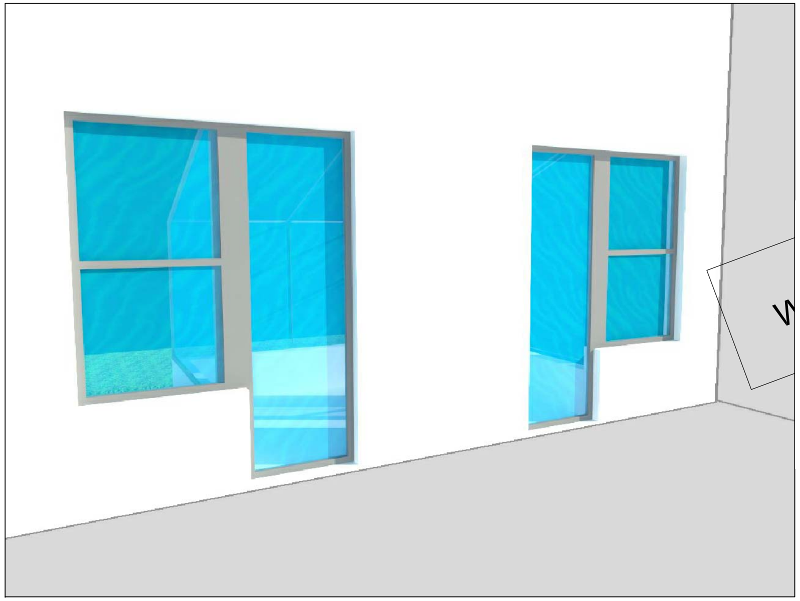
NTS



1 SK015 BIRD'S EYE REAR ELEVATION
NTS



2 SK015 BIRD'S EYE REAR ELEVATION, Greenhouse
NTS

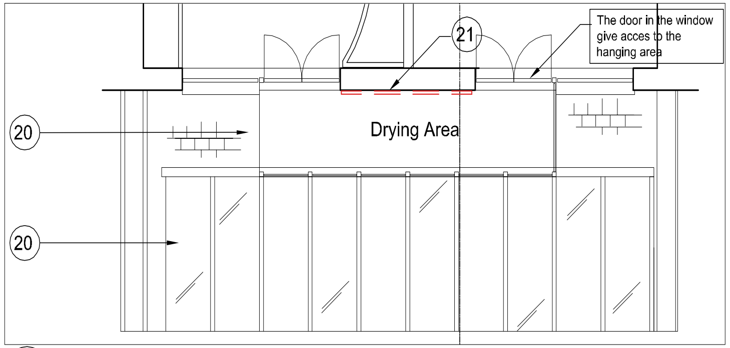


3 SK015 BIRD'S EYE REAR ELEVATION, Greenhouse access from inside
NTS

NOTES
For Construction refs see Schedule of Works A913
01. Boundary
02. Existing timber fence
03. Manholes
04. Existing Thames Water drain
05. Existing tile roof
06. Existing fireplace & chimney
07. New opening with folding doors - see 2.2.2.3, 4.2.2 and 4.2.6.1
08. New beam over - see 3.2.3, 3.10.3 & 3.11.3
09. Island - see 7.10.5
10. Sliding glass panel - see 4.10.6
11. Fixed glass panel - see 4.10.5
12. Ventilation below floor - see 3.10.5
13. New party wall straddling boundary - see 3.10.4
14. New garden wall height existing fence
15. Line of glass roof over
16. 150 mm ventilation air gap
17. Drainage channel - see 5.21.1
18. Tile hung wall - see 3.22.4.2
19. Tiled roof to match existing
20. Obscured glazed drying enclosure - see 4.21
21. Pipes to collect solar gain supported by munson brackets
22. Rooflight - see Section 4
23. Hot water storage - see 5.26
24. Line of sloping glass roof beyond
25. Louvres to vent solar gain
26. Line of existing rear extension
27. Flat roof finished in roofing felt - see 3.22.6.2
28. New stair to loft - see 4.24.3
28. New stair to loft - see 4.24.3
29. Fire protected stairwell - see 4.24.1
30. Existing chimney demolished
31. Solar Panel
32. Roof vent - see 3.22.6.2
33. Extract vent - see Sect 6
34. Suspended timber floor insulated -see 3.1.5
35. Fire resistant door
36. Removable box on wheels - see sect 7
37. Openable base to under stair area - see sect 7
38. Fixed cover plate - see sect 7
39. Cupboard - see sect 7
40. Shelf - see sect 7
41. Existing coving
42. Desk - see sect 7
43. Existing picture rail
44. Bookshelf - see sect 7
45. Wardrobe with rail or sliding shelves inside - see sect 7
46. Fireplace - see 3.2.4
47. Logs storage - see sect 7
48. New Boiler - see 5.18.6
49. Filing cabinet - see sect 7
50. Internal insulation - see 4.1.4
51. Cantilivered slab to SE spec - see 3.10.5
52. Linear drain - see 3.8.2.3
53. New RW gully - see 3.8.2.2
54. Timber dwarf wall finsihed render - see 3.21.4
55. Replacement timber windows - see 4.2.5
56. Lead flashing forming gutter - see 4.10.5.3
57. UPVC Gutter - see 5.8.2

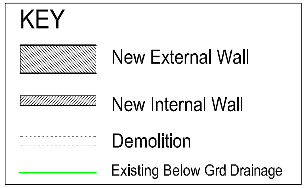
Fig. 153 *“Bird’s Eye Rear Elevation”* Source: Love architecture Ltd.

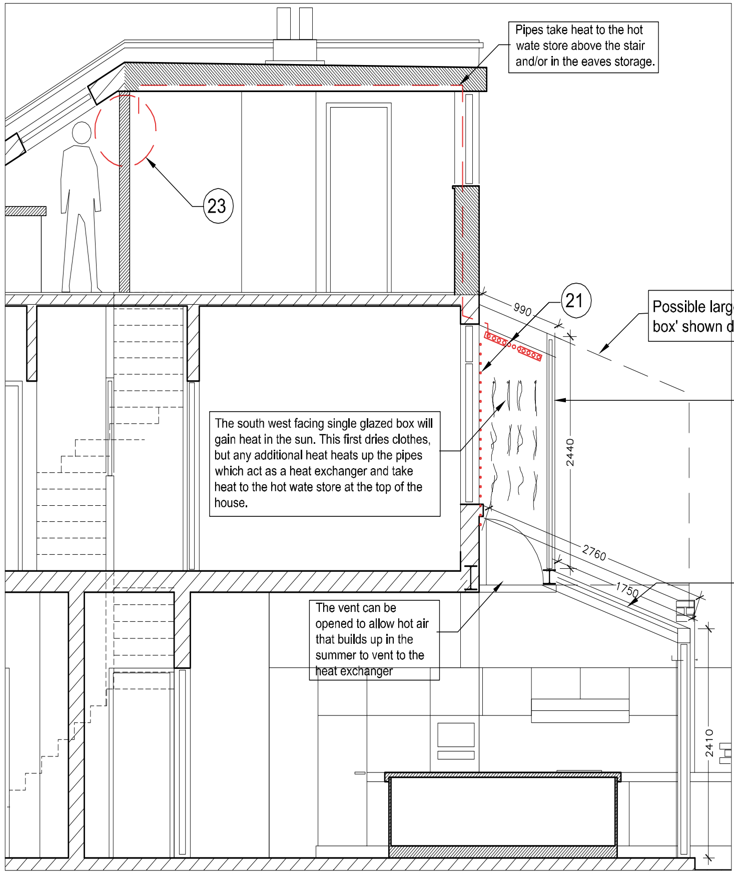
Fig.154 (next page) *“Section AA”* Source: Love architecture Ltd.



3 SK007 PLAN AT 1ST FLR

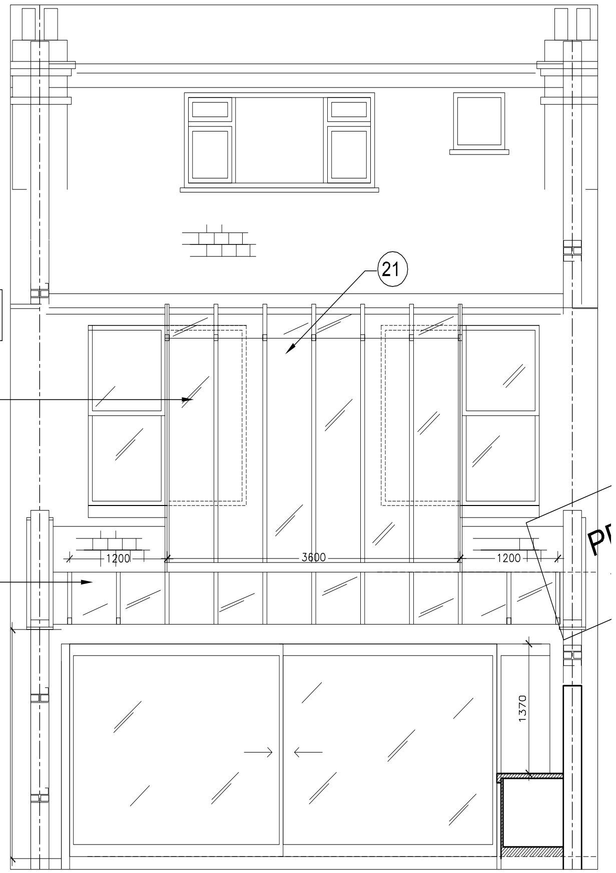
SCALE 1 : 50





1 SK007 SECT AA

SCALE 1 : 50



2 SK007 REAR ELEVATION

SCALE 1 : 50

6. PROJECTS

6.1 24 KING WILLIAM STREET, LONDON

Fig. 155 (previous page) *"24 King William Street view"* (Render)

Fig.156 (above) *"24 King William Street, aerial view looking West"* Source: Bing maps

The aim of the project at 24 King William Street is to create a high quality refurbishment which meets the needs of businesses in the 21st century. A number of key improvements are proposed to the existing building to give the development a new identity within the City, better suited to its prominent location.

It is proposed to strip the existing offi ce building back to the structural frame, extend the building at upper levels and to re-clad all elevations. The building will comprise a sub-basement, basement, ground and nine upper fl oors with 10th fl oor plant well. The scheme retains the principle use of B1 Offi ces, with A1/A3 retail at ground fl oor level. The existing A4 retail unit at ground fl oor is proposed to be retained.

It is proposed to enlarge the footprint of the existing slabs to make better use of the existing site area. A new area of slab extension is proposed on every level on Arthur Street above the existing loading bay.

Additional Net Internal Area (NIA) gains are made by pushing out the cladding line along the facades and enlarging the slab around the perimeter of the building.

The new cladding will be predominantly lightweight limestone and aluminium honeycomb composite cladding panels on a unitised glazing system. The base of the building will feature large format retail glazing defi ned by a decorative bronze frame.

The curved roof will be formed of high quality zinc standing seam, articulated by staggered perforated metal screens.

The new building will be a sensitive modern design that is well integrated with its surroundings. It will make a signifi cant improvement to the King William Street approach to the city and the setting of nearby listed buildings. The curved roof will be formed of high quality zinc standing seam, articulated by staggered perforated metal screens.

The new building will be a sensitive modern design that is well integrated with its surroundings. It will make a signifi cant improvement to the King William Street approach to the city and the setting of nearby listed buildings.

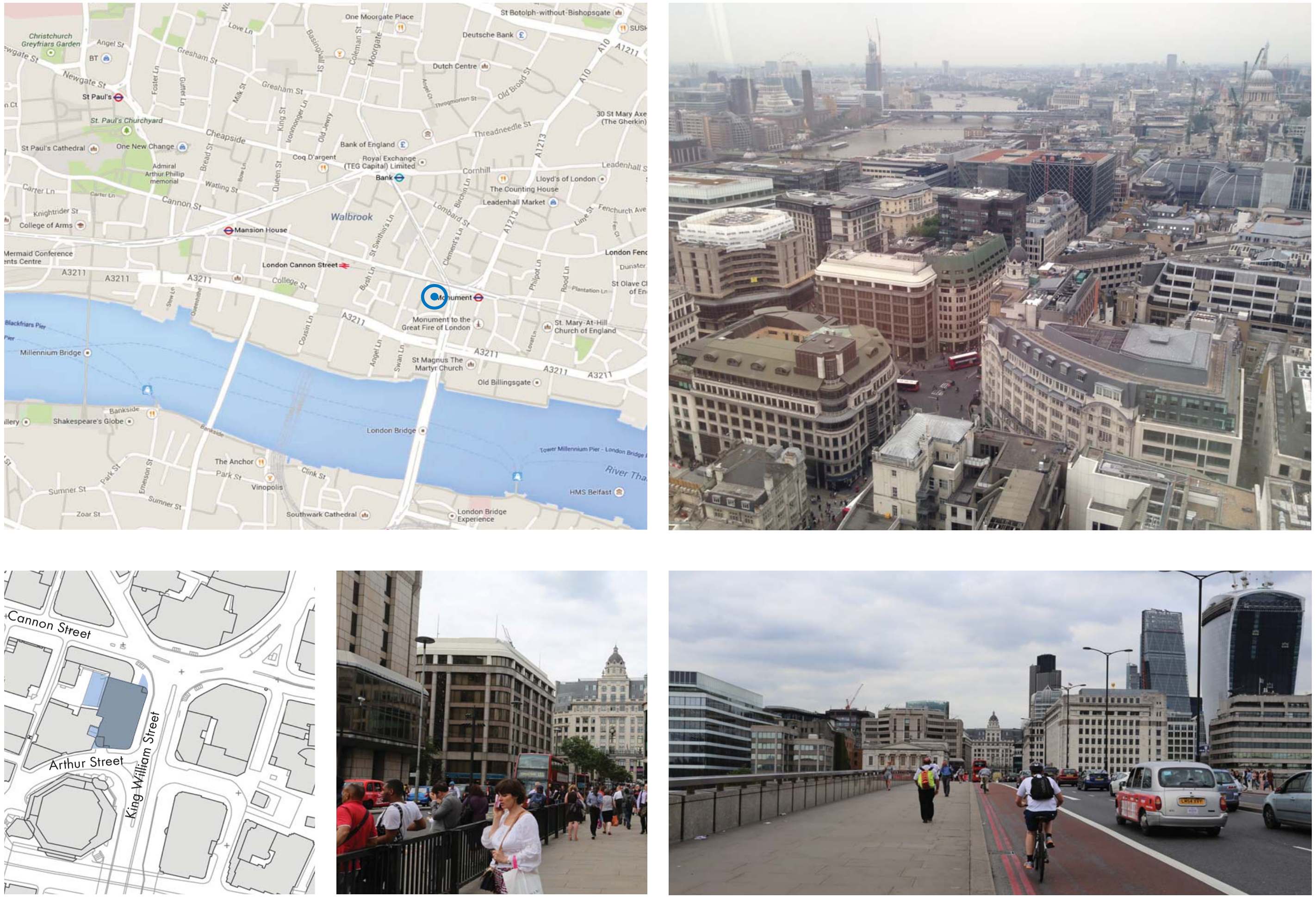


Fig. 157 (From left above) *"City of London location,; View of the site from 20 Fenchurch Street showing the river Thames on the left, and St. Paul's on the right; (bottom left to right) Site Plan; 24 King William Street to the left, House of Fraser on the right; View over London Bridge, showing the Walkie Talkie, Cheesegrader and the Natwest Tower buildings"* Source: Google maps

Location

24 King William Street is located in the City of London, close to Monument Underground Station. It is situated close to several mainline rail stations (London Bridge, Cannon Street, Fenchurch Street and Liverpool Street, and is a short walk from the River Thames.

Due to the bomb damage to the site in WWII the buildings immediately adjacent to 24 King William Street are predominantly modern in character, however there are a number of Listed Buildings and Scheduled Ancient Monuments in the surrounding neighbourhood and the proposed works would be sensitive to the setting of these heritage assets.

Within the immediate context there is a predominance of stone cladding. Many buildings (both historic and modern), incorporate elements of stone in their facades.

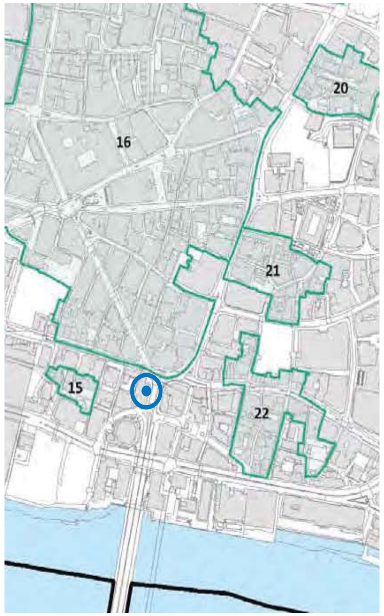


Fig. 158 (From left above) *"The Monument,; Conservation areas within the City of London; The railings of the former St. Martin Ongar Church, 24 King William St. is shown in the background (right above); V(bottom left) iew up King William Street: 24 King WIlliam Street is on the left; View up Arthur Street: 24 King WIlliam Street is on the left. Source: Google. last three pictures taken personally*

The site is bounded on the east by King William Street (an extension of London Bridge), Cannon Street is to the north and Arthur Street and Martin Lane are the south and west respectively.

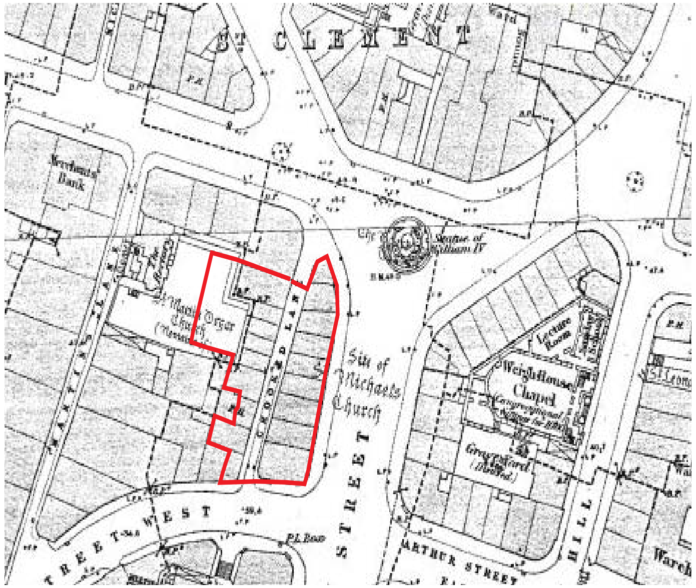
The approach over London Bridge is a key entry point to The City of London. The development at 24 King William street will therefore have high visibility and presence within the city, creating a desirable offi ce and retail address.

24 King William Street has excellent access to the London Underground system and is adjacent to Monument Underground station. The site is also within comfortable walking distance to both Cannon Street and London Bridge stations along with multiple bus stops.

At present private vehicle access and deliveries are accommodated by a loading bay and underground parking, accessed via Arthur Street.

The site is not in a conservation area but is close to the boundary of Bank Conservation Area which is characterised by large scale historic commercial buildings set within a network of historic streets, courtyards and alleyways.

The landscaping to the rear of 24 King William Street abuts the site of the former church of St. Martin Orgar. Care was taken in making the proposals respectful of this relationship while developing the courtyard.



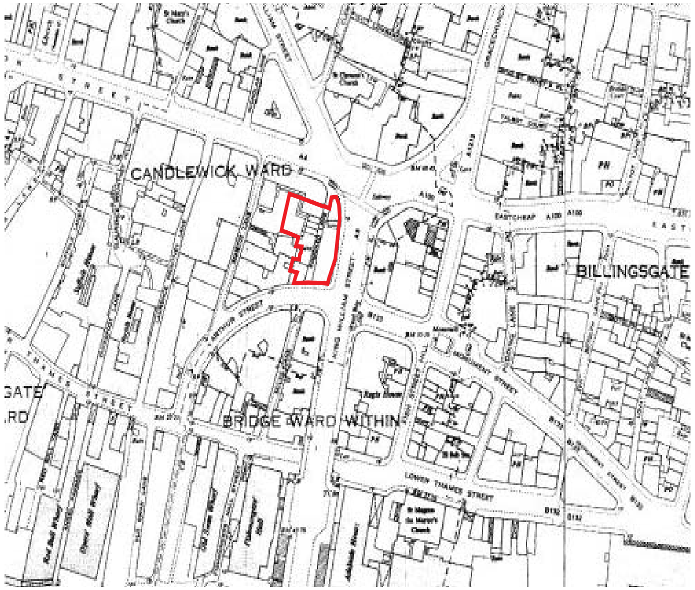


Fig. 159 (From left above) *"1875 Ordnance Survey Map (copyright old-maps.co.uk"; 1953 Ordnance Survey Map (copyright old-maps.co.uk); (bottom left) Crooked Lane 1831; (bottom right) King William Street in 1971". Source: old.maps.co.uk*

Historic context

The site sits on King William Street which was a new approach road created to meet the 'new' London Bridge which opened in 1831. The bridge was designed by John Rennie following a competition in 1799 to replace the existing populated bridge which stood 100m downstream.

King William Street was constructed between 1829 and 1835 and is named after the reigning Monarch of the time King William IV.

To accommodate the new bridge many of the older crowded streets were demolished to improve access.

The site was badly damaged in World War II when a high explosive bomb fell on the site at sometime between October 7th 1940 and June 6th 1941 as recorded within the Aggregate Night Time Bomb Census.

The site was redeveloped in 1956 for use as offi ces and bank premises. In 1987 the offi ce development which stands on the site today was built for Dai Ichi Bank a large corporate group. Retail spaces were introduced at ground fl oor level which currently house a restaurant and bar. The unusual shape of the site was formed following the demolition of Crooked Lane and the surrounding buildings. This can be seen in the top two images.

The buiilding is not a listed building and is not in the conservation area.

Protected views

The London View Management Framework is supplementary planning guidance to the London Plan and aims to protect a list of strategic views which help defi ne London.

It is observed that due to the proximity to St Paul's Cathedral, the site lies within two of the Protected Vistas from the London View Management Framework, namely Primrose Hill Protected Vista (4A.1) and Greenwich Park Protected Vista (5A.2).

Locally Protected Views - The Monument 24 King William Street falls within the Monument Views Policy area.

This policy affects the design of the roofs and associated rooftop plant of buildings which fall within the policy areas.

The roof scape will be sensitively designed to provide an appropriate "5th elevation" to the building, so as to improve the roof scape in the immediate vicinity of The Monument. The proposed roof plant will be housed within a plant well and the open top will be covered with screening above.

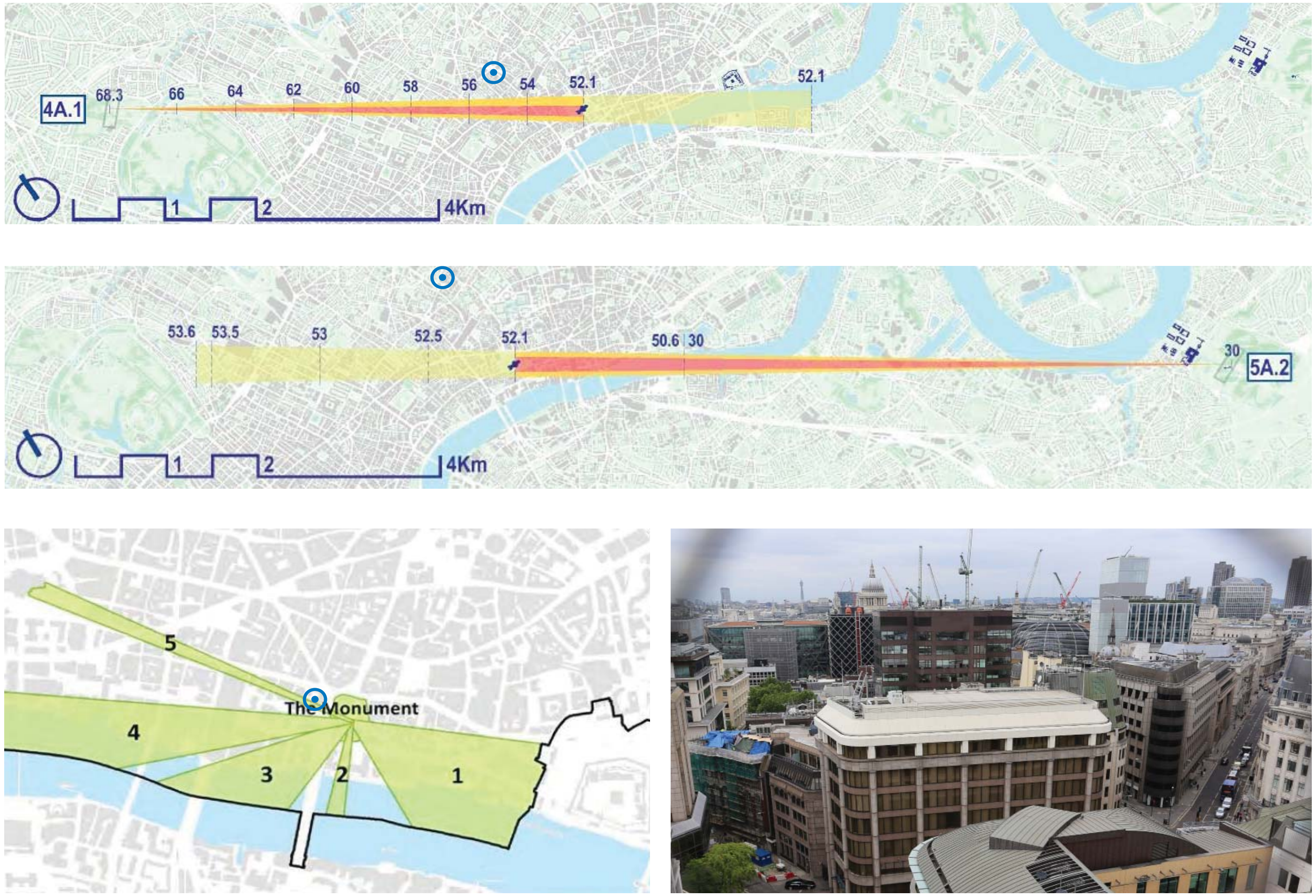


Fig. 160 (From the top) *"Primrose HIll protected Vista, Assessment point 4.A.1; (middle) Greenwich Protected Vista, Assessment point 5A.2; (bottom left) Map of the monument Views Policy area; (bottom right) View of 24 King WIlliam Street from the Monument"* *Source: London View Management Framework*

Fig. 161 (From the top) *"(top left) 24 King William Street from London Bridge; (top right)24 K.William Street upper levels, (bottom left) Existing entrance to retail unit; (bottom right) 24 K. W. street reception entrance"* *Source: Personal pictures taken on site*

Existing building

Development of 24 King William Street 24 King William Street is predominantly an office building consisting of a small sub-basement, basement, ground floor and seven upper floors with a plant floor at roof level. In addition there is designated class A3 use at part ground level as well as the main entrance to the building and A4 bar accommodation in the southernmost retail unit. A refurbishment of the building was undertaken from 2004 to 2005 and the following works had been done:

- October 2004: New ground floor entrance doors, glazed screen and canopy;
- April 2005: Installation of a rooftop generator and satellites

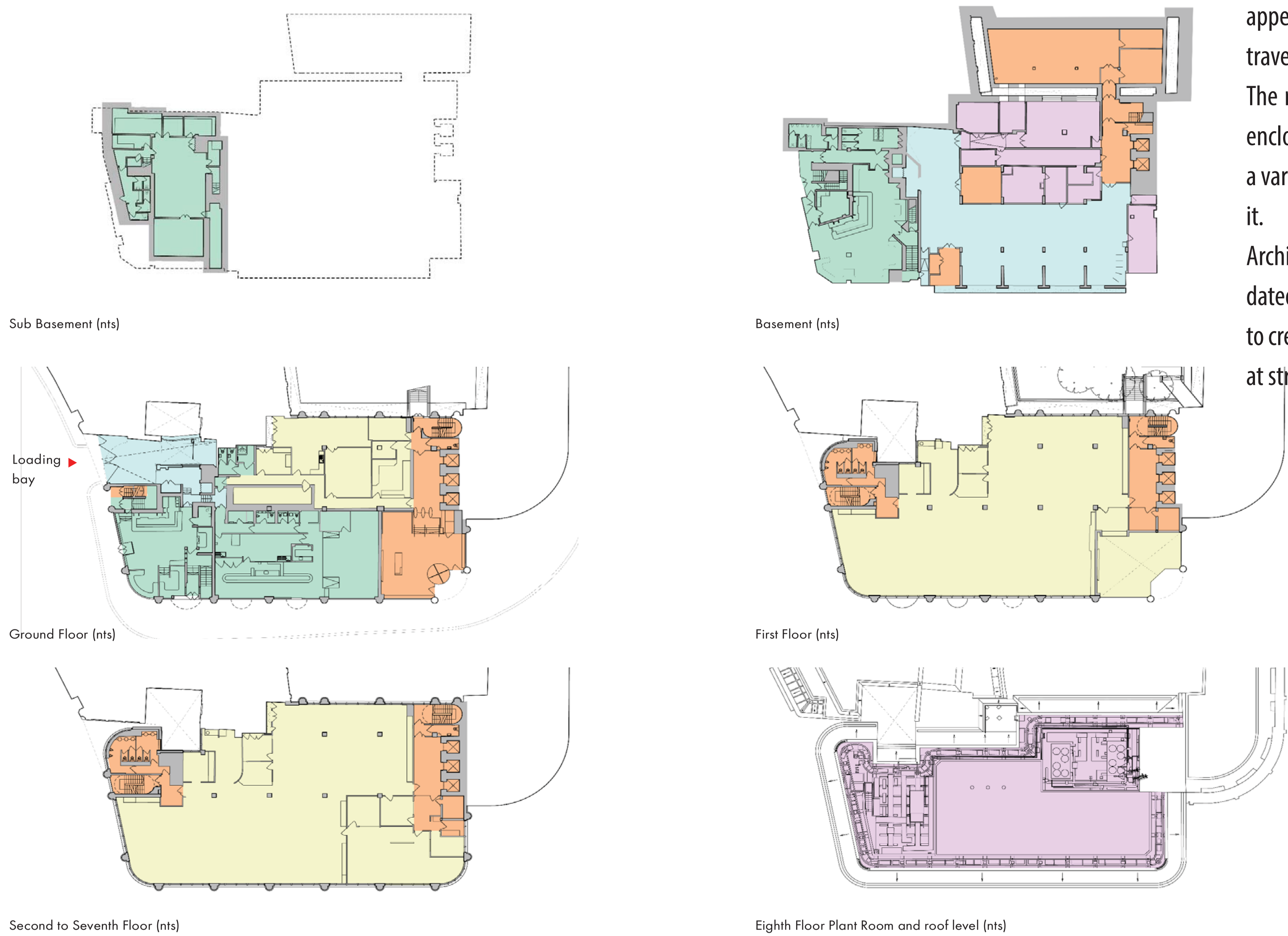
Existing cladding

The building cladding is split into three sections.
The ground and first floor base is clad in frameless shopfront glazing. The mid section of the building is clad in light brown polished granite panels with curved profiles wrapping around the structural columns. The 7th floor top section is clad in metal rainscreen panels, painted white.
The windows to the mid and top section are aluminium double glazed units in a ribbon arrangement.
These have a brown tint to them, delivering a poor

quality of light to the interiors and an impermeable appearance to the facade. A stained glass window travels up the southern stair core.

The roofscape is formed of a variety of louvred plant enclosures and exposed plant wells. It is arranged over a variety of levels requiring laddered access to navigate it.

Architecturally the cladding appears heavy, dark and dated. The building would benefi t from a fresh facade to create an elegant identity and allow more animation at street level.



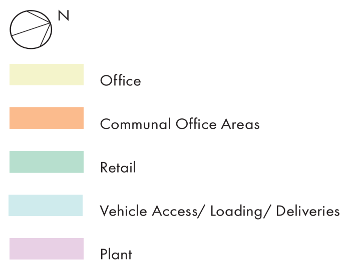


Fig. 162 *"Function plans of 24 K.William Street"*

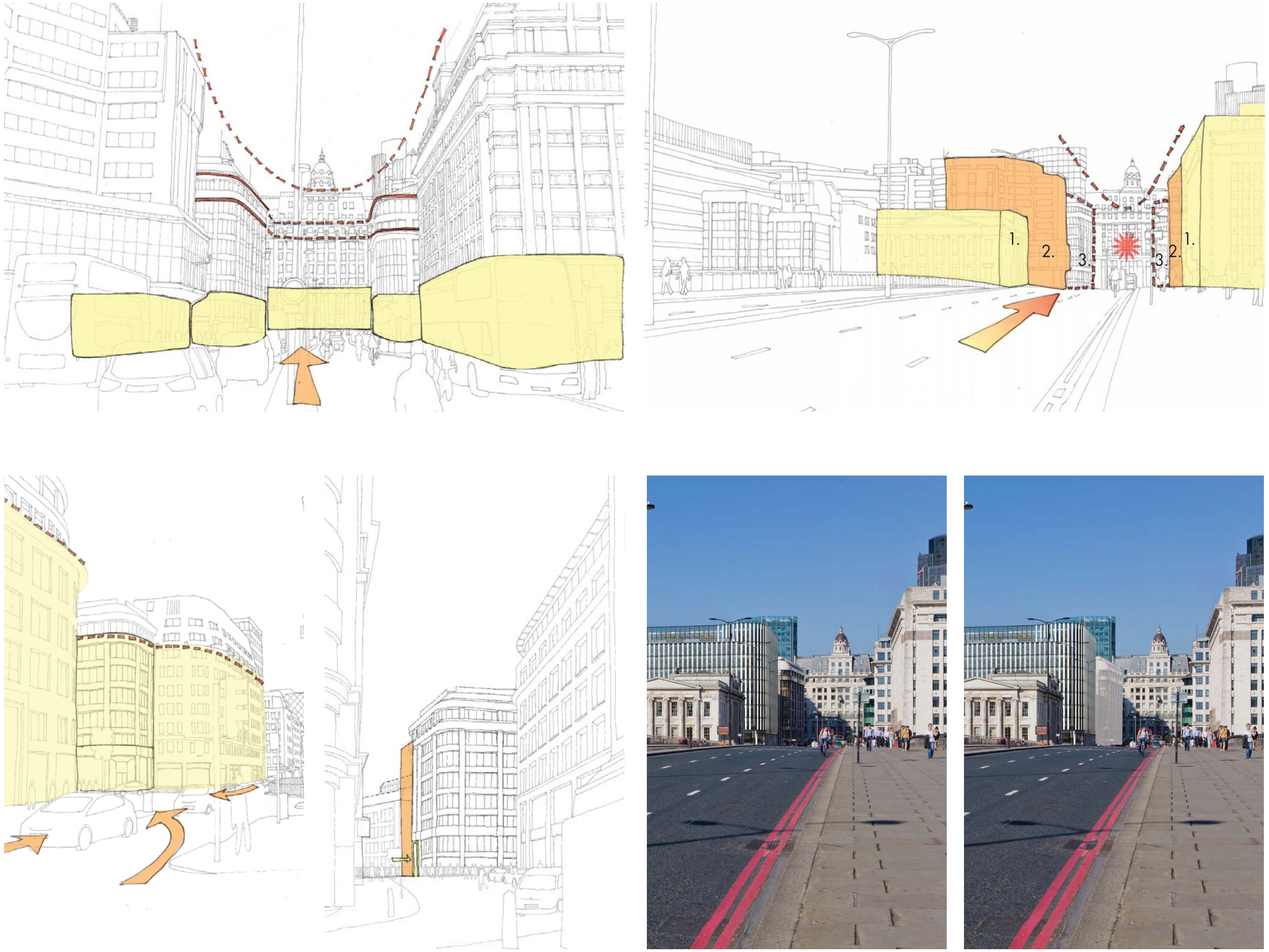


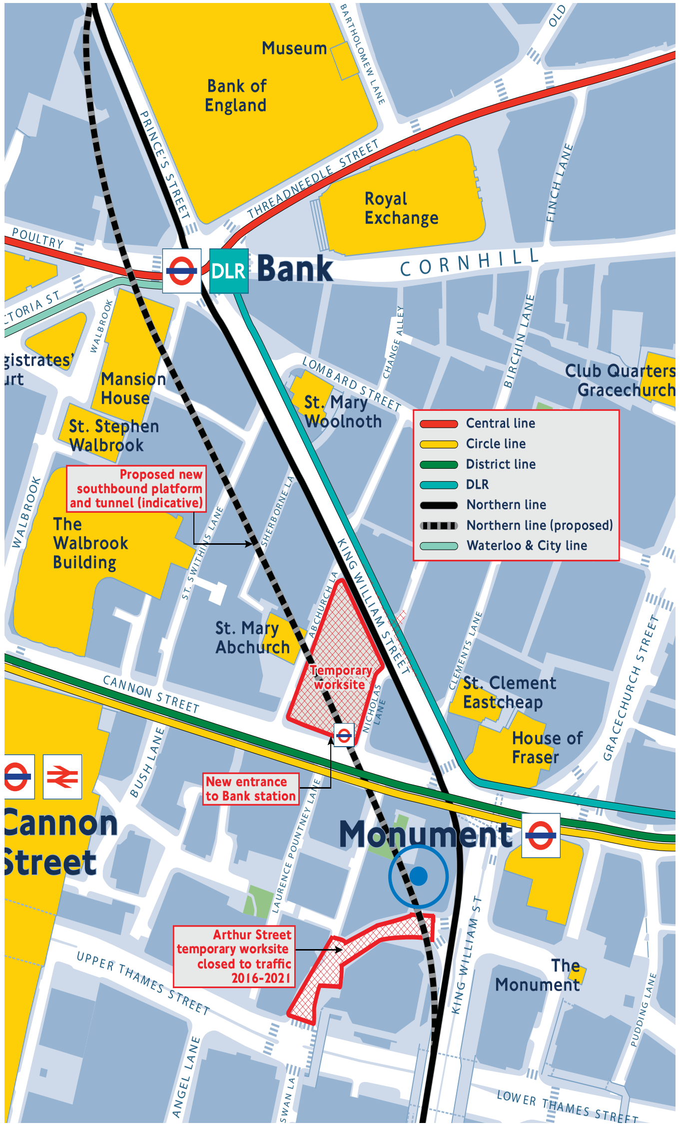
Fig. 163 *"(top left) Important to use existing datum lines to better frame the view of 68 King William Street and improve parity across the valley; (Top right) Approach sequence to "valley" buildings should be retained to draw focus to 68 King W. Street building; (bottom left) potential for a family of roofscape forms imrproving the exit view from the city; (right) imrpoving the tonal balance with a lighter shade" Source: own diagrams and picture*

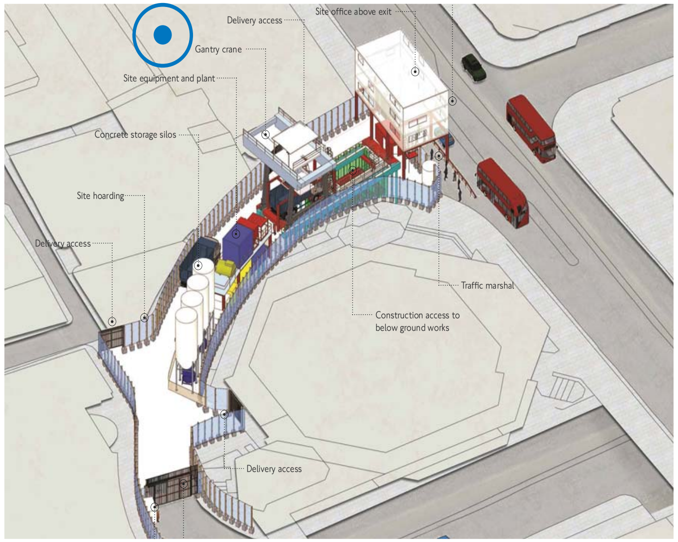
Site analysis

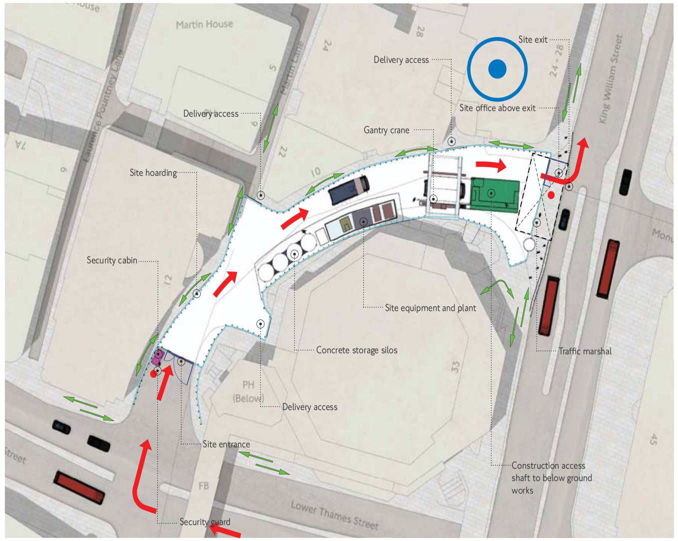
Following a thorough site analysis a number of design drivers have been established. These principles enabled the proposed development at 24 King William Street to be responsive to the surrounding townscape and will ensure proposals are appropriate for both the immediate and borough wide context.

Refurbishment Design Brief:

- A strong hierarchy of base, middle, top.
- The proposed datum lines are set to create an enhanced parity between the site and the surrounding context
- A "transition zone" at 7th fl oor level reduces the apparent mass of the facade when viewed over London Bridge.
- The new stone façade will integrate the site back into the local context by tonally mirroring the surrounding buildings. In addition, this material selection balances the view over London Bridge thus reinforcing the dominance of 68 King William Street
- The building will appear solid when viewed obliquely by introducing depth and relief to the façade
- An inhabited roofscape will respond to the surrounding townscape. The design explores the







provision of accommodation within the roof space and "top" zone of the building

- The raised height of 24 King William Street will reinforce the King William Street/Cannon Street junction and provide a strong and memorable exit sequence from the City
- Straightening the south west corner to follow the site line on Arthur Street makes the building a site line on Arthur Street makes the building a more harmonious part of the streetscape
- The proposals maintain a strong façade line to retain the "valley" effect of the view from London Bridge.

The building will be stripped of all internal loose and fi xed fi ttings, including plant equipment, non load bearing walls and all existing services. Rainwater goods will be retained. An asbestos survey will be updated ahead of the strip out works, to be implemented by the appointed strip out contractor.

Fig. 164 *"(left) Overview of Bank Station proposals; Arthur street work sites (right)-"*

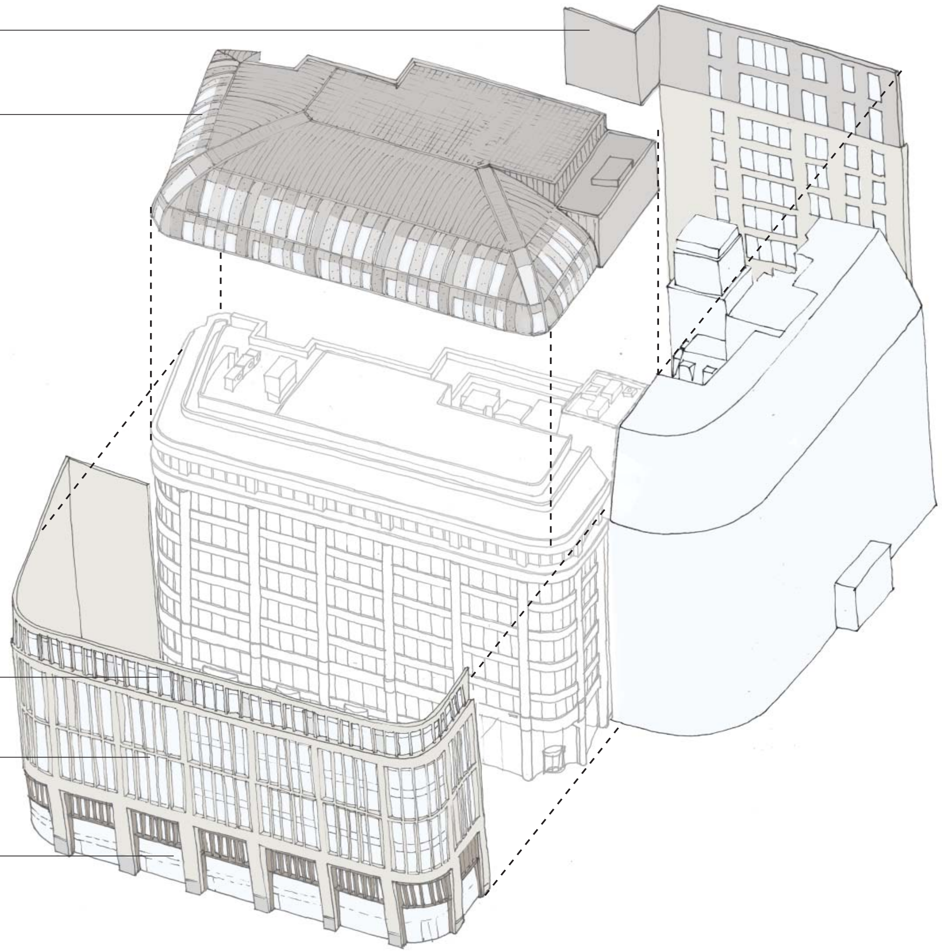


Fig. 165 *"Sketch of the retrofitted building"*

Design

The aim for the building on 24 King William Street is to create a high quality refurbishment and retrofit which meets the needs of businesses in the 21st century. A number of key improvements are proposed to the existing building to give the development a new identity within the City, better suited to its prominent location:

- Provide a new façade system of elegant stone cladding and full height glazing to create high quality aesthetics
- Provide new offi ces
- Create a new reception area with an improved entrance at street level and improved views into the rear courtyard
- Provide three new lifts within the existing lift cores
- New "superloos" will be provided throughout.
- New services and plant will be provided throughout
- Additional fl oor space will be provided at upper levels
- The fl oor plate will be extended on Arthur Street
- The external space in the rear courtyard will be re-landscaped.
- The fl oor plates will have minor extensions at all levels between the existing columns.
- Risers will be rationalised

Fig. 166 *"Uses of the building"*

Use

- The main use of the building will remain as class B1 (offi ces) with ground and basement areas for retail
- The distribution of these uses will be adjusted at ground and basement levels to provide improved serviceability to the building a larger retail units to the ground floor
- Additional usable B1 offi ce accommodation will be provided on the top two fl oors
- No change is proposed to the existing A4 retail unit in the southern corner of the building

In detail

- Sub basement: No proposed change
- Basement: At basement level it is proposed to introduce new areas of retail waste storage to support and supplement the use at ground fl oor. New cycle storage and shower accommodation will be provided. Below ground works have been minimised to mitigate impact on the London Underground network and the existing raft foundation
- Ground floor: The existing retail units will be enlarged by removing the offi ce space to the rear of the plan. At ground floor it is proposed that the existing offi ce space and the existing restaurant be converted to fl exible retail space
- Upper floors: office accommodation will be retained from 1st to 7th fl oor levels and added on 8th and 9th
- At roof level an area of plant is provided within the roof volume, for equipment which requires access to fresh air and therefore cannot be accommodated in the basement

Fig. 167 *"Proposed view from King William Street (render)"*

New envelope

The existing frame will be stripped back to the existing steel frame and the structure will be retained and incorporated in a new external envelope.
The façades of the building will be re clad with a lightweight stone and metal honeycomb panel. A unitised curtain walling system, composed of glazing and the stone/aluminium composite, is proposed for the majority of the building, including the fi ns, cills and columns. At party walls standard construction methods are proposed to negotiate the junctions between buildings. The stone system is outlined in more detail in the next pages.

Re-cladding the building will reduce the building's energy consumption by improving its thermal performance.
New windows and doors will be installed throughout and the U-values of these will meet the Building Regulations. The proposed new façade has a glazed area of under 40% overall to ensure energy loss and solar gains are controlled while allowing excellent light into the building and full enjoyment of the views across the City.
The new 8th and 9th offi ce fl oors are contained within a curved roof form. This new roof also introduces improved insulation to the top of the building, better thermally sealing the building.
By utilising the existing building structure the embodied energy and carbon within the structure is retained and waste to landfi ll is substantially reduced.

Layout

Subbasement

The existing sub-basement is occupied by the retained retail tenant, so It is not proposed to make any alterations to this space.

Basement
Internal finish

The basement serves several purposes. It is the primary location of plant within the building and also is the location for cycle storage and associated facilities. The waste storage for the building is also housed in the basement, and is the area where deliveries will be received.
The proposed layout of the basement is restricted due to the large amount of area attributed to the retained retail unit and is further complicated by the low ceiling height, which is as low as 2m from fi nished fl oor level in some areas. The design needs of the plant and cycle storage facilities confl ict with the restricted headroom of the existing basement.
The layout of these will be carefully coordinated to maximise the headroom of the occupied areas.
The low ceiling height will not permit a suspended ceiling and it is proposed that all service runs are meticulously set out in a neat and orderly manner.
Primary service runs will be locally boxed and branches from the primary routes will be painted where possible.
Finishes and lighting will be selected to provide a bright and crisp interior, despite a lack of natural light. Finishes are to be hard wearing appropriate to the functional nature of this space.
Plant space will designed to be easy to maintain

Fig. 168 *"(top) Ceiling height is extremely restricted in thebasement. This area is shown at 2.4 m. To the right of the columns the ceiling height is 2m. (Bottom left) The existing structure creates a lo*
height of 2m is indicated in the photo, taken at the bottom of the ramp. (Bottom right) Market expectations of cycling changing facilities."

w floor to ceiling heights. A low ceiling

and robust. The plant area below the courtyard will be outside the thermal line of the building and not insulated. The space will be made watertight and existing basement tanking will be utilised.
The existing basement slab is unlikely to be insulated.
It is not proposed to upgrade this as part of the works as this would further reduce the headroom within the basement.

Reception

The reception is accessed from street level, and is set over two levels. The higher level will house the reception desk and is a double height volume. The lower level forms the entry into the lifts and stair.
Both levels are generated by the existing slab levels and the relationship these have with the facade and ground conditions. The rear courtyard is accessed directly from the lower section of the reception space.
The reception is to be remodelled to improve the quality of the internal space to the level expected by prospective tenants for a high quality offi ce building in this location. The interior fi nishes are proposed to echo elements of the facade, with stone wall panels and bronze/brass accent pieces.
To negotiate the level change between the main entrance doors and the lift waiting area a fully concealed platform lift is proposed. This is to be as discrete as possible and integrated into the stairs. Infrastructure will be provided for the future installation of security barriers within the reception.
Containment for lift fob access is also provided should this be required by future tenants. Any further security will be provided by the tenant at at the entrance to their fl oor.

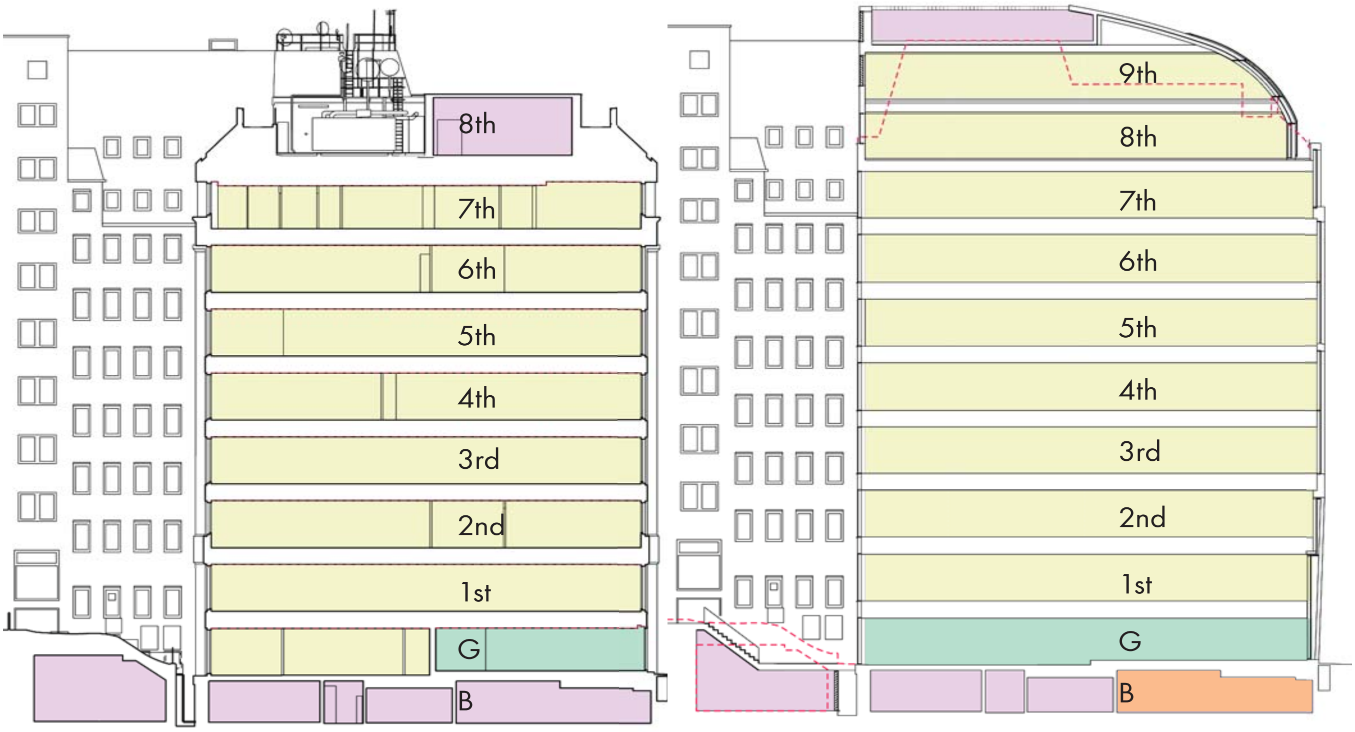
The double height portion of the reception has been enlarged to eliminate the existing pinch point at the top of the steps to the lifts. The result is a more open and impressive space.
The spacious feel is further enhanced by the new full height glazing and open staircase to the rear of the plan offering views through to the courtyard.

Fig. 169 *"Reception proposal (own visualisation)"*

Entrance doors

The curved entrance doors will require careful detailed due to their location on a busy street corner.

Consideration will be made to the high volume of foot traffic on the street outside and the selection of manual or automated door mechanisms. A manual pass door for emergency exit use has been included in the north elevation on to Cannon Street, for use in the event of a fire out of normal working hours.



Existing section (nts)

Proposed section (nts)

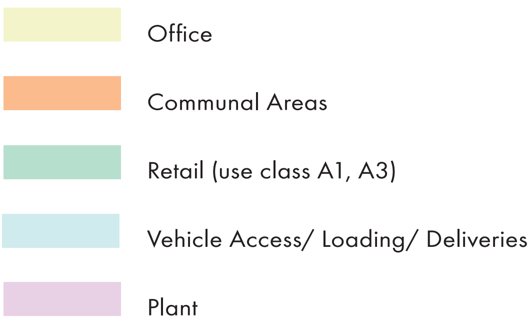


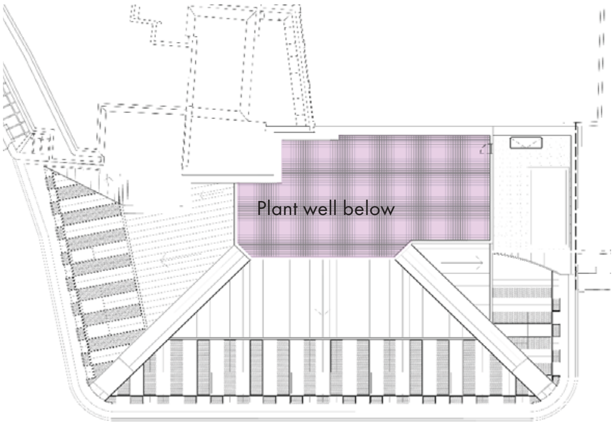
Fig. 170 *"Sections with different uses (own drawings)"*

Typical floors

The existing typical fl oor plates provide open plan accommodation over seven floors. WC accommodation is provided in separate sex facilities to the south of the plan. Large lift lobbies are provided on every fl oor.

New floors (8th and 9th)

The existing plant fl oor at 8th fl oor level will be allocated for offi ce accommodation. The existing floor slab will be removed and a new slab will be installed at a lower height. This will allow for appropriate floor to ceiling heights on this floor and the new 9th fl oor.



8th floor entrance

The 8th fl oor external terrace will offer excellent views across the city and be accessed by sliding door.

9th floor entrance

An entire new fl oor of offi ce accommodation is provided within the roof volume at 9th fl oor level. Excellent views across the river.

A plant room is provided to part of the 9th fl oor, this links vertically with the rooftop plant enclosure creating a double height plant well. The 9th fl oor plant is accessed by ships ladder from above to mitigate maintenance access through the office fl oor, although an alarmed emergency exit door is provided at 9th fl oor level.

The plant well will be drained from two points with an external overflow.

Fig. 171 *"Proposed screening to the roof top plant (top) and proposed roof plan (bottom) (own drawing). (Bottom) Visualisation of toilet facilities"*

Fig. 172 *"Proposed view from the Monument Viewing platform"*

Facade

A new stone skin is proposed to the building. This stone skin is then carved to expose areas of glazing. The new stone façade is proposed from ground to 7th fl oor. The articulation of the façade and the depth of the reveals provides solidity to the façade, integrating it into the surrounding townscape.

Base

• The three storey base section of the facade is grand in scale so responding to the classicism of City architecture
• The stone façade line is pulled forward to engage more positively with the streetscape and reinforce the view of 68 King William Street (House of Fraser)
• Between the stone piers, large areas of glazing allow for a clear retail zone and are recessed from the facade providing depth and articulation at ground and fi rst fl oor level.
• The internal environment is visible and animates the base of the building.

Middle

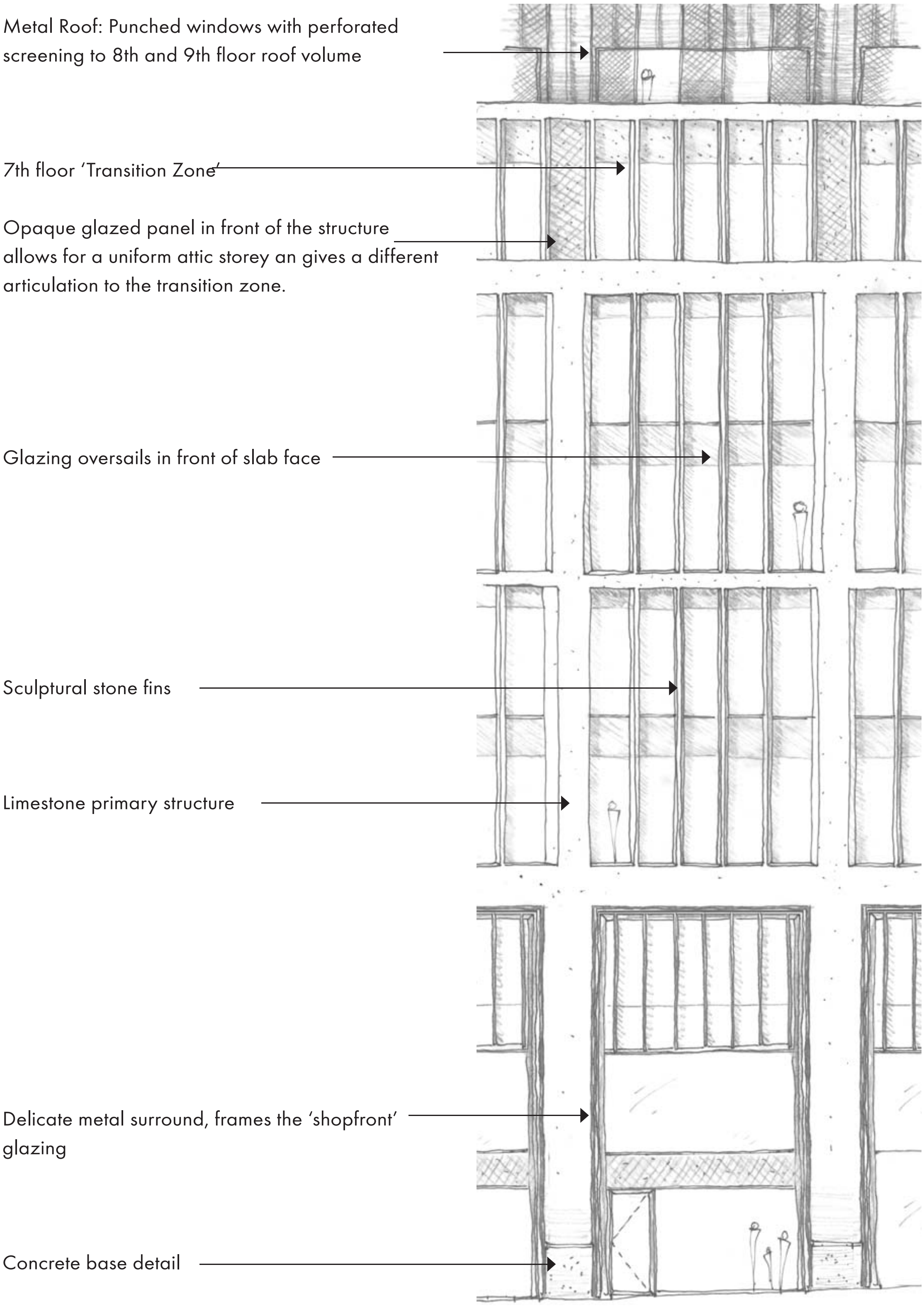
• The depth of the sculptural stone façade will provide solar shading without compromising views out
• The new effi cient glazing system will allow natural light to penetrate deep into the building, improving the internal environment and allowing more visibility from outside, activating the façade
• The subtle splay and changes in orientation of stone elements across the façade changes the external appearance of the building depending on the vantage point, while maintaining solidity within the oblique views.

Transition zone

• An attic storey is created at 7th fl oor through the location of horizontal banding across the facade. This serves to visually reduce the overall mass of the facade and create a "transition zone" at high level

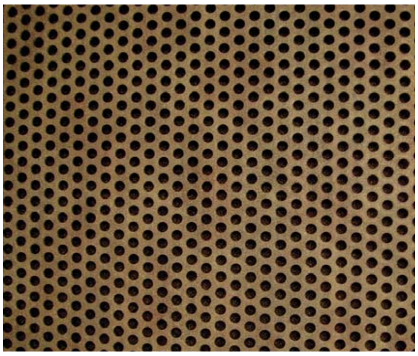
Top

• The curved roof profi le diminishes the perceived height of the building when viewed from street level.
• The roofscape is designed for elegance and simplicity, playing a subservient role to the stone façade at lower levels
• Areas of glazing within the roofscape take full advantage of the excellent views across the City
• The rhythm of windows and panels of screening serve to articulate the roof volume.
• The articulated roofscape provides interest at high level
• The proposed rationalisation of rooftop plant associated with proposals would be of benefi t to the foreground view from the Monument viewing platform.
• The inhabited roof zone echos the mansard at 68 King William Street.


Metal Roof: Punched windows with perforated screening to 8th and 9th floor roof volume
7th floor 'Transition Zone'
Opaque glazed panel in front of the structure allows for a uniform attic storey an gives a different articulation to the transition zone.
Glazing oversails in front of slab face
Sculptural stone fins
Limestone primary structure
Delicate metal surround, frames the 'shopfront' glazing
Concrete base detail

Limestone

Bronze/ Brass



Coloured stainless steel perforated screening

Dark grey zinc roofing

Concrete

Minimal glazing sections

Fig. 173 *"(Previous page)Sketch of the facade. (Above) Materials palette."*

Materials

The palette of materials and the manner in which they have been employed within the proposals for 24 King William Street respond to the surrounding site context while presenting an elegant contemporary facade.

Stone

Limestone cladding has been selected as the proposed facade treatment material through discussions with the planning department. The modelling of the proposed facade provides both depth and relief to the façade. This creates a solid oblique view when the building is viewed over London Bridge, something which was very important to the City of London planning and design offi cers.

Facade

The stone facade provides an element of weight and permanence, to tie it to the heritage of the City. By proposing a pale colour of limestone, the proposed façade will respond better to the surrounding architecture and harmonise with it to enhance the approach from London Bridge

Fenestration

New glazing is provided throughout to improve the quality of the office spaces, both in terms of daylight and thermal performance. A unitised curtain walling system is proposed.

Roof

A zinc standing seam roof is proposed. Using metal to clad the roof will distance it from the stone façade, allowing the roof to play a subservient role. The punched windows within the roof volume are screened in areas by perforated metal panels, reducing solar gain and glare within the top two floors.

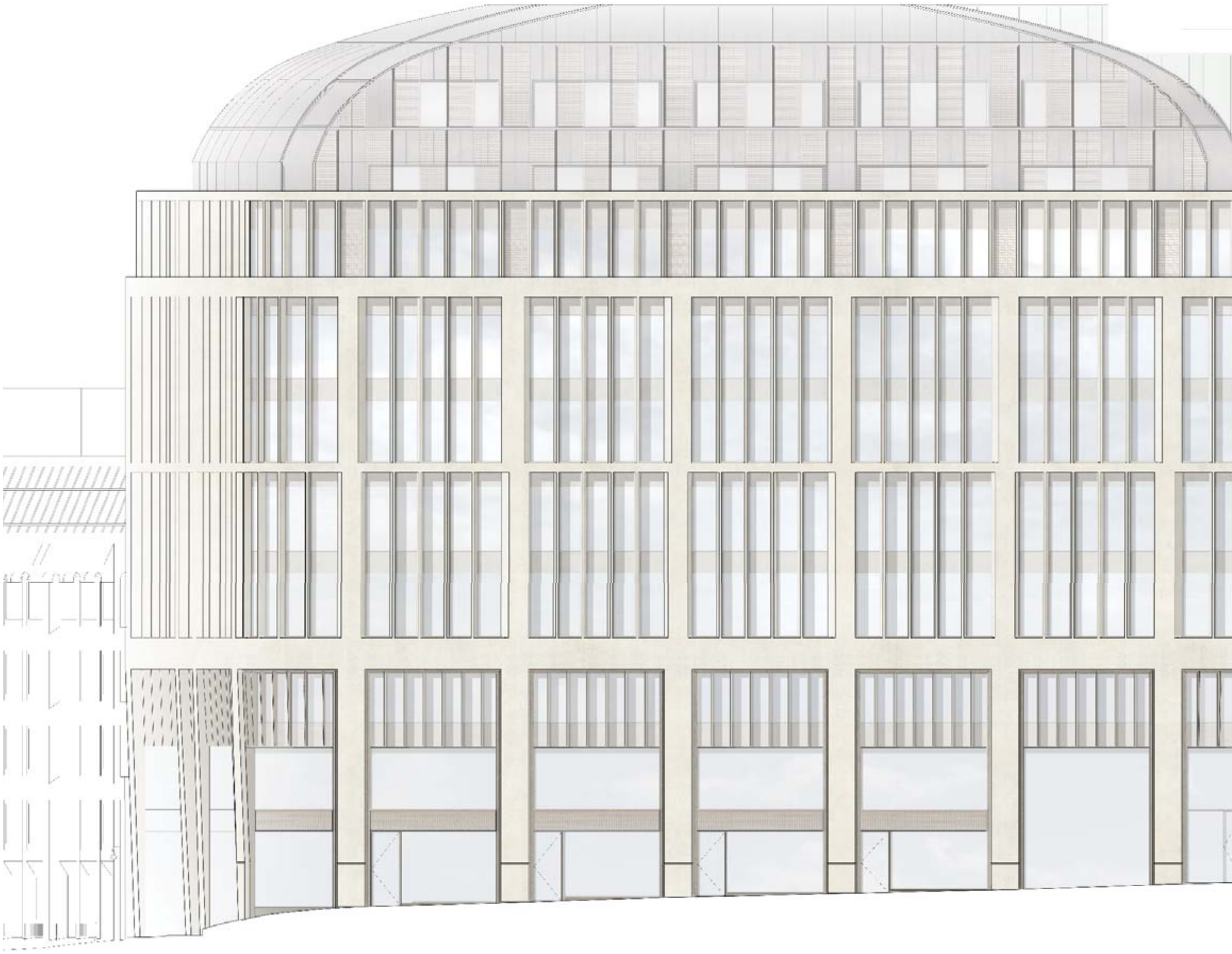


Fig. 174 *"Recladded facade (above). Next page stone panel solutions with honeycomb structure."*

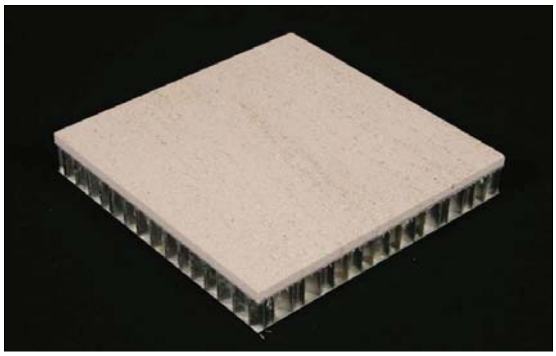
Cladding

A determining factor is also the overall proposed weight of the cladding and the affect this has on the existing structural frame as well as the existing foundations. The proposals must add no additional weight to the existing frame.
The narrow cladding zone permitted by the existing structure has also affected the selection of the proposed cladding system.

The proposed solid element for the cladding is a stone faced aluminium honeycomb composite product. A 6-8mm thick limestone is to be laminated to an aluminium honeycomb backing panel. This provides an elegant, slimline and lightweight cladding solution.

At ground and 1st fl oor, large format shopfront glazing is employed. This will be a thermally broken aluminium stick curtain wall system with bronze/ brass clad feature fi ns. The glass for the ground and first fl oor will have different coatings to respond to the differing internal uses and their energy requirements.
The new 8th and 9th fl oor sit within a curved roof form, clad in dark grey zinc standing seam.
There are large glazed openings within the roof form and at 9th fl oor, these windows will be curved to follow the roof form.

The glazed openings are screened by perforated metal panels which also serve to break up the mass of the roof volume. Coloured stainless steel has been selected for the metal screens to avoid metullurgic reactions with the zinc or existing drainage system.
The surface of the stainless steel is treated to create texture and variation.



6.2 JAMESTOWNROAD, LONDON

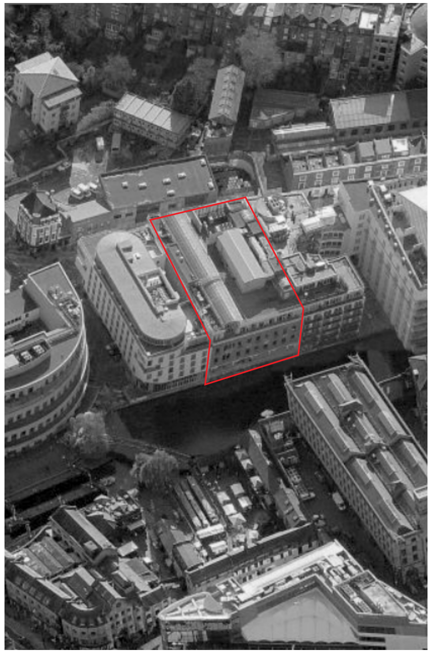


Fig. 175 *"Visualisation of the building, view on the street; Location plan above" and view of the building from the canal."*

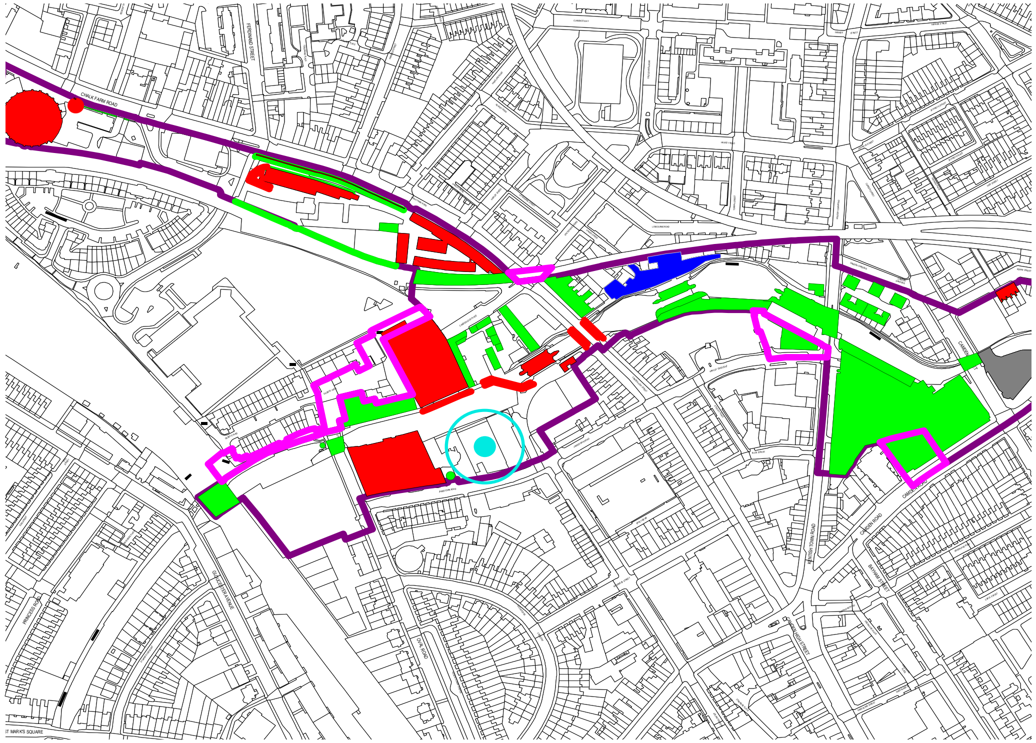
The aim of the project was to remodel and extend Bewlay House located in Jamestown Road, in Camden, London.

The project has been defined by the following criteria:

- High quality contemporary design
- Refurbish and re configure the existing building
- Recycle the existing building structure
- Re clad the existing building creating new facades on Jamestown Road and Regents Canal
- Add two new floors to the existing building providing 9 residential units
- Provide additional office space
- Relocate the existing roof plant to a discreet location

The main aim was to recycle the existing building structure as the basis of a contemporary, mixed-use development. New brick cladding expresses the building's existing structural frame and creates large glazed openings overlooking the Regent's canal, which are animated by projecting steel balconies. Inspiration for this approach has been drawn from the character of historic canal side buildings, adding a contemporary interpretation.

Organised around a light filled central atrium, the offices benefit from generous ceiling heights; 3.4 metre floor to ceiling heights to floors 1-3 and 2.9m to the fourth floor. The glazed central atrium defines the open office floor plates and maximises natural daylight. 9 high-quality flats with floor to ceiling glazing and generous roof terraces have been thought for the top two building storeys.



KEY

- Listed Building
- Negative Building
- Positive Building
- Regent's Canal Conservation Area
- Proposed Conservation Area
- Opportunity Site

Fig. 176 *"(Left) Segment of the Regent' s canal area; (middle) Conservation area and building in red. (Above) Grade II listed building opposite."*

The site is located within the Regent's Canal Conservation Area.

It is not a listed building, but is located on the opposite side of the canal from a listed warehouse building, and there are a number of other listed and 'positive' buildings nearby. In the project of retrofit the building was thought to be enhanced rather than damaged. Bewlay House is a 1980's office building with a basement, ground floor, three upper storeys of office accommodation and a further floor of enclosed plant at roof level. It has two elevations, one that addresses Jamestown Road and one that addresses Regent's Canal. The Regent's Canal elevation is predominantly of brick construction with punched window openings, while curtain walling dominates the Jamestown road elevation. There are setbacks at the ground floor and third floor to both elevations.

Both elevations appear to be tired and need to be retrofitted. The existing building lies on a North West to South East axis and has two facades facing JamestownRoad and Regents Canal. Large windows along both facades are designed to maximise natural daylight. Additional light is gained from the glazed central atrium that will be created in the building floor plate. The proposed offices face onto both facades over the 1st - 3rd floors. At ground level the offices face Jamestown Road.

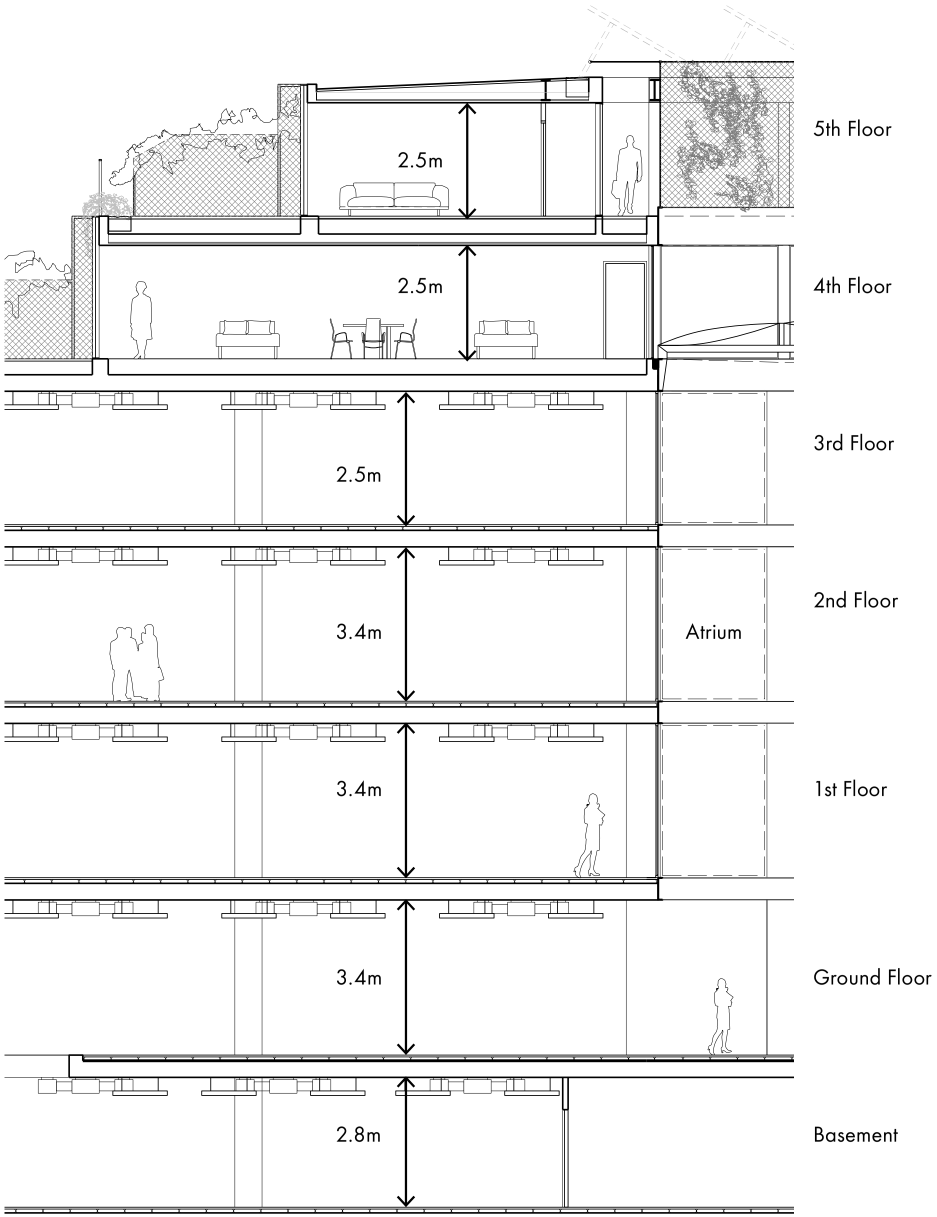


Fig. 177 *"Long section detail (not to scale) showing the heights of the floors"*

The residential units on the fourth floor face out onto the Canal and the fifth floor flats address both elevations.

A series of strategies have been implemented:

- The massing of the additional proposed two storeys ensures that they the additions are not visible from a number of strategically identified views.
- A new central glazed atrium brings light into the centre of the office floor plates and provides a central circulation route.
- On the fourth and fifth floors circulation and access to the apartments are planned around this.
- The lift's to the offices (floors 1-4) are located in the atrium.
- All bedrooms and living spaces benefit from large windows to maximise natural daylight
- The living areas are combined living/kitchen/ eating areas that are placed along the glazed façades with external spaces and planting for additional privacy
- All the apartments have access to a generously sized terrace.
- Built-in storage is provided in all hallways, bedroom and living areas.
- Green privacy screens to the residential terraces allow for privacy between residential units and the adiacent buildings.

The proposed residential units will be a mix of sizes ranging from a 1-bed apartment of 50 sqm to a 3-bed of 177 sqm.

Residential apartments provided as follows:

Fourth floor

- Flat 401: 3 bedrooms/175 sqm
- Flat 402: 3 bedroom/152 sqm

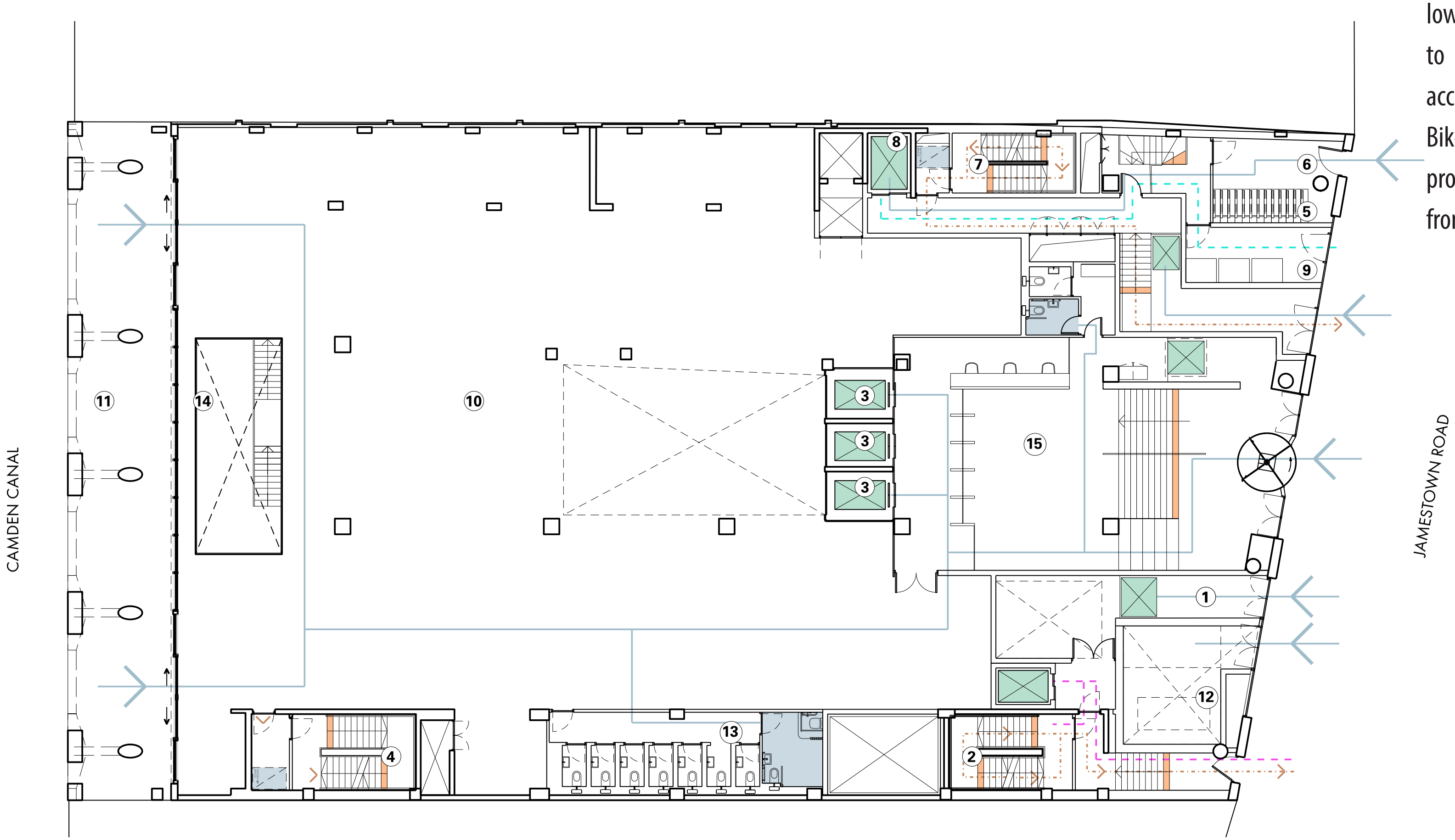
Fifth Floor

- Flat 501: 2 bedrooms/83 sqm
- Flat 502: 1 bedroom/50 sqm
- Flat 503: 1 bedroom/57 sq
- Flat 504: 1 bedroom/50sqm
- Flat 505: 1 bedroom/50 sqm
- Flat 506: 2 bedrooms/88 sqm
- Flat 507: 2 bedroom/96 sqm

The office spaces and residential unit's are designed to maximise natural daylight. Large operable windows are integrated to maximise natural ventilation and daylight The new internal atrium is fully glazed from floors 1-4 to bring daylight into the centre of the office floor plates improving floor plate efficiency.

Ground floor

The existing ground floor slab to the building has been lowered at the entrance area to provide accessible access to the building from Jamestown Road. All floors are accessible via lifts and are equipped with accessible WCs. Bike storage for the office and residential use classes is provided at basement level and has a dedicated entrance from the street.



1. Office bin collection point
2. Stair C
3. Office lifts to all floors
4. Stair B
5. Residential cycle store
6. Residential bin store
7. Stair A
8. Residential lift
9. Residential reception
10. Ground floor office space
11. Accesible terrace to ground floor office space
12. Substation
13. WC's to ground floor office
14. Stairs to basement office
15. Office Reception

KEY

- Lifts
- Accessible facilities
- Stepped Access
- Level access route
- Office cycle store access
- Residential cycle store access

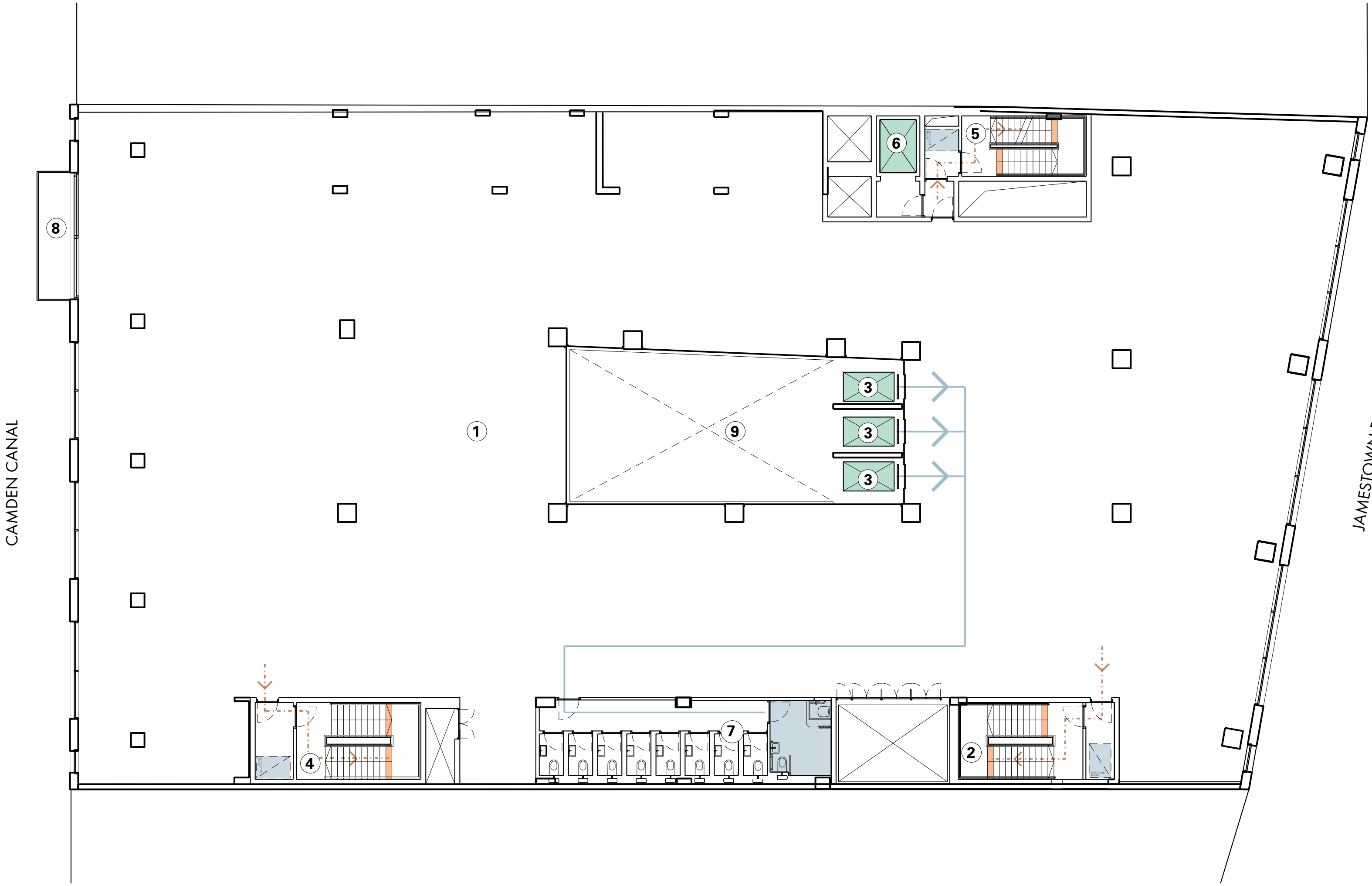
Fig. 178 *"Ground floor plan"*

1st and 2nd floors

Principle access to the floors is via the 3 lifts from the central atrium.

3 stair cores will facilitate escape from the building..

Each floor of office also benefits from a balcony providing external space.



1. Typical office space floors 1-2
2. Stair C
3. Office lifts to all floors
4. Stair B
5. Stair A
6. Residential lift
7. WCs to office
8. External space/balcony to office
9. Atrium- open to below

KEY

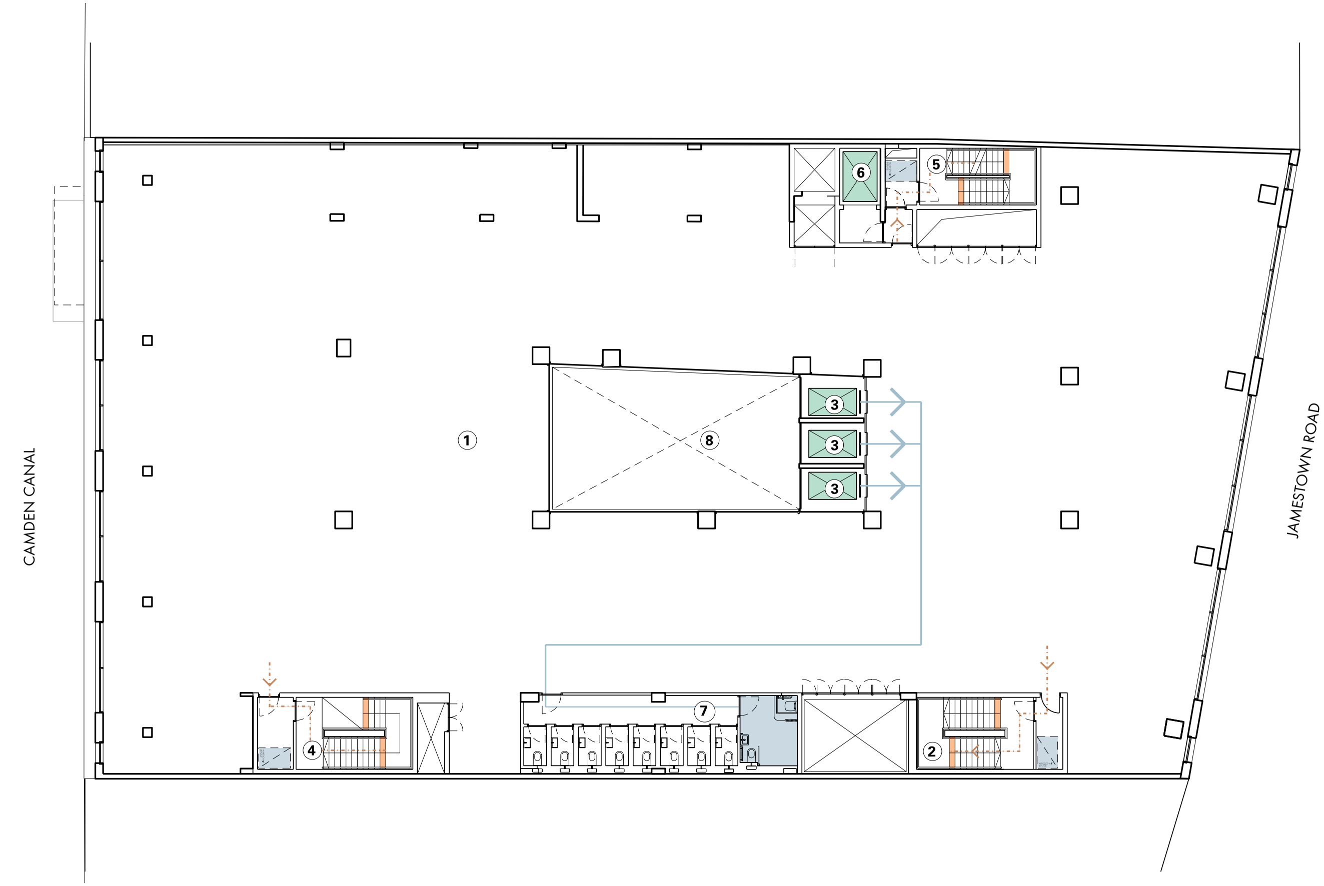
- Lifts
- Accessible facilities
- Stepped Access
- Level access route
- Office cycle store access
- Residential cycle store access
- Fire escape route

Fig. 179 *"1st and 2nd floor plans"*

Third floor

Principle access to the floors is via the lift from the central atrium will facilitate escape from the buildi ing.

Each combines a refuge point. An accessible WC/ shower is located on the floor. The office also benefits from a balcony providing external space.



1. Third floor office space
2. Stair C
3. Office lifts to all floors
4. Stair B
5. Stair A
6. Residential lift
7. WCs to office
8. Atrium- open to below

KEY

- Lifts
- Accessible facilities
- Stepped Access
- Level access route
- Office cycle store access
- Residential cycle store ac
- Fire escape route

Fig. 180 *"Third floor plan"*

4th floor

Access to the office floors is via 3 lifts from the central atrium.

Access to the apartments is via a dedicated lift from ground level.

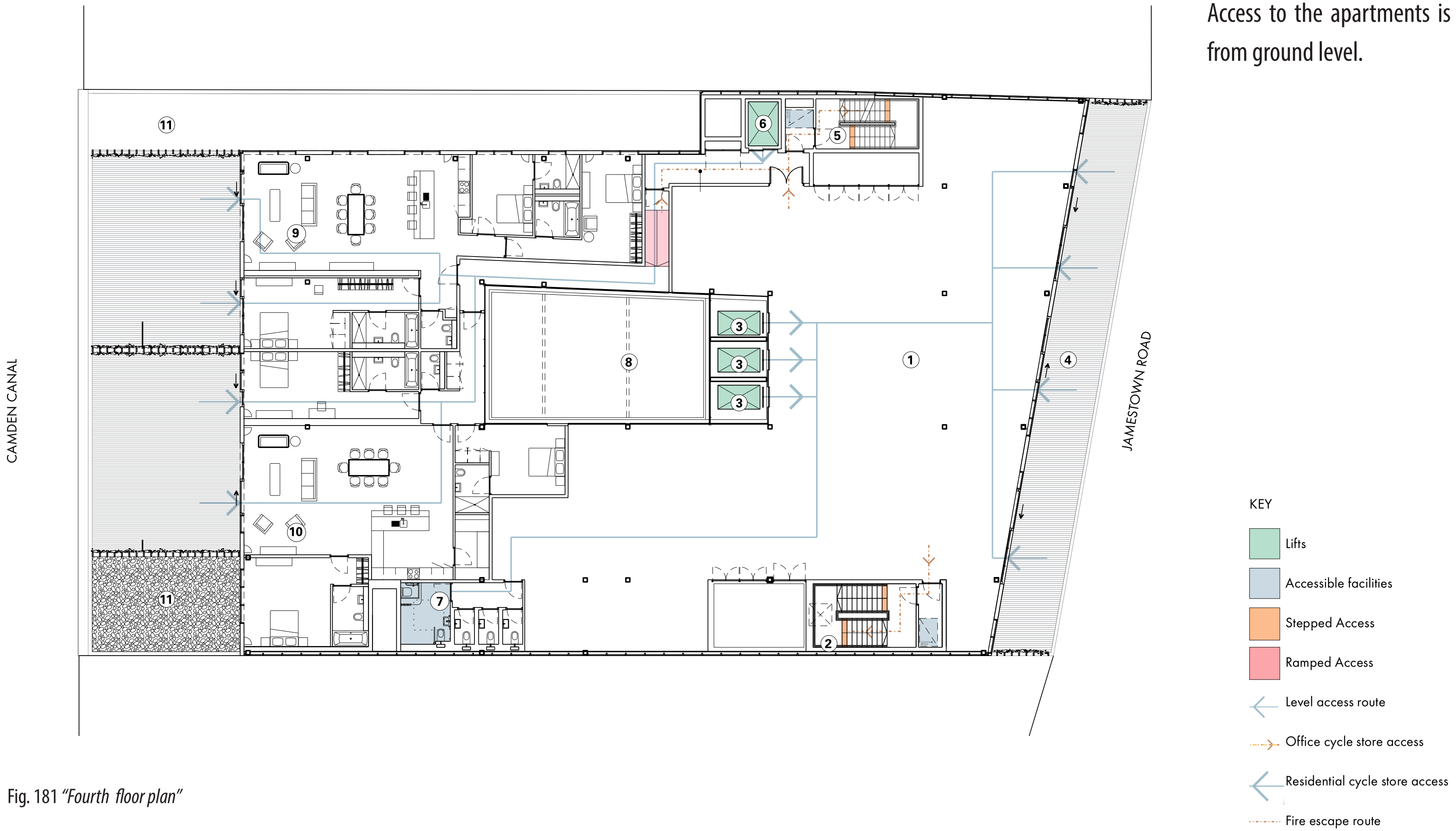


Fig. 181 *"Fourth floor plan"*

5th floor

Access to the apartments is via a dedicated lift from ground level.

There is step-free level access from flat living spaces onto exterior terraces.

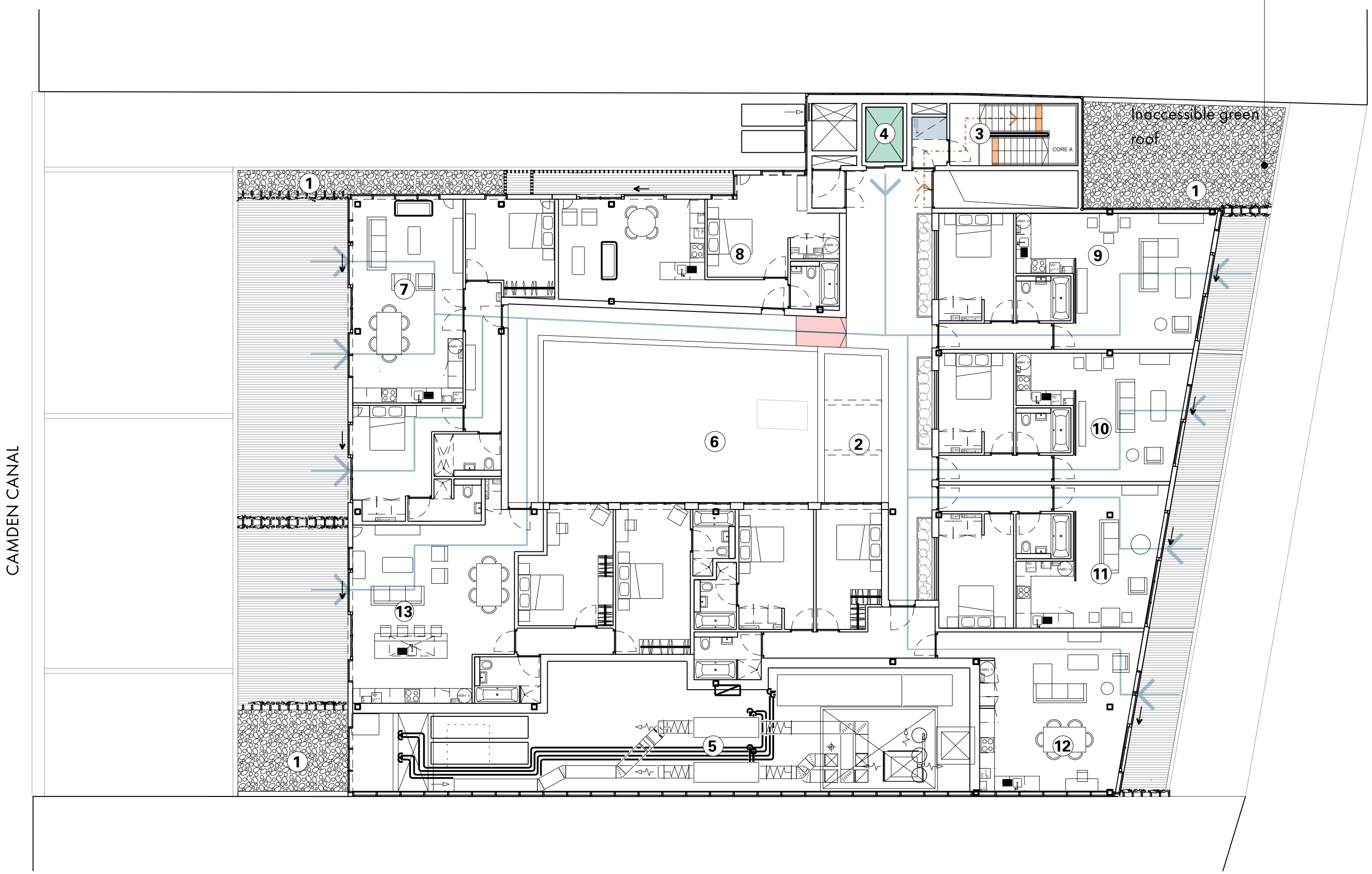
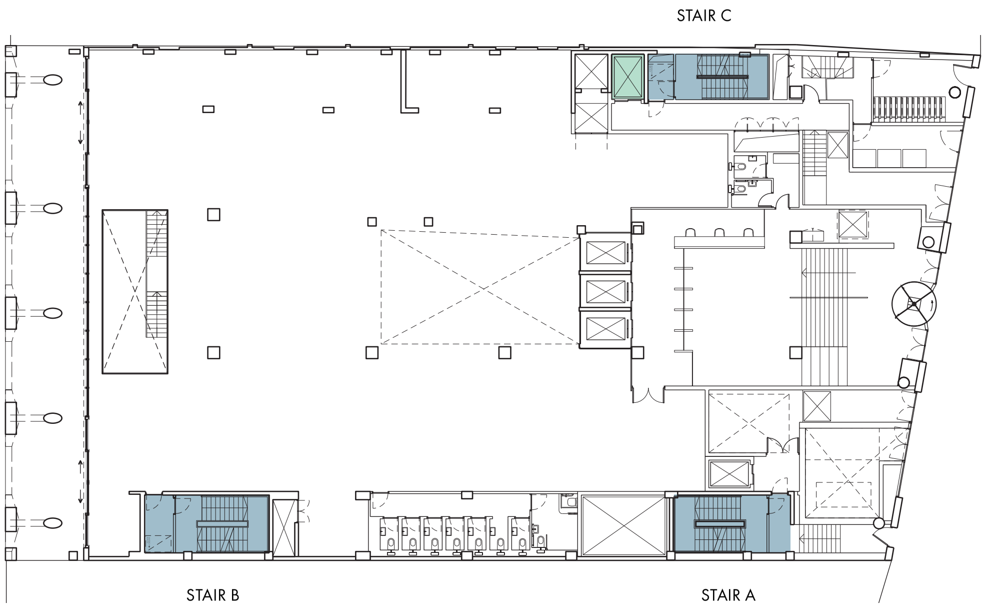


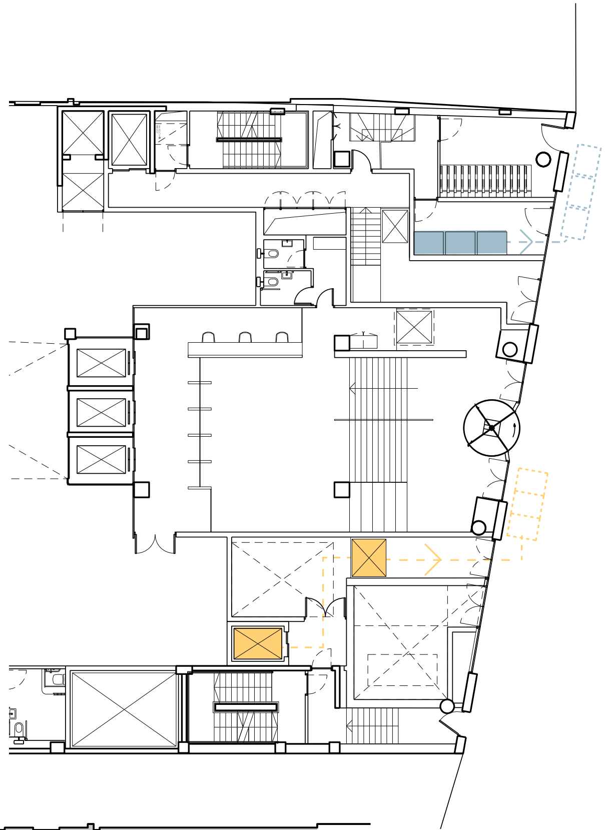
Fig. 182 *"Fifth floor plan"*

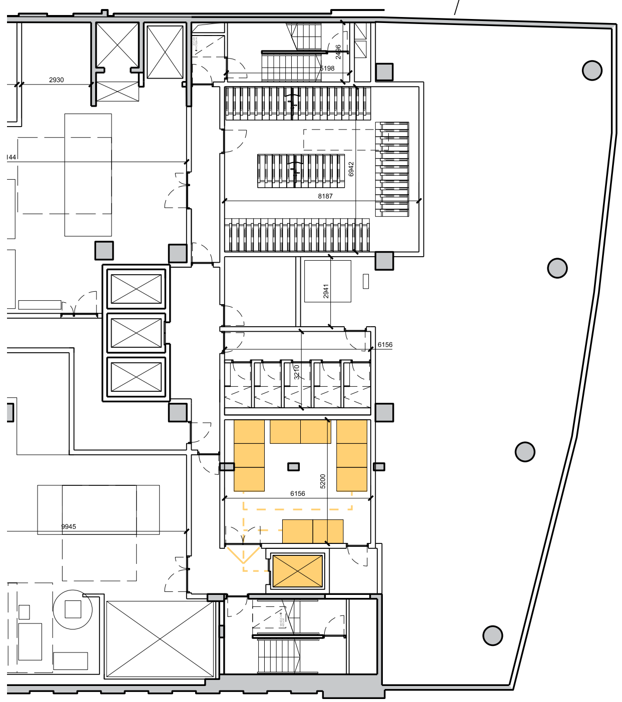
1. Inaccessible green roof
2. Lift overrun
3. Stair A
4. Residential lift
5. Plant
6. Atrium- open to below
7. Flat 5.01
8. Flat 5.02
9. Flat 5.03
10. Flat 5.04
11. Flat 5.05
12. Flat 5.06
13. Flat 5.07

KEY

- Lifts
- Accessible facilities
- Stepped Access
- Ramped Access
- Level access route
- Office cycle store access







Stair cores

Fire fighting lift to residential units

Fig. 183 *"Plan highlighting scale cores (above). Access and waste in the right drawings."*

The plan on the left illustrates the shared escape routes through three main staircases; on the plans on the right, waste deposits are shown.

The waste and recycling storage spaces have been thought be finished in robust durable materials of block and brick to minimise damage from bins.

Fig. 184 *"Ground floor plan"*

Layout

The proposed layout seeks to re-plan the existing building to make best use of its existing structure and effectively manage the circulation.

As the building is inaccessible from the Regent's Canal, all access and servicing must take place from Jamestown Road. To facilitate this, the existing undercroft to Jamestown Road was thought to be infilled to the building line and contains level entrances to the residential accommodation and offices.

A dedicated lift serves the upper residential floors and hugs the easterly party wall of the building.

Lifts and WC accommodation serving the offices hug the building's westerly party wall. The existing undercroft to Regent's Canal is retained, providing a terrace for the office accommodation. To maximise daylight to the office floorplates a central atrium is provided to all floors. From the ground to 3rd floors this is internal. Above this level the well is open to the elements with access to the residential flats via planted open-sided balconies. At the 4th and 5th floors the footprint steps in from the building line to create generous planted roof terraces that serve the residential accommodations. Plant accommodation, cycle storage and showers are located in the basement.

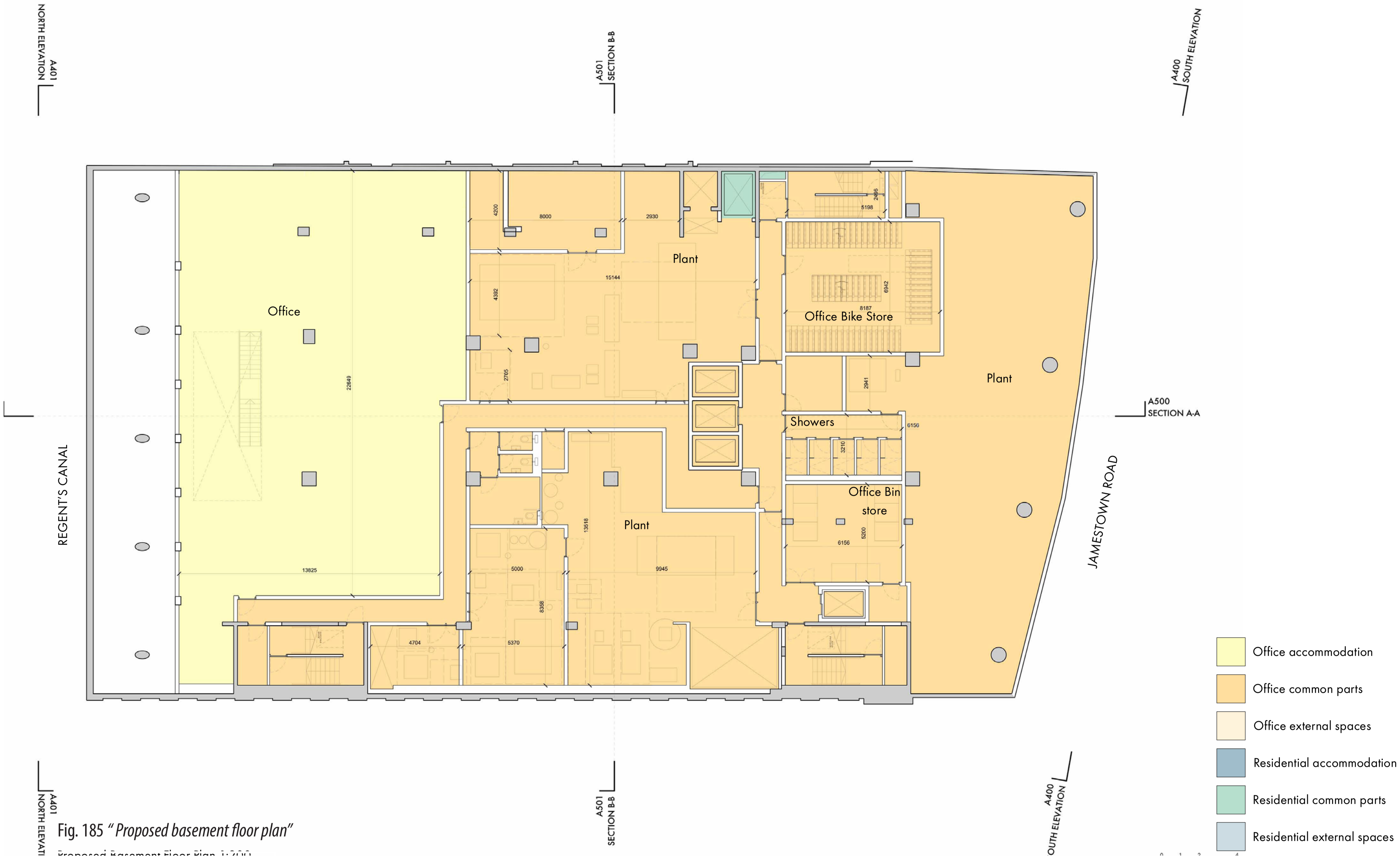


Fig. 185 *"Proposed basement floor plan"*

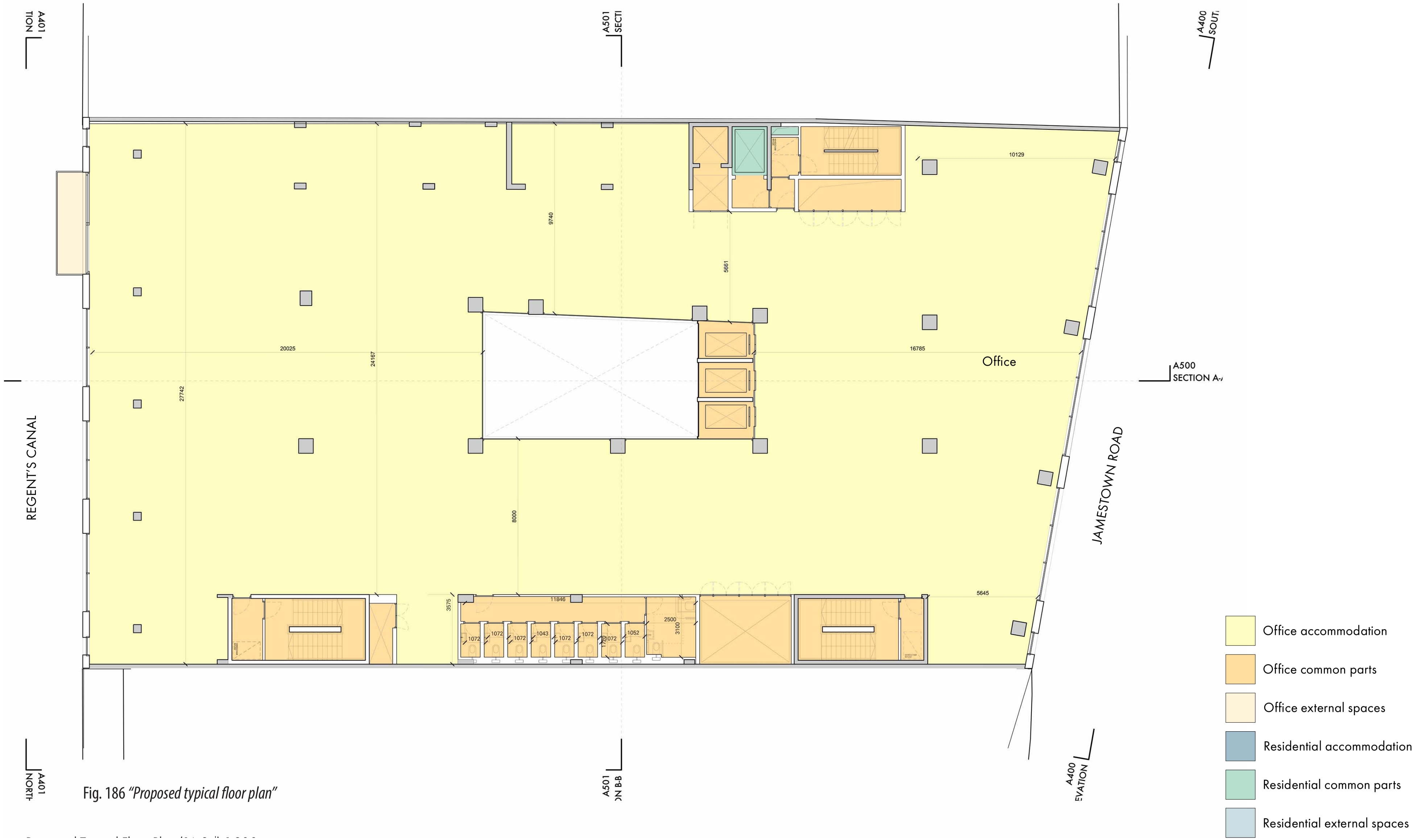


Fig. 186 *"Proposed typical floor plan"*

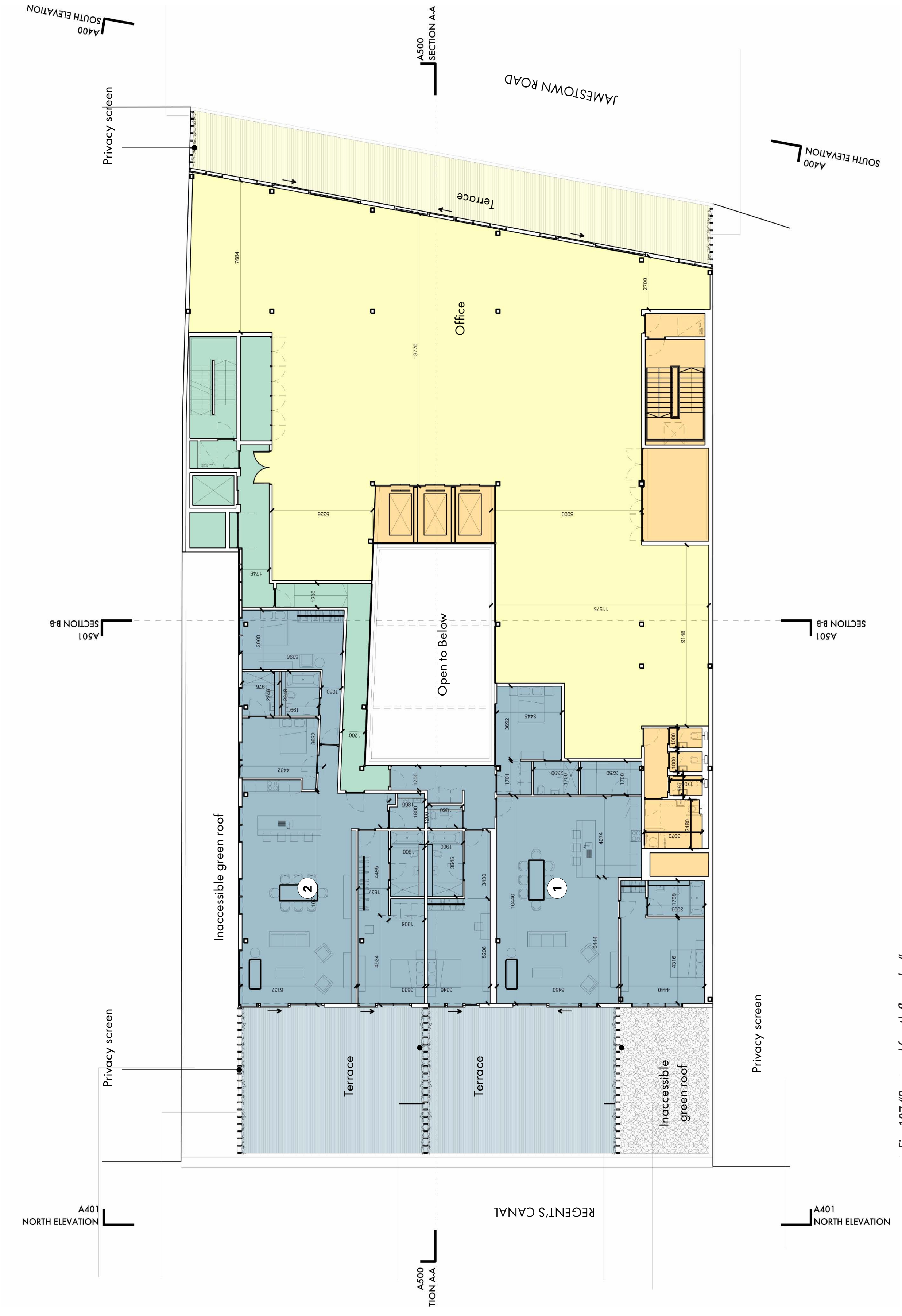


Fig. 187 "Proposed fourth floor plan"

Fig. 188 *"Proposed fifth floor plan"*

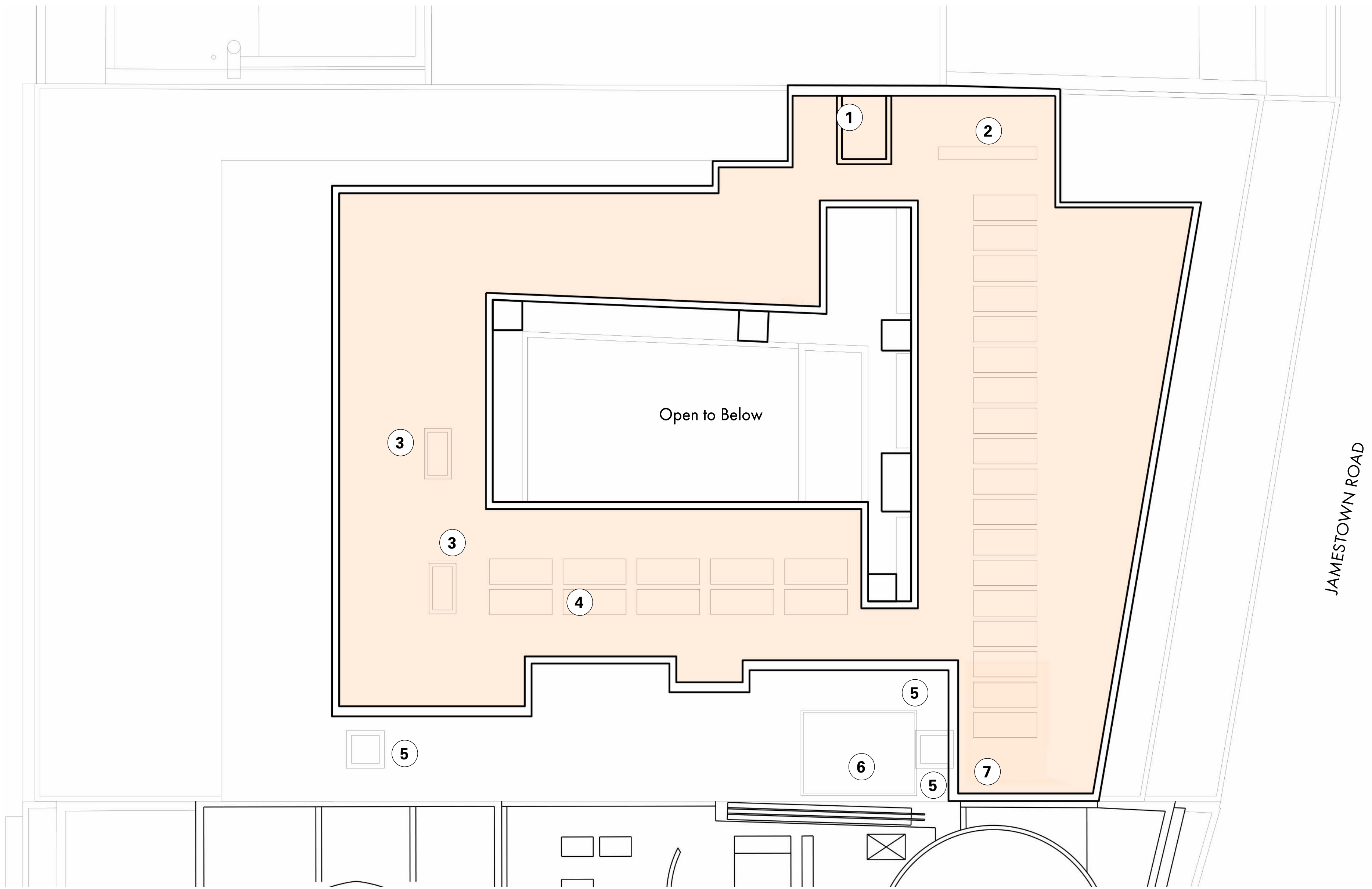


Fig. 189 *"Proposed roof plan - 1.Lift overun, 2. Fire fighting stair fan, 3. Rooflight, 4. Photovoltaic panel, 5.AOV, 6. Boiler fuels, 7. Solar hot water panels"*

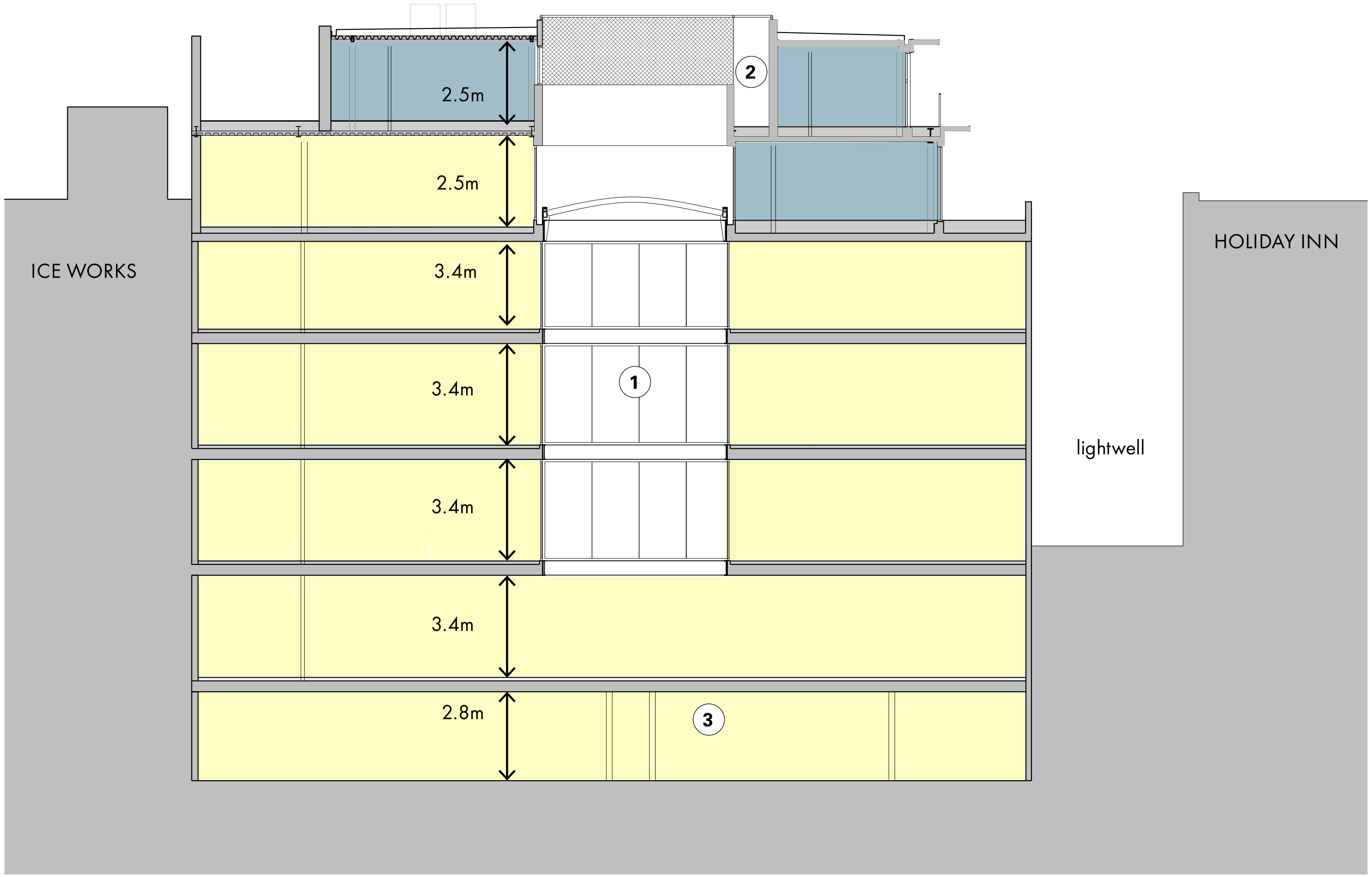


Fig. 190 *"Short section as proposed: 1.atrium, 2.external walkaways, 3.plant"0*

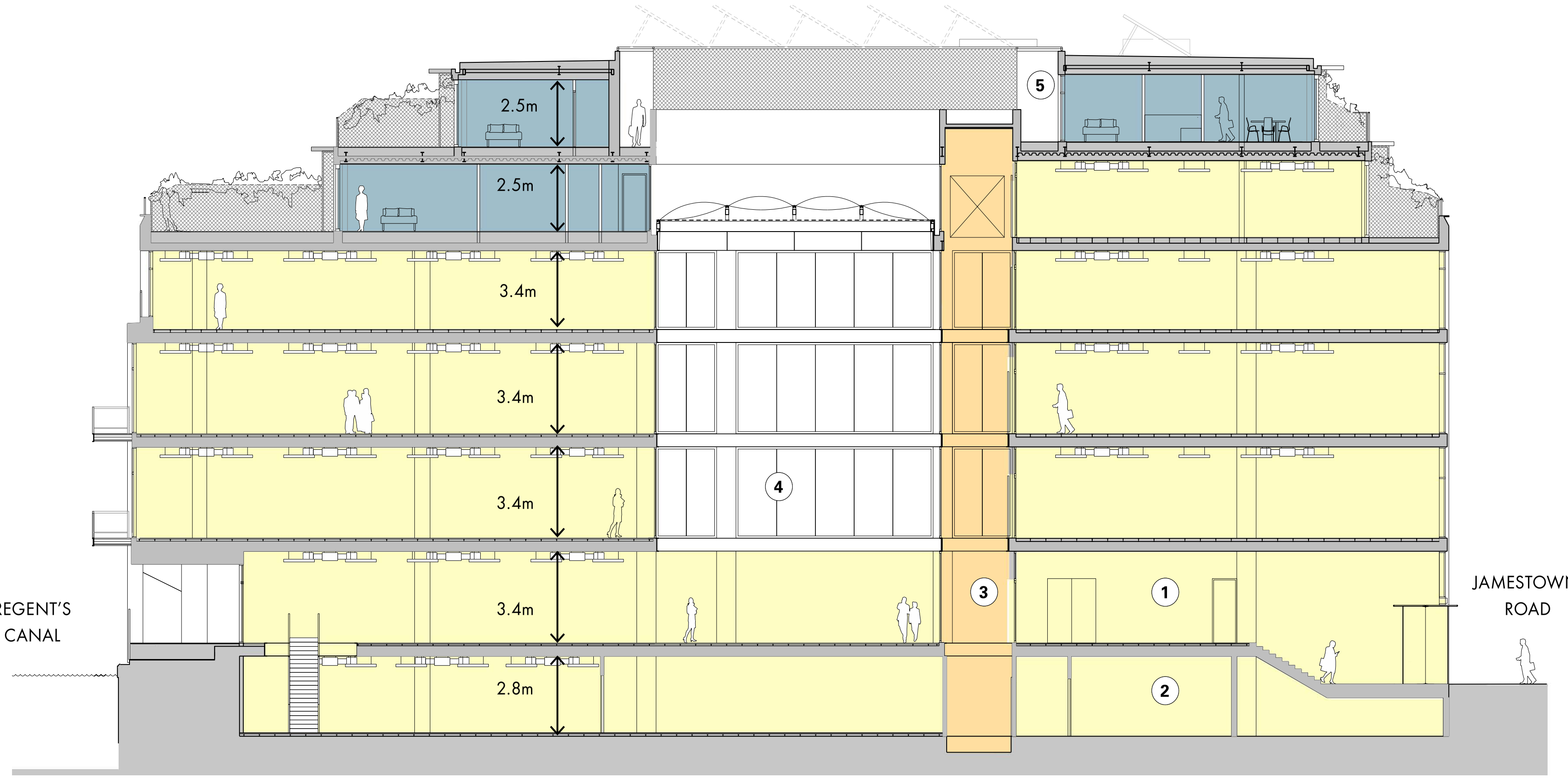


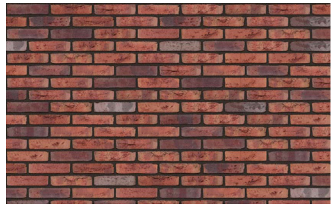
Fig. 191 *"Long section as proposed: 1.office reception, 2.bike store, 3.Lift shaft, 4.Atrium, 5.External walkway"2*


Fig. 192 *"View from the canal. (Next page) View from Camden High street"*

Envelope

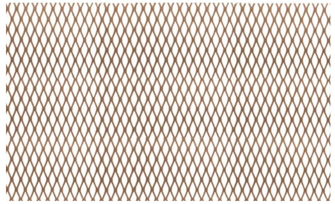
The re-imagined facades for Bewlay House are underpinned by a strong desire to reflect and enhance the Regent's Canal conservation area.
Strong, vertical masonry piers running into the canal echo the fenestration patterns of neighbouring canalside buildings and the Interchange Building opposite. A step in the masonry façade at third floor level continues the cornice line of the adjacent Holiday Inn, while the brick façade a level above is terminated by a steel channel coping. The vertical emphasis of the buildings masonry piers is enhanced by deep, recessed window openings separated by concrete spandrel panels and elegant projecting steel balconies. In such a way, the main building structure reflects a contemporary take on the canalside typology. The upper levels and terraces are a lightweight foil, with minimal, slidinglass walls and generous planting to provide green amenity space for the residential accommodation at roof level.

Fig. 193 *"External envelope materials (visualisation)"*

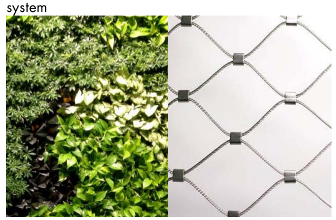


Red colour brick faced external walls

New thermally broken double glazed screens incorporating sliding doors where applicable



Permeable mesh panels incorporated into glazing system



Green wall screens

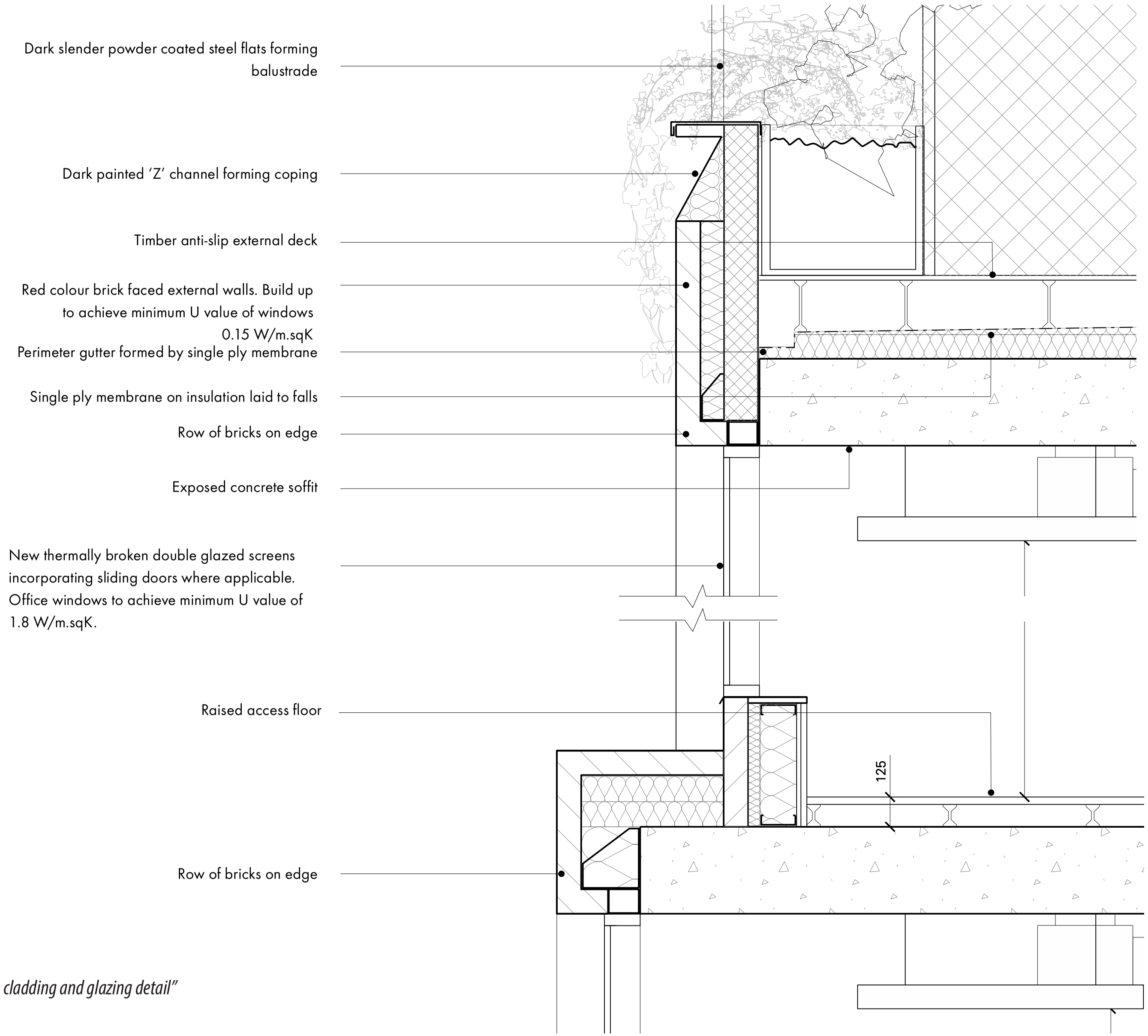
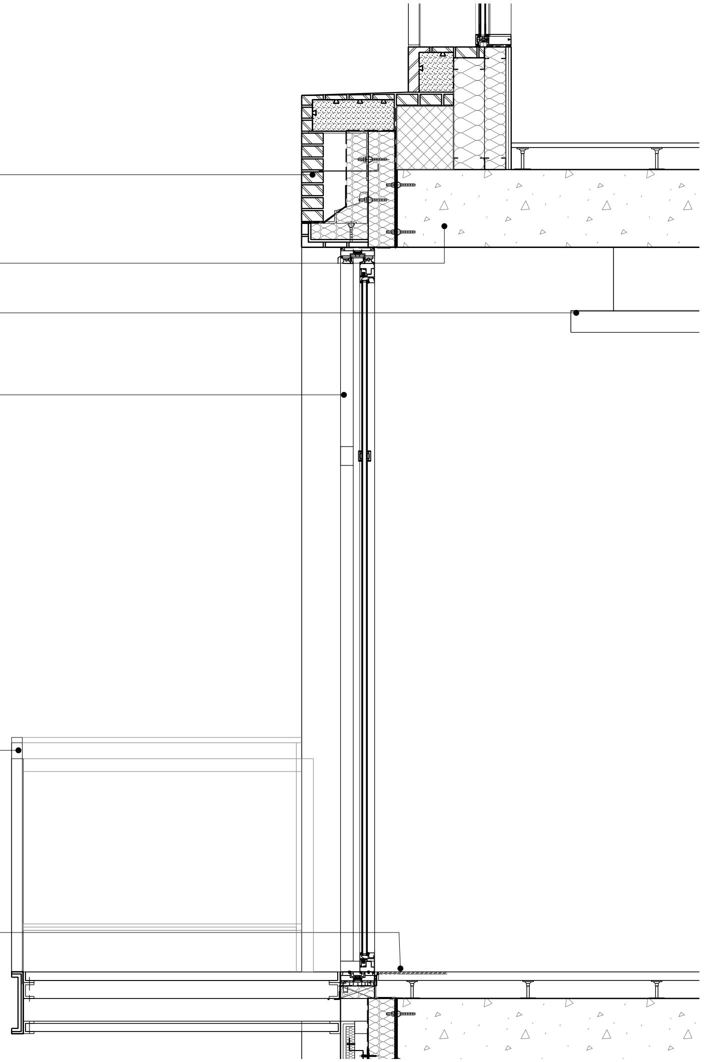
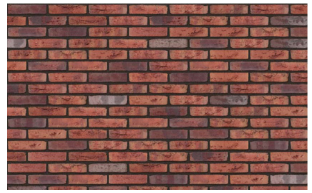


Fig. 194 *"External envelope : cladding and glazing detail"*





Red colour brick faced external walls

New thermally broken double glazed screens incorporating sliding doors where applicable

Dark slender powder coated steel flats forming balustrade

Fig. 195 *"External envelope : cladding and glazing detail on balustrade"*

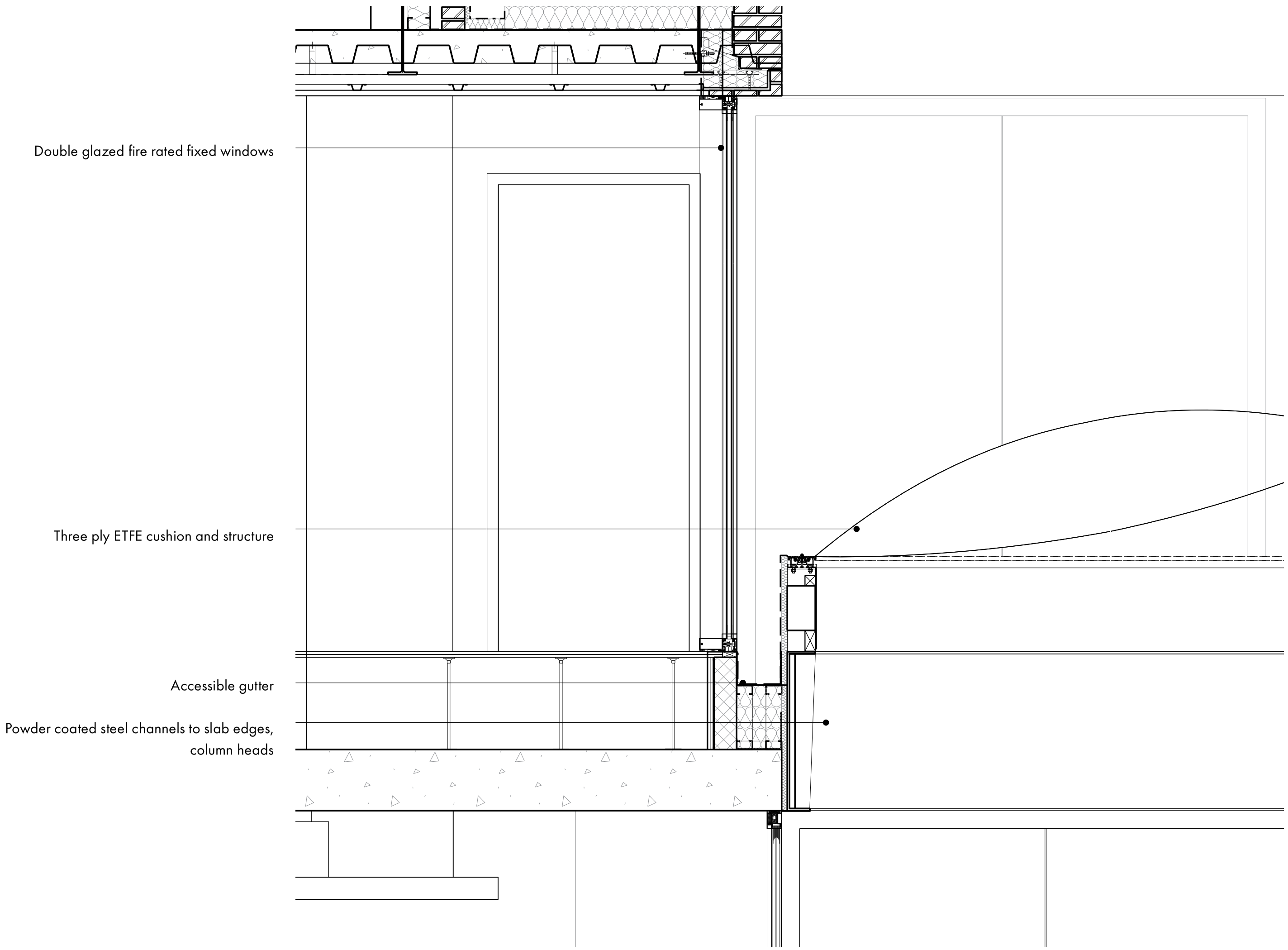


Fig. 196 *"Atrium glazing detail"*

Fig. 197 *"Atrium glazing solution"*

Fig. 198 *"Flat visualisation"*

Fig.199 *"Visualisation for typical office floor"*

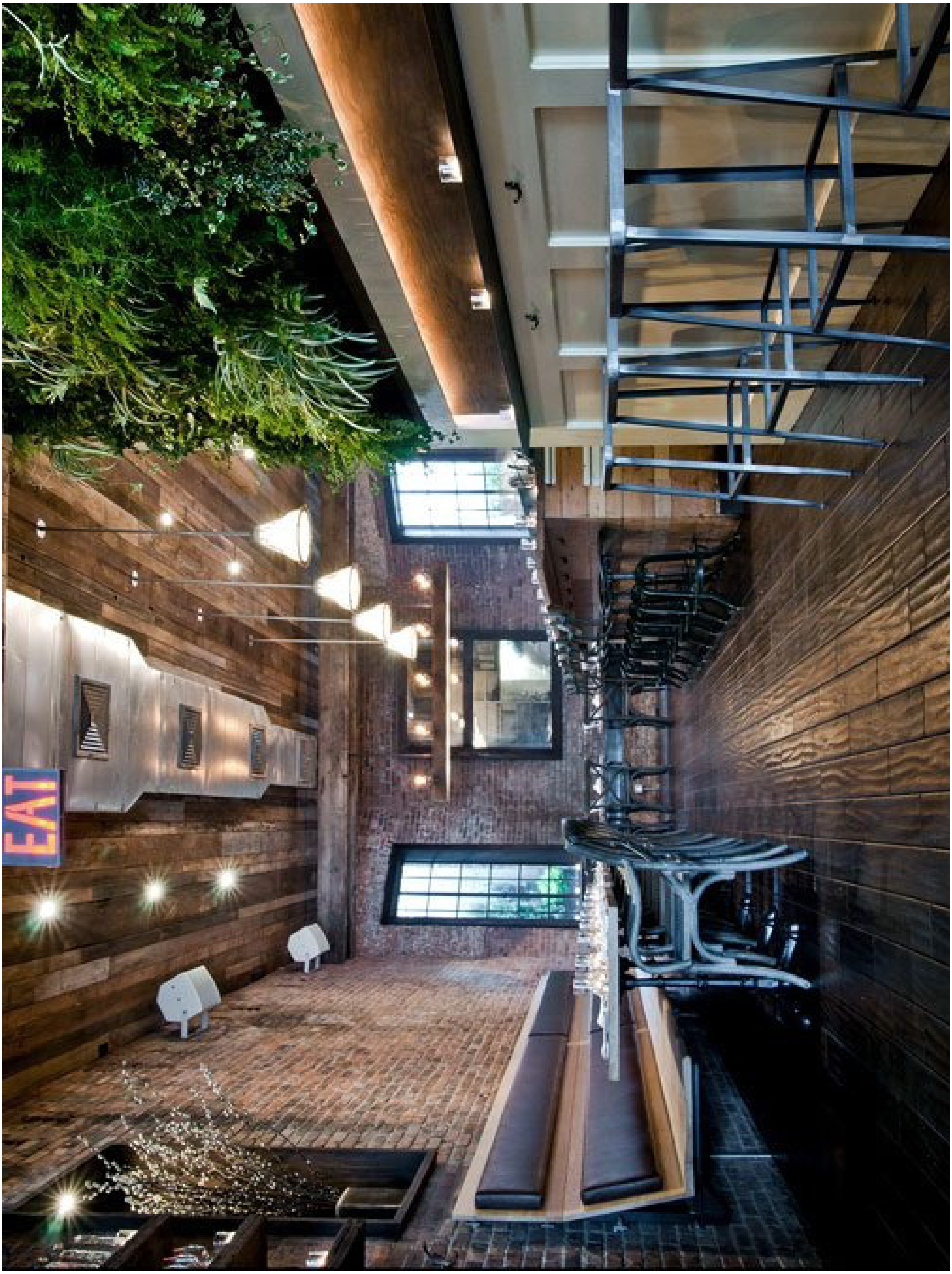


Fig.200 *"Restaurant visualisation for the ground floor"*

Green walls

Numerous green elements have been incorporated within the proposed design, including a number of privacy screens which will act as layers of privacy between the residential accommodation on levels 4 and 5 and neighbouring properties.

Each residential unit will benefit from a generous external terrace which functions as dedicated amenity space.
Timber decking will be interspersed with integrated areas of planting.

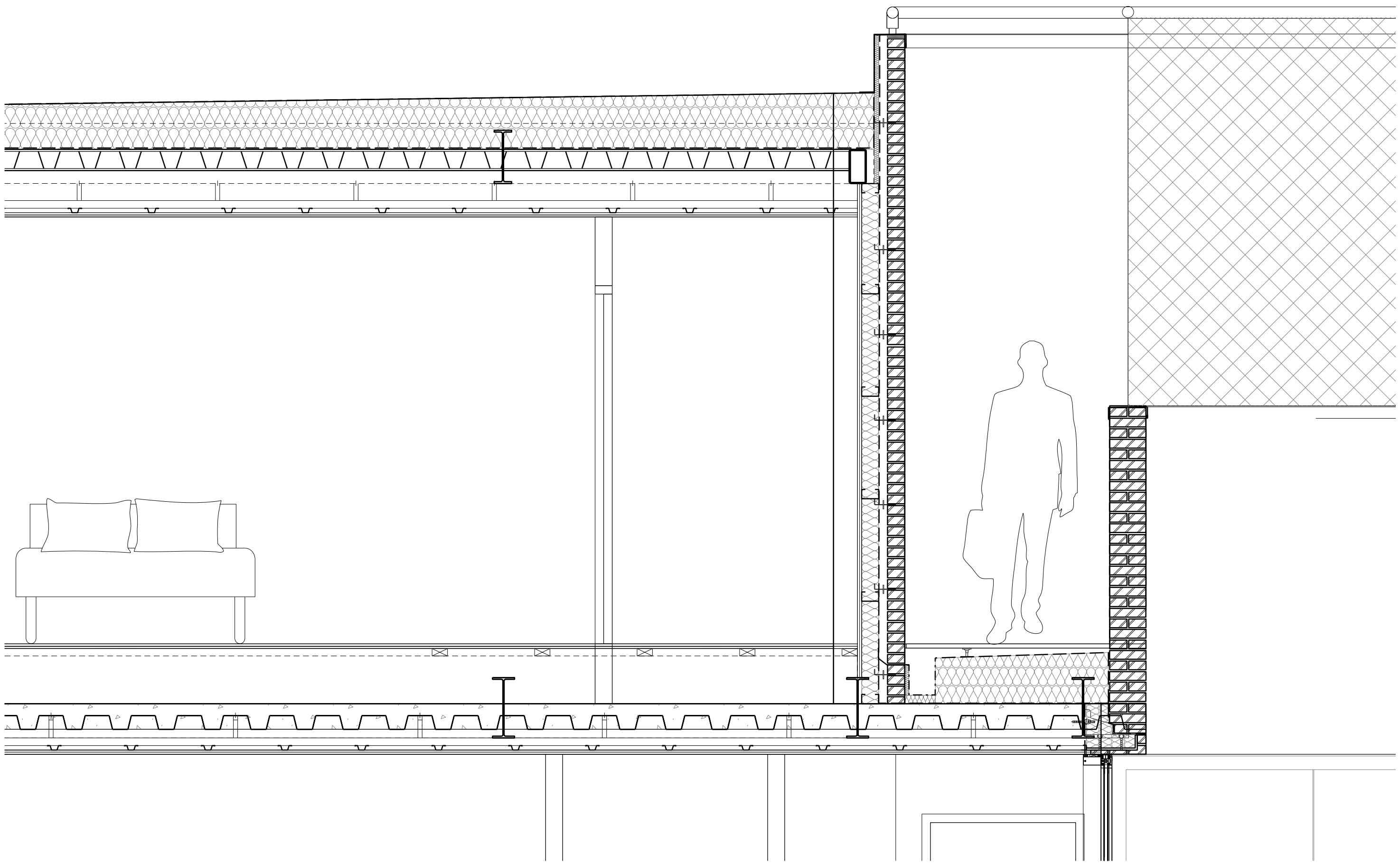


Fig. 201 *"Green wall detail"*

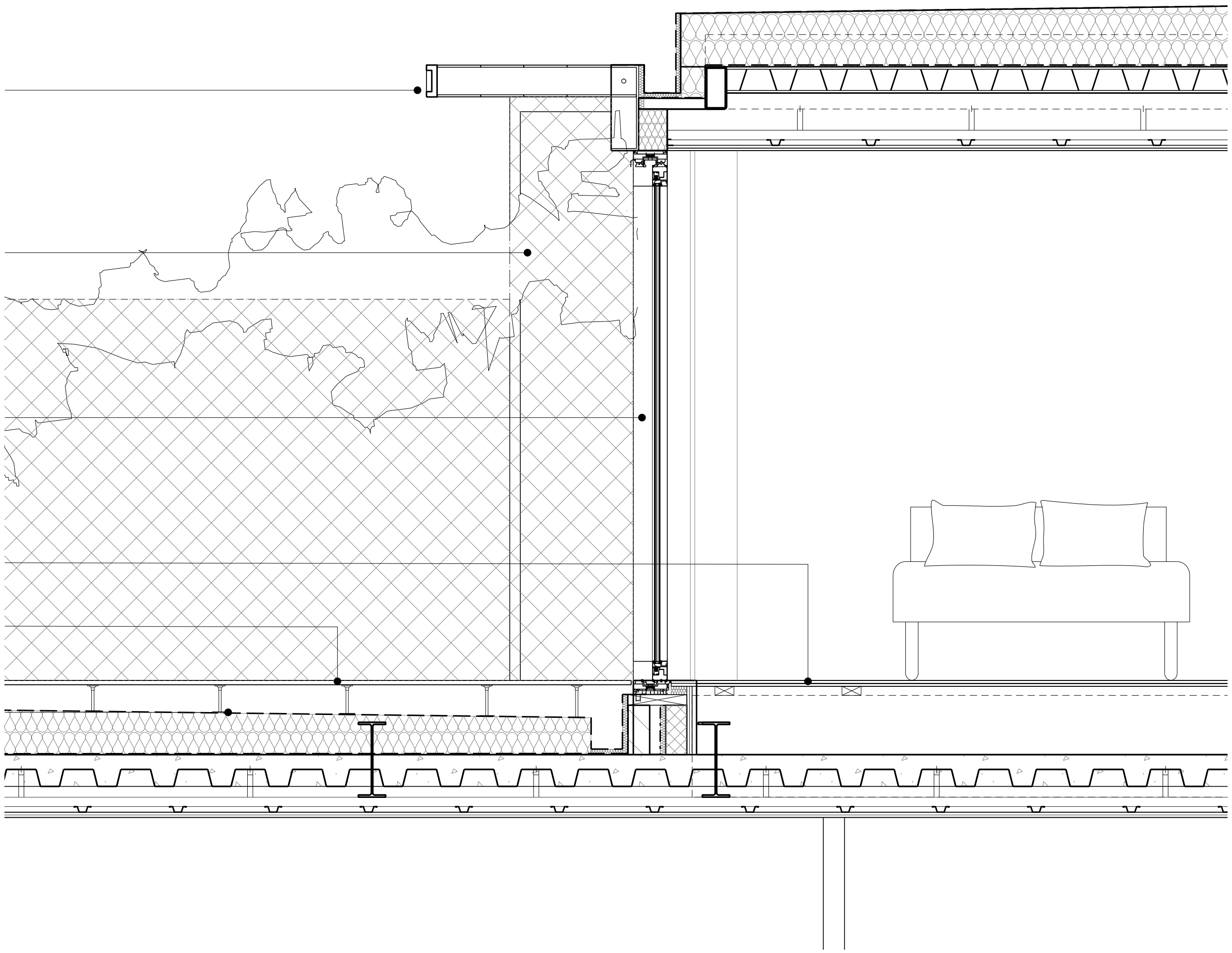
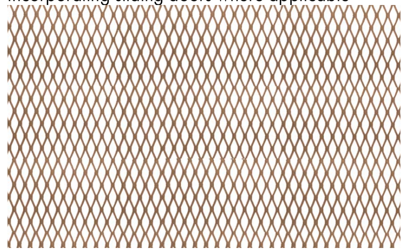


Fig.202 *"Detail with green wall privacy screens""*

Sustainable solutions

New thermally broken double glazed screens incorporating sliding doors where applicable



Permeable mesh panels incorporated into glazing system

Green wall privacy screens

Anti-slip timber decking on supports to be installed

Conclusions

'Waste not, want not' is an expression that has become increasingly pertinent in recent years as economic conditions have forced many of us to save and make the most of what we have, rather than constantly replacing old with new. This has led to the attitude in architecture of adaptive reuse – the conversion of an old building into something better suited to contemporary requirements. The aim of this thesis was to highlight the importance of adaptive reuse in the renovation of the built heritage through sustainability (ecological, social and economical).

We have seen that adaptive reuse balances the planning needs of heritage conservation and economic development. It is therefore a compromise, a negotiation between the new and old. But it is a dialogue that is worthwhile to enter into as the end result can often enrich the urban landscape. Buildings sensitively restored and adapted to new functions have hybrid characters embodying complex social meanings for the city's inhabitants; they are storehouses of memories that also offer possibilities of making new ones.

We have seen that altering existing buildings for new functions is not a new phenomenon; in the past buildings that were structurally secure have been adapted to fit changed needs or new functions without questions or theoretical reflections. For example during the Renaissance period, monuments from ancient times were transformed for new uses. During the French Revolution, religious buildings were transformed for industrial functions or military uses after they had been confiscated and sold. These interventions, however, were done in a pragmatic way and in many cases without heritage preservation as an intention. Instead, the driving force behind these examples of 'reuse' was functional and financial, in essence.
Today, however, working with existing buildings, repairing and restoring them for continued use has become a creative and fascinating challenge within the architectural discipline. The process of wholeheartedly altering a building is often called *'adaptive reuse'.*
In contemporary conservation theory and practise, and this work, adaptive reuse has been considered an important strategy towards conservation of cultural heritage.
But an extensive review of scholarly literature on adaptive reuse from the 1970s onwards learned us that its body of theory is largely based on case study research and not, as one would expect, on architectural theory and/or conservation history. Several 19th and 20th century theorists on conservation and architecture have discussed adaptive reuse, but their ideas have hardly ever been discussed by contemporary theorists working on this topic.
Therefore, this dissertation aimed to present a critical analysis of adaptive reuse techniques

in the field of sustainable redevelopment.

The theoretical discussion on adaptive reuse as a way to preserve historic monuments started in the 19th century. At that moment the practice of restoration was situated between two opposing orthodoxies: the restoration-movement, led by Eugène Emmanuel Viollet-le-Duc (1814-1879), and the anti-restoration movement, led by John Ruskin (1819-1900) and his pupil William Morris (1834 - 1896).

As an architect and chief inspector of monuments in France, Eugène Emmanuel Viollet-le-Duc (1814-1879) had been involved in many restoration works of mostly Gothic buildings, among which the Notre Dame in Paris, the castle of Pierrefonds and the citadel of Carcassonne. His interventions were often far-reaching, as he added for instance completely new parts to the building 'in the style of the original'. His work, however, has been criticized by his contemporaries and descendants. John Ruskin (1819-1900) for example describes this kind of stylistic restoration as 'a destruction accompanied with false description of the thing destroyed' .

Nevertheless, both Viollet-le-Duc's work and writings are particularly relevant to contemporary conservation when it comes to methodological issues and reuse of historic buildings. Concerning reuse of historic buildings, he states:

"… the best of all ways of preserving a building is to find a use for it, and then to satisfy so well the needs dictated by that use that there will never be any further need to make any further changes in the building. … In such circumstances, the best thing to do is to try to put oneself in the place of the original architect and try to imagine what he would do if he returned to earth and was handed the same kind of programs as have been given to us. Now, this sort of proceeding requires that the restorer be in possession of all the same resources as the original master – and that he proceeds as the original master did."[72]

Viollet-le-Duc's ideas contrasted strongly with those of the anti-restoration movement who fought against the destruction of the historical authenticity of the buildings in favour of their protection, conservation and maintenance. Ruskin considered restoration 'the most total destruction which a building can suffer'.

According to him:

"It is impossible, as impossible as to raise the dead, to restore anything that has ever been great or beautiful in architecture… Do not let us talk then of restoration. The thing is a lie from beginning to end...Take proper care of your monuments, and you will not need to restore them".[73]

The concept of use-value of a building was introduced when the conflict between these opposing theories on conservation, and the adherent opinions on adaptive reuse, have been discussed by Alois Riegl (1858-1905) in his essay *"Der Moderne Denkmalkultus: Sein Wesen und seine Entstehung".* He ascribes this conflict in theories to the different values which their proper adherences attributed to monuments. Riegl distinguished different types of values which he generally grouped as commemorative values – including age-value, historical value and intentional commemorative value - as opposed to present-day values - including use-value and art-value (newness-value, relative art-value).
Although different values can be found in one single monument, these values do often conflict with each other. He states: "*The contradiction between newness-value and age-value is at the centre of the controversy which rages over the treatment of monuments"*.[74]
On the one hand, the supporters of the restoration movement, inspired by Viollet-Le-Duc, rested essentially on the amalgamation of newness-value (unity of style) and historic value (originality of style), aiming to remove all traces of natural decay and restore every fragment to create a historic entity. On the other hand, supporters of the conservation movement, led by Ruskin and Morris, appreciated monuments exclusively for their age-value.
For them, the incompleteness of an artefact should be preserved as traces of natural decay that testify to the fact that a monument was not created recently but at some point in the past. Although Riegl is rather critical about the creative restorations executed in the 19th century, by including the use-value in his assessment of monuments, he recognizes reuse of historic buildings as an intrinsic part of modern conservation.
Where a monument has ceased to have use-value, the consideration of age-value has begun to prevail in its preservation. The situation is more complicated where the use-value comes into play; most would prefer to regard a building in use as something sturdy rather than as something ages and decayed. He points to the innumerable monuments that are still in use or that have received a new use in the course of history and says:
"an old building still in use must be maintained in such a condition that it can accommodate people without endangering life or health… [as such] practical considerations allow age-value only in a few exceptional cases."[75]
Although Riegl's thinking has been considered of fundamental importance for the Austrian conservation policy, initially his international influence was rather limited as his writings were conceived in a very abstract and condensed form and were not easy to translate. *"Der Moderne Denkmalkultus: Sein Wesen und seine Entstehung"* only was translated to English in its entirety

in 1982; since then, Riegl's theory has often been cited in relation to value assessment and conservation theory but has not received much attention in relation to adaptive reuse so far.
A few years before Riegl published his essay on monuments, Camillo Boito (1836-1914) presented his paper "*Questioni pratiche di belle arti, restauri,,concorsi, legislazione, professione, insegnamento"* in which he gives practical guidelines for the restoration of historic buildings. He too, compared Viollet-le-Duc and Ruskin and is critical of both. In Viollet-le-Duc's approach, he fears a loss of the material authenticity of the building, while in Ruskin's thinking he dismisses the concept of advocating decay in favour of restoration. Instead, Boito finds that the restoration method should depend on the individual circumstances of the monument. He distinguishes three methodologies which he calls 'archaeological restoration' (for antique monuments), 'picturesque restoration' (for medieval monuments) and 'architectural restoration' (for Renaissance and other monuments). Moreover, he presents eight principles to restore a building. He states, for example, that a monument should be consolidated rather than repaired, and repaired rather than restored. In case restorations or additions are necessary, he also describes how modern interventions may be done in such a way so that they can be recognized as such to avoid misunderstandings about the historic and artistic value of the building.
Although Boito does not mention reuse of buildings in particular in his writings, his ideas are extremely relevant in relation to adaptive reuse as he describes several possible approaches how to deal with alterations and additions to historic buildings. As such, his principles can be recognized in many projects of adaptive reuse from the beginning of the 20th century onwards up to date.
Contrary to Riegl, the influence of Boito's thinking on the international conservation practice was very strong. For example, his ideas have been the basis for the Athens Charter in 1931, the first international document to promote modern conservation policy.[76] This charter was the result of a meeting of the International Museum Office, which had been established after the First World War to discuss the problems related to heritage conservation.
In general, the charter denounces stylistic restorations in favour of regular and permanent maintenance.
About adaptive reuse it says: "*the Conference recommends that the occupation of buildings, which ensures the continuity of their life, should be maintained but that they should be used for a purpose which respects their historic or artistic character*".[77]

The destructions of the war also created an opportunity for modernist architects to apply their ideas not only on the individual building but also on the urban scale. As such, city planning has been the subject of the fourth CIAM congress that was organised in 1933, also in Athens. Participants present at the congress analysed the problems of 33 cities and proposed a set of 'statements' for the creation of the ideal modern city. Their analyses and conclusions were based on the division of the ideal modern city in four main functions: dwellings, recreation, work and transportation. Concerning historic parts of the city, the CIAM states:

"Historic objects (separate monuments or sectors of the city) must be retained:
- When its existence is not bought at the price of bad living conditions for the population that is compelled to live in it.
- When the opportunity is afforded to remove its restricting influence on development by the diversion of traffic round it or the shifting of the focal point.
An aesthetic adaptation of new parts of the city to the historic area has a catastrophic effect on the development of a city and is in no way to be desired.
By the demolition of slum dwellings surrounding the historic monuments, green areas can be created, which improve the hygienic conditions in those areas"[78]

Within the conservation discipline, the post-war era was not only a moment to discuss the principles and techniques of modern conservation, but also to discuss the meaning and scope of 'cultural heritage'. Until the 19th century, the notion of heritage was limited to antique and medieval buildings but due to the destructions of the two world wars, awareness grew about the value of buildings of other periods and typologies including vernacular architecture, industrial buildings and even complete historic cities. As the conservation practice had to deal with these *'new types of heritage'*, interest for adaptive reuse as a methodology towards conservation grew. In 1964, The Venice Charter points to the importance of adaptive reuse within the conservation practice saying saying that *"the conservation of monuments is always facilitated by making use of them for some socially useful purpose" [28, article 5]*.[79]
Within the architectural discipline, a growing interest emerged in conservation of old buildings as a reaction to their increased demolishment in favour of new construction. Where during the first half of the 20th century architects aspired to create new buildings which completely broke with traditional building, during the second half of the 20th century architects started to consider working with historic buildings as an interesting challenge and made it an important

and modern topic.

Until the 19th century, architecture and conservation were converging disciplines. During the Renaissance for example, architects were involved in the construction of new buildings as well as in the adaptation of ancient structures. Although preservation mainly was done because of utilitarian considerations, for many buildings the very fact of their continued use was the reason for their preservation. In the 19th century, Viollet-le-Duc and Morris both played a major role in the development of the first theories on conservation as well as in the field of contemporary architecture (which at that moment basically consisted out of buildings in neo-gothic style). During the first half of the 20th century however, an opposition arose between architecture and conservation. While modern conservation dealt with issues of 'scientific restoration' (Boito) and 'value-assessment' (Riegl) aiming to conserve the remaining historic fabric of the post-war-period, modern architecture showed a strong believe in the future and new technics that would improve the quality of life.
It considered existing architecture as not able to satisfy current needs and demands. From the 1960s onwards, architecture and conservation moved closer to one another again. Architects showed interest in working with historic buildings while conservators saw reuse of historic buildings as an important aspect of their preservation. [80]

Currently, adaptive reuse is emancipating to become a proper discipline within the broader field of architectural conservation. We have seen that it can become a controversial topic, as there is a blurred line between retrofitting and renovation, facadism and adaptive reuse, and can be a compromise between historic preservation and demolition.
Finally, a (re)reading of the architectural and conservation traditional connotation has been presented in this paper, in order to promote in the future the redevelopment of the built heritage through sustainable solutions with a creative approach.

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