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The Adaptive Reuse of Office Buildings in London

Guidelines for a Multi Criteria Decision Analysis Strategic Approach

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Thesis to obtain the Master of Science Degree in

Architecture

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Lisboa, a 10 de Maio de 2014

O aluno nº 76791,

_____

(Emanuel Afonso dos Santos Rebelo)

To Joana.

" [...] the best way to preserve 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 [...]"

(Viollet-le-Duc, 1854)

"[...] buildings can only truly be defined as 'obsolete' when they have become completely useless with respect to all possible uses that they have been called upon to support."

(Nutt, et al., 1976)"

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Resumo

A Conversão e Adaptação de Edifícios de Escritórios em Londres
Diretrizes para uma Abordagem Estratégica através de um Modelo de Decisão Multicritério

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Londres tem assistido à rápida transformação e evolução do mercado de escritórios e à sua promoção imobiliária, intrinsecamente relacionadas com as mudanças da indústria financeira e de serviços e com as flutuações da economia local e global. Esta tipologia de edifícios tem sido adaptada ao longo das últimas décadas de forma a melhor corresponder às fortes mudanças nos padrões de oferta e procura.

No entanto, e uma vez construído, um edifício poderá não só não encontrar as condições para as quais terá sido promovido, como dificilmente será capaz de responder às imprevisíveis mas expectáveis futuras mudanças, provocando muitas vezes o fim do seu tempo de vida útil décadas antes do previsto, apesar dos seus custos de promoção envolvidos ou do valor imobiliário subjacente.

Neste sentido, a investigação pretende, após o estudo da evolução da tipologia de edifício de escritórios nesta cidade, compreender as causas de obsolescência e as ferramentas de reabilitação disponíveis para a sua conversão para outros usos, de forma a desenvolver uma metodologia que permita de uma forma expedita, avaliar o potencial de adaptação para outros usos na cidade de Londres. A avaliação baseia-se na cálculo da diferença entre as preferências dos usos alternativos e do edifício existente, nos critérios gerais de localização e características físicas do edificado, apreciados separadamente através de um modelo multicritério de apoio à decisão, cujo decisor é o próprio investigador, e aplicados a um Caso de Estudo. Os resultados poderão permitir reduzir as hipóteses de reabilitação a serem devidamente estudadas ou constituir um apoio na execução dos estabelecidos métodos de avaliação imobiliária ou estudo prévio de arquitetura, em vista à procura de sustentabilidade na promoção imobiliária.

Diversas conclusões são retiradas, como reflexo da abrangência dos temas envolvidos.

As discrepâncias obtidas entre os resultados obtidos e a proposta do caso de estudo, demonstradas por um exercício de viabilidade financeira, suscitam ainda futuros focos de investigação.

Palavras - Chave : Edifício de Serviços, Conversão, Londres, Modelo Multicritério de Apoio à Decisão

Abstract

The Adaptive Reuse of Office Buildings in London
Guidelines for a Multi Criteria Decision Analysis Strategic Approach

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London has been watching to the rapid transformation and evolution of the office market and office development, in conjunction with the growth and change of the services industry and fluctuations of local and global economies. This building typology has been adapted decade after decade to act as a response to the supply and demand patterns which are undergoing continuous transformation.

However, once a building has been constructed, it may not serve the purposes which were originally intended due to an array of socio-political changes which may come into play. Despite the certainty of such changes emerging, they are unpredictable in nature. Consequently, buildings reach the end of their life-cycle sooner than anticipated, despite the time and resources spent on their development or real estate value..

In this respect this paper aims, whilst understanding the evolution of office building typology in the city of London, to investigate the causes for their obsolescence and the available adaptive reuse tools, in order to construct a method which allows for a prompt appraisal of their potential to be converted to alternative uses in the city of London. The appraisal consists of assessing the difference of preferences between the alternative uses and the existing building, in the general criteria of location and physical characteristics of the fabric, separately assessed through a multi-criteria decision analysis, where the decision maker is the researcher himself, and applied to a real world case study. The overall results may allow a shortlist of rehabilitation alternatives to be fully assessed. Alternatively they may constitute additional data to assist in the performance of adequate and long-established real estate valuations and architectural feasibility studies, in the search for sustainability in real estate development.

Several observations are raised throughout the investigation as a consequence of the different themes embraced. The gap between the results attained and the case study proposal, further supported through a financial viability exercise, present the necessity for further research.

Keywords : Office Buildings, Adaptive Reuse, London, Multi-Criteria Decision Analysis

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List of Abbreviations and Acronyms

ARAM	Adaptive Reuse Appraisal Model
ARR	Annual Room Rate
IRR	Internal Rate of Return
CBA	Cost Benefit Analysis
CF	Cash Flows
CIE	Community Impact Evaluation
CBA	Cost-Benefit Analysis
DCA	David Chipperfield Architects
DCF	Discounted Cash Flows
CBH	Cultural Built Heritage
FA	Financial Appraisal
GEA	Gross External Area
GIA	Gross Internal Area
IT	Information Technology
IDC	Initial Development Costs
LMA	London Metropolitan Archive
LS	Land Securities
MCA	Multi Criteria Analysis
MCDA	Multi Criteria Decision Analysis
MACBETH	Measuring Attractiveness by a Categorical Based Evaluation Technique
NPV	Net Present Value
SCBA	Social Cost Benefit Analysis
SFA	Social Financial Analysis
SIC	Standard Industrial Classification
TCPA	Town and Country Planning Act
UCO	Use Classes Order
UCL	University College London
FA	Financial Analysis
NIA	Net Internal Area
NPV	Net Present Value
RICS	Royal Institution of Chartered Surveyors
SEA	Strategic Environmental Assessment
SFA	Social Financial Analysis
SIA	Social Impact Assessment
SME	Small and Medium-Size Enterprises
OD	Occupational Densities [Office]
TCP	Town and Country Planning [Act]
VFM	Value For Money
VAT	Value-Added Tax
UK	United Kingdom

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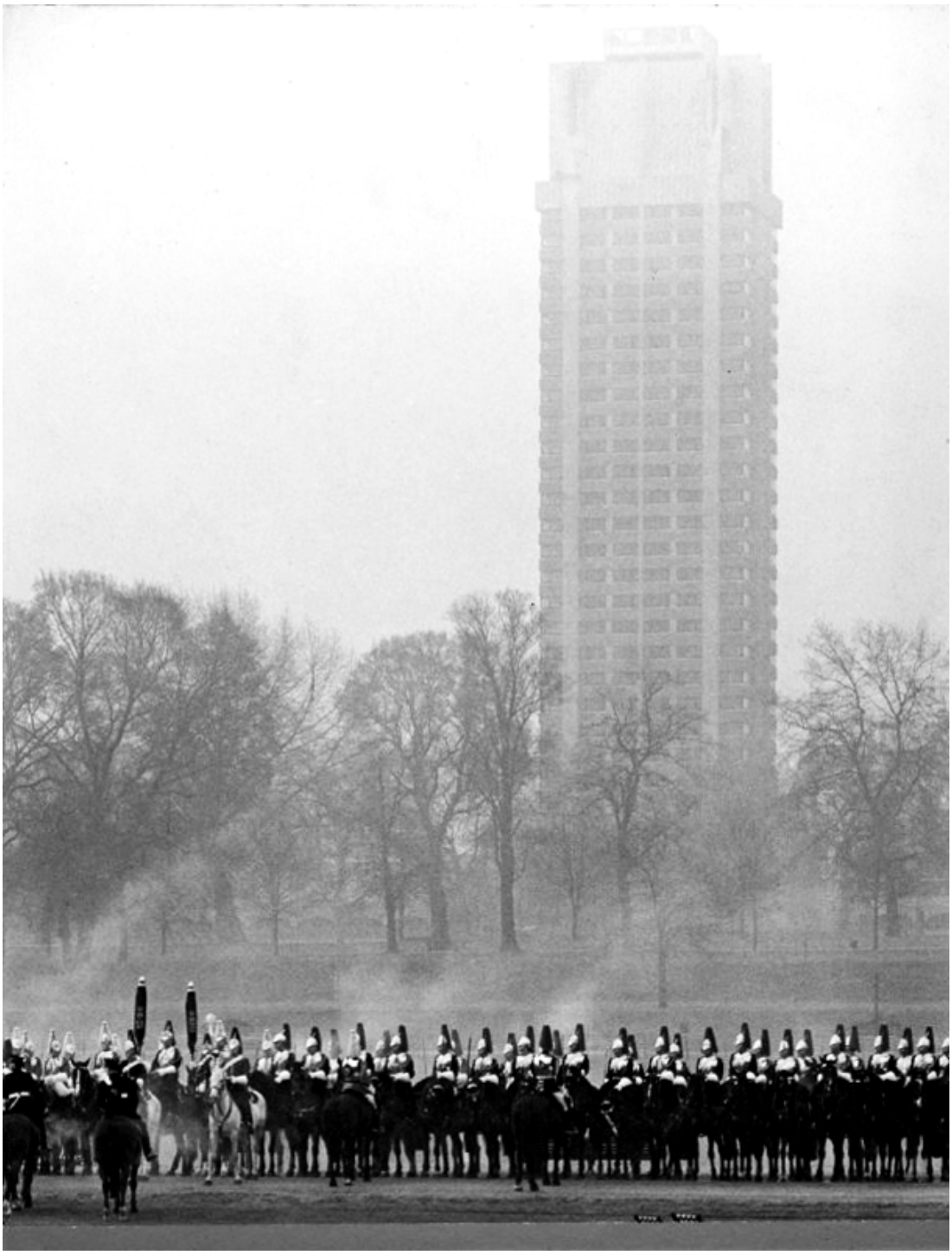

Figure 1 : Hyde Park Barracks (1970) *Source: London Metropolitan Archive (LMA)*

1 Introduction

1.1 Context of the Research

"When planning our buildings we cannot afford to stand still, year by year standards are improving; the office building that was built in the early post-war years began to look a little dated by the 1960s and now in the 1970´s that same building will probably require extensive modernization and adaptation to bring it into line with modern requirements. It is reasonable to assume that the rate of change in the office standards is accelerating". (CALUS, 1974)

The above statement, written whilst observing office transformations which occurred in previous decades, was forecasting the imminent revolution in light of increased use of personal computers, building services, internet, sustainability, new working methods or the property and financial crisis that characterized the sector in the following three decades.

The city of London, a global hub for finance and services, is a living testimony to this change.

Intrinsically related to the economy and Information Technology (IT), office developments were transformed decade after decade to meet evolving demand requisites. Whilst a limited number of buildings were able to prevail and function properly within its intended use throughout its life cycle, many others would either become outdated and useless a few years after its completion, in one of the world´s most competitive real estate markets. The property development booms that occurred in the last decades produced millions of square feet of office space as a similar amount was simultaneously being left vacant, in both prime and secondary locations due to an oversupply or lack of demand, greatly accentuated in economic downturns.

The downturn periods nevertheless alerted people to the importance of profiting from pre-existing buildings thus creating new potential for vacant or underperforming buildings, either by changing the way they are used or by changing their original use. Office buildings in particular, exposed and affected as they are to the above fluctuations, cannot be built as required to meet their present use expectations. Once built, they should be built to last(Ratcliffe, et al., 2006), as a reflection of the years and resources required for its development, real estate value, environmental footprint or presence and significance in the city.

The conversion of office buildings to alternative uses emerging in the 1990´s was predicted at the time to slow down in the following years (1.3). However, recent reports and figures show that they have not only slowed down as predicted, as they have been growing steadily in the last decade and have alarmingly increased in recent years, in particular relating to residential purposes (Lichfield, N. & Partners, 2011) (2.2).

Millions of square feet of office space are still underperforming, vacant, or awaiting redevelopment, many in prime locations, and built within the last thirty years (DTZ , 2013). However, at the same time, increasing construction rates of offices in recent years (DTZ , 2013) show that demand still exists. Hence, many office buildings are clearly inadequate to meet today´s demand expectations, reinforcing the urgency to make the most of the existing fabric.

1.2 Research Question and Objectives

Looking at the radical transformations which occurred over the last century (2.1), it seems apparent to conclude that an office building´s life is becoming shorter its utility less secure as time passes. It is also clear that we can no longer continue to waste the resources spent on their development, nor to promote demolition as a long term approach to facing the unpredictable, yet inevitable, transformation of the office sector or the current instability of local and global economies.

If there is a demand for space for alternative purposes, it seems natural that redundant office buildings could provide space, as an economic and sustainable form of property development, (Anderson & Mills, 2002) envisaging the urban regeneration of our cities and improving the character of the built environment.

However it is less clear how office buildings can meet such demand if they have been designed to respond to a specific use pattern within a specific time which no longer exists.

From this, the below questions were raised narrowing the focus of the research:

- *How to determine which alternative uses are worth full assessing to a redundant office building?*
- *Which aspects should be excluded and which should be considered for appraising their potential?*
- *Where demand exists for certain uses, which buildings would perform best to accommodate such uses ?*
- *What are the preferences of those alternatives and how to assess their performance in office buildings?*
- *Where demand and supply do not match, which tools can increase the chance of likelihood of success in the conversion process?*
- *How is it possible to resume the investigation in an expeditious appraisal to be used by any party involved in their conversion and rehabilitation, actively promoting and enhancing this practice?*

From the above, the research question can be summarized as:

- *How to assessed and evaluate the alternative uses for a redundant office building in London, in a generic and expeditious manner, which warrant further investigation using well known and long established architectural feasibility studies and real estate development appraisals ?*

The main objective is, under this perspective and within the London market context, to define and construct a methodology that is able to appraise an adaptive reuse rehabilitation performance. Consequently alternative uses will be recommended, for a specific building in a specific location, by matching their characteristics with the preferences of each alternative use considered, whilst assuming that with a narrower gap between the two, the easier and more probable is the success of the adaptive reuse scheme.

1.3 Previous Literature and Justification of the Research

With the beginning of office conversions in the early 1990´s (2.2) and a peak in activity just under a decade later (2.2) most of reports about their conversion were written during that period, either reflecting on the figures and case studies experienced during that period, or improving and updating previous investigations on adaptive reuse carried out during the 1960´s and 1970´s.

These mainly fall into three broad subject categories.

The first category discusses the viability and potential, from a planning perspective, to support and encourage conversion schemes. Among them are "Tomorrow. A peaceful path to urban reform for friends of the Earth"(Rudlin, 1998) where the capacity of accommodating new homes in British urban areas is studied; or "Office to Residential Conversions in London: an analysis at the strategic and local level"(Sauer, 2003) where it is understood if office to residential conversions have a positive impact and therefore, whether they should be promoted or discouraged in each specific London Borough.

The second category embraces the technical difficulties and physical opportunities in conversions. Examples include "Redundant Office Buildings, Good Practice in Urban Regeneration" (Department of the Environment; URBED, 1987) "Offices into Flats" (Barlow & Gann, 1993) and "Conversion and Redevelopment – Process and Potential" (DETC, 2000). Additionally, a pioneering and relevant report in the aim of this paper is the "Home Office Report" (APR, et al., 1992). Gathering a team of property analysts, chartered surveyors, quantity surveyors, and architects, it offers a practical example of converting an office building into multiple alternative uses. With a hypothetical case study they were able to resume the planning constraints, expected market and financial costs, and possible floor plan layouts, respectively provided by each member of the above team.

Finally, the third category focuses on the commercial market, understanding the availability and demand for offices and other uses within a certain time frame or within a specific location in London. It includes the "Obsolescence and Performance in the Central London Office Market"(Barras & Clark, 1996) "Forecasting Office Supply and Demand" (RICS, 2002) or the "Back to the Centre" (RICS, et al., 1998) report. The latter concluded that conversion activity would slow down due to the gradual depletion in available stock for conversions, and because the office market was again on the increase (2.2). Events in the following decades refuted these predictions. (2.3).

An important paper of a different nature was conducted at the end of the 90s for the British Property Federation , entitled "Conversion of Redundant Commercial Space to Residential Use" (Freer, et al., 1999). Whilst summarizing in many aspects findings of previous studies, it aimed to examine the role of owners and developers in promoting conversions. The relevance of this investigation is thanks to the results attained from the multiple interviews carried out to both parties. It concluded that conversions are not necessarily related to redundancy since most of the redundant stock was located in secondary locations and most of the conversions in the city core, also reaffirming that these were to diminish in the following years. Additionally, and according to the responses gathered, it was noted that the three main barriers for conversion were the *Unsuitability of buildings (43%); the Costs of conversion relative to redevelopment (40%)* and the *Lack of experience in conversions (26%).*

The above research elicited the aim of constructing an accessible model that could help the appraisal of an adaptive reuse development by any party involved in the process, either architects, developers, engineers, planners, surveyors, agents, contractors, building owners or investors, identifying their potential and helping to address the above constraints of unsuitability, costs or experience. Many studies were also considered in an early stage of the research which focused on rehabilitation and adaptive reuse potential as opposed to redevelopment, such as "Refurbishment or Redevelopment of Office Buildings? Sustainable Comparisons." (Anderson & Mills, 2002).

The author of "Adapting Buildings for Changing Uses – Guidelines for change of use refurbishment", David Kincaid , develops the work commenced by Peter Cowan (1963)[1]; Sigworth & Wilkinson (1967)[2]; or Barlow & Gann (1996)[3]. Together with the University College London, the "Use Comparator" was conceived, a tool which enables users to propose the best alternative use for any building type. This research has served as a strong reference point in this paper. However it was considered too broad and insufficient for a reliable appraisal of the specific office building typology since the building characteristics are too generic and the values and preferences of each use too inaccurate. Due to the amount of possible uses and building typologies, major simplifications were assumed so that the appraisal could be rendered more manageable. Nonetheless it pointed out the way in which aspects should be considered for one specific building type with different performances of certain alternative uses. In this sense the investigation aims to bridge the gap which has emerged since the early noughties – an adaptive reuse investigation and an adaptive reuse appraisal tool, usable by any decision player, specific to office building conversions in the city of London and not exclusive to residential use.

1.4 Scope and Limitations

Many authors have studied office developments and many have different approaches to their rehabilitation (2; 3). Here essays are referenced and compared with other authors, however it is not part of this paper to cover or question What has already been extensively covered on this subject . It is instead to further narrow the focus to the adaptive reuse of office buildings whilst comparing with the previous literature. The aim is to promptly suggest alternative uses, all to be further subject to a full investigation. The architectural and development appraisals are well established and it is not part of this scope to substitute their implementation. It is instead to find a expeditious way of narrowing the options to be appraised, clarify assumptions which have been made or highlight new areas which have so far not received much consideration. (4.1.1).

The field of the investigation is limited to Greater London and the locations are limited to typical urban areas without any exceptional aspects that may immediately exclude one or more uses. Only considered standard buildings may be appraised and exceptional buildings or listed buildings are excluded (4.2.1).

[1] Studies in the growth, change and ageing of buildings"(Cowan, 1963)
[2] "Flexibility in building use: technical feasibility of converting redundant offices into flats"(Sigworth & Wilkinson, 1967)
[3] "Rebuilding or renovation? "(Barlow & Gann, 1993)

The model constructed does not consider any aspects related to the construction economics, financing, planning, uses supply and demand, real estate values, environmental footprint or socio-economic impacts of the adaptive reuse (4.2.1). The financial viability of the proposals is also excluded, although a financial appraisal has been carried to the Case Study (5.3) in order for further questions to be raised. Any of these complex themes may be subjected to similar research on their own and were thus excluded.

The judgemental approach adopted can only provide recommendations as it is not conclusive by nature, aggravated by the significant number of alternatives and criteria considered here. It should also be remarked that in certain instances, information was contradictory or disperse, and precise data was unavailable, regarding the location preferences of each individual use. (4.2.4; 4.2.5).

Finally, the decision maker is the researcher, therefore the methodology constructed is more informative than the actual results obtained, in particular in the Case Study, since the former aspect vastly suggests the inaccuracy of the criteria selected or the judgments taken. With a deeper investigation, each decision maker could have participated so that their point of view was fully understood. Furthermore a more extensive study would have been able to collect more adequate and realistic assumptions on the preferences of each alternative on each criteria and more accurately define the differences between office building typologies and their locations.

1.5 Structure and Methodology

Chapter 1 sets out the research question and the objectives, listing the most relevant previous investigations on this theme, thus justifying the purpose of this paper, and defines the scope, limitations and methodological approach. The dissertation is then divided into three distinct parts, with the purpose of providing an overview of the investigation's context and summarising what has been written in existing literature; developing the research question and constructing the methodology; and then applying this to a real world case study as an evaluation of the model constructed, enabling further discussion.

Part I, consisting of Chapters Two and Three, aims to investigate and understand the context of the investigation and summarize what has been written in the literature on office buildings and their adaptive reuse.

Chapter Two provides an overview of the evolution of office building typology throughout the twentieth century in London, understanding the impacts of major socioeconomic and real estate market aspects on building design and condition (2.1). The results of the analysis are summarized so that we may comprehend the transformation within each development period leading up to the present (2.1.4). This summary also enables us to determine the causes of obsolescence whilst suggesting the aspects that should be considered for appraisal (4.2.3). The conversion activity in recent decades is also summarized, in particular to apartments, comparing reports published during the 90's, when activity increased, with articles written in more recent years (2.2). The current and emerging demand for office space and housing are presented to reinforce the relevance of the research question (2.3).

Chapter 3 will first investigate the life cycle of office buildings and discern potential difficulties to predict the future market trends (3.1.1).

The definitions of obsolescence and redundancy will be explored (3.1.3), further clarifying the causes on the office property in particular, whether Originating from the supply or alternatively the demand (3.1.2) with potential options to address such conditions being discussed (3.1.4). The adaptive reuse instrument is then defined (3.2.1) and explored its potential as an instrument towards sustainability in property development (3.2.2) and urban regeneration (3.3.3). The available, physical, tools that enable and optimize the adaptive reuse of an office building are then researched (3.3), an essential aspect that enables the understanding of the adaptability of each *criterion* considered, further reflecting their respective importance.

Part II constituted by Chapter Four, constructs the Adaptive Reuse Appraisal Model for Office Buildings in London. Chapter Four constructs, with the elements previously gathered, the Adaptive Reuse Appraisal Model (ARAM). First, the scope, field and limitations of the model are defined, and thus establishing which appraisal method is most adequate (4.1.1) The Multi-Criteria Decision Analysis (MCDA) is selected and its structure explored in detail though the international literature (4.1.2; 4.1.5), envisaging the following steps to be taken in the investigation. Firstly, the scope of the appraisal is further narrowed (4.2.1) and the possible alternative uses selected and re-arranged into workable sections, continuing previous research on the subject (4.2.2). Secondly the relevant criteria is identified and grouped into workable sections (4.2.3). Aspects that relate to the building location (4.2.4) are separate from those related to the building location (4.2.5) and all related aspects are further researched in the literature, whilst considering the scope of the investigation and the available time and resources. For the location criteria *descriptors* were constructed on each aspect that enable us to evaluate a specific location; for the physical criteria were suggested the preferences of each alternative use on each aspect in order to estimate how well a specific use applies to a certain building.

Part III consisting of Chapters Five and Six is where the investigation will apply the model to real and ongoing adaptive reuse case study as an evaluation of the investigation, resuming the conclusions attained and enabling further discussion. In Chapter Five the case study and its adaptive reuse are firstly understood, considering the history of the site and the building, its current location and the characteristics of the existing building (5.2) and the building proposed (5.3). The location is then evaluated (5.2.1) followed by the physical characteristics of both existing and proposed buildings (5.2.2) so the improvement may also be assessed. The results will be discussed (5.2.3) and the discrepancies suggests that a financial appraisal would be beneficial for its comprehension, which may challenge the model constructed as well as its scope. In this sense, an overview to the long established real estate valuation methods is provided. The Discounted Cash Flow (DCF) method is selected and carried out on all alternatives, and the results have been interpreted.

Chapter Six summarizes the main findings and proposals, states the strengths and weaknesses of the research and points out future research.

Additionally, the Appendices comprise the elements necessary for a comprehensive understanding and evaluation of the methodological approach and the Case Study. They include the alternative uses considered (A.1), the case study images and drawings (A.2), a questionnaire which was completed by key decision agents involved in the case study development proposal (A.3), the MACBETH data (A.4, A.5) and finally the financial appraisal exercise carried out to the case study (A.6).

2 Development of Office Buildings

2.1 Development Periods

2.1.1 1918– 1950

In the early 20th Century, London was a centre for international trade and industry.

The Industrial Revolution which had occurred in the previous centuries had had profound consequences in the urban structure and built environment. The mass migration of rural populations to work in industry required a continuous and prompt provision of housing located near factories, very poorly constructed and badly built, with no basic sanitation and shared by multiple families (More, 2000).

The population increased dramatically until the 1900s but so did the per capita income. Greater London´s population in 1901 was over 6.5 million and 5 million of those were employed. The triumph of middle class industrialists and business man over the long established family business elicited the spread of "white collar" work, in the banking, insurance, and brokerage industries, as a result of the accumulation of capital. Regulations were introduced to regulate construction , the quality of housing substantially improved and the spread of rail and tube transportation made it possible to reside in the suburbs and continue working in the city (More, 2000) .

The end of First World War, which had boosted employment in the industry, provoked a slump in the sector and instigated a number of socio-economic responses, including economic growth, demographic changes, greater mobility and a concentration of economic activities in former industrial zones.

The 1920´s witnessed relatively prosperous conditions in the property market. Although investment was still relatively low, insurance companies became interested in office developments (Scott, 1996). However, in 1929 the effects of the Great Depression in the United States were felt in London, inducing a fall in the industry and a loss of foreign investment. The low employment rates in the following decade were insufficient to generate the required demand for any relevant office developments (Murphy, 1984).

A small number of buildings were nonetheless built even if for a short period, from 1933 to 1937, due to decreasing construction costs and cheap money[4] and considerable improvements could still be made on their design, imported from the United States. In particular, this included the introduction of the use of steel framed structures, which improved the occupational ratios and allowed a much wider fenestration, enhancing daylight and providing flexible internal planning (Marriott, 1967)[5].

Nevertheless the majority of buildings were still being built as typical Victorian warehouses with load bearing masonry walls, high ceilings, narrow floor plates and internal structural partitions (Lichfield, N. & Partners, 2011). Despite the short supply and constrained morphology, any available stock represented development opportunities, in particular to other uses, due to its character and heritage value.

[4] Credit available at a low interest rate - an incentive from the government to encourage business, lowering the reserve requirements for banks who can this way increase lending at lower rates without loss of profit.

[5] E.g. “Bush House”, 1923-35. The tallest office building ever built in London until then, by Arch.Harvey Willey Corbet.

Figure 2 : Offices in Oxford Circus (1940). *Source: LMA*

Figure 3 : Offices in the City of London (1940) *Source: LMA*

Figure 4 : Demolition of Victorian buildings, Victoria Street (1944) , *Source: LMA*

Therefore, any office built prior to the 1940´s is expected to be listed[6], and in conservation areas[7], in the core of London City, with reduced possibility for internal or external alterations (Gold & Martin, 1999).

By 1938 the fear of war provoked a very weak market. The first hostilities with Germany lowered property values even further in London because of the eminent risk of bombing (Scott, 1996).

Notwithstanding, a small number of entrepreneurial developers capitalised on this emergence of low prices and purchased significant amounts of buildings during the war, foreseeing the great value that they would accumulate during the recovery, should the Allies win the war, as there was not much to lose should Germany have won. Besides, even in the event of being bombed, buildings could be refurbished and plots redeveloped, generating even higher profits. Upon Germany's defeat, some entrepreneurial developers became the key players in the property development scene in the 1960´s (Marriott, 1967).

With parts of London severely bombed during the blitz[8], the ensuing post-war years focused the attention solely on re-construction. In the City, for instance, more than a third of buildings had been completely destroyed but the shortage of available construction materials and workforce delayed this re-construction process until the early 1950's (Marriott, 1967). Moreover, the Town and Country Planning Act (TCPA), released in 1947 under the Labour Government, required planning permission for any sort of development, when before the war ownership of the land was the only pre-requisite to the construction process. Adding to this, 100% tax over new-build removed any incentive to develop land.

2.1.2 1950 - 1980

The post-war reconstruction of London responded to a massive urbanization and a transformation of urban life. The Athens Charter [9] in 1933 produced rules for protecting the inner-city historic heritage of a functional city and endorsed historic preservation in the urban development process, a heritage-led *urban regeneration* (3.2.3) where social cohesion and economic development were targeted (Hall, 1998).

The four keys to urban planning were the four functions of the city: dwelling, work, recreation (use of leisure time) and transportation (CIAM, 1946): Fine architecture, whether individual or groups of buildings should be protected from demolition; residential areas should occupy the best places in the city and places of work should be closer since connections between both were no longer considered reasonable; office buildings should be concentrated in the downtown business district, served by the most complete system of communications. However, since offices were private concerns, effective planning for their best development was already considered difficult (CIAM, 1946) .

The tertiary sector raised from 6% before the war to 16% of the total employment in 1951, as a response to the growth of administrative jobs within manufacturing industry[10] (Scott, 1996).

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[6] *Grade Listed Buildings*, A building that has been placed on the Statutory List of Buildings of Special Architectural or Historic Interest. E.g. [offices] 55 Broadway (1929), I; Admiralty Arch (1912) I, to convert to Hotel.(Crown, 1990)

[7] *Conservation Areas*, Considered worth preserving / enhancing due to architectural / historic interest. (Crown, 1990)

8 Blitz – the German aerial bombing to Britain during the Second World War

[9] The Athens Charter, 1933 - A document on urban planning published by Le Corbusier in 1943 and produced as a result of the Congress Internationaux d'Architecture Moderne (CIAM) (Hall, 1998).

[10] The tertiary sector grew up to 24% of GDP between 1955 and 1964 (Marriott, 1967).

The increasing demand and static supply in the early 1950´s led to a constant rise of property prices and made property investment a highly secure sector with rapid expansion (Scott, 1996). In 1954 the Conservative Party won the elections and many laws were lifted, including the restrictions imposed on property development. London could by such means not only compensate the loss of rentable space during the war but also compete for the status of the world´s financial capital once again.

A property development boom took place in the absence of supply for almost 15 years, leading, for the following decade, to the biggest kind of development boom ever seen in the world[11] (Marriott, 1967) which only showed signs of slowing down a decade later, in 1964, with new restrictive legislation.

In this context it is it is important to observe the role that propitious legislation played in boosting property development and their consequences on new built property, in three particular aspects.

Firstly the Third Schedule Rule introduced with the Town and Country Planning Act, determined that any extension, or redevelopment, of an existing building could increase its volume by 10%, prompting a substantial reduction in typical slab heights to 10 feet (just over 3m slab to slab) in order for the square footage to be maximized (Marriott, 1967).[12] Secondly, plot ratios[13] were also introduced, curiously not to regulate the market but instead to control the amount of workers and traffic congestion within an area. This forced developers to hastily build as much as was allowed, an increment not forecasted by the planning authorities (Cowen, et al., 1969). Thirdly, the introduction of the rent review principle[14], in 1956, was the most important innovation in the property investment market, as it oppose an inflation rate of up to 5% a year (Scott, 1996) thus further attracting investment.

With such demand for office space a vast number of developments became speculative, i.e. not commissioned by an owner and without a secured tenant. Inevitably built with a strict budget, as low as 60% of a traditionally commissioned building. This approach resulted in a rapid provision of unattractive office buildings (Scott, 1996) with the typical brutalist look of the period, poor character, maximised plot ratios, low ceilings, badly built (Marriott, 1967) and insufficiently serviced of air conditioning or power(Rose, 1985). These buildings would typically have a framed structure, generally in concrete, with low floor loadings and be relatively lightweight. They would typically present shallow plan widths of approximately 10m to 14m, open plan layouts and with any false ceilings or raised floors (Gold & Martin, 1999). As a consequence, a few number of innovative design features were introduced. The curtain wall system[15] replaced the structural facade design with a lower cost and lower quality solution, used until the present time. A common New York building typology was also embraced, with a podium occupying the whole plot and a tower at the end[16], economically viable with London´s plot restrictions (Scott, 1996).

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[11] Between 1955 and 1964 the property investment was of £1800 million a year, compared to the £90 million a year in the previous decade (Fleming 1980).

[12] This fact led to premature obsolescence during the eighties where many buildings were demolished because they could no longer meet the requirements of financial and business institutions, despite a decade had only passed (Gold & Martin, 1999).

[13] Plot Ratios are the legally permissible maximum floor area of buildings that could be put on a site of given size.

[14] The mechanism to adjust the tenant´s rent to the current market level. The growing inflation of up to 5% a year In 1956 introduced the rent review which could only function upwards (Scott,1996).

[15] Curtain walling is a construction method whereby the external walls are hung like curtains from the concrete floors.

[16] E.g. Fountain House, Fenchurch Street, built in 1957

Figure 5 : Centre Point , 1965. *Source : LMA*

Also, it was a more flexible to accommodate ancillary uses. The newly acquired building methods of steel and concrete could also provide high-rise office blocks reaching heights between 300 and 400 ft[17].

In just a few years, the huge gap between demand and supply was bridged, ending with an unique period in property development of incredible profit margins and low competition climate (Rose, 1985). With such growth, leaving the property empty for a few years and waiting for higher values would compensate the loss of having tenants with a fixed rate (Rose, 1985) . It is worth mentioning the example of the office tower Centre Point[18], developed by Harry Hyams and designed by Richard Seifert[19]. The thirty-four storey office tower was completed in 1967 but refused to be occupied until 1972 due to increasing rental values[20]. Supply quickly expanded even further and in 1964 new legislation, i.e. the "brown ban" almost completely banned new office development in London, preventing an expected oversupply and a consequent downturn in the market. Such restrictions determined the end of the 60´s Property Boom and led to an Investment Boom (Scott, 1996), increasing market rents and property values, with investors seeking prospective earnings and property as a safe investment against inflation[21].

In 1970, development was again allowed to release pressure on property prices. London hadn´t had new supply since the mid-60´s. However the economy was already shrinking and the credit in the banking system increasing to finance companies' rent values, which were based on the value of the property - should property values fall, the outstanding credit did not have any support. In 1972 the Bank of England put a cap on the financing of property investment due to the risk of the high amount of money that the sector was monopolizing. A property market crash occurred in 1974, the most severe until then, avoiding however the serious risk of bringing down the entire financial system (Scott, 1996) .

Commercial property from this period, although not much different, constitutes an improvement of the previous decade´s model. Floor to ceiling heights became high enough to allow routing of services behind the false ceilings which had been introduced and the floor became much deeper. Fully glazed facades were introduced with single glazing and poor insulation leading to high heat gains, only overcome by increased provision of air conditioning (Gold & Martin, 1999).

2.1.3 1980 - 2000

The early 1980´s brought an economic recession, high rates of inflation, unemployment, rising building costs, low property value, low rents and unprecedented future demand (Scott, 1996). By 1985 the economy in London was recovering, boosted by financial deregulation and the era of information technology, supported by Margaret Thatcher's incentives to spur private economic activity since 1979 (Ratcliffe, et al., 2006). The output of financial and business services doubled, increasing demand for office space, lowering vacancy rates and real estate values (Fainstein, 2001).

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[17] E.g. Britannic Tower, Ropemaker Street, 400 ft, built in 1967 and refurbished in 2000.

[18] Grade II Listed mixed use tower, 385 ft, New Oxford Street

[19] Richard Seifert, the most successful architect in London during the 60´s and 70's, specialized in maximizing the plot ratios allowed (Marriott,1967).

[20] Completed in 1964 at a cost of 5.5 million and a value of 20 million in 1973 (Rose, 1985).

[21] Office rents increased as much from 2£ per square foot in 1963 to 18£ a decade later (Rose, 1985).

Such a positive climate eradicated the property market clash of the mid-70's and led to, once more, the increase of confidence and a sharp increase in construction and development activity, which had remained low for the previous decade. Developers, basing their calculations on availability of finance and governmental incentives[22], anticipated demand and carried the biggest surge in property development until then (Fainstein, 2001). This period is known as the "Big Bang Boom" (Scott, 1996) whereby more than 16.5 million square feet of office space was built between 1985 and 1990 (Byrne & Kostin, 1990). Additionally, It was not only the available capital and high confidence which would become the main features, but also the revolution in the property industry that was imminent.

Many changes took place in the location and design of office buildings. These new demanding requirements and standards shortened the life span of office property, from an expected life time of 20 to 30 years in the 60´s to 10 years by the late 80´s (Rose, 1985).

They were characterized by much deeper floor plates, to improve planning flexibility, and structural loads almost twice as those required by the British Standards. Typical slab heights increased, between 3.7 and 4.2m, so raised floors could be introduced to accommodate computers, and suspended ceilings becoming more common in order to accommodate services with adequate efficiency (Gold & Martin, 1999). In fact the majority of these buildings are clearly over specified for today´s standards. Building´s fashion was also changing, with commercial offices as a never before seen focus of public attention [23].

However the rise of Information Technology (IT) in this period has been widely studied as the most relevant factor to economic growth rather than natural resources or capital value (Ratcliffe, et al., 2006). The impact on the whole property industry, in particular on offices, was also vast.

Easier business communications, reduced the need of physical proximity allowing companies, among other factors, to move out of core locations to more competitive rents and improved accesses (Fainstein, 2001). Alternatively, back office space could move to peripheral locations while headquarters were kept in the city centre. Technological development also contributed to the obsolescence of many of the 1960's boom's office buildings as these weren't able to accommodate modern requirements like trading floors, communications grids, power and outlet or fibre-optics (Fainstein, 2001). At last, the increasing employment growth in internet, communications or technology services required a different kind of working space (Fainstein, 2001). If technology improvements could reduce, to a certain extent, the number of employees, the demand for better working environments led to a substantial growth in office space per employee. Tenants begun to indicate a preference on the quality of space over a central location, which until that time, had been the key element (Scott, 1996) following the typical Anglo-Saxon expression of the three key determinants of property value : "location, location, location" (Havard, 2008).

The shift of many of these factors allowed the development of office space in locations that were formerly considered unsuitable.

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[22] Developments were fuelled by the government´s policy of low interest rates and tax cuts(Scott, 1996).

[23] Three key tendencies were prevailing in the office design at the time: the "Neo-Georgian" type, quite successful between tenants however a *pastiche* with obvious inadequate relations to the past and unsuitable for tall structures; the Post–Modern type as that emerge from the Italian and American scenes, and the High-Tech type which incorporate high-end technology into the building design (Scott, 1996).

Figure 6 : Canary Wharf during construction, 1989, *Source: Magnum Photos*

Figure 7 : Canary Wharf completed, 2008. *Source, The Telegraph.*

Figure 8 : The Shard during construction, 2013. *Source, The Telegraph.*

In this respect, the largest property development scheme in Europe, the Canary Wharf Development[24] by Olympia & York, within the Docklands area regeneration scheme, deserves some attention. In 1988 the construction of Canary Wharf in the Docklands began, enjoying good accesses, lower rents, immediate planning permission, large floor plates and high quality and technological spaces. It was clear that a new iconic address in the financial and Business sectors was being created [25] (Fainstein, 2001).

However, since it was started just after the October Stock Market crash in 1987, demand was already dropping sharply, with vacancy rates high and real-estate values low. Between Black Monday and December 4th 1987, property shares fell by 29 % dragging down with it the entire financial sector (Scott, 1996). The developer became bankrupt in 1992, leaving an enormous dept to investors. The Canary Wharf Development could only fully recover towards the end of the 1990´s (Fainstein, 2001).

2.1.4 2000 – 2010

The new millennium profited from the economic prosperity of the late 90´s which brought a steady growth in property development, with an average of over 3 million square feet a year of new developments. The growth in the size and profitability of London´s financial services created a considerable market for high-quality flexible offices (BCO, 2009).

However, in October 2008 the London Stock Market had the largest percentage drop in decades, amidst the worldwide financial crisis, as a result of the bankruptcy of Lehmann Brothers in the US.

All financial sectors in London were affected, sharply slowing the economy, generating high levels of unemployment, and a loss of property values (Adair, et al., 2009). The period of recession was followed by a steady recovery from 2012 leading to strong growth in 2014 (The Economist, 2014).

Today office buildings are more and more detailed and customised. The changes that have been occurring in the design during the last decade, and which are perceived to continue, can be summarized in four main criteria: *flexibility*, *sustainability*, *design excellence* and *changing working patterns* (BCO, 2009).

Since 2008 it has became more important for offices to be more flexible. The floors should therefore be given great freedom of layout, meeting the immediate demand of today´s tenants, and still be able to do so in the medium future when occupancy intensity or character changes (BCO, 2009). Also, there is a growing awareness that office life is changing. IT has altered the social composition of offices, producing a more equal and demanding workforce in a more competitive employment market (Ratcliffe, et al., 2006), whilst restructuring concepts such as down-sizing, right-sizing; outsourcing; telecommuting; hot-desking; working from home; part-time; freelance or start-ups are becoming increasingly common (Ratcliffe, et al., 2006).

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[24] Canary Wharf had over 4.5 million square feet built in 1991 and over 8 million square feet in 2000 (Fainstein, 2001).

[25] In this respect, it is also worth to understand the response of the City. The "square mile" enjoyed the benefits until the mid-80´s of a monopoly position. Based on ancient freehold family property, its structure prevented development and growth. But London was also, and still is, the only worldwide financial competitive city in the United Kingdom making the City the only considerable location in a vast territory for the principals in baking, finance and services. (Fainstein, 2001). In the new highly competitive climate, the City had to accelerate growth or would risk to lose its main central location. The typical conservative position of development in the City led to promotional efforts, identification of new developable land, encouraged planning permissions and expansions of plot ratios by 25% (Fainstein, 2001).

It is also being further studied that office design can significantly enhance the work environment, productivity and value for money; (Battle, 2003).

Sustainability is also the office design directive today. It has been studied (Matthiessen & Morris, 2007) that an excellent environmental performance does not add significant initial costs yet productivity gains and operational savings are substantial However, a more thoughtful and collaborative process is required, particularly on the façade design from the early stages. Full glazing units have started to become already obsolete, as the thermal solar impact should be reduce, making use of passive ventilation solutions in a strategy of decreasing dependence on full air conditioned environments (BCO, 2009). However their greater levels of performance may increase their specific costs, thus developments consequently rely on a tighter building envelope, optimized wall to floor ratios and lower slab to slab heights (BCO, 2009).

Furthermore, façades are also the defining element of a *project character* and presence. Offices are a most notorious typology in property development and a strong architectural expressiveness and construction quality is being sought more than ever. A new generation of icons has been emerging in the sector, designed not only to attract secure tenants but also to guarantee planning consent, in particular in sensitive and valuable locations such as central London (BCO, 2009). Also, office building in such sites are no longer isolated, bur more and more a mixed-use complex scheme. The public realm that can offer is not only significant to the urban environment as it is also a crucial element in the early stages of design.

2.2 Conversion of Office Buildings to Other Uses

As previously seen (2.1.4) the stock market crash in 1987 led to an abrupt decline in demand for office space, at a time when the market was not only full of buildings from the post-war period and from the 60's property boom, as it was being supplied by millions of square feet every year until the early 1990´s.[26]

On one hand the consequent loss of value became an opportunity to the sector in the economic recovery a few years later [27]. On the other hand the rising housing prices, continuous demand for residential city-centre locations and the emerging demographic changes in the following decade made this redundant space a desired opportunity to be converted for residential purposes (Fainstein, 2001).

The first office building conversions occurred in the late 1980´s, in fact not by the private sector but by housing associations[28], as an affordable solution to provide residential space. With financial support from the City Council, speculative vacant office buildings in isolated locations[29] were sought, acquired and usefully converted into inexpensive flats, at a time when housing prices were steadily rising (RICS, 1998).

[26] The vacancy of office space in the City of London hit its peak in 1992 with over a million and a half square metres. The London School of Economics estimated a fall of 36% in the value of commercial property, from £250bn to 160£bn, between 1989 and 1992 (Scott, 1996).

[27] Vacant space was sought by the growing number of new firms that needed affordable space to start their businesses. This represents the 'filtering down process' (Lichfield, 1988). A property which is no longer adequate for a some tenants can become adequate to tenants with lower profit margins, preferring worse premises with lower rents.

[28] In 1987, the fifteen storey office block Middlesex House was converted into 78 flats in Alperton, with an acquisition cost of £1.83m and construction cost of £5.5m (RICS, 1998) - an average cost of £94k per flat. The conversion occurred in 1993, by Try Homes, in the expensive area of Battersea, generating 53 flats. (RICS, 1998)

Research was carried out during the early 1990´s to report on the potential of vacant office buildings (1.3) [30], inevitably attracting the interest of developers and increasing their value, with costs of conversion being significantly lower than new build (Freer, et al., 1999). The first speculative development conversion occurred in 1993, from brick wall buildings from the pre-war period, transformed into flats in the services areas of Farringdon, Shoreditch or Clerkenwell[31](APR, et al., 1992).

Buildings were not only being refurbished and the built environment improved, but accommodation was also being provided close to workplaces, introducing positive demographic changes in areas typically associated with business, normally empty for a period of 48 hours (Freer, et al., 1999). But it was the value-gap between the housing market and the business market that was becoming as sharp as 90% higher by 1994 (Heath, 2001) that dictated the attractiveness of conversions, even if buildings were still suitable as offices (Freer, et al., 1999). New developments were in fact being converted without ever being let as office space.

The scale of conversions rapidly expanded[32], not only in the number of companies involved (from niche market-specialists to mainstream developers) but also in the size, type and location of the office buildings being considered. However, by the end of the 1990´s, the enthusiasm for conversions was beginning to ease, with reports (1.3) suggesting that the activity was foreseen to mitigate.

"[...] the great shake-out [of office conversions] has pretty much finished [...] unless the office market faces a very severe collapse[...]"(RICS, et al., 1998) .

Two main reasons were identified. Firstly, the stock of potential buildings was being rapidly exhausted and therefore the opportunity offered by suitable vacant buildings was ending. Secondly because the office market was already showing positive signs by the end of the 1990's, meaning that redevelopment option was likely to speed up. Research suggested that the main advantage of conversion to redevelopment was the time factor, since limited demolition would be required, as well as a far shorter construction phase and an easier planning process. However, if the scale of the intervention was major, costs were not much lower once compared to redevelopment of redundant space (RICS, et al., 1998).

It was also remarked by another research that the definition of the *redundancy* (3.1.3) was not clear for building owners, since the appraisal would vastly vary with the market conditions, floor plan adaptability or building location. A survey of developer´s opinions showed that conversion activity was highly specialized and still difficult to undertake. Moreover, with the common rule-of-thumb that conversion costs were 70% to 80% of redevelopment costs, a realistic assessment would had to be carried out, taking time and money, meaning most possible conversions are not even being investigated (Freer, et al., 1999).

This means that there could have been even more opportunities for residential conversions, as demand was high, should developers and building owners had been able to assess the potential of conversion without necessarily having to carry out a full architectural and financial appraisal (4.1.1).

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[29] Many of these buildings located outside the commercial cores were designed during the 60´s for a specific tenant which for any reason pulled out, leaving a vacant and unlettable building with low commercial value. (RICS,1998)

[30] Applied Property Research (1992) Home Office Report; Joseph Rowntree Foundation (1993) Offices into Flats

[31] The 1930´s mill by Manhattan Loft Corporation in Summers Street, Clerkenwell, 1993

[32] Between 1993 and 1998 more than half a million net square feet was converted into hotels and residences within. the City of London, with another 735,000 square feet planned (LPR,1999).

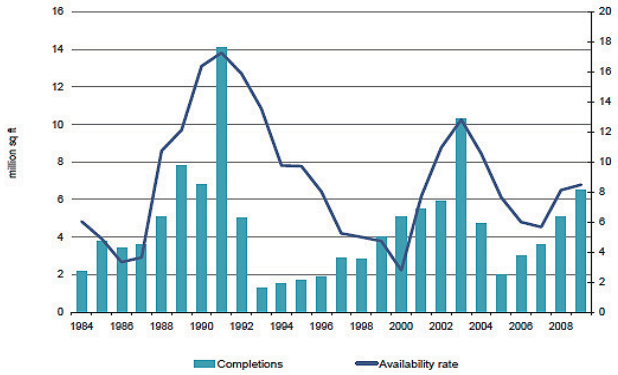

Figure 9 : Development Completions and Availability. *Source: CB Richard Elis*

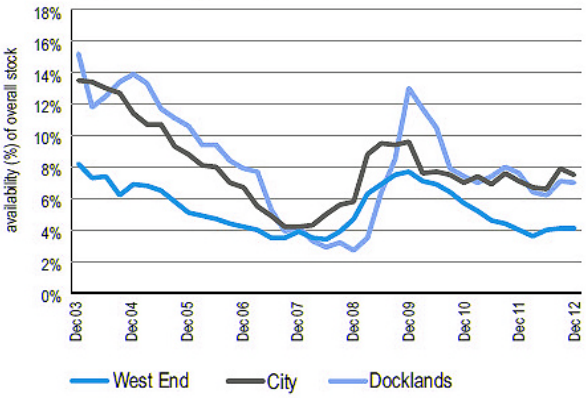

Figure 10 : Central London Vacancy Rates. *Source: Jones Lang LaSalle*

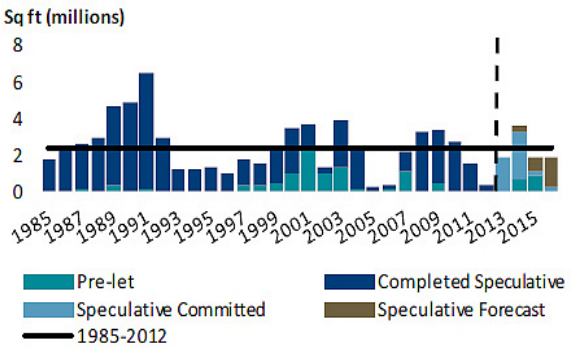

Figure 11 : Newly Built / Refurbished Supply in the City. *Source: DTZ Research*

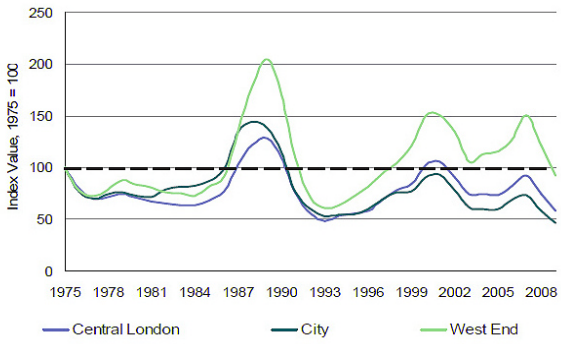

Figure 12 : Central London Rent Index. *Source: CB Richard Elis*

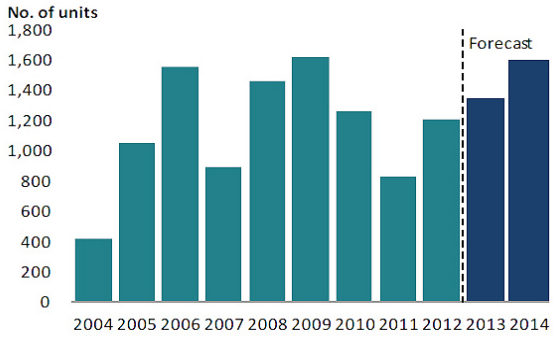

Figure 13 : Conversion Residential Units from Offices, 2004-2014. *Source: DTZ Research*

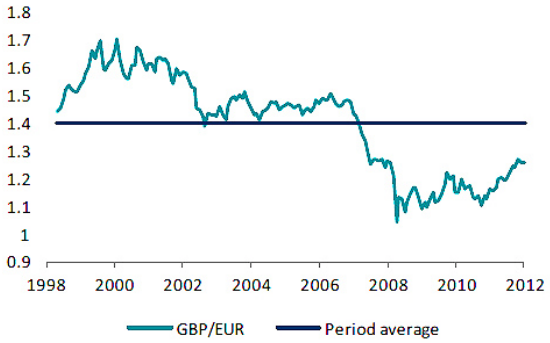

Figure 14 : Sterling exchange rate vs. euro: 1998-2012. *Source: DTZ Research*

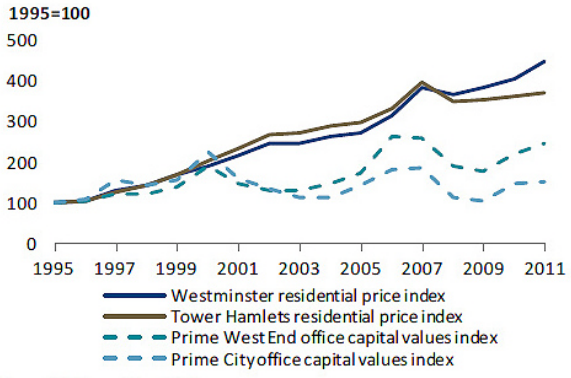

Figure 15 : Long Term Residential and Offices Capital Value. *Source: DTZ Research*

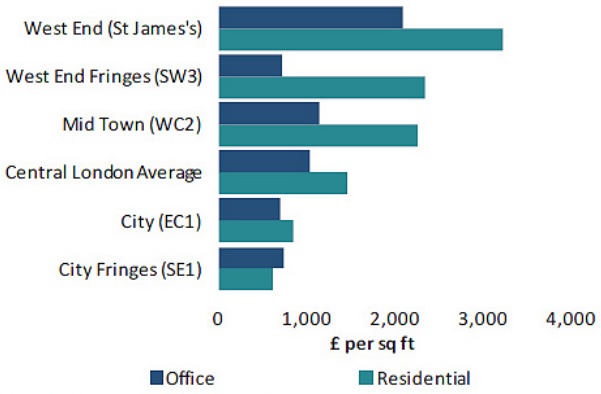

Figure 16 : Sterling exchange rate vs. euro: 1998-2012. *Source: DTZ Research*

2.3 Current and Emerging Conditions for Conversion

The last decade brought an unforeseen discrepancy between residential and office markets, in particular in the prime sector in central London. (DTZ, 2012) Whilst during the 90´s both markets had similar values in prime locations, equally and steadily growing, by the year 2000 residential values continued to rise whilst office values started to decrease. It is worth reflecting on the performance of both markets and regard conversion as a process that results from the balance between the two.

Several factors have contributed to the increment in residential values since the late 90´s. In addition to the decades-long shortage of housing, the low interest rates; strong levels of employment (Adair, et al., 2009); increased demand; demographic changes; migration; and, more recently, increasing overseas investment in central London *prime* residential property all also factor (DTZ, 2012). Being heightened by the large profits of the financial sector, wealthy foreigners are being motivated by the uncertainty of the Eurozone´s future, making London property a safe investment. Moreover, with the Value of the sterling pound depreciating since 2000, prime property in London is even more attractive to buyers from overseas (DTZ, 2012). These combined factors have led to a strong increase in housing prices in both *prime* and *secondary* sectors[33], expected to rise even further (DTZ, 2012), and already suggesting a bubble which may require the Bank of England´s intervention (The Economist, 2014).

On the contrary, commercial property which was enjoying the longest cycle of growth until 2007 driven by strong capital growth (Adair, et al., 2009) was struck by a sharp drop in the value of office property in 2008 as a consequence of a financial crisis (DTZ, 2012)(2.1.5) - the severe market collapse which could not be predicted during the aforementioned conversion research carried out a decade ago.

The investment banking and financial sectors are substantially reducing long term employment and companies are willing to shrink their presence in prime locations, such as the City or Canary Wharf, aggravated by regulatory and tax concerns. This climate contributes to a general loss of competitiveness regarding London´s position as a financial centre, already struggling with the dynamic delete growth of Asian economies, more attractive for investment than the markets of slow-growing and unstable Europe. (DTZ, 2012) In addition, businesses have become more alert and cost sensitive, focusing on using space more efficiently, demanding less area and transforming offices into meeting places, while the work is transferred to the worker's desk at home. Also, new working methods require less workforce, as a result of the impact of IT, suggesting a decrease in the need for space in the long term (Ratcliffe, et al., 2006).

With increasing residential values and decreasing demand for office space, conversions are now beyond the levels achieved during the mid 90´s and are expected to increase in the forthcoming years (DTZ, 2012). The reports from the 1990´s could not predict today´s landmark office buildings[34], mainly from the 60´s, and in prime locations either being planned and converted for other uses, in particular flats, but also hotels or retail, due to their obsolescence or financial underperformance.

[33] The average house price until 2008 increased by 100% in ten years. Average housing values in London today are rising by 10% a year as a result of a strong recovery of the economy and employment rates (The Economist, 2014).

[34] Centre Point(1967); Portland House(1963); Kings Cross House(1974); Shell Centre(1961); St. George´s House(1964).

	Building Space					Building Fabric					
Office Period	*1* Floor Depth (m)	*2* Window to Core (m)	*3* Slab Height (m)	*4* Internal Grids (m)	*5* Efficiency (NIA:GIA)	*6* Loading (kN/sqm)	*7* Insulation (mm)	*8* Power (W/sqm)	*9* Structure Type	*10* Facade Type	*11* Expected Condtion
1900 - 1950	n/a	n/a	3.5 to 5	n/a	n/a	5 (1910) 2.5 (1930)	Not Required	n/a	Load bearing masonry walls; Steel frame and brickwork walls.	Brickwork	*Low.* Major structural works required from façade to core.
1950 - 1970	10 to 12	n/a	2,9 to 3,2	0.6 / 0.9 (p)	n/a	2.5 to 5 4 (typ.)	25 mm	n/a	Concrete frame;	Pre-cast concrete panels	*Low to Medium.* A complete refurbishment with substantial structural repairs.
1970 - 1980	>12 - 20	n/a	3.2 to 3.6	0.6 / 0.9 (p)	n/a	2.5 to 5 4 (typ.)	60mm	n/a	Concrete frame;	Pre-cast concrete panels; fully glazzed	*Medium.* Services / façade obsolete, structural reinforcement required.
1980 - 2000	18 / 40	n/a	4	1.2, 1.3, 1.5 (p); 6 x 9 (c)	n/a	2.5 to 5	100mm 200mm	45	Pre-stressed concrete frame; Steel frame	Fully glazzed, curtain wall systems ;	*Medium to Good.* Services to be replaced, Façade to be pottentially obsolete.
2000 - 2010	12 to 21	6 to/ 12	3.1 to 4.2	1.5 (p); 7.5, 9, 12 (c)	80% - 85%	3 (GF) 2.5 (TF)	250mm	25	Reinforced concrete frame, Steel frame; mixed solution	Fully glazzed, curtain wall systems ; natural ventilated;	*Excellent* . Only minor changes to services are expected. excellent environmental performance

Table 1 : Office buildings physical preferences per development period. Source: Author

Crossed References : (Gold & Martin, 1999); (BCO, 2009)(Gann & Barlow, 1996)(Lichfield, N. & Partners, 2011)(Salway, 1986)
1 . External Building Depth (m) ; 2 . Window to Core Depth (m) ; 3 . Typical Floor Slab to Slab Height (m) ; 4 . Internal Structural (s) and Planning (p) Grids (m) ;
5 . Plan Efficiency, Net Internal Area : Gross Internal Area (NIA:GIA) ; 6 . Typical Slabs Structural Loadings (kN/sqm) ; 7 . Insulation Required, if with the same U-Value (mm) ;
8 . Power Provision (W/sqm); 9. Structure Type ; 10 . Façade Type ; 11 . Expected Condition ;

3 Adaptive Reuse of Office Buildings

3.1 Obsolescence in Offices

3.1.1 Property Development Cycles

The previous overview of twentieth century developments highlighted the typical and well established business cycles of commercial property development[35].

A typical cycle begins within a period of economic growth whereby the demand for commercial space increases. Vacancy rates fall to levels lower than 5%, where business performance becomes difficult and supply is no longer sufficient to satisfy demand. As a result, rents and property values increase, as well as owner´s profits, attracting new investments which often exceed the number of investments needed. (McKee, 1996).

The overproduction of space occurs with the expectation of higher values to improve the growth of other investments (Fainstein, 2001). However, since developments are only completed three to five years later, and because supply rapidly exceeds demand, once they are completed demand may no longer exist. The excess of space will negatively affect the economy as a whole, bringing down demand even further. Rent levels and property values fall and vacancy rates increase rapidly (McKee, 1996).

With low occupancy, developers cannot pay the debt of construction loans nor re-finance their own loans. As a consequence, lenders seek to dispose of the property they have acquired by lowering its price. The property market at this stage is so unattractive that even when demand rises again years later developers are still resilient in any investment. Financial institutions also hesitate to lend, forcing the market to absorb the previous surplus by lowering vacancy rates and making demand outrun supply (Fainstein, 2001).

Although business cycles are common in general economies, the cyclical nature of the property market has a larger amplitude, in part because of financial institutions (Havard, 2008)[36] and in part because of the time lapse between the opportunity to develop and building completion (Scott, 1996).

Since property cycles do not match the average cycle of the economy, there is a tendency to peak before the rest of the economy but also to reach the trough before it, too. If interest rates increase, The development sector becomes one of the first sectors to be affected. Nonetheless, a slowdown in that sector will inevitably depress the rest of the economy (Ratcliffe, et al., 2006).

[35] It has been identified four distinctive types of cycles which affect investment and development decisions in property markets: The Random fluctuations, the short-term and irregular changes; the Seasonal fluctuations, the regular and reasonably predictable cycles; the Business cycles, the fluctuations that affect the overall economy; and the Secular changes , the underlying economic conditions that influence generations (Barrett & Blair, 1982).

[36] When property values fall financial intuitions do not normally fund any schemes and even when values hit its upturn levels only few institutions are willing to lend. Their profits eventually start to attract other institutions which, on an even later stage, start competing with each other to lend. But values by this time are already falling and developments may become unprofitable, at a point where commitments are already made with developers (Havard, 2008).

In light of the above, those buildings[37] should be distinguished which are hardly affected by the economy and the market in general, due to their unique character or function, and do not normally require any short or medium term measures to be exempt from property cycles (Lichfield, 1988).

All remaining properties are subject to these fluctuations, in particular offices, built to last for five or six decades (Ratcliffe, et al., 2006) and thus likely to experience multiple cycles throughout their life.

It is worth remarking that once a building is completed, it suits a particular demand or market through a particular design, i.e. it is anchored to a function at the present time, not to a future nor past. Even if it becomes suitable for many decades, it has been developed to respond to the initial conditions, since it is required to attract tenants, customers or purchasers to secure the return of the investment. Hence a building cannot be developed *out of date* or *ahead of its time,* considering the increasing risk for developers not being able to protect the loan nor the value of the property (Lichfield, 1988)[38].

This aspect, particularly relevant in office buildings, has major consequences on the design. Although future market conditions could be considered, it must inevitably respond to present conditions one despite inevitable, yet uncertain, changes. As seen above (2.1.3), less than two decades took place between the largest property booms and yet the differences between buildings from these eras are vast (Table 1). This happened because office developments are particularly sensitive to the economy, technology or working patterns, which have profoundly evolved in both periods, and buildings had to response as much as possible to those changes. Although the reasons behind new developments might be clear as well as any required improvements, it is less straightforward to discern the conditions which existing buildings will withstand in the coming decades when the cycle is down, or alternatively when it is again up, but this time in different circumstances.

3.1.2 Supply Side and Demand Side Changes in Offices

The changes that affect each business cycle can either arise from the building stock, the *supply*, or from the wider context, the *demand*. Significant shifts are likely to occur from both sides, with a typical *suppressed demand* and *over supply* in a recession period and an *exceeding demand* and *under supply* in a boom period (2.1). This mismatch is well understood in the property market (Kincaid, 2002) and normally compensated by users themselves who naturally adjust their needs (Lichfield, 1988). However there is a common disagreement in differentiating many factors from each category, since they can actually affect both, although each cause tends to affect one side more than the other (Barrett & Blair, 1982).

Table 2; 3 summarize the changes that an office building may experience within each property cycle. Maintenance operations and internal refurbishments will be carried out to adjust to the market conditions and the user's *preferences,* extending its life and *utility*. At a certain point however a state of exhaustion may be reached, when the above works are not, or no longer able, to satisfactorily address those changes. When this occurs, the building becomes *obsolete*. (Lichfield, 1988).

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[37] E.g. Mosques, Cathedrals, Palaces

[38] E.g. Even if it is fashionable for commercial buildings to have an outdated character, it is not in reality *out of date* at all, since there is a demand for that character at the time of its design.

Supply Side Causes	Description
Age and Condition	Physical depreciation; structural deterioration; mechanical, electrical or plumbing services out of date and not easily replaceable; poor corporative image; high maintenance costs; low energetic performance (Ratcliffe, et al., 2006)
Physical Constraints	Inadequate floor shape or size; inadequate core layout; insufficient ceiling heights; ineffective structural grid or planning grid; inadequate internal layout; inflexible construction method, insecurity for people or information (Ratcliffe, et al., 2006)
Over Supply	When supply greatly exceeds demand either by buildings under project, approved, in construction or already built, normally due to the response time for provision (Ratcliffe, et al., 2006)
Vacancy Rates	When buildings are subject to under utilization or left vacant, leading to a faster depreciation or vulnerable to vandalism and squatting (Douglas, 2006)
Asset Value	Reduction in the building value, land value, rental and yield trends, construction costs trends; availability and terms of finance (Ratcliffe, et al., 2006)
Urban Environment	Depreciation of the quality of the urban context; loss of a cluster effect; lower social standards; built environment decadence (Douglas, 2006)

Table 2 : Summary of the Supply Side causes affecting Office Buildings. *Source: Author*

Demand Side Causes	Description
Economy	National, regional or local economic performance (either growth or recession); employment levels; population income; prices; taxes; interest rates; down-payment requirements (Ratcliffe, et al., 2006);
Information Technology (IT)	Networking; mobile telecommunications; teleconferences; fibre-optics; web data-base; electronic filing (Douglas, 2006);
Employment Strategies	Down-sizing; right-sizing; outsourcing; telecommuting; hot-desking ; core business; home working; part-time and free-lance employment (Ratcliffe, et al., 2006);
Working Practices	Flexible working hours; smaller and more flexible working units; short contract leases; sharing of premises by different companies;
User Expectations	Floor space--worker ratios; health work environment; energy efficiency (Kincaid,2002);
Code Compliances	Health and safety; fire escape; accessibility; environmental impact; power

Table 3 : Summary of the Demand Side causes affecting Office Buildings. *Source: Author*

Figure 17 : The London Stock Exchange (1981) *Source: Magnum Photos*

Figure 18 : Trading Floor in Bishop´s Gate, London (2013) *Source: Unknown*

3.1.3 Obsolescence Definitions and Theories

The word 'obsolete' derives from the Latin 'obsoletus', in use since the sixteenth century as an adjective to describe something worn-out, dilapidated or fallen into disuse (Lewis & Short, 1879). The literature offers multiple definitions of obsolescence[39] in the context of the built environment, originating from different and conflicting meanings.

Obsolescence was defined as the *process* of decline in utility (Baxter, 1971) which is not directly related to physical usage, nor the action of the elements and the passage of time (Baxter, 1971). It is instead the process of becoming antiquated, old fashioned, outmoded, or out-of-date (Baum, 1991) and it represents the degree of usefulness of a building relative to the similar available stock (Nutt, et al., 1976).

In this sense, *utility*[40] is the central concept of obsolescence - if something is not felt to be providing utility, it will be considered obsolete (Smith, et al., 1998)

However, a building may not show any signs of obsolescence, i.e. it is still useful, yet may still be vacant. If so, the building is considered to be *redundan*t - surplus to requirements or in a greater quantity than what is required (Douglas, 2006). Therefore, a building becomes redundant simply because there is not a *demand* for its use. Although obsolescence is often a cause for redundancy, it is not the only one. The difference between both conditions is subtle and mainly quantitative (Douglas, 2006).

But obsolescence, unlike redundancy, is a condition that does not emerge suddenly or uniformly, impacting different parts of a building. It is instead a condition that may arise from different *causes* (3.1.2) and induce different *impacts* (Lichfield, 1988). From the causes, it is important to differentiate between the two *classes* of obsolescence defined (Bryson, 1997) :

The first class, *Locational Obsolescence*, occurs when a building within a given geographical area suffers from either relative or absolute devaluation and it is dependent upon *extrinsic* factors that influence the building's utility. The second class, *Building Obsolescence,* occurs when the building value bears little relationship with the value expected in the building´s location and it is concerned with the *intrinsic* attributes that influence the building´s utility.

In fact, these two classes are most relevant for the investigation as they encapsulate the main two aspects to be considered on the appraisal of an obsolete office building (5.2.1, 5.2.2).

Furthermore, obsolescence can be also be grouped into different *types*. Since it is dependent from a dynamic multi-layer context, it is directly related to the nature of the causes, which can be both independent from and dependent on each other (Lichfield, 1988). Table 4 summarizes the many different *types of obsolescence* comprehended in the literature and excludes one obsolescence type which is further introduced below (3.1.4).

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[39] (Lewis & Short, 1879) (Baxter, 1971) (Baum, 1991) (Nutt, et al., 1976)

[40] The key criterion in the valuation of property is its utility. Procedures employed in the valuation process have the common objective of defining and quantifying the degree of utility or usefulness of the property valued. This process calls for interpretation of the utility concept. *Utility* is a relative, or comparative term, rather than an absolute condition. land value is established by evaluating its utility in terms of the legal, physical, functional, economic, and environmental factors that govern its productive capacity. (IVS, 2003)

Obsolescence Types	Description
Legal	The inadequate compliance with the present legislation and regulations (Douglas, 2006).E.g. Planning departments, local councils decisions, building regulations;
Functional	When the building is no longer suited to its function (Douglas, 2006) E.g. The function no longer exists; the function pattern has changed
Physical	The deterioration of the physical fabric of building as function of use and the effect of the passage of time. (CALUS, 1974); E.g. level of deterioration is beyond repairs or normal maintenance, affecting the façade, structure, services or finishes.
Aesthetical	An outdated appearance and incompatible with the corporate image (CALUS, 1974); E.g. character or aesthetics no longer adequate, a change on the building owner
Technological	As a result of technological innovations, the building´s components are no longer suitable or superior in terms of performance or efficiency. (CALUS, 1974); E.g. IT impact on the services sector; adequate provision of power, data, audiovisuals, security, heating or air conditioning.
Environmental	When the social, human and natural environment has changed, making the fabric no longer suitable, or adequate, for the contemporary requirements (Lichfield, 1988); E.g. demography, pollution, noise levels,hazardous substances such as asbestos .
Locational	When the surrounding urban conditions of the fabric are no longer the same as the ones when the building was developed (Lichfield, 1988); E.g. changes in the transportation or accessibility, surrounding uses changes;

Table 4 : Summary of the different Obsolescence Types. *Source: Author*

A building can be obsolete in one or more of the aforementioned aspects and yet can continue to perform well with regards to other aspects. Once the types of obsolescence are indentified and the causes understood, it may be possible to completely reverse the process and delay such conditions within its current use. Buildings from the 1960´s property boom, for instance, could be as *technologically obsolete* during the late 1980´s as those built in the post-war because of inadequate services provision and yet not show any other signs of obsolescence. If services are *replaced,* the building may be rendered useful again .

3.1.4 Conservation, Rehabilitation and Redevelopment Alternatives

Once an office building is completed, the occupier (owner or tenant) will have a financial and business objective to maximize the value of the services being enjoyed through occupation while at the same time minimizing the operation costs consistent with its enjoyment .

Equally, the building owner will have the overriding objective of finding the maximum net value or benefit that can be obtained from the building over time. Until that happens the building will be conserved and only maintenance or minor refurbishments will be carried out (Lichfield, 1988) .

As previously discussed, the building may show many *types* of *obsolescence* during its lifespan (3.1.3) which may originate from multiple *causes* (3.1.2), and consequently the building will become less useful. Since there is not a rational measure for its *utility*, it was suggested to measure the degree of obsolescence in terms of real or nominal decrease in value (Salway, 1986) .

Although exceptions[41] are made, it is expected that the value of the property decreases parallel to its obsolescence (Baum, 1988)[42].

Depreciation has been defined as the loss in the real existing use value of property (Baum, 1988).

Obsolescence Only one in a group of causes of depreciation (Baum, 1988).

A building may not be *obsolete* and yet may still show signs of loss in its value because it shows signs of being *redundant* within present market conditions. Either way, and as a result, the building owner, developer or buyer will be faced with a decision regarding the building´s purpose through a number of *alternative actions*.

The immediate action is not to undertake any physical improvements, over and above the necessary maintenance works, not further investing in the property whilst waiting for more agreeable market conditions However, schemes can be introduced or plans intensified arrangements to encourage potential occupiers to purchase or rent the building (Kincaid, 2002).

Alternatively, and if this is required, the building can be closed and left vacant through the operation of *mothball* [43], stripping it out and preparing its rehabilitation in due course when the market opportunity arises, whilst reducing any running costs until then.

However the building can also be refurbished, either by optimizing the building performance to meet with changing requirements within its current use, adjusting it to different types of occupancy, embracing ancillary uses, or even converting it into a mixed use facility or a new use.

Eventually the building can be demolished and the site sold or redeveloped, for same or different use.

The decision of whether a building should be conserved, refurbished, converted or redeveloped, will inevitably have to address the financial costs and returns expected of each *alternative* (Lichfield, 1988).

Once a building is considered to be *obsolete*, it will not be refurbished if the expected return from the renewal does not exceed the cost of maintaining it as it is. However, if still the building presents the expected returns and yet shows clear signs of obsolescence, a rehabilitation plan will be devised to delay the impact of obsolescence and extend the building´s life, taking both time and quality into account. (Lichfield, 1988). The owner or developer will compare the building´s value (which already includes the land value) and the costs of rehabilitation, with the added value obtained from the operation, which needs to be sufficiently high to provide an adequate profit.

The assessment, will also have to consider the prospective loss or gain of the rehabilitation works only cover minimum maintenance works. (Lichfield, 1988)

However it could also happen that the potential value of the site for redevelopment, as generated by demolition, could be higher for new development than the value of the property as it stands.

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[41] Occasions may occur where obsolescent property investment can increase in value, for instance, as a result of advantageous planning that may generate opportunities for that building. (Baum, 1988).

[42] In this sense, the real estate market is a reliable indicator of a building´s usefulness, since its value will over time increase or depreciate, according to the demand and supply. If an office building presents a lower value than expected, once compared to the surrounding competing buildings, it is more likely that the causes may arise from the building itself. If instead the whole office market decreases compared to previous years, it is likely that the causes may arise from the market. Equally, the comparison could be performed to assess a certain location, i.e. not considering a building but instead a relevant number of buildings in a certain area, once compared to other areas.

[43] To strip out the building, covering all windows and entrances to prevent vandalism and maintain the building shell.

If the value is high enough to include the developer´s profit, the site can be described as *economically obsolete,* which may result in the demolition of buildings which are not obsolete, nor *economically obsolete*, in order to release the site because of the value of its redevelopment. (Lichfield, 1988).

Economic Obsolescence in the built environment, which was excluded from the above obsolescence types (3.1.3) due to its particular nature, has been defined as the condition where the building is no longer able to generate any surplus over the operating costs. (Salter, 1966). This definition is in line with the above concept of *depreciation*. Although a building may show signs of being obsolete, consequently generating a loss of value, it may still not be economically, despite being depreciated.

However, if we consider a different approach, *Economic Obsolescence* is the loss of value that occurs due to changes external to the property, whilst Depreciation is a loss of value from any cause (Wofford, 1983).

This introduces the concept of Highest and Best Use of the land (Salway, 1986), the most probable use of a property which is physically possible, appropriately justified, legally permissible, financially feasible, and which results in the highest value of the property being valued[44]. (IVS, 2003) (5.3).

From the latter it can be understood that a building becomes economically obsolete when a different use may result in a higher value than the existing one. In fact, since buildings can be used to house more than one economic activity, when a building becomes economically obsolete in one use it does not mean it cannot be profitable in another use, due to changes in the demand or supply.

In this concept, it has been stated that :

"[...] buildings can only truly be defined as 'obsolete' when they have become completely useless with respect to all possible uses that they have been called upon to support" (Nutt, et al., 1976).

This is most interesting to the investigation and, in many ways contradictory to the aforementioned definitions since it suggests that a change-of-use rehabilitation is a necessary measure to be considered before recognizing obsolescence of a building.

Above all, it recognizes that a change-of-use rehabilitation is a powerful tool that needs to be considered In order to overcome obsolescence.

[44] Application of this definition permits valuators to assess the effects of deterioration and obsolescence in buildings, the most appropriate improvements for land, the feasibility of rehabilitation and renovation projects, and many other valuation situations. In markets characterised by extreme volatility or severe disequilibrium between supply and demand, the highest and best use of a property may be a holding for future use. In other situations, where several types of potential highest and best use are identifiable, the valuator should discuss such alternative uses and anticipated future income and expense levels. Where land use and zoning are in a state of change, the immediate highest and best use of a property may be an interim use. The concept of highest and best use is a fundamental and integral part of *Market Value* estimates (IVS, 2003).

Figure 19 : Queen Victoria Street (1945) future Bucklesbury House. *Source : Museum of London*

Figure 20 : Queen Victoria Street (2013) redevelopment of Bucklesbury House. *Source : NY Times*

Figure 21 : Bucklesbury House Model (1955), demolished (2012), *Source : LMA*

Figure 22 : Fleet Building, to be demolished (2015), *Source : LMA*

3.2 Adaptive Reuse Development

3.2.1 Adaptive Reuse Definitions

Adaptation is derived from the Latin words "ad" (to) "aptare" (fit) and it is defined as:"any work to a building over and above maintenance to change its capacity, function or performance" (Douglas, 2006).

This term embraces any sort of improvement works to an existing building, with or without a change of use, and therefore it is considered inadequate for the investigation. Moreover, the term *adaptation* has also been commonly used in the literature[45] as a solution to overcome the '"unhappy" confusion of different terms in this built environment field (Markus, 1979). Conversion, adaptive reuse, rehabilitation, refurbishment or renovation are terms whose meaning and scope differ from author to author.

The concept *adaptive reuse* (Cowan, 1963); (Iselin & Lemer, 1993); (Kincaid, 2002) is the designation considered in the investigation when referring to the adaptation works, which go beyond maintenance and improve the building´s performance or capacity, on a material change-of-use refurbishment.

Material change of use in turn has been defined as "the start of a new use of the premises, the re-establishment on the premises of a use that has been abandoned or a material change in the intensity or scale of the use of the premises" (Ratcliffe, et al., 2006)[46].

These two definitions are most important as they broaden the scope of a change-of-use.

It means that the change needs to be substantial or significant, rather than a small shift in activity and also that an increase or decrease in use can constitute a material change of use, which is exclusive to the activity itself, and not to the physical works carried out on a building (Ratcliffe, et al., 2006). In this sense, a building refurbishment does not constitute a change-of-use. What is more, a change-of-use does not require any sort of physical modifications to the existing building. Furthermore, the *scale* of the fraction being adapted is also relevant. E.g. an office building that has converted a retail unit on the ground floor to a conference room has not changed its use, as it is a small fraction of the entire property and therefore its adaptation is not significant as far as buildings are concerned.

For the purpose of this paper, the adaptive reuse of an office building can still result in an office use, as its intensity or nature can vary, therefore that *alternative* should be considered (4.2.2).

However, *adaptive reuse* has also been defined as "a conversion of a facility or part of a facility to a use significantly different from that for which was originally designed" (Iselin & Lemer, 1993).

This definition, confirming that adaptive reuse occurs if part of a facility changes its use, although contradictory with the above, is most relevant in commercial property which embrace *ancillary uses*, that not only provide an additional purpose and value but also complement its *primary use,* whose function may rely on them. (Ratcliffe, et al., 2006). A building with ancillary uses is considered a single use building but if a refurbishment intensifies them to such an extent that becomes no smaller than the primary use then the property becomes a *mixed use* development (Ratcliffe, et al., 2006).

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[45] (Douglas, 2006);(Iselin & Lemer, 1993)(Markus, 1979)

[46] From the Sustainable Planning Act (SPA), 2009

3.2.2 Adaptive Reuse as Property Development

The term *property development*, widely approached in the real estate literature[47], has been defined as:

"carrying out building, engineering, mining or any other operations in, on, over or under land, or making any material change in the use of any building or land. " (Town and Country Planning Act, 1990).

This definition is of most relevance in any adaptive reuse *development*, as it clearly states that a material change of use is an act of property development[48], which typically starts with *concept and an initial consideration* stage[49] (Ratcliffe, et al., 2006).

In this early stage the objectives and the overall strategy are determined by considering the size, use, and location of the development as well as the timing and the expected property market. All these aspects are then the subject of research, both formally and informally, rationally and intuitionally (Miles, et al., 1991), establishing the criteria that points out a few possible development options. These will then be the subject of a preliminary financial appraisal that will determine the most suitable option, based on a likely cost and value, determined by the market environment and the developer´s own experience.

The following stage is the *site appraisal and feasibility study* (Ratcliffe, et al., 2006), consisting of researching and gathering all necessary information to conduct a deep appraisal of the financial viability of the project. The appraisal will include an assessment of the market demand and supply, the projected values and yields and the cost and time of construction or the planning viability. It is also at this stage that the developer searches for available sources to finance the project, as this is one of the essential elements without which a developer cannot start.

From the above, the purpose of this paper and of the constructed Adaptive Reuse Appraisal Model (4.2) is to assist in the two early stages by selecting or assisting in the set of relevant criteria, the preferences of each alternative and suggesting options which warrant further research.

As with any other development, the quality of the final product will highly depend on the level of efficiency and commitment by those involved (Ratcliffe, et al., 2006) and also on their early involvement in the development decisions so that different *points of view* could be considered in the above initial stages. The strategic approach towards an obsolete building should be as comprehensive as possible to the different fields of architecture, finance, planning, management, construction, or market.

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[47] E.g. (Graaskamp, 1981) ; (Miles, et al., 1991) ; (Millington, 2000) ; (Havard, 2008) ;(Wilkinson, et al., 2008)

[48] In simple terms, a developer in London will typically buy a site, secure planning permission and commission an architect and a builder to put a building on site. He employs an agent to find a tenant prepared to pay an agreed rent from the space and, once he has the tenant, he sells the property. The investor treats the building with its sitting tenant as a business and buys the income stream from the rent in the knowledge that he will eventually cover the purchase costs and moves into profit. There are many variations on this theme but they all revolve around someone buying the income stream from the rent. It is on that basis that the value of a building is calculated(APR, et al., 1992).

[49] Typical Property Development Stages (Ratcliffe, et al., 2006):
1. Concept and an Initial Consideration; 2. Site Appraisal and Feasibility Study;
3. Detailed Design and Evaluation; 4. Contract and Construction; 5. Marketing, Management and Disposal

Decision Agents	*Role*	*Professional Affiliations*
Investors	Financing	Banking, Insurance
Producers	Design and Construction	Architects, Engineers, Surveyors, Contractors, Suppliers
Marketers	Market and Value	Surveyors, Real Estate Agents
Regulators	Planning and Legislation	Local Council, English Heritage, Legislators
Users	Tenants, Owners, Users	Companies, Individuals, Public
Developers	Inception and Management	Developers, Contractors, Landowners, Project Managers

Table 5 : Decision Agents for Adaptive Reuse. *Source: Bartlett Research;* (Kincaid, 2002)

	Investors	*Producers*	*Marketers*	*Developers*	*Regulators*	*User*	*Totals*
Investors	52%	**54%**	49%	42%	na	**84%**	56%
Value	44%	28%	**81%**	55%	**79%**	65%	**59%**
Risk	**57%**	35%	60%	**61%**	62%	51%	54%
Robustness	35%	39%	71%	48%	49%	55%	50%

Table 6 : Decision Agents Viability Criteria Preferences. *Source: Bartlett Research; (Kincaid, 2002)*

The *decision agents* that represent each of those fields have been summarized in the literature in a total of six distinct groups (Table 4). These are the decision makers considered in the investigation (4.2.3).

Also, research carried out by University College London summarized the elementary criteria that would be determinant in the selection of alternatives for a successful adaptive reuse development in four different categories (Kincaid, 2002) : *Cost*[50]*, Value* [51]*, Risk and Robustness.*

These four viability dimensions were then presented to the above decision agents involved in adaptive reuse developments through a questionnaire, in order to understand the average *preference* of each decision group on each criteria (Kincaid, 2002). The results (Table 6), alert us to the vast discrepancies between each group, highlighting the importance of collaboration in the development process.

It is worth reflecting on the Value criterion, which was found to be the one with the most discrepancies in its relative importance, in the context of office buildings and their adaptive reuse. A building that has been designed to be versatile enough to accommodate more than one use is less specialized and so it may have a lower initial market value. In the long term however, its value may be higher (Millington, 2000).

[50] *Cost* is the price paid for goods or services or the amount required to create or produce the good or service. The cost is an historical fact. *Price* is a term used for the amount asked, offered, or paid for a good or service. Price is related to cost because the price paid for an asset becomes its cost to the buyer (IVS, 2003)

[51] *Value* is an economic concept referring to the price most likely to be concluded by the buyers and sellers of a good or service that is available for purchase. Value is not a fact, but an estimate of the likely price to be paid for goods and services at a given time in accordance with a particular definition of value. (IVS, 2003)

A building which has been designed instead for a particular use, for a particular tenant or a particular company has an expected higher market value, since it is intended to be highly efficient only for that purpose, but if demand is not high enough, the building will be more difficult to sell or let, leading to a significant loss of its value in the future (Millington, 2000).

This aspect is particularly relevant in office developments. Offices tend to be less speculative since the 1960´s (2.1.3), due to previous uncertainties in the market, and as a consequence have been thoughtfully designed either as a specific typology, that can be discontinued[52], or for a specific company (with particular needs and a corporate image) that can change premises [53].

Hence the solution for overcoming *redundancy* in offices in the short term may decrease the chances for their adaptation in the long term. This balance should be carefully considered in adaptive reuse developments as well. It should serve its immediate purpose and yet should consider its own re-conversion in the future, either to the previous use or to even a new one. Moreover, it is also a tool that allows the transformation of a highly specialized building into a more flexible one.

However, an adaptive reuse rehabilitation, as another form of property development, embraces the same objectives as the profit maximization goal, either monetary or non monetary, and therefore will only be possible if the value of the rehabilitated building matches at least the site cost, the development cost and the profit that the developer establishes to reward himself, while considering the risk of the investment. Since the value of a development is the one established by the market, only the uses that have an expected demand by the time its completion can be considered (Lichfield, 1988).

The above condition automatically excludes the majority of alternative uses for a redundant office building, in the concept of *highest and best use* above introduced (3.1.4). The developer should seek to satisfy the market demand, with adequate buildings and suitable locations, whilst developing , and constructing, in such way that enables him to obtain an adequate net return(Lichfield, 1988)[54]

This aspect is the clear differentiator from the public sector, which embraces wider objectives. For the public sector, the aim is to attract private investment as well as maximize the public benefits that a development can generate to a community, whilst ensuring it fulfils its duties (Millington, 2000). The benefits that could be obtained may include economic growth, generation of employment, provision of shelter, improved public space or the attractiveness of the development. The duties may include code compliances, environmental sustainability, social responsibility or urban landscape. The balance between the private and public interest is most relevant in the context of urban regeneration as the profitability for the former and the integrated approach of the latter are required.

Since many aspects exceed private sector goals, it is up to the public sector to ensure that these aspects are considered and regulated, within a broad and sustainable urban regeneration perspective.

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[52] E.g. The Stock market trading floors typology, which became redundant due to the information technology.

[53] E.g. The NatWest tower, now called Tower 52 , developed to house the NatWest Bank

[54] E.g. It might be the case that for instance only a high end residential use is viable because it is the only use that generates enough return; or it might be the case that only affordable housing is viable should construction costs be required to remain low,; or even that any is possible because there is not a sufficient expected demand for both.

Figure 23 : Angel Building (1980s), during refurbishment (2010). *Source: AHMM Architects*

Figure 24 : Angel Building (1980s), during refurbishment (2010) *Source: AHMM Architects*

3.2.3 Adaptive Reuse as a tool towards Urban Regeneration

Urban regeneration has been defined as :

" a comprehensive and integrated vision and action which leads to the resolution of urban problems and which seeks to bring about a lasting improvement in the economic, physical, social and environmental condition of an area that has been subject to change." (Lichfield, 1988)

Buildings do not stand isolated, neither physically or economically. They instead have a purpose for existence which defines their quality and determines their usefulness (Lichfield, 1988).

As previously seen (3.1.2), once a building becomes obsolete or redundant, many causes are behind that status which are much wider than the physical condition itself. In the same way, there will be not only a physical impact as a consequence but also an environmental, economic and social impact as well. Hence, any developments should plainly reflect these concerns with the surrounding environment, rather than be focused on the short-term, fragmented and singular project-based approach without an overall strategic framework for city-wide development (Hausner, 1993).

Whilst not suggesting that individual private developments are not welcome or beneficial to an area or city, it is clear that they should not address the full set of problems without an integrated vision.(Roberts & Sykes, 2000). The aim of the approach for urban renewal should be instead to create conditions for an environmental, economic and social regeneration to happen (Healey, 1997).

With that said, and considering the needs and opportunities for the city, (Hausner, 1993) the adaptive reuse of a building is a powerful tool and an opportunity towards urban regeneration.

For centuries, London naturally adopted this approach in order to make the most of the resources that were already available. Urban areas adapt themselves in a prompt and cost-effective way by changing the use of their buildings to respond to rapid socio-economic changes, which historically grow at a faster rate than the physical depreciation of the existing stock[55] (Roberts & Sykes, 2000).

The main causes for urban decadence were summarized as (Roberts & Sykes, 2000):

1. *The physical obsolescence and the contemporary property requirements;*
2. *The economic transition and the employment levels;*
3. *The social and community aspects;*
4. *The environmental quality and the sustainable development.*

[55] The area of Covent Garden has been widely studied in this particular aspect since it has constantly change for almost four centuries. The many characters and social status that has embraced was inevitably absorbed by the buildings, not only in the square but also in the surrounding areas, since many are as old as Covent Garden itself. The nº 43 King Street for instance, has been used as a private dwelling house, a hotel, a coffee-house, the headquarters of the Royal Institute of British Architects, a music hall, a club, a store, an office and a restaurant. This peculiar example illustrates the capacity, or necessity, that buildings have to adapt themselves to other uses in order to meet the circumstances of a demanding urban area (Christie, 1973).

Based on the above One must comprehend the opportunities which become available following the adaptive reuse of redundant or obsolete office buildings as an integrated vision of urban regeneration.

The first cause is the most notorious manifestation of urban decadence - the physical inadequacy and deterioration of buildings (1.). A physical renewal is usually a necessary and sometimes sufficient condition for a successful regeneration since it is a major cause for a building's obsolescence in terms of supply. As the physical condition and the environmental quality of cities are symbols of their prosperity, the key to successful physical regeneration is to understand the constraints and the potential of that physical stock and the role that its improvement has in enabling urban regeneration (Roberts & Sykes, 2000).

Commercial property is in general most sensitive to this aspect (Ratcliffe, et al., 2006) with a constant demand for better premises and increasing user expectations. A company´s success is directly affected, both positively and negatively, by its premises. Inefficient and inadequate buildings can be a cause of their decline, delivering a wrong image, increasing maintenance costs and mitigating a company's performance. Adaptive Reuse enables the re-use of the existing fabric, improving its conditions, adequacy and image, through a new alternative use that allows the profitability of the rehabilitation when its current use does not.

The second cause refers to the economy and employment (2.) The built environment is deeply dependent on the economy that sustains it. The more a building is bonded to that economy, the greater are the chances of becoming unusable if that economy is dissolved. The *Brownfield* areas which resulted from the deindustrialization process during the twentieth century draw attention to this dependence once more. The *economic regeneration* is therefore a vital part of the process of *urban regeneration*, and the latter cannot succeed without the former (Roberts & Sykes, 2000). It is useless to provide infrastructures without the demand to sustain its use, as it is useless to promote a city and attract investment if there if adequate infrastructures are not already in place.(Roberts & Sykes, 2000).

Offices are highly dependent on the status of the service sector. In economic downturns their purpose becomes questionable. By changing its use, it not only allows the building rehabilitation – a beneficial action for the economy – which would not have been possible with its current use, but it also opens the opportunity for a new use to be implemented in that location.

However, the impact of adapting office space is not clear, which acts as an "employing" space, to other uses such as housing, which is typically a "non employing" space. Regarding this concept, the relationship between the provision vacancy of office space and its impact on the employment rates has already been shown[56]. The vacancy of space, even if redundant, can keep rents lower and favour the maintenance of jobs, whilst its scarcity can eventually evoke the loss of employment opportunities. Besides, once the economy is in recovery, vacant space becomes useful once more, whereas if converted that opportunity is no longer available (2.2).

[56] (Rosen, 1984); (Wheaton, et al., 1997); (Hendershott & MacGregor, 2000)

The third cause refers to the social and community aspects (3.). The conversion of office space into housing is in this case the most relevant. Companies are increasingly reducing their presence in the city centres thus the vacant space can be used for other functions.

London has had scarcity of housing for decades (2.3). In this domain, the demand pattern is actually changing. The increasing levels of transportation makes commuting to peripheral areas much less attractive than before, away from more appealing public space, or cultural and leisure attractions. Also, recent demographic changes such as immigration, single residents, or couples without children, all require a specific residential typology which many current housing units cannot provide.

At the same time, In London it is common to find typical offices´ areas which are often empty for 48 hours (Kincaid, 2002). The introduction of residential use through obsolete buildings could provide a mixed use character to the area, which could result in beneficial social and environmental changes – new services, shops, facilities, better urban space and reduced criminality levels in the evenings. An adaptive reuse could improve the mismatch between supply and demand in residential and office markets, deliver adequate housing typologies and improve the character of single use urban environments.

The fourth cause refers to the environmental impact and the need for sustainable development (4.)
It was not until the late 1970´s that the most obvious destiny for obsolete buildings became demolition and redevelopment (Douglas, 2006). The preference for built heritage is recent and the awareness of the environmental impact is even more. The ecological footprint of an urban area often exceeds the city´s administration and reflects the consumption of resources of the associated urban living (Roberts & Sykes, 2000). Previous research (Anderson & Mills, 2002) has concluded that the rehabilitation of office buildings has a lower environmental impact than redevelopment. Rehabilitation provides lower whole life costs, lower emission of C02, lower consumption of energy, lower pollution of land, water and atmosphere and lower demolition waste. Furthermore, a fully rehabilitated office building can have the same 60 year predicted life which is anticipated on a new building (Gold & Martin, 1999).

From the above discussion, the potential success of adaptive reuse lies in two key reasons: it prevents a building becoming obsolete allowing space for a new use. Both aspects are able to cover all the above conditions required for urban regeneration, conscious of the economic, social and environmental needs of the urban area to which it belongs.

This subtle difference between being able rehabilitate and to actually generate or be part of the change is a significant progress when considering the desired strategic and integrated vision.

All these aspects are clearly beyond the scope of this paper as each one of them is wide enough to be subject of research in their own right. Nevertheless they clarify the extension that the adaptive reuse tool can produce in a redundant building and, within a wider perspective, in the urban area to which they belong.

That said, the methodological approach that is being constructed, although not considering the above aspects, should be used as an instrument to maximize possible alternatives, to be used consciously with the wider opportunities and impacts implicit in an adaptive reuse.

3.3 Adaptive Reuse Tools

3.3.1 Alternative Use Flexibility

The most immediately available tool that allows the accommodation of a new use in an existing building, designed for a different purpose, is to adapt the requirements of the new use to the available physical conditions of that building.

As seen above (3.2.2) some buildings are more adaptable than others. This depends on the characteristics of the building itself but also on the *difference of preferences* between the previous and new uses. If some may require similar characteristics, others may have the flexibility to adapt to a certain type of room layout, dimension and arrangement. Or, on the contrary, there may be a certain type of room layout, arrangement and dimension that has the qualities and capacity to serve more than one use [57].

If considering the above comparison from a two-dimensional standpoint only, ignoring other factors such as ceiling heights, structural strength or natural day lighting, one can assess the frequency of use of certain room types and floor areas across a wide range of uses (Kincaid, 2002). This method could enable us to identity universal rooms, i.e. the rooms that could easily serve the purpose of the largest number of uses. An investigation was carried by Peter Cowan (1963) to the University College London (UCL) indicating that a vast number of activities occur in a space provision of up to 20 square meters, with a sharp decline thereafter as space size increases. The research also shows that spaces of 2.5 square meters were found to be most useful for a large number of ancillary activities across most uses (Cowan, 1963).

In the best scenario, the difference between the building supply and the use demand is *low*. The overall morphology, the dimensions and the fabric condition of the existing building would match the use preferences (Kincaid, 2002). Only minor works are required because the adaptation will largely rest on the flexibility of the new use. The process is relatively easy, short, or cheap, thus more likely to occur.

In the worst scenario the difference is *high*, either because the building is 'tight-fit' or because the new use requirements are substantially different from the existing building. In this case major works should have to be consider for the overall morphology and structure. With a predictable longer and more expensive process, the viability of the proposal is no longer clear, not are the advantages of rehabilitation over redevelopment.

In this sense, an evaluation of the adaptive reuse potential would measure the *difference,* or the *similarity* between the preferences of the alternative uses and the existing building conditions (4.2).

Between the two extremes, it is possible to reasonably modify the existing building so that the differences between the two become distorted and the adaptive reuse performance enhanced. Whilst a few characteristic are barely changeable (4.2.5), all the others can more or less easily be physically modified through adaptation tools that go beyond minor internal or external works.

They can be summarized as *Physical Extensions*, *Selective Demolitions* and *Replacement of Components*.

[57] For instance, small and medium-sized enterprises that convert a residential space into an office use with hardly any physical permanent change. Or convents and monasteries that are converted into hostels or hotels.

3.3.2 Physical Extension

The extension operation has been defined as any addition that is physically as well as functionally linked to an existing building (Kincaid, 2002).

In this sense any construction which is detached from the existing building, is not considered an extension but a new build as it does not involve any physical alteration to the existing features (Douglas, 2006). But if an extension, although physically attached, does not involve any relevant adaptation of the original building (e.g. a door opening) they may also not be considered as extensions[58].

Extensions primarily respond to the particular necessity of increasing the internal floor area and so becomes one of the more efficient methods to raise a property´s value and respond to many forms of economic obsolescence. An extension can either expand the current use or easily provide an ancillary use which may require different physical preferences than the primary use.

However, extensions are in fact unrestrained new build parts of an existing building therefore the opportunities are wide in addressing code compliance, plant requirements, spatiality and character. They can be expressed as horizontal or vertical (Douglas, 2006):

Horizontal Extensions

Which can be internal*, e.g. extending a slab towards a double height space or a lift shaft; or* external*, e.g. adding balconies, extending floor slabs or adding volumes with higher floor to ceiling height.*

Vertical Extensions

Which can either be *upwards*, e.g. additional storeys at roof level or a mezzanine storey in a high ceiling space, such as roof tops or ground floors; *or downwards*, e.g. additional storeys at basement level, to accommodate uses that can be located below ground level.

Horizontal extensions are more typical in commercial properties due to the amount of space required and the structural challenge and costs involved in vertical extensions in reasonably sized buildings. However, horizontal extensions are invariably restricted by plot boundaries and adjacent amenities (Douglas, 2006). Vertical extensions are more common on either large scale developments or in small interventions, such as housing.

Either way, the common aspect of both is that additional floor *area* or additional *space* is being provided and therefore the available space of the original building was increased.

[58] The size of the extension is also an ambiguous figure, especially in the cases when it matches or exceeds the size of the existing building, often visible in commercial or industrial property. This aspect is not contemplated in this research, assuming that any physical addition is considered an extension regardless of its relative size.

3.3.3 Selective Demolition

Selective demolition has been defined as the conscious and precise removal of some parts of a building´s usable floor space, in addition to the demolition during refurbishment of specific elements of buildings such as walls, services and parts of primary structure (Kincaid, 2002).

A reason to carry out a partial demolition on a building refurbishment is to delete unsafe or unused parts of a building (Douglas, 2006). Their removal can release structural overloads, prevent construction deterioration, remove obsolete and redundant spaces or facilitate refurbishment works.

Furthermore, in the demolition process, new space is released, both internally or externally, which may be required by the new use or be necessary to make way for a new extension. Also, it can allow a building to return to its original shape, deleting the additions and modifications endured throughout the years or even re-think and improve the original design.

However, the opportunity and value of selective demolition are not as evident as the extension tool in an adaptive reuse development. Since extensions permit an increment in floorspace they may directly increment the building value whereas demolition actually reduces the amount of floor space. The loss would therefore need to be covered by the added value of the operation. But in which circumstances does a selective demolition add value and how can it be determined ?

This aspect, as complex and interesting to warrant its own area of research, has been assessed by surveying planning applications which included demolition and a change-of-use refurbishment in order to identify their potential. They were further compared with capital values, rental rates and property values of the refurbished asset. The major benefits which were achieved were the following (Kincaid, 2002):

Building Site

The site access and site amenities were improved permitting multiple uses at ground floor and lower ground floor areas. Parking provision was also increased by the removal of poor standard extensions;

Space

Total floor areas were in general subject to marginal changes, being normally compensated by the addition of new storeys or horizontal extensions. However, deep floor plans were in most cases reduced, in certain areas, especially in residential conversions, to optimize the area closer to daylight. Atria and light wells were also introduced to extend natural lighting provision inside the building core and floor slabs were also removed at ground floor and first floor to achieve double height spaces, most appreciated for entrance lobbies or to accommodate more demanding such as retail;

Fabric and Structure

The character of the building was substantially improved through selective demolition either outside and inside the building. The core was frequently changed in most cases because of the opportunities that it offered in reconfiguring the usable floor space. However, structural bay widths and depths were hardly changed, indicating the relevance and inflexibility of this criteria for an adaptive reuse.

3.3.4 Replacement of Components

To the previous tools appointed by David Kincaid (20t03) a fourth tool has been added in this paper which has been considered to be of a different nature and impact to the former ones.

The *Replacement of Components* embraces any operation of a partial or entire substitution of a building element which goes beyond internal partitions and finishes. It could not be part of demolition nor extension because the external or internal *area* is hardly modified. However the building´s environmental performance, image, character and real estate value could certainly be increased with the operation.

Façade

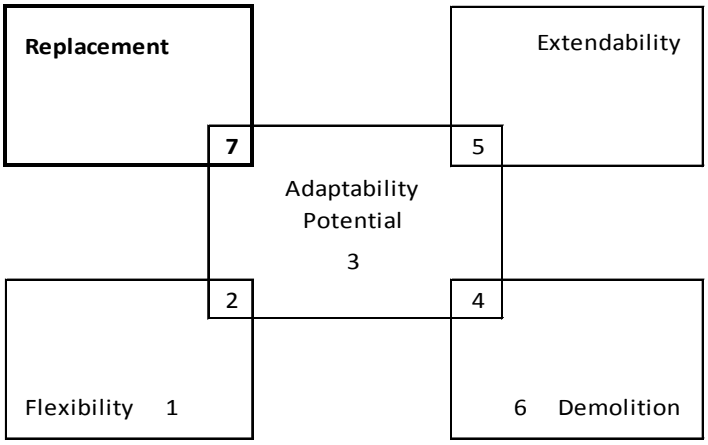
The most evident example is the facade replacement schemes, sometimes a necessary operation in commercial property, whereby a great number of obsolescence types can be addressed: to enhance the façade condition and structure; to improve the building image and character; to increase building sustainability ratings (E.g. BREAM), environmental performances or even to improve the plan efficiency ratio by reducing the wall thickness. Curtain façades wall systems allow a much easier replacement.

Structure, Core and Access

Structural replacement may be necessary in order to prevent physical obsolescence or extend the building´s life. Modifications to the building configuration will have an impact on structural elements, by either increasing, decreasing or re-directing loads (Douglas, 2006) which will provide a reinforcement or replacement of existing structure. Additionally it may also be necessary to replace circulation elements, both horizontal and vertical, for code compliance, disabled access, health and safety or means of escape.

Services

Any mechanical, electrical, plumbing, drainage, power or data services replacement, a common operation in the majority of any refurbishment scheme. Building services have a predicted life span of 7 to 20 years (Douglas, 2006) and since the 1980´s it is a common practice to dimension shafts above the required area, with improved accessibility, in order to be updated in the following years.



1. flexibility of the building as found
2. flexibility with minor adaptation
3. adaptation /refurbishment of building
4. adaptation /with selective demolition
5. with extension of facility
6. demolition
7. **replacement of components**
8. **full replacement (redevelopment)**

Table 7 : Basic Development Combinations. *Source :* (Kincaid, 2002)*, adapted by author*

4 Adaptive Reuse Appraisal Model

4.1 Methodological Approach

4.1.1 Objective and Selected Methodology

The aim of the Adaptive Reuse Appraisal Model (ARAM) regarding Office Buildings in the city of London is to provide an expeditious methodology that enables decision makers to evaluate the building location and its physical characteristics without carrying out a financial appraisal or an architectural feasibility study, so alternative uses can be assessed which are worth further investigating, by measuring the difference of the existing conditions and the preferences of each alternative use considered.

The specific objectives embrace, with the researcher being the decision maker in the entire process, select an adequate appraisal method from the literature, identify the relevant criteria, narrow the possible alternatives, summarize their preferences on each criteria and apply the constructed model to a real world case study so its purpose and utility can be tested, whilst enabling further discussions.

It should be remarked that it is not an attempt of the investigation to deal with, or supersede, the well known and long established techniques of architectural and development appraisals, nor embrace all the knowledge associated with those fields. The literature on those areas is extensive and long standing and it was considered by the researcher as valid (Kincaid, 2002).

What is being provided instead is a new approach of how locational and physical criteria can be considered in a systematic way to provide guidance on the specific Adaptive Reuse of Office Buildings in London, without requiring the expertise to conduct the above methods, and thus be accessible to anyone involved in the proposal. If the method is constructed successfully and thoughtfully it could assist on the architectural or financial appraisals, further enhancing the success of a proposal.

In this sense, and from the analysis carried out in the previous chapters, it is essential to evaluate and score the possible alternatives from a range of locational (4.2.4) and physical (4.2.5) criteria.

! In order for this to take place, those which best coincide with the above objectives and context should be selected from the available analysis methods, within the time and resources available.

Whilst the private sector usually supports their own decisions on a Financial Analysis (FA) or a Cost Benefit Analysis (CBA) to compare the financial costs and benefits of a certain action, the public sector embraces wider objectives (3.2.2) as being concerned with the real cost to the economy in the short and long term. Thus the public sector can also consider wider appraisal methods, as Social Financial Analysis (SFA); Social Cost Benefit Analysis (SCBA); or Cost-Effectiveness Analysis (CEA) (Lichfield, 1988).

Since adaptive reuse a form of property development (3.2.2), and within the aims of the investigation, the objectives match those of the private sector by maximizing the profit for the developer, investor or building owner; i.e. considering the highest and best use of land.

These methods, although able to embrace different objectives, summarize multiple analytical ways of comparing different types of inputs and outputs, expressed in monetary terms.

From the research objectives it is clear that the above *financial appraisals* are not adequate, since not all the locational and physical aspects considered can be expressed in monetary terms, at least in an early appraisal stage. Furthermore, many of those aspects are exogenous, intangible, imprecise or from an ill-defined nature (Mateus, et al., 2008).

Therefore a non-monetary technique should be adopted instead, avoiding an assessment of all the direct and indirect *costs* involved in an adaptive reuse development.

The technique should be able to summarize the *mismatch* between whatever the existing building is (or can be) and whatever each alternative use demands. The greater the mismatch, the more inadequate a building is, thus the less cost-effective (and valuable) a proposal is expected to be. However this also means that any conclusions or recommendations will not have a purely objective or neutral meaning, i.e. it is dependent on the values of the researcher (which is the *decision maker*) and not on the existence of a hypothetical consensual economic rationale (Mateus, et al., 2008).

A non-monetary form of analysis is the Community Impact Analysis (CIA) (Lichfield, 1996) where the decision requires one to embrace a fully social form of analysis, in the range of sectors and externalities, where the SCBA is limited. Although the relevance and performance of each criteria could be compared to each decision maker involved, it would only be focused on the social impact of the proposal.

Another non-monetary analysis is the Multi Criteria Analysis (MCA), which embraces techniques for decision making by comparing any possible alternatives without necessarily relying on monetary valuations, although monetary data from any of the above analysis could be included. A specific form of MCA commonly used in both the private and the public sector is the Multi-Criteria Decision Analysis (MCDA) (Keeney & Raiffa, 1976). It is both an approach and set of techniques, with the goal of providing an overall order of options, from the most preferred to the least preferred alternative (DCLG, 2009).

This approach was considered the most suitable for dealing with a complex multitude of conflicting aspects which are expected to occur in the ARAM.

4.1.2 Multi Criteria Decision Analysis Definitions and Structure

The MCDA has been defined as:

" A way of looking at complex problems that are characterised by a mixture of monetary or non-monetary objectives, of breaking the problem into more manageable pieces to allow data and judgments to be brought to bear on the pieces, and then reassembling the pieces to present a coherent overall picture to decision makers" (DCLG, 2009).

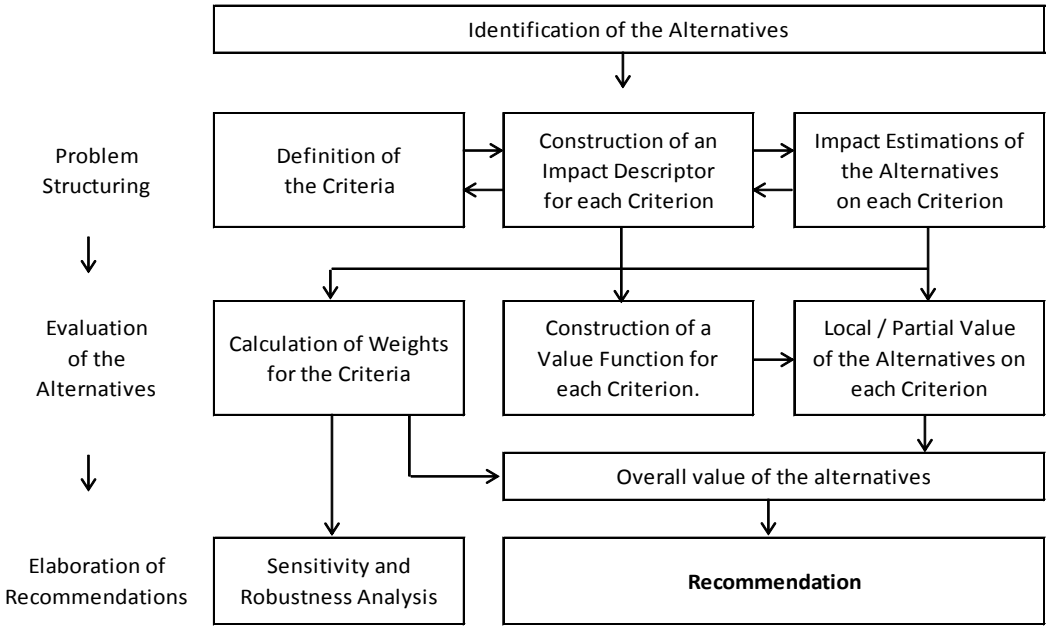


Table 8 : Multi Criteria Decision Analysis Framework. *Source:* (Mateus, et al., 2008)

The MCDA methodology to be adopted follows the three fundamental phases defined by Bana e Costa (1992): It structures the problem through a socio-technical process in which the various decision makers and other stakeholders participate – *Structuring\ Phase* – to produce a formal evaluation model – *Evaluation Phase* – using an interactive and recursive learning approach, and never adopting a normative or optimizing stance (Mateus, et al., 2008). In the end, a sensitive and robust analysis of the model´s results are fundamental for producing recommendations – *Recommendations Phase* – on the relative attractiveness (preference) of the different alternatives (Mateus, et al., 2008).

4.1.3 Problem Structuring

The first step towards *Problem Structuring* is the *Identification of the Alternatives* (4.2.2), where possible alternative uses for conversion are identified. Hence, it is necessary to provide a sifting of all possible options to come out with a manageable short list of plausible alternatives (DCLG, 2009), using both intuition and standard procedure analysis. However it is also important to consider the objectives prior to the alternative selection since the latter are only important, i.e. should only be considered if they meet the objectives of the analysis (Keeney, 1992).

In the *Definition of the Criteria (4.2.3)* is identified and organized in a hierarchical structure, all aspects considered relevant for the comparative analysis of the alternatives (Ferreira, et al., 2013). Each *criterion* reflects a fundamental aspect that at least one stakeholder considers relevant to the evaluation of the alternatives (either concerns, objectives, attributes or consequences) as an isolated evaluation axis (Bana e Costa, 1992).

However, any aspect with equivalent impacts on all alternatives should be excluded, as well as every aspect not concerning the current decision context (Keeney, 1992); (Mateus, et al., 2008).

To ensure the model´s intrinsic coherence, it is necessary that all evaluation criteria satisfy the properties of completeness[59]; redundancy[60]; operationality[61]; mutual independence of performances[62]; double counting[63]; size[64] and impacts occurring over time[65] (Keeney, 1992) (Dogson, et al., 2000).

Criteria is then re-arranged in a logical tree diagram (4.2.4; 4.2.5) which structures the many criteria into coherent groups and sub-groups, addressing separated and distinguishable components of the overall objective of the decision, ensuring that criteria is appropriate, easing the proves of calculating criteria weights and facilitating the emergence of higher level views of the issues (DCLG, 2009).

The *Impact Descriptors*[66] , an ordered set of plausible impact levels (quantitative and qualitative), associated to each criteria to make it operational (Mateus, et al., 2008) are then defined. The relationship between descriptors and criteria should be as clear and understandable as possible, as well as the method to evaluate its performance. Direct and objective descriptors make criteria more intelligible and evaluation models more clear and easily acceptable (Mateus, et al., 2008) (4.2.4; 4.2.5).

In the *Impact Estimations* phase, the impact of the different alternatives on each criterion is estimated using the aforementioned descriptors. They should reflect the present awareness of the problem as well as the knowledge and experience of the project team (Mateus, et al., 2008) (5.2.1; 5.2.2).

4.1.4 Evaluation of the Alternatives

In the *Evaluation Phase* a *Value Function* on each criterion is defined allowing the assessment by converting the impact units of different criteria (metres, strength, access, character, etc) into a consistent numeric scale which measures the relative attractiveness, i.e. the value of each impact level.

An interval scale is created with value "100" conventionally set to a "Good" performance and value "0" to a "Neutral" performance, determining the *Local Value* of each alternative on each criterion. Once determined, the next step is to calculate the weight of each criterion so the Global Value for each alternative can be attained. To reduce the number of criteria, the procedure starts with a hierarchical additive model that aggregates the local values on each criterion up to the criteria immediately below each evaluation area (bottom-up approach) (DCLG, 2009).

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[59] Completeness - To include all important criteria; any major category of performance and all criteria necessary to compare the option´s performance has been included; the selected criteria captures all key aspects of the analysis;

[60] Redundancy - To exclude any unnecessary, unimportant and duplicated criteria or criteria where all options are likely to achieve the same way of performance when assessed against it;

[61] Operationality - To ensure that each option can be judged against each criterion, either objectively - by a shared and understood scale of measurement - or judgmentally - reflecting the subjective assessment of an expert;

[62] Mutual independence - To ensure that preference scores for an alternative can be assigned in one criterion without knowing their performance in another criterion since they are independent from each other;

[63] Double counting - To prevent any double count effects which are likely to increase erratically the weight of a certain point of view in the final overall decision;

[64] Size - To prevent an excessive number of criteria that leads to extra analytical effort in assessing input data and making communication of the analysis more difficult;

[65] Impacts over time - To explicitly define the time horizon over which the consequences are being valued so that temporary consequences can be distinguished from permanent ones;

[66] Descriptors can be : *Natural* - impact levels reflect the effects directly; *Proxy* - impact levels reflect the causes rather than the effects; *Constructed* - impact levels are defined as a finite combination of reference levels. (Keeney, 1992)

The additive hierarchical model is a composition of simple additive models, adapted to a hierarchical criteria structure, and represented through the following model (Mateus, et al., 2008):

$$V_i(a) = \sum_{j=1}^{n} k_j \cdot v_j(a), \qquad \sum_{j=1}^{n} k_j = 1 \qquad and \qquad 0 < k_j < 1, \forall_j$$

where:

$V_i(a)$	Partial value of alternative a on criterion i;
j	Each sub-criterion under criterion i;
n	Number of sub-criteria under criterion i;
$v_j(a)$	Local value of alternative j, with "Good" = 100 and "Neutral"=0;
k_j	Weight for sub-criterion j.

In order to determine the criteria weights inside each group of criteria a set of fictitious alternatives is created, one per criterion. Each of these alternatives was set with a "Good" (100) performance on one criterion and a "Neutral" (0) performance on all the other criteria. An additional fictitious alternative is then added with the neutral impact on all criteria. The decision maker is then asked to rank all alternatives by decreasing the level of their attractiveness. This is the *evaluation* phase, a process of examining options and assessing their *relative merits* (Keeney & Raiffa, 1976).

Once the (within) weights inside each bottom evaluation group are determined, it is possible to calculate the partial values of each alternative on each bottom criteria. The partial values are then normalized, so that the best alternative, i.e. the highest partial value on that criterion, is transformed into a partial value of 100 and the worst alternative, i.e. the lowest partial value on that criterion, into a partial value of 0. The same method is followed to determine the (within) weights of the immediate upper evaluation level (criteria group) to all the remaining evaluation areas. Once the partial values for each alternative and the (within) weights on the criteria under each evaluation level are determined, the overall value of each alternative is at last calculated.

Using the aforementioned additive model, the general equation is (Mateus, et al., 2008):

$$V(a) = \sum_{j=1}^{n} k_j \cdot v_j(a), \qquad \sum_{j=1}^{n} k_j = 1 \qquad and \qquad 0 < k_j < 1, \forall_j$$

where:

$V(a)$	Overall value of the alternative a;
j	Each criterion under all evaluation areas;
n	Number of criteria under all evaluation areas
$v_j(a)$	Local or partial value of alternative a under criterion j
k_j	Final weight for criterion j

However, the described methodology still requires an appraisal method that converts the performance of the alternatives on each criterion (with its own units or judgmental rating), and the performance of each fictitious alternatives (determining the within weight of each criterion) into an interval scale of 0-100. An approach has been selected which Measures the Attractiveness by a Categorical Based Evaluation Technique, MACBETH[67] (Bana e Costa & Vansnick, 1997).

This methodology supports the process of taking qualitative judgments regarding the difference in attractiveness between pairs of options converting them into numerical scores (Bana e Costa, et al., 2003)

The decision maker is asked to verbally judge the difference of attractiveness , i.e. the preference between each pair of alternatives, by choosing one of the seven following semantic categories: *No* (indifference); *Very weak*; *Weak*; *Moderate*; *Strong*; *Very strong*; *Extreme*. During the process a matrix is filled with the elicited judgments. In the end all value functions translate the impacts measured in the various units into a numeric scale of 0-100 transforming the *Impact Matrix* (judgmental) into the *Local Value Matrix* (numerical). The approach is a visual and interactive learning process about the evaluation problem (DCLG, 2009). Throughout the evaluation process, each step is continuously reassessed, as awareness and new insights were integrated (Philips & Stock, 1984) to improve the model and create the best possible mirror of the decision maker´s point of view and preferences (Mateus, et al., 2008).

4.1.5 Elaboration of Recommendations

The results obtained from the above form an initial idea of what the best alternative is. However the results should then be submitted to a sensibility and robustness analysis in order to validate the preliminary recommendations on the overall ranking of the alternatives (Mateus, et al., 2008) .

The *Sensitivity Analysis* consists of analyzing the modifications that occur in the overall ranking of the alternatives when the weight of a certain criterion, which is judgmentally determined, changes, maintaining the proportions among the remaining weights unchanged. However, it can also determine the impact of any variations on the performance of each alternative on a certain criterion.

This becomes particularly useful to measure the building performance if a physical change potentially occurs during the refurbishment to accommodate the alternative use better (3.4).

Furthermore, after measuring the impact of isolated variations – *sensibility* – the impact of multiple simultaneous variations should be measured – *robustness* (Mateus, et al., 2008) by changing the various weights at the same time, regarding some predefined constraints such as their ranking[68].

Once sensitivity and robustness analyses are carried out it is possible to validate the preliminary *Recommendations* on the overall ranking of alternatives.

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[67] See www.m-macbeth.com

[68] *Robustness Analysis* is based on the concept of additive dominance (Bana e Costa & Vincke, 1995): Alternative x *Additively Dominates* alternative y for a given set of constraints defined among the weights if the difference between the overall value of x and y is always positive for any set of weights respecting the constraints defined among them. The classic concept of A*bsolute Dominance* – where x dominates y if and only if x is not worst than y in any criterion and is better than y in at least one criterion – incorporates the additive dominance (Mateus, et al., 2008).

4.2 Adaptive Reuse Appraisal Model Construction

4.2.1 Scope of the Appraisal

The following questions were set to ensure the coherence of the model regarding the location:

1- *Is the building located within the Greater London Area in one of its 32 boroughs?*
2- *Is the building on a considerable low density location?*
3- *Is the building part of a business park complex ?*
4- *Is the surrounding land mainly agricultural, industrial, brownfield or undeveloped?*
5- *Is there any imminent environmental threat or is the location hostile to any user?*

A positive answer means that it may not be possible to appraise the considered location.

From a locational perspective, it not only narrows the options of different environments where the appraisal might not perform equally but it also equals the number and type of assumptions made on each criterion. For instance, back office premises or isolated business parks that sit on a peripheral non-urban location, with remote access to public transportation or any other surrounding uses are excluded. These types of locations, common within office premises, require specific criteria and different weighting coefficients. Any peculiar locations that could be hostile for most people´s normal activity, with excessive noise, smell, or mess (Kincaid, 2002) are also excluded.

The following questions are then asked to ensure the coherence of the model regarding the building:

6- *Was the building designed for office purposes, regardless of its current use ?*
7- *Is the building less than 3 or more than 35 storeys high ?*
8- *Does the building have an unconventional plan configuration (circular, triangular, …) ?*
9- *Does the building have a non repetitive plan configuration ?*
10- *Is the building constituted by different volumes ?*
11- *Is the building Grade Listed ?*

A positive answer means that it may not be possible to appraise the considered building.

The building has to be originally designed as offices, considered to be vacant, and with planning permission for conversion expected to be granted. It is also expected that the building is considered a typical office development (2.1.4), i.e. a repetitive multi-storey central access open plan building, with a varying number of stories, floor plate dimensions and configurations. The construction date, site constraints, peculiar programmes, specific tenants, architectural briefings or iconic designs can easily change any of the above standards. Buildings which are excessively high or small, with atypical floor plan configurations or complex volumes or morphology are excluded.

Finally any Listed buildings are excluded. As it is not common that office premises are Listed, either by its commercial nature or relatively recent construction date, any exceptions mean that the building configuration may be atypical, the façade exceptional or the building history significant. Either way, it represents unpredictable constraints to the adaptive reuse, thus any judgments will not be conclusive.

4.2.2 Selected Alternatives Uses

Since the 1990´s it is possible to record the number and type of office conversions which have taken place (2.2).

The alternatives considered in the Adaptive Reuse Model should inevitably include at least all uses that have a history of conversion. Nonetheless the alternative selection should not be based exclusively on the statistical data because it may be a cause of criteria which has been excluded from the scope of the research. This may include the macroeconomic factors, political climate, local authorities regulations, refurbishment costs or real estate market values. Furthermore, it could potentially hide alternatives which are not typically considered and yet may constitute a potential use for a certain location or building. Therefore, although the records are an important element of analysis and evaluation of the model, they were not considered in the alternative uses selection.

If the research should then embrace a wider spectrum of alternatives, a starting point is the Use Classes Order[69], employed by any planning body, which subdivides the uses into 14 general categories. This range was considered inadequate because the relevant uses are either too wide (e.g. C3: covers all uses from prime flats to suburban detached houses) or too narrow (e.g. A1, A2, A3 and A4 should be one single alternative as it is not of the scope of the investigation to distinguish a restaurant to a pub).

The CI/SfB Building Type[70] relates more to the physical attributes of the building and less to their use. In contrast, the list of more than 500 economic activities which was identified in the Standard Industrial Classification (SIC) is too detailed for practical use and without direct relation to the actual buildings.

Previous research however was performed by the University College London in 2002 over the adaptive reuse of buildings in general. It essentially shortlists (A6) the number of activities by relating each SIC activity with its specificity to locational and physical characteristics by questioning : (Kincaid, 2002):

1- *Does the activity relate to a specific dedicated building space?*
2- *Are types of activity known to be relevant to characteristics for existing general categories?*
3- *Is size important ?*
4- *Are there specific physical and locational characteristics identifiable for this activity?*

Although the 77 uses that were previously selected are still too many to be considered, it pointed out a reliable basis to narrow the possible use alternatives for the specific scope of the investigation.

Accordingly, to each of the 77 identified uses the following questions were posed :

5- *Is the size inappropriate as the primary use for a standard office building?*
6- *Does it require spaces incompatible to the ones provided in a standard office building?*
7- *Does it require highly technical or complex facilities?*
8- *Can it generate an expected adequate profit, either from capital gain or rental income?*

[69] Use Classes Order (UCO) for Commercial Property, defined by the Town and Country Planning Order in 1987.
[70] Classification of Building Object Types

From the above questions, it is possible to exclude uses that are clearly not potential alternatives[71].

All the remaining uses were then intuitively re-arranged in groups which have similar physical and locational preferences. This allowed the practicality of the evaluation model to reduce not only the number of alternatives but also the specificity of the criteria. And yet, once the recommendations are made, specific uses inside each group can be looked at through a full detailed viability analysis.

Finally, each group was crossed with the common real estate terms *Prime* and *Secondary,* (DTZ , 2013). Each term embraces specific requirements on locational and physical criteria for each use. Prime property is defined as property of the highest quality and specification and in the best location whilst secondary property is defined by exclusion: "any property not meeting the prime criteria" (DTZ , 2013). These definitions are extremely broad and remind us that the categories mainly serve to establish benchmarks for property pricing. However it enables us to understand the impact that each would have in assessing the location and physical criteria. The results are summarized in Table 9 and detailed in Appendix A.1.

Alternative Use Category	Abbreviation	Description
Offices, Secondary	O.S	Business, Administration, Services - Secondary Category
Offices, Prime	O.P	Business, Administration and Services - Prime Category
Residential (Flats), Secondary	R.S	Residential - Secondary Category
Residential (Flats), Prime	R.P	Residential - Prime Category
Hotels, Secondary	H.S	Hotels and Other Accommodations - Secondary Category
Hotels, Prime	H.P	Hotels – Prime Category
Retail	RE	Retail, Leisure, Entertainment, Food and Beverage

Table 9 : Multi Criteria Decision Analysis Framework. Source: Mateus, et al. 2008

O.S and O.P are the most broad as they include all kinds of office uses, services, administrations or research facilities, with less relevant sectors and back office uses exclusive of the secondary subgroup. R.S and R.P refer exclusively to flats, with the exception of apartments with employed people in R.P. H.S includes hotels, hostels and other types of accommodation such as student residences, whilst H.P is exclusive to standard and luxury hotels. RE embraces all types of retail, food and beverage and some entertainment uses, suitable in a typical office layout.

Even though the real estate market typically refers to *prime* and *secondary* in retail, this was not considered since it was not possible, within the scope of the investigation, to distinguish between both. In general, retail use is indeed one of the uses with a wider range of natures (Ratcliffe, et al., 2006), varying from individual small units to large outlet stores and shopping centres. As retail locations are also highly sensitive to variations (Havard, 2008) the investigation could not embrace all aspects that distinguish both categories, only achievable with the established architectural and real estate appraisal methods.

[71] For instance, Individual Residential or Hairdressing are excluded with question 5.; Sporting Activities or Motion Picture are excluded with question 6.; Hospital Activities and Construction Industry are excluded with question 7.; Library or Primary Education are excluded with question 8.

4.2.3 Criteria Selection

To ensure that all criteria relevant for the evaluation of the alternatives were identified, the hierarchical structure of the criteria was organized (Mateus, et al., 2008), at a first level, in two evaluation areas which related to the building obsolescence classes previously identified (3.2.1). Also, because criteria identification will depend not only on the building supply (top-down approach) but also on the uses preferences (bottom-up approach) it should be identified that all criteria, within the scope of the research, have a clear neutral effect on identifying the best alternative so that both approaches can be used more effectively to assess the relevant criteria (Kincaid, 2002).

The Locational Criteria embraces any aspects which concern the building location in the city, the character of the adjacent environment or its position within the urban net. The Physical Criteria relates to the building´s physical characteristics, its morphology and space as well as also site boundary characteristics which are within the building property. Both criteria have been kept separated because it was assumed to be too difficult to reasonably suggest the weight of one criteria over the other, when considering the British property market commonly stated maxim, of the three main determinants of "location, location, location"(Havard, 2008).

At a second level, each group is subdivided In order to more easily comprehend the supply characteristics i.e. the set of *characteristics* of the typical redundant office building; and the demand characteristics i.e. the set of *preferences* of the aforementioned alternatives, so the difference between both can be measured (4.2.1). Once this data is structured, it is possible to understand the *performance requirement*s, i.e. the interface between supply and demand, matching the set of physical provisions with the set of operational requirements (Kincaid, 2002).

It is expected that many criteria have a *neutral* impact*,* with little measurable relevance on the adaptive reuse viability, whilst others will clearly have a *positive* and a *negative* impact on a certain building or alternative use. From this, the viability will depend, on the one hand, on the degree that the negative characteristics can be overcome, and on the other hand, on the positive characteristics that can be enhanced and exploited (Kincaid, 2002). Many discrepancies occurred from source to source so it was part of the scope of the investigation to summarize the information, with all associated uncertainties.

For the selection of criteria, grouping structure, weighting process, impact descriptors and preferences of each alternative use on each criterion, different sources of information was considered, which included previous guidelines for conversions and adaptive reuses[72], British construction legislation[73], international literature on architectural design guidance to the different uses[74], real estate development literature[75]; the case studies overviewed of office conversions in London during the 1990´s and 2000´s (2.1.4) and, finally, the experience and intuition of the decision maker, i.e. the researcher, inevitably part of the nature of selected methodology.

[72] (Kincaid, 2002);(APR, et al., 1992);(Barlow & Gann, 1993);(Douglas, 2006);(Sigworth & Wilkinson, 1967) (Freer, et al., 1999); (Markus, 1979);

[73] Building Regulations Approved Documents (2013); British Standards; Construction and Design Management (2007);

[74] (LDA, 2010); (BCO, 2009);(Battle, 2003); (RICS, 1997); (Neufert & Neufert, 2012); (PKF, 2001);(Littleford, 2012)

[75] (Ratcliffe, et al., 2006); (Wilkinson, et al., 2008); (Miles, et al., 1991);(Havard, 2008)

The latter, despite its inherent limitations, is a necessary condition within the resources and scope of the investigation. Thus the researcher will tentatively respond to all *decision-makers* (3.3.2). If there is an aspect which at least one decision maker would be expected to regard as relevant to the evaluation of the alternatives, (Mateus, et al., 2008) it is being considered by the researcher. Because it is only possible provide one point of view per decision required, an intuitive judgment will be carried out that is expected to be the most comprehensive and more widely accepted by all the decision makers considered (3.2.2).

Since the appraisal is being applied to a real-world case study, interviews and questionnaires were nonetheless carried out (A8), *a posterior*, clarifying the conflicting answers, *or points of view,* between different decision makers involved, whilst enabling further discussions and future research (6.4).

Another particular aspect noted in the investigation is that many of the criteria selected have a certain capacity of changeability, i.e. criteria that can be changed or adapted during the rehabilitation of the building, something expected to happen to best suit the needs of the use to the existing building. This means that the appraisal should be able to consider the *potential* of a certain building to be adapted to other uses thus should not be limited by what the building (or part of the building) currently but also what it could become to accommodate the new use.

The investigation addressed this complex aspect by, although recognizing its limitations, attributing to each criterion a *Degree of Changeability* (Gann & Barlow, 1996), i.e. a rating attributed by the researcher that indicates the extent of changeability (4.2.4; 4.2.5) of that aspect by one or more of the selected Adaptive Reuse Tools (3.3), when judging the local and global weights of each criterion (5.2). In this sense, a criterion becomes more relevant than others not only because of its nature but additionally because of its sense of permanency. If it is easily changeable, the weight of that criteria is (additionally) lower; if hardly changeable, the weight is (additionally) higher. Although in location criteria this factor is not particularly relevant, i.e. hardly any aspect is changeable, it becomes most relevant to assess the criteria weight of the physical characteristics, which are expected to change during refurbishment.

4.2.4 Location Criteria

The factors that influence the property value have been systemized in three main categories; *general factors*, *macro location factors* and *micro location factors* (Derycke, 1981).

These conclusions were considered a strong starting point in order to determine the relevant location criteria which influences the conversion of an office building to an alternative use.

The *general category* (Derycke, 1981) embraces any factors which are related to the wider city context. This may include the city´s competitiveness with other cities, global and local economies, real estate market or urban growth. It may also include social and demographic factors, such as immigration, employment and population wealth or political factors such as urban administration efficiency, urban policies, taxation and credit policies and even the overall political climate.

The *macro location* category (Derycke, 1981) determines the difference between the average price of a city area and the average price of the whole city. This is then subdivided into three groups. Firstly, the inherent features of that city area - the natural environment quality; parking provision; community facilities; the surrounding city infrastructures and their quality or condition; the population and urban

densities. Secondly, the accessibility of that city area to any kind of urban clusters or attractions, either by private or public transport. The latter should consider the number, proximity and time distance but also their quality or their cost. Thirdly, the legal aspects of that city area related to real estate developments. It includes conservation or non-conservation areas, urban regulations or plot ratios.

The *micro location* category (Derycke, 1981) determines instead the difference between the specific price of a certain building and the average price of that building in the city area in which it is located, again subdivided into three sub-groups. Firstly, factors related to the development cost. Soil and sub soil characteristics, plot and building dimension or shape, slope, topography and its position within the urban grid. Secondly factors related to the quality of the building itself such as light exposure, views and sightlines, building visibility, amenities, urban facilities or the adequacy of supply within the actual or expected demand in the surrounding buildings. Thirdly, factors related to the investment risk.

From the above, all aspects embraced by the *general* category are clearly beyond the scope of the investigation, and have thus been excluded from the selected locational criteria.

On the *macro location* category, the legal frame subcategory has been excluded since any legal or planning aspects are highly specific to each London borough or to each single building and context, fluctuant over time and government therefore irrelevant to assess within the aims of the investigation.

On the *micro location* category, factors related to the building shape and size, are being considered in the physical criteria. Factors related to the building costs and investment risk were excluded for the aforementioned reasons. The factors related to the property age and condition were also excluded from the analysis - within the generic guidance purpose of the research they were considered to be equal regardless of the use and equally relevant since any use will have to address the same refurbishment issues. As a result, location criteria sub grouping was organized as follows (Table 10, 11, 12, 13):

A	Location	Description
A.1.1	Distance to Centre	Directly related to proximity but not necessarily with access – the linear distance to a designated city centre - a similar approach of the Vandermotten and Rothestein-Farell to the Metropolitan Area of Brussels (Carvalho, 2005);
A.1.2	Accessibility	Evaluating the proximity to public transport, private transport routes and the consequent access to parking spaces in the surrounding building´s area;
A.1.3	Amenities	Evaluating the city area provision of large infrastructural equipment, recreational and leisure facilities (from museums and galleries to retail centres and night life) and services facilities (such as schools, nurseries or local libraries).
A.1.4	Environment	Evaluating the city area general ambience, either natural (proximity to parks, streets with trees or a water front) or built (the quality of exceptional buildings, surrounding façades or the design and maintenance of public space)
A.2.1	Street Character	Evaluating the character of the street / square where the building is, considering the above aspects of access, environment and position but including also the noise levels or the pedestrian flow.
A.2.2	Building Position	Characterizing the building in relation to the street / square that sits in, considering its orientation, visibility and presence but also the external views offered from the building to its surroundings.

Table 10 : Location Criteria Sub grouping Description. *Source: Author*

Criterion			Component		Degree of Changeability	Value Function Type
A.1 Macro Location	A.1.1	Distance to Centre			xxxxx	P
	A.1.2	Accessibility	A.1.2.1	Public Transport Access	xxxxx	p
			A.1.2.2	Private Transport Access	xxxxx	P
			A.1.2.3	Parking Provision	xxxxx	P
	A.1.3	Amenities	A.1.3.1	Infrastructural Amenities	xxxxx	P
			A.1.3.2	Cultural and Recreational Amenities	xxxxx	P
			A.1.3.3	Services Amenities	xxxxx	P
	A.1.4	Environment	A.1.4.1	Built Environment, a), b)	xxxxx	C
			A.1.4.2	Natural Environment, a), b)	xxxxx	C
A.2 Micro Location	A.2.1	Street Character	A. 2.1.1	Street Environment, a), b)	xxxxx	C
			A. 2.1.2	Street Position	xxxxx	P
			A. 2.1.3	Street Access	xxxxx	P
			A. 2.1.4	Pedestrian Flow	xxxxx	P
			A.2.1.5	Noise Levels	xxxxx	P
	A.2.2	Building Position	A. 2.2.1	Building Presence	xxxx (d/r/e)	P
			A. 2.2.2	Building Views	xxxx (d/r/e)	P
			A. 2.2.3	Building Orientation	xxxx (d/r/e)	P

Degree of Changeability : Impossible (xxxxx) ; Very Difficult (xxxx); Difficult (xxx); Relatively Easy (xx); Easy (x)
Tool for Changeability: Extension (e); Demolition (d); Replacement of Components (r);
Value Function Type: Natural (N); Proxy (P); Constructed (C)

Table 11 : Location Criteria Structure. *Source: Author*

Criteria	Descriptor	Local Performance	Scoring
A.1.1.1	Distance to Centre		
	Present linear distance (km) to London city centre (defined as the City of Westminster)	0.0 km, City of Westminster	Good (100)
		10.0 km, E.g. Richmond	Neutral (0)
A.1.2.1	Public Transport		
	Present and expected number of public transports types (5min walk / 400m)	> 3 Different Types	Good (100)
		> 1 Bus Stop with >1 route	Neutral (0)
A.1.2.2	Private Transport		
	Present and expected access to any route part of the London Distributor Road Network	>1 / 500m	Good (100)
		1 / 1000m	Neutral (0)
A.1.2.3	Parking Provision		
	Present waiting time for car park space, street parking (5min walk / 400m)	Less than 1 minute	Good (100)
		Up to 3 minutes	Neutral (0)
A.1.2.1	Infrastructural Amenities		
	Present and expected, proximity or direct connection to urban infrastructures	National or regional infrastructures	Good (100)
		Local infrastructures	Neutral (0)
A.1.2.2	Cultural and Recreational Amenities		
	Present or expected proximity to cultural / leisure facilities (5min walk / 400m)	At least 1 exceptional facility / cluster	Good (100)
		At least several minor facilities	Neutral (0)
A.1.2.3	Services Amenities		
	Present or expected proximity to relevant services facilities (5min walk / 400m)	At least 1 major service	Good (100)
		At least several minor facilities	Neutral (0)
A.1.3.1	Built Environment		
	a) External quality and character of the urban environment (5min walk / 400m)	A Conservation Area	Good (100)
		A coherent area with facades well maintained	Neutral (0)
	b) Public Space	Several architectural or historic features	Good (100)
		Well defined, maintained and clean	Neutral (0)
A.1.3.2	Natural Environment		
	a) Proximity to a significant natural environment (5min walk / 400m)	A city park, a water canal, the river	Good (100)
		A local green space	Neutral (0)
	b) Streets natural environment quality	Trees/shrubs/grass with strong presence	Good (100)
		Trees presence in a few streets	Neutral (0)

Table 12 : Macro Location, Descriptors and Local Performance. *Source: Author*

Criteria	Descriptor	Local Performance	Scoring
A. 2.1.1	Street Environment		
	a) External quality and character of the building street in comparison to the adjacent streets	+++	Good (100)
		+	Neutral (0)
	b) Presence of natural elements of the building street, in comparison to the adjacent streets	+++	Good (100)
		+	Neutral (0)
A. 2.1.2	Street Position		
	Present street position in the urban net	High Street / Square or similar	Good (100)
		High Street / Square or similar in 5 min walk / 400m	Neutral (0)
A. 2.1.3	Street Access		
	Present street accessibility by private transportation	Street part of the London Distributor Network	Good (100)
		Street with direct or easy connection	Neutral (0)
A. 2.1.4	Pedestrian Flow		
	Average presence of people in the surroundings along the day	Constantly crossed by crowds at every hour / day	Good (100)
		Occasional pedestrians for entrances and exits only	Neutral (0)
A.2.1.5	Noise Levels		
	Noise levels felt in the street during the day, considering People, Road, Rail, Industry or Air	<55 Db (A) during the day	Good (100)
		< 70 Db (A) during the day	Neutral (0)
A. 2.2.1	Building Views		
	a) Quality of external views towards a natural or urban scenario	Exceptional and exclusive views within surroundings	Good (100)
		Any main view is avoidable or unpleasant	Neutral (0)
	b) Extent of external views within the average floor layout	Main views from at least 2 sides in all floors	Good (100)
		Main views from at least 1 side on the top floors	Neutral (0)
A. 2.2.2	Building Presence		
	Building visibility from the surrounding urban environment	Highly visible from several streets on at least 2 sides	Good (100)
		At least 1 side visible from a main street or square	Neutral (0)
A. 2.2.3	Building Orientation		
	Building exposition to direct sunlight	Direct sunlight to most floors on at least 3 sides	Good (100)
		Direct sunlight to at least half of the floors on 1 side	Neutral (0)

Quality Impact Levels : Very Good (+++); Good (++); Decent (+) ; Poor (-)

Table 13 : Micro Location, Descriptors and Local Performance . *Source: Author*

4.2.5 Physical Criteria

A building can only be on a suitable location for a certain use and yet its physical characteristics may not match the requirements of that use. Neither the use can easily, nor economically, adapt its requirements to the physical supply unless substantial physical works are carried out.

All criteria that relate to internal, non-structural, building layouts have been excluded - loose furniture, built in furniture, partition walls, floor and ceiling finishes, internal circulation widths, ancillary uses or bathrooms´ provision. It is also assumed that the existing building services - air conditioning units, ventilation ducts, plumbing, electric wiring, security – are obsolete, either because its age (unless the building is considered new) or because of the specificity of today´s requirements to each use. Services shaft space has also been excluded since it was not possible at an early stage to determine the amount of that each use may need as it is dependent on the building configuration, orientation or plant equipment performances[76]. All operational aspects, related to tenancy arrangements and project manageability have been excluded - buildings are considered to be vacant. The building area, number of floors and building length have also been excluded. Only buildings considered standard (4.2.1) can be subject of the appraisal thus the above aspects were not embraced.

Once the neutral effects have been selected, the factors that have been appointed as clearly positive and negative in an adaptive reuse were looked at in the international literature :

A study carried out in the 1960´s (Sigworth & Wilkinson, 1967) identified seven main categories:

- *Structural; Constructional; Spatial; Environmental; Servicing; Financial; Operational.*

A more specific study conducted in the mid-1990s (Gann & Barlow, 1996) indicates that the viability of offices becoming converted into flats depended on eight main characteristics of the existing building:

- *Size, Height and Depth; Structure; Envelope and Cladding; Internal Space, Layout and Access; Services; Acoustic Separation; Means of Escape.*

At last, a recent studied in adaptive reuse (Kincaid, 2002) grouped the aspects into three categories :

- *Site; Space (internally divided in Size, Shape and Linkage); Fabric & Structure (subdivided into Character, Strength and Dimension).*

The previous researches were crossed with office buildings' characteristics(2.1); the selected methodology (4.1.2) and the alternative uses selected (4.2.2). The criteria was divided in two groups: *Building Space,* embracing *spatial* aspects; and *Building Fabric,* embracing *material* aspects (Tables 14, 15).

[76] Nonetheless, studies have already demonstrated (Gann & Barlow, 1996; Gold, et al.1999) the importance of this aspect in the viability of an adaptive reuse development since it may incur significant structural stress to the existing building - in particular for apartments and hotels where the servicing is spread out across the floor plate.

B.1	Building Space	Description
B.1.1	Plot	Relating to all relevant aspects of building plot boundary, such as the type and number of accesses, the size and quality of the external space or the provision of car parking spaces.
B.1.2	Size	Evaluating the dimensional characteristics of the open plan floor space, in particular the height of the slab on the ground floor and typical floor and the depth of the floor plate.
B.1.3	Configuration	Evaluating the space configuration of the floor plate. This includes the spacing between columns and the location of the access cores.
B.2.1	Structure	Measuring the strength of the ground floor and typical floor slabs
B.2.2	Envelope	Characterizing the performance of the façade regarding the percentage of opening areas and the daylight factor.
B.2.3	External Character	Qualitatively judging the character of the building, include aspects such as the façade aesthetics, the building morphology, the presence of balconies and, as a consequence, the adequacy to the alternative use .

Table 14 : Physical Criteria Sub grouping. *Source: Author*

Comparison between location and physical criteria assessment

On the location appraisal (4.2.4) the performance of each alternative on all criteria is equal to the performance of the building location that is being evaluated on that criteria. This aspect immediately raises the question of how to assess the difference of performance of each alternative. To this it was introduced variations of the *relative merit* (Keeney & Raiffa, 1976) of each criterion to each alternative use, i.e. criteria have a different relative importance to each use. E.g. the presence of a building within the surrounding urban environment, although relevant to all uses, appears to have a stronger merit to *retail* or *hotel prime* functions than to *office secondary*, or definitely to *residential secondary* (5.2.1).

Since the MACBETH approach does not contemplate this condition (6.4), the assessment resulted in a complex process of individually calculating the relative weight of each criterion to each alternative and, further to that, the judgmentally comparison and adjustment of the values obtained (A.4) which were considered to be inconclusive (5.2.1) although most interesting to the investigation (Table 19).

This aspect is also true for the physical criteria. The relative merit of the *floor to ceiling height,* for instance, although being relevant to all uses, is expected to be more relevant to *office prime* than to *residential secondary*. However, each alternative use will have a different performance on each criterion, although the building is also the same, because it could be assessed by the different preferences of each use on each of the building aspects (Table 17). Therefore the performance varies according to how close or how far the building is to the considered optimum characteristics. Since the performance of each alternative varies on each criterion, and because the relative weighting process above described resulted in a laborious and inconclusive process, it is assumed on the physical criteria that the relative weight of each criterion is the same to all alternative uses (5.2.2).

Criterion			Component		Degree of Changeability	Value Function Type
B.1 Building Space	B.1.1	Plot	B. 1.1.1	Plot Access	xxxx (d/r/e)	P
			B. 1.1.2	External Space	xxx (d / e)	P
			B. 1.1.2	Car Park Space Provision	xxxx (d)	P
	B.1.2	Size	B.1.2.1	Slab Height, TF	xxxxx	P
			B.1.2.2	Slab Height, GF	xx (d)	P
			B.1.2.3	Building Depth	xxx (e)	P
	B.1.3	Configuration	B.1.3.1	Core(s) Location	xxxx (d / r)	P
			B.1.3.2	Column Grid	xxxxx	P
			B.1.3.3	Plan Configuration	xxx (e / r)	P
B.2 Building Fabric	B.2.1	Structure	B.2.1.1	Slab Strength, TF	xxx (d/e)	P
			B.2.1.2	Slab Strength, GF	xxx (d/e)	P
	B.2.2	Envelope	B.2.2.1	Opening Ratio	xx (d/r)	P
			B.2.2.2	Daylight Factor	xxxx (d/r)	P
	B.2.3	External Character			xxx (d/e/r)	P

Degree of Changeability : Impossible (xxxxx) ; Very Difficult (xxxx); Difficult (xxx); Relatively Easy (xx); Easy (x)
Tool for Changeability: Extension (e); Demolition (d); Replacement of Components (r);
Value Function Type: Natural (N); Proxy (P); Constructed (C)

Table 15 : Physical Criteria Structure. *Source: Author*

Component	Descriptor
B. 1.1.1 Plot Access	Present number of possible entrances, by car (C) or pedestrian (P), to the building premises;
B. 1.1.2 External Space	Confirm existence (Yes / No) of private external area (within building property) on (lower / upper) ground floors;
B. 1.1.3 Parking Space	Present potential number of interior car/bicycle parking spaces per Gross Floor Area, GFA, (n/sqm) (in this case, in Westminster);
B.1.2.1 Slab Height, TF	Present distance (m) from top of floor slab level to bottom of ceiling slab level on a typical floor;
B.1.2.2 Slab Height, GF	Present distance (m) from top of floor slab level to bottom of ceiling slab level on (lower / upper) ground floors;
B.1.2.3 Building Depth	Present building width (m),(smaller than the building length), measured from the outer face to outer face of building;
B.1.3.1 Core(s) Location	Confirm if distance between façade and core/s stairs or between core/s stairs, comply with Building Regulations (Yes or No);
B. 1.3.2 Column Grid	Present typical distance (m) from column centres, measured in parallel to the façade;
B.1.3.3 Plan Efficiency	Present ratio between Perimeter Wall and Gross Internal Area (PW : GIA) on a typical floor (%);
B.2.1.1 Slab Strength, TF	Present Slab Strength (kN/sqm) on a typical floor;
B.2.1.2 Slab Strength, GF	Present Slab Strength (kN/sqm) on the (lower and/or upper) ground floor (s);
B.2.2.1 Opening Ratio	Present ratio (%) of windows and personnel doors of exposed wall;
B.2.2.2 Daylight Factor	Present Daylight Factor (%)in a typical floor;
B.2.3.1 Exterior Character	Present external building character, potentially suitable to each alternative use demand and aesthetics: +++ ,++ ,+ , –;

Quality Impact Levels : Very Good (+++); Good (++); Decent (+) ; Poor (-)

Table 16 : Physical Criteria Descriptors. *Source: Author*

	Office				Residential				Hotel							
	Secondary		Prime		Secondary		Prime		Secondary		Prime		Retail		*Universal Building*	
	N(0)	G (100)	N(0)	G (100)	N(0)	G (100)	N(0)	G (100)	N(0)	G (100)	N(0)	G (100)	N(0)	G (100)	N(0)	G (100)
Plot Access	1P,0C	1P,1C	2P,1C	2P,1C	1P,0C	1P,1C	1P,1C	2P,1C	2P,0C	2P,1C	2P,1C	2P,2C	1P,0C	3P,1C	2P, 1C	3P, 2C
External Space (y/n)	n	y	n	y	n	y	n	y	n	y	n	y	n	y	n	y
Parking Space	1c +12b / 1500sqm				1.5c + 1b / Dwelling				1c / 10 units				1c + 1b / 1500sqm		n/a	
Slab Height TF(m)	3,1	3,5	3,3	4,1	2,4	2,8	2,8	3,2	2,8	3,1	3,1	3,4	4	6	3,1	3,5
Slab Height, GF (m)	3,3	4,1	3,6	6	2,4	2,8	3,2	3,8	3,1	3,6	3,6	6	4	6	4	6
Building Depth (m)	14	20	16	40	12	15	15	18	12	18	16	20	18	40	14	18
Core(s) Location (m)	18m (1co) / 45 (2co)				7,5+9 (1co) / 30 (2c)				18 (1co) / 35 (2co)				18 (1co) / 45 (2co)		16 (1co) / 30 (2co)	
Column Grid (m)	7,5 / 9 / 12				6	7	7	8,5	6	7,5	7,5	9	5	12	7,5	
Plan Efficiency (%)	0,65	0,5	0,55	0,4	0,35	0,2	0,25	0,1	0,4	0,25	0,3	0,15	0,7	0,5	0.40	0.20
Strength, TF (kN/sqm)	2,5	3	2,5	3	1	2	2	3	2	3	2	3	4	5	2,5	3
Strength, GF (kN/sqm)	3	5	3	5	2	5	2	5	3	5	3	5	5	5	3	5
Opening Ratio(%)	30	50	40	60	20	40	30	50	20	40	30	50	0	20	30	50
Daylight Factor(%)	0,8	2	2	3	1	2	2	3	0,5	1,5	1,5	2,5	0	1,5	2	3
External Character	+	++	++	+++	+	++	++	+++	+	++	++	+++	+	++	++	+++

Table 17 : Physical Criteria Preferences - Universal Building Characteristics. *Source: Author*

External Character Levels : Very Good (+++); Good (++); Decent (+) ; Poor (-) (Considering the quality of the façade and the adequacy to each use)
Crossed References (4.2.3) : (Kincaid, 2002);(APR, et al., 1992);(Barlow & Gann, 1993);(Douglas, 2006);(Sigworth & Wilkinson, 1967) (Freer, et al., 1999); (Markus, 1979); Building Regulations Approved Documents (2013); British Standards; Construction and Design Management (2007); (LDA, 2010); (BCO, 2009);(Battle, 2003); (RICS, 1997); (Neufert & Neufert, 2012); (PKF, 2001);(Littleford, 2012); (Ratcliffe, et al., 2006); (Wilkinson, et al., 2008); (Miles, et al., 1991);(Havard, 2008)

5 Adaptive Reuse Case Study

5.1 Introduction

5.1.1 Case Study Selection Criteria

From the many office conversions that have occurred since the mid-90´s which could become the investigation of a case study, an initial number of aspects had to be considered to shortlist potential candidates. Firstly, it was required that the location was easily recognizable, in London and overseas, whilst intuitively suggesting a few possible alternative uses, either by its urban nature or by its central location. The City, being predominantly a services district, was discarded thus the historic and prime location of Westminster was selected instead, embracing the highest market values for offices, housing, and retail premises, coexisting together in mixed use areas. Being the most touristic borough, with cultural clusters, historic monuments and natural elements such as the Royal Parks or the River Thames, it is also a common location for hotels. Furthermore, conversions of office buildings have been increasing in Westminster since the late 1990´s bringing an additional depth to the investigation[77].

From the possible examples, it would be relevant that the adaptive reuse is either recent or an going project for the pertinence of the appraisal; to be a recognizable building and of some urban relevance; the refurbishment proposal to have substantially changed the existing building; and the decision makers involved to be long-standing and of renowned prestige, in particular the project architect.

5.1.2 Portland House History and Characteristics

Further to a negative response to all questions set above (4.2.1) the building selected is Portland House, located in Bressenden Place (SW1) off Victoria Street, linking Buckingham Palace Road and Parliament Square, 500m south of Bucking Palace and the Royal Parks, 200m north of Victoria Station and Pimlico, west of the heritage area of Westminster and east of the prime areas of Kensington and Chelsea.

The area was until the 18th century predominantly rural, yet has traditionally hosted many small and medium size breweries over the centuries. The actual building site was in fact one of London's biggest beer producers[78]. From the 18th century onwards the whole area experienced significant and rapid developments with the construction of the Grosvenor Canal in the area of Pimlico in 1825, the new Victoria Street and Grosvenor Gardens in the 1850s, the Victoria Railway Station in 1861 and the underground railway network just after, soon becoming the main access point from the south of England and one of the preeminent points on the east-west axis of Victoria Street (DCA, 2013).

[77] As a result of the high residential values and the available stock of offices, in particular from the 1960s.

[78] The Brewery, known as the "Stag Brewery" was founded in 1641 by Sir William Greene, distinct member of the Greene family, owner of many similar businesses since the medieval times. It slowly grew to eventually became the largest brewery in London in the early 18th century and the main building in the area. In 1788 the business was sold to Moore, Elliot & Co., and the Stag Brewery was rebuilt 1797-1807 by George Saunders and adopted in 1860 for James Watney, from the distinct Watney family – the last owners.

Figure 25 : View of existing Portland House from St. James Park (DCA, 2013)

Figure 26 : Simulated View of Portland House Proposal from St. James Park (DCA, 2013)

Throughout the 19th century many terrace houses and squares where built transforming the character of the area to become a residential and commercial district.

During the Second World War the area was significantly bombed thus all Victorian terrace houses were demolished. Being a central location and the entrance to London by rail from continental Europe, it became most desired for the growing demand of offices, dictating its main use for the upcoming decades. The main occupiers were in fact governmental facilities, expanding their departments south from Whitehall, together with large oil companies. (DCA, 2013).

The brewery continued producing until 1959, when it was sold and demolished. The new scheme covered a 6-acre site and comprised seven new buildings, five of them around a new public square, named Stag Place, in recognition of the former Stag Brewery, with Portland House as the main building in the most prominent location and with the greatest height. Like so many large-scale post war office schemes there was a trade-off between developers and planners. In order to build so high and so close to Buckingham Palace Gardens the developer had to improve the London Road Plan by creating an important traffic link between Buckingham Palace Road and Victoria Street – Bressenden Place. The brewery site was split in two and, along with Palace Street, the footprint of Portland House was formed (DCA, 2013).

Portland House was built between 1959 and 1964, developed by Land Securities[79] (LS), designed by Howard, Fairbairn and Partners and constructed by Sir Robert McAlpine; and is a typical speculative brutalist office from the 60s (2.1.2). The building was polemic from the start of construction, due to its presence in the Royal Parks, eventually becoming for many decades the last office tower built in a considerably visible position above the treetops of St. James, Hyde Park or Green Park (Marriott, 1967).

Historically the building has performed well as a commercial office building, being in the early days the Head Office of British United Airlines. Despite several internal and external refurbishments over the years, the space can no longer provide the quality expected by today´s standards.

The building is 101 metres high above ground level with a basement level shared with adjacent buildings. It has two banks of lifts - the first serving up to the fifteenth floor, and the second from the fifteenth floor upwards, a total of 29 floors, with the last two floors reserved for services. In plan the building is 62 metres long, 25 metres at its maximum width, tapering to 18 metres wide at the north and south ends[80]. The structure is a reinforced concrete frame on piled foundations, with a column spacing of 4.4 m on the ground and mezzanine floors and 2.2 m on the floors above. It is clad in reinforced concrete with fins at its penthouse to shield service elements from view and double height arches at its base. The facade comprises aluminium framed windows recessed within precast concrete panels which have an exposed aggregate finish of Cornish granite. The current clear ceiling height ranges between 2.4 and 2.6 m, clearly below the tenant´s expectations for a prime location. The façade requires increasingly intrusive maintenance and fails the thermal, ventilation and day lighting performance requirements.

[79] Land Securities , founded in 1944, is one of the many developers that emerged after the Second World War (2.1.1).

[80] The conceptual approach behind the tampering is to reduce the impact of the geometry and in turn increase the central lettable space. The plan shape and the façades are a smaller and poorer version of the contemporary Pan Am building in New York from Walter Gropius, in turn inspired by the Pirelli Tower in Milan by Gio Ponti.

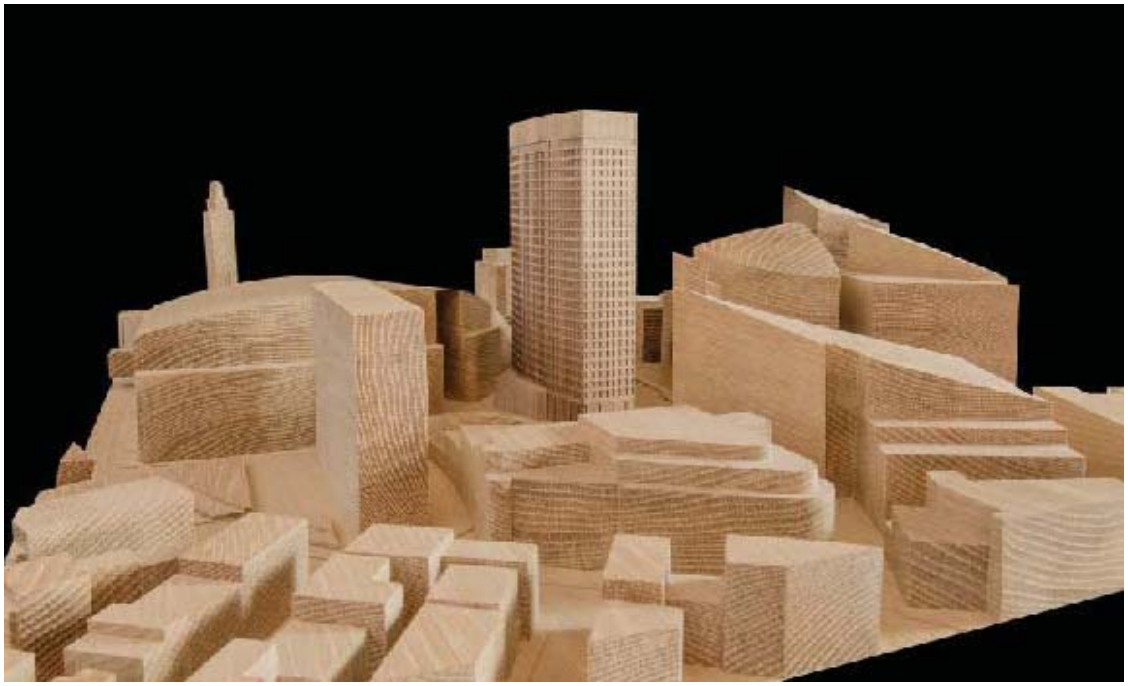

Figure 27 : Portland House Physical Model, Existing (DCA, 2013)

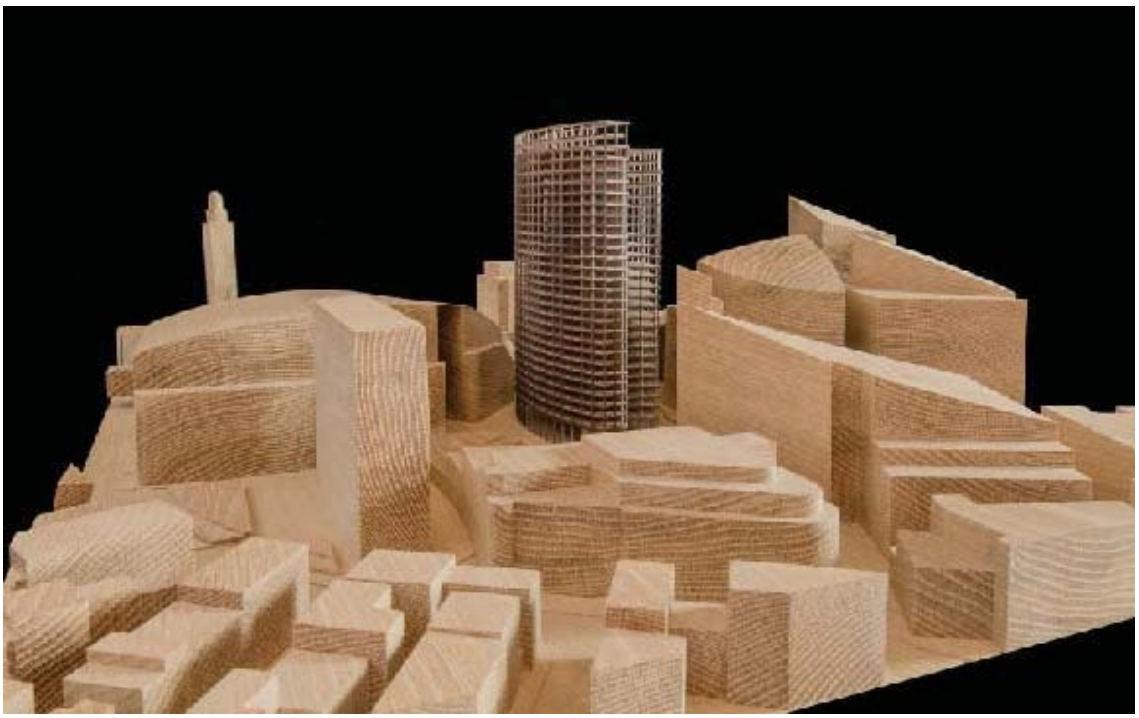

Figure 28 : Portland House Physical Model , Proposal (DCA, 2013)

5.1.3 Portland House Adaptive Reuse Proposal

From the seven buildings built in the 60´s only two were not demolished. Along Victoria Street many other buildings from the same period were or are at the present time being replaced by either offices or mixed-use developments, with large retail units on the ground and first floors.

Showing signs of underperformance and increasing vacancy rates, LS held a competition in October 2010, inviting leading architectural practices to propose converting Portland House to prime residential. David Chipperfield Architects (DCA) were appointed and planning permission was granted in 2013.

The proposal consists of 206 apartments across 28 floors with retail on the ground and first floors.

The façade was considered inappropriate with a negative urban presence, in particular in the surrounding conservation areas and the historic adjacent buildings; and the building configuration not adequate to residential functions.

"The proposal creates two distinct blocks, of varying heights to the east and the west, breaking down the form of the building, improving the proportions and reducing the visual impact. The two curved forms, offset to each other in plan and section, establish a dynamic, light composition with a sculptural quality.

The external appearance of the building is further transformed by expressing the new external balcony floors and supporting columns which wrap around the building. This provides a physical depth to the exterior, allowing a play of light and shadow on the façade and imparting a strong sense of solidity and materiality." (DCA, 2013).

The retention of the existing structure dictates that the apartments radiate from the existing central core, surrounded by a new distribution corridor. The floor plate depth is extended to accommodate the corridor and to provide private balconies to all the apartments. The *floor extension* takes the shape of two 'wings', on the west and east sides and further expressed on the tops, *partially demolishing* the existing building. It is a steel composite lightweight frame solution, adequate to the restricted building heights. The existing pile foundations were re-used and extended to support the increased loads. The new services strategy allowed reducing the building height on the west side, creating a stepped profile between the two wings, minimizing the building presence from afar. The re-use of 75% of the existing concrete structure recycled most of the embodied carbon, vastly reducing the ecological footprint of the development.

The proposal is an extraordinary achievement. The building´s character and presence were profoundly improved, delivering a strong contemporary architectural proposal from a 1960´s brutalist structure. Unrecognizable from the previous building, it improves the character of the adjacent streets whilst reducing and enhancing its presence from the surrounding sensible sites. In this sense is a true-case study of an adaptive reuse, further reinforcing this solution as a flexible, sustainable and serious alternative.

Nonetheless, the size and planning of the apartments was dictated by the existing structural grid, reducing the layout opportunities.

The existing core resulted in excessive lobby and distribution spaces, many single load apartments either facing east or west, insufficient car park spaces, complex layouts and long corridors in the larger apartments. Additionally, the floor plate became even deeper and the low ceiling heights remained.

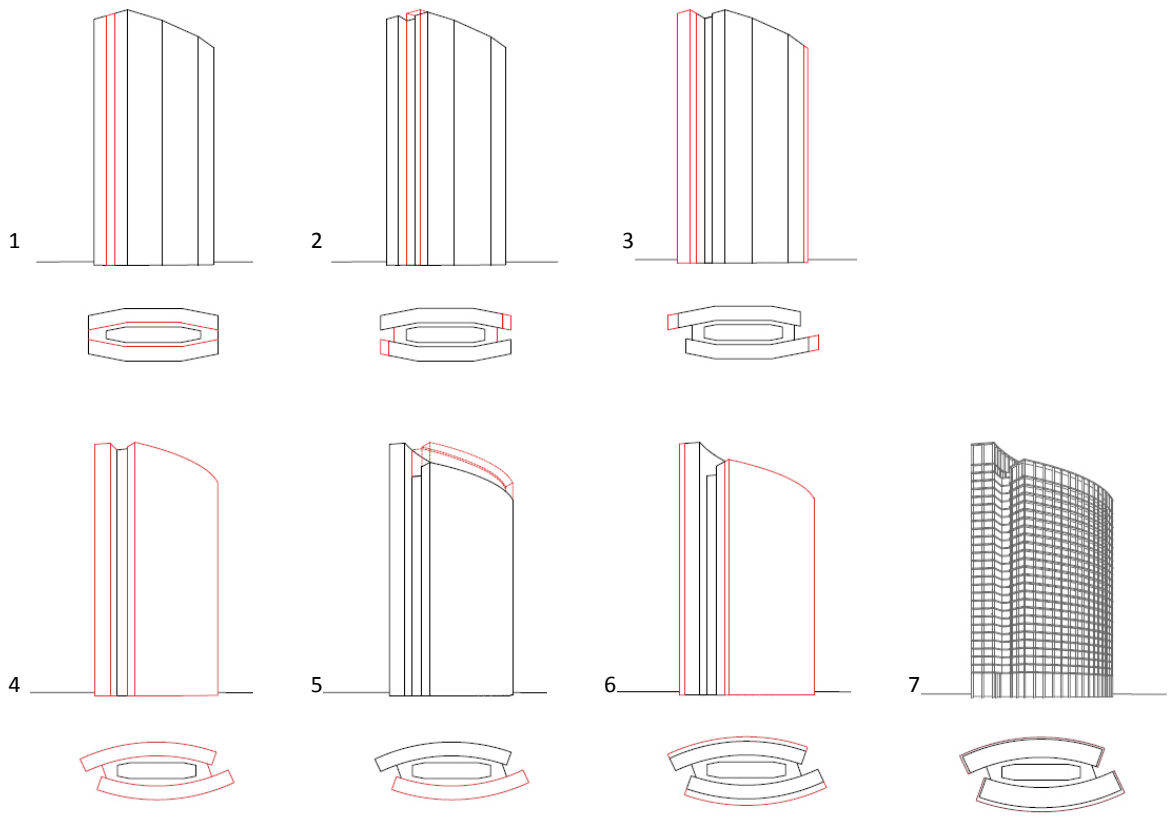

Figure 29 : Adaptive Reuse Tools evolution diagram (DCA, 2013)[81].

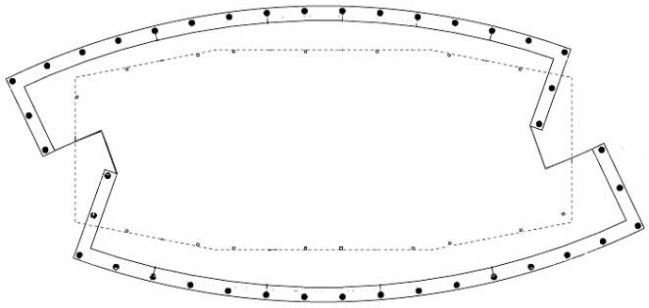

Figure 30 : Portland House plans overlaid – existing and proposal (DCA, 2013)

[81] Legend:

1 Circulation Corridor dividing the floor accommodation
2 Reducing the floors to the north and south side
3 Extending the accommodation to the north and south
4 Smoothing the building profile
5 Reducing the building height
6 Extending the floor to allow for corridor and residential accommodation
7 Adding the Residential Balconies

5.2 Adaptive Reuse Appraisal Model

5.2.1 Location Criteria Appraisal

Criteria		Descriptor	Score
A.1.1.1	Distance to Centre	In the core of Westminster (distance was considered 0 km)	100
A.1.2.1	Public Transport	4 types of Public Transport within 400m :Tube; Bus; Train; Coach;	125
A.1.2.2	Private Transport	3 Principal Routes within 500m	100
A.1.2.3	Parking Provision	Average waiting time of 4 to 5 minutes in peak times;	-20
A.1.3.1	Infrastr. Amenities	Any urban infrastructure but a direct link to Gatwick Airport;	40
A.1.3.2	Cultural Amenities	Buckingham Palace; Westminster Cathedral and minor galeries;	120
A.1.3.3	Services Amenities	1 Public School; 1 Private School; 1 NHS centre; other minor services;	100
A.1.4.1.a	Built Environment	Well mantained; incoherent; obsolete offices or with poor character	60
A.1.4.1.b	Built Environment	Any qualified public space except the retail corridor	40
A.1.4.2.a	Natural Environment	Proximity to the Royal Parks, just at the fringe of 400m	80
A.1.4.2.b	Natural Environment	Just a few streets with trees	15
A.2.1.1.a	Street Environment	Obsolete buildings not well mantained; corporative offices.	30
A.2.1.1.b	Street Environment	Any natural elements in the street	-20
A.2.1.2	Street Position	Off - High Street (Victoria Street)	80
A.2.1.3	Street Access	Bressenden Place is part of the London Distributor Network	100
A.2.1.4	Pedestrian Flow	Crowds at every hour of the day, quieter on weekends	100
A.2.1.5	Noise Levels	Bressenden Place : 70 - 74.9dB (A); Victoria Street : up > 75dB (A)	-40
A.2.2.1	Building Presence	Exceptional views to Buckingham, Westminster, Royal Parks; Thames	160
A.2.2.2.a	Building Views	Highly visible from all sides and from far, in important public spaces.	140
A.2.2.2.b	Building Views	Relevant views in all fronts and to the majority of the floors	100
A.2.2.3	Building Orientation	Direct sunlight across the majority of the floors on three sides.	90

Table 18 : Case Study Location Performance Matrix. Source: Author

From the methodology previously constructed (4.2.4), within the *Evaluation of the Alternatives* stage (4.1.4) the building Location was evaluated by defining its performance on each criterion, obtaining both qualitative and quantitative data.

The performances were transformed into a numerical scale, through the MACBETH approach (4.1.4). With the *Good (100)* and *Neutral* (0) performances previously defined, qualitative Judgements were made regarding the difference of attractiveness on each criterion. The values obtained are shown in Table 18.

With the *Location Performance* determined, the next step is to calculate the *Criteria Weights*.

Figure 31 : Macro Location Plan, Portland House, London. *Source* (DCA, 2013)[82]

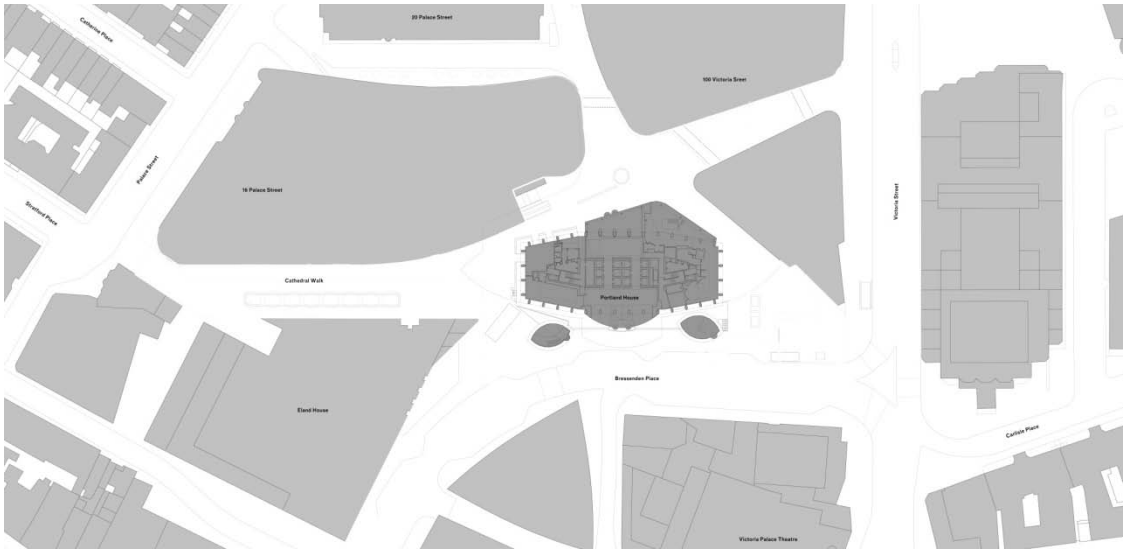

Figure 32 : Micro Location Plan, Portland House, London. *Source* (DCA, 2013)

[82]Legend: 1 Portland House; 2 Victoria Palace Theatre; 3 Westminster Cathedral; 4 Victoria Station; 5 The Royal Mews; 6 Buckingham Palace; 7 Queen Victoria Memorial; 8 Wellington Barracks; 9 Birdcage Walk; 10 St. James Park; 11 The Mall; 12 Constitution Hill.

Location Criteria Weighting

		Office		Residential		Hotel			
		Secon.	Prime	Secon.	Prime	Secon.	Prime	Retail	Aver.
A.1.1.1	Distance to Centre	17,6	22,29	2,31	14,33	7,2	7,72	4,55	10,857
A.1.2.1	Public Transport	9,06	10,83	16,33	1,2	15,12	1,03	7,57	8,7343
A.1.2.2	Private Transport	6,47	4,52	5,44	3,59	4,32	9,25	3,78	5,3386
A.1.2.3	Parking Provision	6,47	1,81	3,62	7,17	2,16	5,14	3,78	4,3071
A.1.3.1	Infrastruct. Amenities	2,93	2,29	0,87	0,8	8,4	4,53	0,51	2,9043
A.1.3.2	Cultural Amenities	4,69	5,14	5,19	6,38	7,2	11,32	0,91	5,8329
A.1.3.3	Services Amenities	1,17	1,14	7,8	2,4	1,2	1,13	0,1	2,1343
A.1.4.1.a	Built Environment	2,64	6,22	5,17	6,37	4,95	6,62	5,13	5,3
A.1.4.1.b	Built Environment	0,53	0,45	0,74	1,06	4,05	1,32	0,93	1,2971
A.1.4.2.a	Natural Environment	1,58	4	6,64	9,57	3,15	6,62	3,73	5,0414
A.1.4.2.b	Natural Environment	1,85	1,33	5,9	2,12	2,25	3,97	2,33	2,8214
A. 2.1.1.a	Street Environment	4,11	5,14	5,66	7,13	6,6	7,38	7,08	6,1571
A. 2.1.1.b	Street Environment	3,52	4,28	3,4	6,59	6,15	6,86	6,06	5,2657
A. 2.1.2	Street Position	6,46	3,71	1,13	1,1	5,72	6,33	12,12	5,2243
A. 2.1.3	Street Accessibility	11,16	1,72	5,28	2,2	2,2	2,64	3,03	4,0329
A. 2.1.4	Pedestrian Traffic	1,17	0,86	0,76	0,55	3,98	1,06	20,2	4,0829
A.2.1.5	Noise Levels	0,59	0,28	3,77	4,94	0,44	0,53	1,52	1,7243
A. 2.2.1	Building Presence	9	13,33	1,05	2,25	5,74	6,77	10,32	6,9229
A. 2.2.2 a	Building Views	3,27	5,33	5,26	9	2,29	4,52	3,97	4,8057
A. 2.2.2 b	Building Views	0,82	1,33	5,26	6,75	1,72	3,76	1,59	3,0329
A. 2.2.3	Building Orientation	4,91	4	8,42	4,5	5,16	1,5	0,79	4,1829
	Total	100	100	100	100	100	100	100	

Table 19 : Case Study Alternatives Weighting Coefficients. *Source: Author*

Because the building, as expected, does not perform equally *Good* in all criteria, the alternatives´ performances will be determined once their *preferences* i.e. weighting, on each criterion is crossed with the building *location performance* previously identified (Table 18).

The preferences of each alternative on each criterion were considered in the investigation to vary from use to use in the location criteria (4.2.5), hence, those preferences are being expressed on the *coefficient weights*. The more relevant that *point of view* is to a certain use, the higher the weight of that criterion to that use. This weighting process, also determined with the MACBETH approach, was carried out until the partial values for each alternative, on the criteria below each evaluation area, and the resultant (within) weights are attained (Mateus, et al., 2008).

Taking the criteria grouping structure, fictitious reference alternatives were created (one per criterion) each one with the best impact on one criterion and the worst impact on the others. An additional fictitious reference alternative was then created with the worst impact in all criteria (4.1.4). Then, the decision maker, i.e. the researcher, ranked the different alternative uses by decreasing the level of its overall attractiveness. Lastly, he semantically judges the differences in attractiveness between every pair of fictitious reference alternatives with the MACBETH approach (Mateus, et al., 2008).

Once the partial values of each criterion within each sub-group were determined, it was necessary to determine the corresponding final weights for all these criteria in order to calculate the global weights of each criterion on the Locational Appraisal. The previous hierarchical additive model was used (4.1.2) for aggregating the local values on the various elementary criteria up to the criteria immediately below each evaluation area – the bottom up approach (Mateus, et al., 2008).

The same semantic judgment approach was used to determine the weights of each group and sub-group of criteria until the global weights were achieved. Because the weight of each criterion differs from use to use, the above process is individually carried out on each alternative, in order to obtain a table which summarizes the preferences of each alternative per each point of view (A.4).

The results obtained (Table 19) show the different preferential percentages of each alternative use on each criterion, based on the location case study, and many conclusions can be taken from its interpretation, as values vary as much as 20% from one use to another on the same criterion.

Through a horizontal analysis, it suggests that *Distance to Centre* and *Access to Public Transport* criteria are prominently the ones with most weight across all uses, followed by respectively, *Building Presence*, *Access to Cultural Facilities,* the *Street Natural Environment*, the *Street Position* and the proximity to a *Natural Environment.* Hence, a location that comprehends a good performance on the above criteria is expected to be more flexible to accommodate different alternatives in an adaptive reuse scheme.

Through a vertical analysis, it suggests the criteria with most weight per use: *Distance to Centre* for both office categories and for Residential Prime, which also attributes a significant weight on the proximity to a *Natural Environment. Proximity to Public Transport* for both Residential and Hotel Secondary categories whilst for Hotel Prime it is *Proximity to Cultural Amenities.* For the Retail use it is instead the *Pedestrian Traffic* which is the most important, followed by *Street Position* and *Building Positions*.

Since the weighting coefficient values have been obtained vertically, i.e., within each alternative preference on each criterion, some values might become questionable when compared horizontally, i.e. within each criterion. This happens because the vertical approach attributes a *relative* weight to the criteria, if it is more relevant to a certain criterion than another, and so the weight is allocated accordingly. E.g. the building orientation is at least as relevant to a secondary apartment as to a prime apartment but the results do not express that. However when compared to the quality of the external views, this is undoubtedly a more relevant factor to the latter than the former. A percentage was therefore allocated to define that difference since the total is always equal to 100.

The entire locational weighting was revised once this summary was constructed, shown over the values obtained. The results, which were still considered inconclusive due to the above interpretation of the discrepancies, were nonetheless carried out through the end of the appraisal.

Overall Value of Alternative Uses

Rank	Locational Criteria	Score
1st	Office Prime	95,36
2nd	Office Secondary	87,42
3rd	Retail	82,82
4th	Hotel Secondary	80,72
5th	Residential Secondary	79,73
6th	Hotel Prime	75,79
7th	Residential Prime	70,05

Table 20 : Case Study – Global Values and Ranking, Locational Criteria. *Source: Author*

With both locational performance and weighting coefficients determined, the global value of each alternative (Table 20) was determined by the aforementioned additive model (4.1.2); (A.4).

The model suggests Office Prime as the most attractive use and Residential Prime the least attractive one, as it is being proposed in the case study refurbishment. However it is also worth remarking that all alternatives have a score above 70, as a result of the exceptional and multi-functional building location. .

Sensitivity and Robustness Analysis

Since the MACBETH approach does not allow different weighting criteria on each alternative (6.4), a robustness analysis was carried out by observing the local and global values obtained on each use and each criterion, indicating that there is no absolute dominance on any alternative. Equally, a sensitivity analysis was also carried out, which focused on the judgmental decisions of the case study location performances. Therefore, each criterion was manually the subject of incremental variations of 5%, up and down, up to 20%. The ranking previously obtained was maintained except on the following conditions: (Table 21).

Criterion		Variation to Local Performance	Impact on Overall Ranking
A.1.1.1	Distance to Centre	-20%	O.P > O.S > RE > **H.S = R.S** > H.P > R.P
A.1.2.1	Public Transport Access	-20%	O.P > O.S > RE > **H.S = H.P > RS** > R.P
A.1.3.1	Infrastrctural Amenities	-20%	O.P > O.S > RE > **H.S = R.S** > H.P > R.P
A.1.3.3	Services Amenities	15%	O.P > O.S > RE > **R.S > H.S** > H.P > R.P
A.1.4.2 a	Natural Environment	20%	O.P > O.S > RE > **H.S = R.S** > H.P > R.P
A.2.1.2	Street Position	-20%	O.P > O.S > RE > **H.S = R.S** > H.P > R.P
A.2.1.4	Pedestrian Traffic	-20%	O.P > O.S > **H.S > R.S > RE** >H.P > R.P
A.2.2.1	Building Presence	20%	O.P > O.S > RE > **R.S > H.S** > H.P > R.P
A.2.2.3	Building Orientation	20%	O.P > O.S > RE > **R.S > H.S** > H.P > R.P

Table 21 : Case Study Sensitivity Analysis - Locational Criteria. *Source: Author*

Interpretation of the Results

From the sensitivity analysis the results mostly identify the uncertainty of the Hotel Standard use performing better than Residential Standard use, on almost half of the weighting criteria, thus it is not robust to affirm which use is best on this particular location. It is robust to say that from the appraisal carried out that Office Prime, Office Secondary and Retail are the most attractive alternatives and that Residential Prime is the least attractive alternative use, exclusively considering the locational criteria.

One of the main constraints for the appraisal is that the site has a good performance in the majority of the criteria and therefore it is expected that the *weighting* of each criteria will vastly determine the results which, as previously seen (Table 19), were considered inconsistent.

For decades, the area was typically used for office purposes (5.1.2), justifying the appraisal results.

Nevertheless the area has undergone some changes, tending to become a mixed use location. It is extremely well served by public transportation connecting different tube lines, trains, buses and airport links thus is constantly crossed by thousands of people. Hence, any building adjacent to Victoria Station and Victoria Street typically has high street retail shops on the lower floors. The public way on the east side of the building is a cluster of retail, conveniently linking different office buildings, Victoria Street and pedestrian access to Buckingham Palace. Retail is so a certainly reliable option on the lower floors.

Furthermore, the building is centrally located between a great number of important cultural, historical and natural attractions, suggesting that it would also be worth considering hotel purposes for its adaptive for its adaptive reuse. In fact Victoria has plenty of terrace houses from the 19th and 20th centuries that have long been converted into small and affordable small scale hotels due to steady demand, together with medium scale purpose built hotels, located in the rear streets of Victoria.

The exclusive views that the building offers to the Royal Parks, Buckingham Palace or even the Thames are a most attractive asset for residential uses, in particular prime residential.

However, despite being on the fringes of the most desired locations for *prime* private housing of Vincent Square, Belgravia, Sloan Square, St. James or even Chelsea it does not hold the quietness, privacy, public space, façades character, trees and private parks of any of the above places.

The scale of the adjacent buildings are monumental and highly corporative, with a poor urban and natural environment. The high traffic levels in Victoria Street and Bressenden Place are among the highest in central London. The excessive amount of transitory people during the day, as the second most crowed train station in London, the levels of noise and air pollution, the lack of social life in the evening and the emptiness of the streets during the weekends seem to justify the lower result of Residential Prime .

The Financial Viability Assessment presented to WCC for obtaining planning permission, remarks that:

"[...] Victoria has historically been dominated by parliamentary and historic functions [...] and lacks significant residential infrastructure or identity. [...] Although the building site is not a recognized prime residential address, its close proximity to the prime locations [...], amenities and London´s core business district underpins it overall value" (DCA, 2013)

Figure 33 : Portland House, South Elevation - Existing (DCA, 2013)

Figure 34 : Portland House, South Elevation - Visualization (DCA, 2013)

5.2.2 Physical Criteria Appraisal

Criteria		Existing	Proposal	Optim.
B.1.1.1	External Space	No Private External Area	No Private External Area	0%
B.1.1.2	Plot Access	2 Vehicle (shared); 4 Pedestrian	2 Vehicle (shared); 4 Pedestrian	0%
B.1.1.3	Parking Space	86 Spaces / 44057 sqm GEA	86 Spaces / 53.809 sqm GEA	-18%
B.1.2.1	Slab Height TF	2,95 m (slab to slab)	2,95 m (slab to slab)	0%
B.1.2.2	Slab Height, GF	5,20 m (slab to slab)	8,30 m (slab to slab) on lobby	60%
B.1.2.3	Building Depth	25,50 m (maximum)	36.90 m (maximum)	45%
B.1.3.1	Core(s) Location	11 m / 36 m (complies with BR)	11 m / 36 m (complies with BR)	0%
B.1.3.2	Column Grid	4,40 m (every two of 2.2 m)	4.70 m (maximum); radial	7%
B.1.3.3	Plan Efficiency	0,52%	0,44%	18%
B.2.1.1	Slab Strength, TF	3,5 kN / sqm	3,5 kN / sqm	0%
B.2.1.2	Slab Strength, GF	3,5 kN / sqm	3,5 kN / sqm	0%
B.2.2.1	Opening Ratio	40%	75%	88%
B.2.2.2	Daylight Factor	2.00	2.51	26%
B.2.3.1	External Character	Typical office block tower ; obsolete pre-cast concrete façade; not required for preservation	Purpose built, fully glazed; slabs revealed; stone clad structure; architecturally relevant	100%

Table 22 : Case Study Physical Appraisal - Impact Descriptors. *Source: Author*

Because the adaptive reuse is so radically changing Portland House, the same physical criteria appraisal was performed on both conditions, i.e. on the building as it stands and on the one proposed.

This would ultimately constitute an evaluation of the architectural and development project on its adequacy and capacity to accommodate the new use (Prime Residential and Retail as ancillary use) and also to understand which criteria was considered most relevant for the refurbishment, measured by how much each aspect had improved. Furthermore, the evaluation will also determine the success of the new building to be adapted for any future alternative uses.

As seen from above (4.2.5), each alternative use has nevertheless its own *preferences* on each criterion therefore the score of each criterion, does not relate exclusively to what the building is (as occurred in the location appraisal) but instead in the performance of the difference between the characteristics of the building and their adequacy to each alternative use. Therefore the local values cannot be presented on Table 22, as they vary according to each use (Appendix A3).

As per the methodology established (4.1.2) once the performance of the existing and proposed building are determined, they were converted into a unique numeric scale to all criteria through the same MACBETH approach. To do so each descriptor is compared to the different *Good* and *Neutral* values on each criterion of each alternative (4.2.5), by verbally judging the difference of attractiveness (4.1.2).

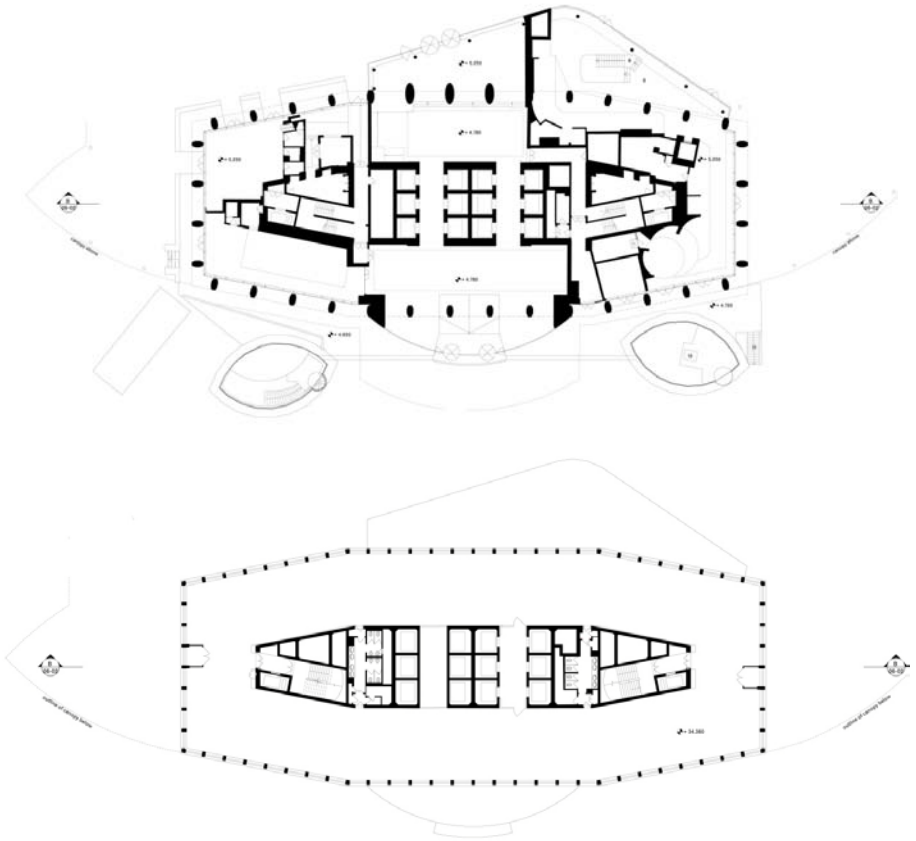

Figure 35 : Portland House, Existing, Ground and Typical Floor Plan (DCA, 2013)

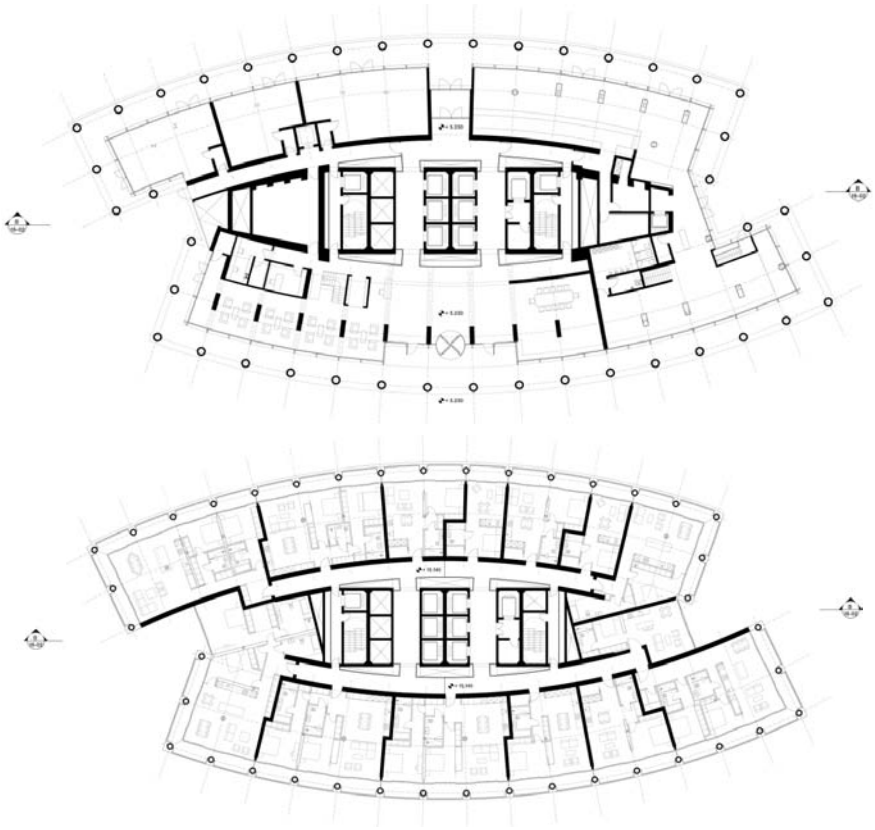

Figure 36 : Portland House, Proposal, Ground Floor and Typical Floor Plan (DCA, 2013)

Weighting

Rank	*Criteria*		*Score*
1st	B.1.2.3	Plan Efficiency	**14.60**
2nd	B.1.2.1	Slab Height TF	**14.21**
2nd	B.1.2.3	Building Depth	**14.21**
4th	B.2.3.1	External Character	**13.75**
5th	B.1.2.2	Column Grid	**11.35**
6th	B.1.3.1	Slab Strength, TF	**8.70**
7th	B.1.2.1	Core(s) Location	**4.86**
8th	B.1.1.3	Parking Provision	**4.20**
9th	B.2.1.1	Opening Ratio	**3.75**
10th	B.1.1.1	External Space	**3.15**
11th	B.2.2.2	Daylight Factor	**2.50**
12th	B.1.2.2	Slab Height, GF	**2.37**
13th	B.1.3.2	Slab Strength, GF	**1.30**
14th	B.1.1.2	Plot Access	**1.05**

Table 23 : Case Study Physical Appraisal - Weighting Criteria and Ranking. *Source: Author*

The above weighting criteria were obtained also through the MACBETH approach (4.1.2).

For the purpose of the investigation, the assumption was made that the weight of each criterion on the physical appraisal is equal to any alternative use (on the contrary of the locational criteria where the relevance of each criterion is assumed to be different to each use) E.g. the ceiling heights are as relevant for offices as for hotels and, equally, more relevant than the façade opening ratio.

As the example shows, this might not be true, especially considering the number of alternatives and the number of criteria involved. It is expected, just as on the location criteria, that some aspects are more relevant than others, in particular within the secondary and prime categories. However, and since the MACBETH approach does not allow a relative weighting procedure, this aspect was simplified on the physical criteria, due to the amount of data and resources that were required to take in the location appraisal and because of the uncertainty of the results obtained. As a consequence a single set of weighting values is being considered for all alternative uses (Table 23).

The results suggest that the most relevant criteria are *plan efficiency* (to provide natural light across the floor plate), *typical slab height*, *building depth*, *external character* and also *column grid*. An improvement on these aspects will inevitably enhance the accommodation of a different use.

Furthermore, they suggest that these aspect should be addressed, in new developments, as comprehensive as possible to any potential alternative uses, as they will largely determine its adaptability to change. They are in fact the ones with less *Degree of Changeability* intrinsically part of a building structure and morphology and so, only a profound refurbishment will permit their adaptation.

Figure 37 : Portland House Proposal, northwest visualization (DCA, 2013)

Figure 38 : Portland House proposal, typical apartment internal visualization (DCA, 2013)

Overall Value of Alternative Uses

Rank	Existing Building	Score	Proposal	Score	Interval	Optim.
1st	Residential Secondary	73,88	Hotel Secondary	93,77	21,41	**30%**
2nd	Hotel Secondary	72,36	Residential Secondary	92,64	18,76	**25%**
3rd	Office Secondary	54,37	Hotel Prime	81,46	59,73	**275%**
4th	Residential Prime	26,62	Residential Prime	78,2	51,58	**194%**
5th	Hotel Prime	21,73	Office Secondary	63,71	9,34	**17%**
6th	Office Prime	14,36	Office Prime	55,88	41,42	**288%**
7th	Retail	12,87	Retail	46,94	34,07	**264%**

Table 24 : Case Study Physical Appraisal - Global Scores and Ranking. *Source: Author*

Once the *local values* have been determined, the aforementioned bottom-up approach (4.1.2) was also carried out, using the additive model, in order to calculate the *global values* of each alternative on both existing and proposed buildings.

The results (Table 24) show the performance of each alternative on both existing and proposed buildings. The overall performance of the alternatives are not as good as in the locational appraisal, suggesting that it is not the site, but the building which is clearly obsolete. Moreover, the function to which the building has been designed to 50 years ago is just above a *Neutral* performance.

Regarding the existing building the most adequate uses are suggested to be Residential Secondary and Hotel Secondary and, with an intermediate performance, Office Secondary. Regarding the adaptive reuse proposal, a substantial physical improvement occurred, which enhanced all alternative uses´ global values and changed the order of preference. Hotel Secondary and Residential Secondary are suggested to be the best alternatives respectively followed by their Prime counterparts.

Sensibility and Robustness Analysis

The above results were once again submitted to a sensitivity and robustness analysis to further understand their significance and validate the preliminary recommendations on the overall ranking of the alternatives (Mateus, et al. 2008) on the building proposal. They were focused on the criteria weights' variations since the nature of the estimated impacts were considered more tangible and precise than the ones defined in the locational criteria[83]. The alternatives' ranking, within the selected weighting,:

HS > RS > HP > RP > OS> OP > RE

[83] A series of graphics were obtained representing the impact of variations of each criterion weight on the overall ranking of alternatives. The vertical axis represents the overall value of the alternatives and the horizontal axis represents the variation scale of the weight, from 0 to 1, for each evaluation area. The dotted vertical line represents the current value of the weight for each evaluation area and the lines the overall value of the alternatives, as the weight for each evaluation area varies between 0 and 1. (Mateus, et al. 2008). The snapshots from MACBETH are combined in Appendix A3

Criterion		Weight Coefficient Used	Ranking is kept within the weghting vatiations
B.1.1.1	Plot Access	0.0105	**if < 1**
B.1.1.2	External Space	0.0315	**if < 1**
B.1.1.3	Parking Provision	0.0420	**if 0.019 < 0.163**
B.1.2.1	Slab Height, TF	0.1421	**if 0.069 < 0,164**
B.1.2.2	Slab Height, GF	0.0237	**if <1**
B.1.2.3	Building Depth	0,14210	**if 0.038 < 0.221**
B.1.3.1	Core Location	0,04860	**if < 1**
B.1.3.2	Column Grid	0,01135	**if < 0.9**
B.1.3.3	Plan Efficiency	0.1460	**if 0.130 < 0.267**
B.2.1.1	Slab Strength, TF	0.0870	**if 0.014 < 0.136**
B.2.1.2	Slab Strenght, GF	0.0130	**if < 1**
B.2.2.1	Opening Ratio	0.0375	**if < 0.138**
B.2.2.2	Daylight Factor	0.0250	**if < 0.080**
B.2.3.1	Exterior Character	0.1375	**if < 0.218**

Table 25 : Case Study Sensibility Analysis – Physical Criteria. *Source: Author*

From the sensitivity results for each evaluation area it was concluded that the above ranking is kept within the above variations of the weighting coefficients, on each evaluation criteria (Table 25).

The results show that the above ranking remains on the majority of the criteria, except on four which, if changed beyond the boundaries set above, would present different results (although the changes are significant, they have still been considered as plausible).

In this sense, O.S would perform better than O.P on the *Exterior Character* criterion; H.S would perform worse than R.S and H.P would perform worse than R.S by lowering the importance of *Floor Plate Depth Ratio*; R.P would perform better than H.P by lowering the importance of *Parking;* R.S would perform better than H.S and R.P better than H.P *if more importance is given to the* Typical Slab Height.

Additionally, a robustness analysis of the model´s output was also performed with the MACBETH approach, by changing various weights at the same time, regarding some pre-defined constraints on weights, such as the pre-defined ranking. The model organizes the information into three different types (Ordinal[84], MACBETH[85], Cardinal[86]) and two different sections (Local[87], Global[88]). It is possible to see the impact of variations on each type/section, by noticing the *Dominance* or *Additive Dominance* (4.1.2).

[84] Ordinal information relates to the ranking decisions only, thus excluding any information pertaining to the differences of attractiveness (strength of preference);

[85] MACBETH includes the semantic judgments entered into the model however it does not distinguish between any of the possible numerical scales compatible with those judgments;

[86] Cardinal information denotes the specific scale validated by the decision maker;

Criterion		Criteria Variation	Impossible to determine the following ranking
B.1.2.1	Slab Height, TF	6%	**R.S > O.P**
B.1.2.2	Slab Height, GF	21%	**H.P > R.P**
B.1.2.3	Building Depth	6%	**R.S > O.S**
B.1.3.2	Column Grid	7%	**H.S > R.S and O.P > RE**
B.1.3.3	Plan Efficiency	6%	**H.S > R.S and O.P > RE**
B.1.3.3	Plan Efficiency	26%	**H.P > R.P**
B.2.1.1	Slab Strength, TF	18%	**H.S > R.S and O.P > RE**
B.2.3.1	Exterior Character	6%	**H.S > R.S and O.P > RE**
B.2.3.1	Exterior Character	18%	**H.P > R.P**

Table 26 : Case Study Robustness Analysis – Physical Criteria. *Source: Author*

From this understanding, and with regards to the existing building condition, it has been concluded that only ordinal information is required to affirm that H.S dominates H.P and R.P; that O.S dominates O.P and that R.S dominates R.P. Once the approach considers the MACBETH Information, it is concluded that R.S additively dominates H.P. At last, once the approach considers the *Cardinal Information* (Table 26) , variations can be tested on each criterion degree of precision determining in which circumstances it is impossible to confirm the above results. Therefore, it is robust to say that H.S, R.S and H.P are better alternatives than R.P. Nonetheless, it is also robust to say that the H.S and R.S subcategories dominate H.P and R.P since their requirements are lower and less specific. The same is true for the Office uses, which are both dominated by the former.

Interpretation of the Results

The results suggest the existing building to be obsolete in its current use, just above a *neutral* score. When comparing both *performance matrix* and *weighting matrix*, its low performance is attained by the low *floor to ceiling heights*, the inadequate *column grid* and the *outdated façade*, constituting alone almost 40% of the weighting criteria, thus a profound rehabilitation is expected to be required if its current use is to be maintained and its performance enhanced to today´s standards.

The character can be partially addressed by a full façade replacement; however the column grid can hardly improve; and the ceiling heights, only within years or decades of developments in technology and services, could free up the floors and ceiling voids.

Furthermore, when considering other alternatives, further building , which for Prime Offices are still satisfactory, become a clear constraint.

[87] Local information is all information specific to a particular criterion;
[88] Global Information pertains to the model´s weights;

The *floor plan efficiency* for instance, that ensures that enough area is being allocated close to the façade, is an utmost requisite for hotel or residential uses due to their highly compartmented, light required nature. This significantly contributes to the relatively low positions of Residential and Hotel Prime. Hence Hotel and Residential Secondary, less demanding in the above aspects, become the best recommended alternative uses.

Nevertheless, and with the Adaptive Reuse proposal, the building has improved an average of 23% in all criteria, inevitably enhancing the performance of all alternatives. The façade re-configuration was able to improve the *lighting performance*, *plan efficiency*, *building depth*, and, surprisingly, *column grid,* on its own, which became radial. The *building character* was indeed remarkably enhanced due to the above, although the new façade, undoubtedly belonging to a Prime category building, is closer to reinforce the character of its previous use than manifest the new function of Prime Residential.

It is worth remarking at last that the proposal is so profoundly changing the existing building that a thin line emerges between an extensive adaptive reuse and a new build that embraces pre-existences.

5.2.3 Discussion of the Results

From both results it can be remarked that a *prime* alternative use, whose performance is low in a certain building, is expected to have the corresponding *secondary* use to perform better. This is based on the assumption that requirements for a secondary use are generally lower than the prime ones in all criteria i.e. a *good* performance on one criteria to a secondary use may be unsatisfactory to the same prime use. Equally, only an *exceptional* performance on a secondary use could enable a *good* performance in its prime category.

Furthermore, it can also be remarked that, when comparing the global weights of each criterion, although those values on the location criteria were assumed to be inconclusive (5.2.2) and variable to each alternative use, the relatively strong importance of the *distance to centre* and *access to public transport* is suggested. From the physical appraisal, almost 70% of the weight of all criteria are resumed in the 5 core aspects of *plan efficiency*, *typical slab height*, *building depth*, *external character* and *column grid*.

Carefully considering the above elements on an office building design is suggested to ensure Ease and success of its adaptive use in the future for other purposes (6.1).

From the insights of the location appraisal, if alternative uses are being researched for Portland House, a mixed use development could be a strong alternative to be further investigated, with Retail on the lower floors, Prime Offices on the mid level floors and Prime Hotel on the Upper floors where the view is greater. Both could potentially share ancillary uses or present a common business strategy. E.g. the gym or food and beverage facilities can be used by the office´s employees; hotel conference rooms for training purposes and hotel bedrooms for the office´s clients.[89]

[89] Multifunctional and multipurpose facilities are in line with today´s requirements for prime offices (BCO, 2009)

However, conversions of office buildings to residential purposes in Westminster City Council are attracting developers, planners, and local and non-local buyers (The Economist, 2013). There is a demand in central London for modern housing with parking, comfort cooling and security that is often rare in second hand stock in established prime locations. The Portland House proposal could deliver these needs whilst improving the services profile of the area and improving the outdated brutalist image of the building.

However, the results obtained from both the locational and physical criteria appraisal suggest other alternative uses as more attractive as the one being considered - prime residential.

The adaptive reuse proposal suggests a performance improvement of almost double in the residential prime use when compared to its performance if the building is to be kept as it currently is, but still presents a relatively low performance.

From the location appraisal, although the views and the building position are exceptional, it does not seem to compensate for the lack of character, privacy and quality of the urban environment that characterizes the long established prime residential neighbourhoods distanced just a few blocks away. Additionally, from the physical appraisal, although the building has vastly improved with the refurbishment, the deep floor plate, the dark plan configuration and the overall "office" character suggests that intrinsic morphological features of an office block are still present.

The present and aforementioned discussion (2.3) about current and expected London residential values suggests the attractiveness of that use, and the prime sector is the one expected to cover the substantial upfront investment to refurbish and adapt over 40,000 sqm of office space. In fact, it is this use that is being proposed by the developer.

This suggests that the results obtained from the investigation are insufficient to comprehensively recommend the best alternative use for an office building in London. As a form of property development (3.2.2), it is expected from a private sector perspective (3.2.2) for the alternative use to be the one that presents the highest return to the developer.

Although the location was recognized as not being typical to that use (DCA, 2013); (5.2.1) and the building configuration not adequate, the market demand and the expected profit are the driving factors.

Hence, other criteria are expected to have a relatively high importance and thus should have been embraced on the appraisal model, such as the *financial costs and benefits* of the proposal or the *demand* for that use.

The gap between the proposal and the results obtained can be justified by the absence of those *criteria*, whilst suggesting their clear decisive relevance in an adaptive reuse proposal. However, this gap can also mean that the appraisal model constructed can be incomplete or inaccurate, either on the weighting established to each criteria or on the criteria selected itself, that should have been able to somehow *reflect* those aspects.

5.3 Financial Appraisal

At this point it becomes pertinent to a further research the question raised above (5.2.3) and compare the above results with the results obtained from a *financial appraisal* to the alternative uses by simulating, even in possession of limited and imprecise data, the expected financial return of each alternative. It can result in Residential Prime and Retail being indicated as the most financially viable uses, justifying the adaptive reuse proposal, or indicating other uses as most viable, enabling further discussions.

Either way, they will constitute an evaluation of the appraisal which might enable further discussions to the model constructed or question the role/utility of the results that can be obtained from it.

Appraisal Method

Hence it should be selected amongst the established valuation methods the one that is the most adequate within the scope of the appraisal. Although not being an attempt to summarise what has been so completely covered in the literature on the real estate[90] valuation[91], the three well known approaches are the *Market Approach*[92], the *Cost Approach*[93] and the *Income Approach*[94] (IVS, 2003).

From the latter, and at earlier stages of the appraisal where the details of the scheme are not certain, the 'rule of thumb' conventional evaluation is the *Residual Income Approach.*

It is mainly used in developments to appraise the value of the land and the profit that can be obtained, with the main advantage of speed of construction and ease of interpretation and with the weaknesses of being inflexible in handling the timing of when the expenditure or revenue actually occur (Havard, 2008). As a result, it is inaccurate in the calculation of interest costs and inadequate to forecast the future market rents once construction is finished (Wilkinson, et al., 2008).

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[90] *Real estate* is defined as the physical land and those human-made items, which attach to the land (IVS, 2003).

[91] Valuation is the estimated value itself or the preparation of the estimated value (the act of valuing) (IVS, 2003).

[92] *Market Approach* – Provides an indication of value by comparing the subject asset with identical or similar assets for which price information is available. Under this approach the first step is to consider the prices for transactions of identical or similar assets that have occurred recently in the market. If few transactions have occurred, it may also be appropriate to consider the prices of identical or similar assets that are listed or offered for sale provided the relevance of this information is clearly established and critically analysed. It may be necessary to adjust the price information from other transactions to reflect any differences in the terms of the actual transaction and the basis of value and any assumptions to be adopted in the valuation being undertaken. (IVS, 2003).

[93] Cost Approach - Provides an indication of value using the economic principle that a buyer will pay no more for an asset than the cost to obtain an asset of equal utility, whether by purchase or construction. This approach is based on the principle that the price that a buyer in the market would pay for the asset being valued would, unless undue time, inconvenience, risk or other are involved, be not more than the cost to purchase or construct and equivalent asset. Often the asset being valued will be less attractive than the alternative that could be purchased or constructed because of age or obsolescence. Where this is the case, adjustments may need to be made to the cost of the alternative asset depending on the required *basis of value* (IVS, 2003).

[94] *Income Approach* - Provides an indication of value by converting future cash flows to a single current capital value. This approach considers the income that an asset will generate over its useful life and indicates value through a capitalisation process. Capitalisation involves the conversion of income into a capital sum through the application of an appropriate discount rate. Methods that fall under the income approach include : a) Income capitalization, where an all-risks or overall capitalisation rate is applied to a representative single period income b) Discounted cashflow, where a discount rate is applied to a series of cashflows for future periods to discount them to a present value c) Various options pricing models (IVS, 2003).

It involves calculating the total development costs being deducted from the Gross Development Value of the development, once completed and let or sold, in order to establish the Residual Profit[95] (Ratcliffe, et al., 2006). It can be based upon the simple equation (Ratcliffe, et al., 2006) :

Residual Value = Gross Development Value – (Development Costs + Developer´s Profit)

The Residual Income Approach would have been the most adequate appraisal method, despite its fragilities, since at this point the access to information is limited and the detailed costs of finance were not considered relevant within objectives of the appraisal.

However, with this method it becomes difficult to assess the financial viability of hotel uses. Hotels, as another form of investment property[96], typically have a highly irregular pattern of expenditures and revenues, where the residual method is inflexible in handling, and a significant amount of data to consider. Moreover, acknowledging that construction itself will take up to four years to complete, it becomes relevant to include on the financial appraisal the significant rate of inflation and rental growth forecasted.

From the above, the different *Cash Flow* (CF) methods[97], which are a less simplified residual approach best rewarded when the scheme´s details are at a more advanced stage (Havard, 2008), enable the developer to assess an irregular pattern of cost or income, giving a more explicit presentation of the flow of expenditure and an accurate assessment of the cost of interest(Wilkinson, et al., 2008).

A widely used CF method is the *Discounted Cash Flow* (DCF).

On the one hand, it enables the different cash flows, i.e. the sums and expenses on each period of time, to be discounted back to a present day equivalent, to establish the value of the profit in today´s value[98] - the Net Present Value (NPV). A positive NPV indicates that the scheme is potentially profitable, whilst a negative one indicates that a loss is likely (Havard, 2008).

On the other hand, it also enables a calculation of the *discount rate* that, when applied to all inflows and cashflows, produces an NPV value of £0, the Internal Rate of Return (IRR) (Ratcliffe, et al., 2006).

The IRR is the measure used by some developers to assess the profitability of a scheme since it considers both timing, and magnitude of each cashflow[99] (Wilkinson, et al., 2008) avoiding a subjective selection of a discount rate (Ratcliffe, et al., 2006).

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[95] An alternative approach is the estimation of the yield or return produced by a development scheme. This can be a simple comparison of the anticipated initial income expressed as a percentage of the likely development costs, or it can be a more refined relationship between estimated income allowing for rental growth and the attainment of a specified yield by a selected target rate (Ratcliffe, et al., 2006).

[96] *Investment Property* – Property that is land or a building, or part of a building, or both, held by the owner to earn rentals or for capital appreciation, or both, rather than for the use in the production or supply of goods or services of for administrative purposes; or sale in the ordinary course of business (IVS, 2003).

[97] Cash Flow Methods : Phased Residual Valuation; Residual Cash Flow Valuation; Net Present Value Discounted Cash Flow Analysis; Internal Rate of Return Cash Flow Analysis (Ratcliffe, et al., 2006).

[98] This introduces the concept of *time value for money*: the money received today is worth more than in the future. The discounting component acknowledges the relationship between time and money, which is especially relevant in property development where extended periods are expected between acquisition and building completion. (Havard, 2008).

[99] As opposed to examining just a percentage return on a cost (not considering the timing of cashflows) or the present value of the profit (not fully considering the initial financial outlay and degree of risk) (Wilkinson, et al., 2008).

Therefore it becomes useful for a comparison of different potential developments with their own variations in nature, timing and size of cashflows (Wilkinson, et al., 2008), as being required in the present appraisal.

The DCF was the selected valuation, despite the 'early stage' nature of the appraisal, since it allows a fair comparison between all alternative uses, including hotel, through a common value of the projected NPV or IRR, further enabling a ranking of alternatives, in the same layout as the ones obtained on the location and physical appraisal.

Due to the unavailability of precise and updated values, and due to the vast assumptions[100] carried out for simplification, the results obtained shall only be considered for the purpose of the exercise as a simulation of the most likely valuable alternative.

The two DCF valuations can be represented through the following equations (Havard, 2008):

$$dcf = \frac{cf_1}{(1+r)^1} + \frac{cf_2}{(1+r)^2} + \ldots + \frac{cf_n}{(1+r)^n}, \qquad npv = -idc + dcf, \qquad irr = r, when\ npv = 0$$

Where,

npv	Net Present Value
idc	Initial Development Costs
dcf	Discounted Cash Flow
cf	Cash Flow
r	Discount Rate
n	Time in years
irr	Internal Rate of Return

The valuation considered the different alternative uses on the conditions of refurbishing the existing building, and adapting the building as per Land Securities and DCA´s scheme, whilst it suggests in which circumstances it is financially viable to adapt the building as extensively as it is being proposed.

Retail use was assumed to be an *ancillary use* only, for rental, in all alternatives, on Ground and First Floors. It was assumed to be unlikely that the entire building would be converted to retail and likely that any proposal would consider retail it on those floors. The residential uses were considered to be for sale only whilst the offices for rental. In the hotel uses, the expenditures and incomes from bedrooms and from other *ancillary uses* (E.g. Food and Beverage, Spa, etc.) were both considered and estimated, in addition to the hotel use.

All assumptions[101] and sources are further detailed in the *Sources and References* (A.6.1), and the Discounted Cash Flows (A.6.2 to A.7.5).

[100] Assumptions are matters that are reasonable to accept as fact in the context of the valuation without specific investigation. They are matters that, once stated, are to be accepted in understanding the valuation (IVS, 2003) .

[101] A statement that describes the fundamental assumptions on which the reported value will be based (IVS, 2003).

Financial Appraisal Results

	Existing Building (Refurbished)		*Proposed Building (Adaptive Reuse)*	
Alternative Uses	NPV	*Rank*	NPV	*Rank*
Office Secondary and Retail	-£75.154.192	10th	-£99.840.367	12th
Office Prime and Retail	-£61.268.470	9th	-£92.822.700	11th
Residential Secondary and Retail	-£11.131.563	8th	£57.555.578	6th
Residential Prime and Retail	**£122.063.470**	**2nd**	**£183.979.051**	**1st**
Hotel Secondary and Retail	£83.768.703	4th	£121.561.169	3rd
Hotel Prime and Retail	£8.896.671	7th	£74.791.528	5th
Alternative Uses	IRR	*Rank*	IRR	*Rank*
Office Secondary and Retail	5,71%	11th	5,49%	12th
Office Prime and Retail	6,39%	9th	5,86%	10th
Residential Secondary and Retail	6,78%	8th	13,07%	3rd
Residential Prime and Retail	**17,60%**	**2nd**	**20,60%**	**1st**
Hotel Secondary and Retail	10,05%	5th	10,65%	4th
Hotel Prime and Retail	8,23%	7th	9,49%	6th

Table 27 : Case Study Financial Appraisal - DCF, NPV and IRR. *Source: Author*

Interpretation of the Results

The results suggest a clear dominance of Prime Residential and Retail as the most valuable alternative.

Although they should just be considered for the purpose of the exercise, it is largely suggesting the significant relative weight of the *cost-benefit criterion* on an adaptive reuse proposal, justifying the alternative use selected by the developer and the discrepancies with the previous results attained from the location and physical criteria appraisals.

It has been said that property possess development potential (3.2.2) whenever an element of latent value can be released by the expenditure of capital upon it (Baum & Mackmin, 1989). This can be achieved, among other options (3.1.4) by upgrading the existing building for a change of use (Ratcliffe, et al., 2006). From this, the concept of Highest and Best Use should be reintroduced (3.1.4):

" the most probable use of a property which is physically possible, appropriately justified, legally permissible, financially feasible, which results in the highest value of the property being valued".

This means that a use that presents the highest value and that is legally permissible, financially viable but not appropriately justified nor physically possible cannot be considered as the highest and best use. It is therefore part of the *valuer´*s role, to justify why a certain use is the highest and best use for an existing building, by explaining how it addresses all the above conditions (IVS, 2003).

This aspect opens up, in fact, the opportunity for the investigation and the Model constructed.

If the *financial appraisal* is required, at early stages, to determine which use may result in the highest value, it can be part of the scope of the ARAM, considering the location and characteristics, to assist on the *appropriate justification* and *physical possibility* of a certain use, so the highest and best use is determined.

6 Concluding Remarks

6.1 Summary on the Adaptive Reuse of Office Buildings

The revolution that the office sector has been experiencing for decades and the accelerating quantitative and qualitative changes in demand for office space forecast a continuous mutation of the nature of the office sector and offices development in the near future. The long term uncertainty output of the economy, reducing the need for space, the impact of information technology, the new working patterns and the requisites that buildings should fulfill today, compromise the utility of many (2.1.4).

The selected Case Study clearly shows that the conversion of office space in London is not slowing down, nor does it represent a niche market as was remarked just over a decade ago (1.3). The amount of space now involved and the character of the buildings that are being considered (2.2) keep the redevelopment option even further away as a sustainable long term approach to obsolescence (3.1.4).

Adaptive reuse of office buildings is becoming an established scope in the construction sector across all *decision makers*, and a new expertise in architecture and property development (3.2.2). There is not only a market opportunity (2.3) as there is also a vast availability of buildings, with exceptional presence and unique spatial qualities of free plans and deep floor plates, uncommonly found in the other typologies.

In this sense, *sustainability* should go further beyond carbon emissions reduction, waste management or recycling of materials. The resources, time and labor invested in developing are still being lost with demolition. Towards an integrated vision in *urban regeneration* (3.2.3), it should be first understood how to make the most of the buildings that already exist. What can be done must, at least in part, depend on the nature and extent of their utility, regardless of the uses for which they had been designed and built in the first place.

Until now, the historic centres and the cultural heritage had been the main focus of *adaptation* schemes in academic and professional environments. The paradigm changes however if concerning commercial buildings developed a few decades ago. As the vast majority have a relatively low architectural or historic value, the reasons for them to be kept are mostly economical (3.2.2) and environmental and therefore the approach towards them is much more open and the opportunities much wider. There is less to preserve and maintain and more to improve and mutate instead.

However, when looking to new developments, the same approach should be embraced. As it is clear that the quality of construction and materials employed reduce the maintenance needs and extent of the building life, it should be clear that those exceptional buildings which were thoughtfully designed will last longer. They should be able to respond efficiently to the short term demand for its current use in the same way as to the long term necessity of accommodating new uses (3.2.2).

This balance suggests that the qualities of a building should still prevail than the way they address their function, because the latter will inevitably change. A sustainable approach to new developments might be to create spaces within a building which have such an arrangement, configuration, quality or presence that are prepared to host a wide range of human uses (3.3.1), whilst creating exceptional spatial qualities and character which will further reinforce the reasons to be kept.

6.2 Conclusions and Main Findings

The opportunity to study the alarming obsolescence of office buildings and the vast demand for their conversion to other uses in the complex city of London provided a unique insight into both fields.

The most noticeable and original contribution of the investigation was the construction of the Adaptive Reuse Appraisal Model (ARAM) to Office Buildings in London (4), through a Multi-Criteria Decision Analysis (MCDA) approach. The model can be used as a tool to evaluate the potential to convert offices, in London, to other uses prior to (1.2), or assisting on (5.3), the long established architectural feasibility studies and development appraisals, considering its location (4.2.4) and physical criteria (4.2.5). Although not being able to embrace all details involved it can still open new opportunities in those fields.

The adaptive reuse appraisal can also be carried out to determine the performance of a proposal (5.2) as a design guidance which is able to measure the impact of each adaptive reuse tool on each criteria and evaluate their efficiency to accommodate the new use (5.2.2). Since it does not require any architectural or development expertise, it can be used by any of the *decision agents* (3.2.2) involved in the adaptation of an existing office building. Furthermore, it can be used in new office developments as well, embracing a strategic approach for a future re-use and ensuring the robustness of the design options.

Prior to the model construction, a significant amount of themes were researched and a few conclusions can be remarked from their investigation.

a) From the literature overview of the characteristics of office developments throughout the past century (2.1), the physical preferences of each building across the main development periods were summarized (2.1.4). This table is incomplete since some of the information is either dispersed or contradictory. Nonetheless it help us to understand the radical evolution of office building characteristics and requirements, bringing to light the reasons for obsolescence in some aspects when compared to today's standards.
b) From the office' conversions in London (2.2) and the present and emerging market conditions (2.3) it was remarked that the research carried out just over a decade ago, predicting the downturn of the activity, were incorrect. Neither the crisis in the office market or the boom in residential property values of the last years could have been forecasted. The demand and opportunity for conversions is steady rising, reinforcing the aims of the investigation.
c) Also, from the literature, the types and causes for office buildings obsolescence were summarized (3.2) suggesting the role of their adaptive reuse towards urban regeneration (3.3.3).
d) To the four adaptive reuse physical tools (3.3) previously identified *(Kincaid, 2002)*, a fifth tool has been distinguished, the *replacement of components* (3.3.4), an aspect partially perceived in the *selective demolition* tool. Because of its specificity, it was considered as relevant as the other tools, particularly notorious in the scope of the investigation (3.4.4).

Equally, other themes and remarks emerged during the construction of the ARAM:

e) It was necessary to narrow the alternative use options for office buildings for the practicality of the appraisal model. Therefore, a previous methodology developed by the University College London *(Kincaid, 2002)* to determine possible uses in the adaption of buildings, was extended and focused on the investigation subject (4.2.2). The resulting uses were then rearranged in seven groups, which also consider their prime and secondary characteristics (A1);
f) The evaluation criteria constructed attain a new summary of the aspects relevant for an adaptive reuse of office buildings to the alternative uses identified. The locational criteria, which required the definition of descriptors (4.2.4), are a tentative approach to transform the subjective and relative appreciations of location aspects to a comparable scale across all uses. Equally, the physical criteria gathered disperse any contradicting information (4.2.5) summarized in a table which enable a comparison of the physical preferences of each use. From the latter, a suggestion of the physical characteristics of the universal building was raised, which more easily accommodates different alternative uses.

Finally, from the Case Study, further remarks were attained and further discussions enabled:

g) The selected case study confirms the strong potential of adaptive reuse to avoid redevelopment;
h) The weighting process in location criteria (5.2.1) and physical criteria (5.2.2) suggests the relative importance of each criterion to each use and, additionally, the average of importance of each criterion in all uses, aspects which may also become relevant in new development appraisals;
i) The results attained show the clear obsolescence of the existing building in its current use (5.2.2) and the clear non-obsolescence of the building site (5.2.1). Furthermore, they confirm the physical improvement that is being proposed and its further adaptability to accommodate other uses;
j) The financial appraisal carried out (5.3) suggests that the use being proposed in the case study to be the most valuable. The discrepancy with the location and physical appraisals´ results reinforce the importance of the cost benefit criteria on an adaptive reuse appraisal;
k) Finally, and from the above, a significant change in the purpose of the model constructed is suggested. In the concept of *highest and best use,* i.e. the most probable use of a property which is physically possible, appropriately justified, legally permissible, financially feasible, and which results in the highest value of the property being valued *(IVS, 2003),* the model constructed can assist in presenting the *appropriate justification* and *physical possibility* of the alternative use, for an office building in London, which is suggested to be the highest and best use for that building.

6.3 Weaknesses and Limitations

Whilst constructing the Adaptive Reuse Appraisal Model and evaluating the case study, the limitations of the methodology and the insufficient or inadequate available data became evident.

The MCDA approach, does not provide the right answer by default, neither will it follow the optimization paradigm. Despite its rigorous analytical process, it does not provide an objective recommendation because of the subjectivity that it is inherent in the choice of criteria and the relative weighting coefficients (Belton & and Stewart, 2002). It is instead a simple aid to the decision making process of identifying the most adequate alternative uses to a certain building and location.

From this, a fragile point in the investigation arises immediately because the decision maker is exclusively the researcher, a fact aggravated by the significant number of alternatives and criteria considered. This aspect already compromised the selection of the criteria and the construction of the descriptors. It became evident that it was not possible for the researcher to accurately cover each point of view of each decision maker on each criterion. As demonstrated in the interviews (A8), the points of view are sometimes clearly contradictory. However, the nature and resources available to conduct the research dictated the current methodological approach, despite its recognized limitations, as a simplified and manageable process. Nevertheless, the appraisal model constructed could have been given to each decision maker, each one individually proceeding with the weighting process. However, their input would have been required for the construction of the model from the start.

Since the MACBETH approach does not allow variations on the weighting process on each criterion to each alternative, this process was improvised by constructing individual local and global performance tables to each alternative. The weights attained were considered to be inconclusive, (5.2.1) compromising the results obtained on the location criteria. Consequently, no adequate sensitivity and robustness analysis was carried out.

Regarding the selection of the alternatives, although practical, it forced many assumptions to be carried out on each alternative use, in particular on distinguishing the *prime* to *secondary* groups. Although these two intervals allow a flexible range, some performances could only be accessed through comparison, assuming that the *prime* will always demand a higher performance across all criterion.

The preferences are, as a result also inaccurate, in part because of the unavailability and contradictory information, in part because it is expected that each use may have more than one preference, i.e. equally *good* which may depend on various factors such as the user, the market or the different specific *uses* of each alternative use.

Finally, a cost-benefit criteria should have been considered from the start, anticipating its determinant factor on any development, further enabling the usability and utility of the model constructed.

6.4 Emerging Themes

Because of the relevance of the subject involved and the variety of themes embraced, a significant number of future research has arisen during the investigation.

Regarding the Adaptive Reuse Appraisal Method, it would be worth continuing the investigation by interviewing the different *decision agents* so that their unique point of view is considered in the definition of criteria and construction of the descriptors. Furthermore, each insight could also be considered in the production of recommendations, either by allowing the model to provide the distinct points of view or by summarizing their differences in one single judgment. It would be required though, for a decision maker, to understand which point of view is most comprehensive or to judge the relative weight of each decision maker on each criterion, which may result in a complex and laborious process.

The performances of the alternative uses could be further researched, carrying out interviews on the *decision agents*, or by surveying a significant number of case studies. The two groups of uses excluded from this paper, because of resources management and insufficient data gathered, could also be researched, i.e., uses related to health and care such as hospitals or medical centres and uses related to educational purposes, such as high schools, universities or adult training.

The MACBETH approach could be further researched in order to allow a relative weighting process per alternative, whilst enabling the same sensitivity and robustness analysis.

The whole research could at last become available in a software for ease of use and its wider divulgation. The results could then be crossed with accurate construction costs and real estate values, , the cost and benefits of the adaptive reuse and the efficiency of the adaptive reuse tools are determined.

Regarding office buildings and their adaptive reuse, a number of themes have also arisen:

a) As a prompt manner to respond to obsolescence in offices, it should be researched how much its utility can be improved by modifying its internal layout only, adjusted to a different level or nature of occupation, considering the changing work patterns observed for more than a decade.
b) Research should also be carried out dedicated to understanding the economics of an office building developed in the last decades once it becomes listed. Although rare, a few recent examples seem to justify the understanding and the consequences of such statuses on their future adaptability and, consequently, their value.
c) The case study building height alerted for the adaptive reuse of large developments, in particular high-rise office towers, ditto, skyscrapers. It is expected that their adaptive reuse should involve specific considerations because of the amount of area involved or its linear distribution.
d) At last, the literature showed that consequences might arrive from people working away from their typical spaces. Regardless of whether or not it is an efficient working method, measuring the consequences for the built environment becomes urgent. Vacant space might increase and housing might be allocated even further from the city centre, since commuting becomes less necessary. As a consequence it might be necessary to enlarge the average house area if people are meant to stay at home more, or introduce the *office room* in the standard housing layout.

Figure 39 : Architectural Office in London, 1960´s. *Source : LMA*

8 References

8.1 Bibliography

Adair, A. et al., 2009. *The Global Financial Crisis; Impact on Property Markets in the UK and Ireland,* s.l.: University of Ulster, Real Estate Initiative.

Anderson, J. & Mills, K., 2002. *Refurbishment or Redevelopment of Office Buildings? Sustainable comparisons.* London: CRC Ltd..

APR, Clutons & Garnier&Theobold, 1992. *The Home Office Report,* London: Publishing Business.

Bana e Costa, C. A., 1992. *Structuration, construction et explotation dún modele multicritiére dáide à la décision..* Technical University of Lisbon: Phd Thesis.

Bana e Costa, C., De Corte, J. & Vansnick, J., 2003. *MACBETH.* s.l.:LSE OR Working Paper.

Bana e Costa, C. & Vansnick, J., 1997. Applications of the MACBETH approach in the framework of an additive aggregation model.. *Journal of Multi-Criteria Decision Analysis,* Volume 6(2), pp. 107-114.

Bana e Costa, C. & Vincke, P., 1995. Measurin credibility of compensatory preference statements when trade-offs are interval determined.. *Theory and Decision,* Volume 39(2), pp. 127-155.

Barlow, J. & Gann, D., 1993. *Offices into Flats.* London: Joseph Rowntree Foundation.

Barras, R. & Clark, P., 1996. Obsolescence and performance in the Central London office market. *Journal of Property Valuation & Investment,* Volume 14, No. 4, pp. 63-78.

Barrett, V. & Blair, J., 1982. *How to Conduct and Analyze Real Estate Market and Feasibility Studies.* New York: Van Nostrand Reinhold.

Barrett, V. & Blair, J., 1982. *How to Conduct and Analyze Real Estate Market and Feasibility Studies.* New York: Van Nostrand Reinhold.

Battle, T., 2003. *The Commercial Offices Handbook.* London: RIBA Publishing.

Baum, A., 1991. *Property Investment, Depreciation and Obsolescence.* London: Routledge.

Baum, A. E., 1988. Depreciation and Property Investment Appraisal. In: A. a. N. N. MacLeary, ed. *Property Investment Theory.* London: Spon.

Baum, A. & Mackmin, D., 1989. *The Income Approach to Property Valuation.* 3rd ed. London: Routledge.

Baxter, W., 1971. *Depreciation.* London: Sweet and Maxwell.

BCO, 2009. *BCO Guide 2009: Best Practice in the Specification for Offices..* London: British Council for Offices.

Belton, V. & and Stewart, T. J., 2002. *Multiple Criteria Decision Analysis.* Dordrecht: Kluwer Academic Publishers.

Brand, S., 1994. *How Buildings Learn.* London: Phoenix llustrated.

Bryson, J., 1997. Obsolescence and the Process of Creative Reconstruction. *Urban Studies,* Volume 34 (9), pp. 1439-1458.

Byrne, T. & Kostin, D., 1990. London Office Market II : Breaking the Code. *Solomon Brothers Bond Market Research - Real Estate*, August.

CALUS, 1974. *The Property Development Process. The future of the Office Market.,* Derby: The College of Estate Management.

Carvalho, J., 2005. *Planeamento Urbanístico e Valor Imobiliário.* Cascais: Principia.

Christie, I., 1974. Covent Garden, approaches to urban renewal.. *Town Planning Review*, 45(1).

CIAM, 1946. *La Charte d´Athens or The Athens Charter - Congress Internacionaux d´Arhchitecture Moderne, 1933.* s.l.:The Library of the Graduate School of Design, Harvard University.

Cowan, P., 1963. Studies in the growth, change and ageing of buildings. *Transactions of the Bartlett Society*, pp. 56-59.

Cowan, P., 1963. Studies in the growth, change and ageing of buildings.. *Transactions of the Bartlett Society,* Volume 1, pp. 56-59.

Cowen, P. et al., 1969. *The Office : A Facet of Urban Growth.* London: Heinemann Educational Books Ltd..

Crown, 1990. *Listed Buildings and Conservation Areas Act.* London: Her Majesty´s Stationery Office and Queen´s Printer of Acts of Parliament.

DCA, 2013. *Portland House, Westminster City Council Planning Application.* Available from www [Accessed 30.03.2013]: <http://idoxpa.westminster.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=MJCI2HRP01R00> ed. London: David Chipperfield Architects.

DCLG, 2009. *Multi Criteria Analysis: a manual.* London: Department for Comunities and Local Government.

Department of the Environment; URBED, 1987. *Re-using Redundant Buildings: Good Practice in urban regeneration.* London: Urban and Economic Development Ltd..

Derycke, P., 1981. *Economia y Planification Urbana.* Madrid: Instituto de Estudios de Administration Local.

DETC, 2000. *Conversion and Redvelopment: Process and Potential.* London: Department of the Environment, Transport and Regions.

DETR, 2000. *Conversion and Redevelopment: Process and Potential.* London: Department of the Environment, Transport and the Regions.

Dogson, J., Spackman, M., Pearman, A. & Philips, L., 2000. *DTLR Multi Criteria Decision Analysis Manual.* London: Office of the Deputy Prime Minister.

Douglas, J., 2006. *Building Adaptation.* 2nd ed. Oxford: Elsevier Ltd..

Douglas, J., 2006. *Building Adaptation.* 2nd Edition ed. New York: Spon Press.

DTZ , 2013. *Property Times Central London,* London: DTZ Research.

DTZ, 2012. *London Office to Residential Conversions,* London: DTZ Research.

Fainstein, S., 2001. *The City Builders - Property Development in New York and London, 1980-2000.* Oxford: Blackwell.

Ferreira, J., Ramos, I. & Silva, J., 2013. *What to do when all seems lost? Exploring alternative options using a multi-criteria decision aid..* Dublin, AESOP-ACSP Joint Congress .

Freer, N., Lawson, D. & Salter, M., 1999. *Conversion of Redundant Commercial Space to Residential Use.* London: British Property Federation.

Gann, D. & Barlow, J., 1996. Flexibility in building use: the technical feasibility of converting redundant offices into flats.. *Construction Management and Economics,* Volume 14, pp. 55-66.

Gold, C. & Martin, A., 1999. *Refurbishment of Concrete Buildings:Structural and Services Options.* Berkshire: The Building Services Research and Information Association.

Graaskamp, J., 1981. *Fundamentals of Real Estate Development.* Washington DC: Urban Land Institute.

Hall, P., 1998. *Cities of Tomorrow: An Intellectual History of Urban PLanning and Desing in the Twentieth Century.* Oxford, UK; New York, USA: Blackwell.

Hausner, V., 1993. The future of urban redevelopment. *Royal Society of Arts Journal,* Volume 141, no. 5441, pp. 523 - 533.

Havard, T., 2008. *Contemporary property development.* London: RIBA Publishing.

Healey, P., 1997. A strategic approach to sustainable urban regeneration. *Journal of Property Development,* Volume 1, no.3, pp. 105-10.

Heath, T., 2001. "Adaptive re-use of offices for Residential Use: The Experiences of London and Toronto. *CITY, Vol.18; No.3*, pp. 173-185.

Hendershott, P. & MacGregor, B., 2000. *Estimating the rental adjustment process.* s.l.:National Bureau of Economic Research, Cambridge, MA..

Iselin, D. & Lemer, A., 1993. The Fourth Dimension in Building: Strategies for Minimising Obsolescence. In: B. R. Board, ed. *Committee on Facility Design to Minimize Premature Obsolescence.* Washington D.C.: National Academy Press.

IVS, 2003. *The International Valuation Standards Comitte.* [Online]
Available at: http://propertystandards.propertyinstitute-wa.com/documents/IVSC-3_000.pdf
[Accessed 04 03 2014].

Jones Lang la Salle, 2013. *Residential Eye. Central London Development,* London: Jones Lang la Salle.

Keeney, R., 1992. *Value-Focused Thinking: A Path to Creative Decisionmaking.* Harvard: Harvard University Press.

Keeney, R. & Raiffa, H., 1976. *Decisions with Multiple Objectives: Preferences and Value-Tradeoffs.* s.l.:John Willey & Sons.

Kincaid, D., 2002. *Adapting Buildings for Changing Uses - Guidelines for change of use and refurbishment.* London and New York: Spon Press Taylor & Francis Group.

LDA, 2010. *London Housing Design Guide.* London: London Development Agency.

Lewis, C. & Short, C., 1879. *A Latin Dictionary.* Oxford: Claredon Press.

Lichfield, N. & Partners, 2011. *Departments to Apartments,* London: s.n.

Lichfield, N., 1988. *Economics in Urban Consevation.* Cambridge: Cambridge University Press.

Lichfield, N., 1996. *Community Impact Evaluation.* London: University College London Press.

Littleford, D., 2012. *Metric Handbook, Planning and Design Data.* 4th Edition ed. Oxford: Taylor and Francis.

Markus, A., 1979. *Building conversion and rehabilitation; designing for changing in building use.* London: Newnes-Butterworth.

Marriott, O., 1967. *The Property Boom.* London: Hamish Hamilton.

Mateus, R., Ferreira, J. & Carreira, J., 2008. Multicriteria decision analysis (MCDA): Central Porto high-speed railway station. *European Journal of Operational Research*, 187, pp. 1-18.

Matthiessen, L. & Morris, P., 2007. *Cost of Green Revisited,: Reexamining the Feasibility and Cost Impact of Sustainable Design in Light of Increased Market Adoption,* London: Davis Langdon.

McKee, W., 1996. The changing commercial property market and the relationship between the landlordand tenant in the future.. *Proceedings ot the British Institute of Facilities Management Conference*, 17-18 September.

Miles, M. et al., 1991. *Real Estate Development: Principles and Process.* Washington DC: Urban Land Institute.

Millington, A., 2000. *Property Development.* London: Estates Gazette Ltd.

More, C., 2000. *Understanding the Industrial Revolution.* London: Routledge.

Murphy, S., 1984. *Continuity and Change : Building in the City of London 1834 - 1984.* London: Corporation of London.

Neufert, E. & Neufert, P., 2012. *Neufert Architect´s Data.* 4th ed. Oxford: Wiley-Blackwell.

Nobbs, P., 1935. Architectural Economics Design. *The Journal, Royal Institute of Canada,* pp. 1-3.

Nutt, B., Walker, B. & Holliday, S. a. S. D., 1976. *Housing Obsolescence.* Hants: Saxon House.

Oswald, A., 2009. We´re going back to work - but will we be siting comfortably ?. *The Times.*

Philips, L. & Stock, A., 1984. A theory of requisite decision models. *Acta Psychologica 56,* Volume 56, pp. 29-48.

PKF, 2001. *Hotel Design and Construction in the UK.* London: Pannel Kerr Forster.

Ratcliffe, J., Stubbs, M. & Keeping, M., 2006. *Urban Planning and Real Estate Development.* 3rd ed. London: Routledge.

RICS, 1997. *Overcrowded, Under-utilized or Just Right? Report of a study of office occupational densities..* London: Royal Institution of Chartered Surveyors.

RICS, 1998. *Refurbishment in the Office Sector 1997/8. The Connaught Report.* London: Royal Institution of Chartered Surveyors.

RICS, 2002. *Forecasting Office Supply and Demand.* London: Royal Institution of Chartered Surveyors.

RICS, Westminster, U. o., Grimley & Research, L. R., 1998. *Back to the Centre.* London: Royal Institute of Chartered Surveyors.

Roberts, P. & Sykes, H., 2000. *Urban Regeneration: A Handbook.* London: SAGE Publications.

Rose, J., 1985. *The Dynamics of Urban Property Development.* London: E&FN Spon.

Rosen, K., 1984. Toward a model of the office building sector. *AREUA Journal,* Volume 12, pp. 261-269.

Rudlin, D., 1998. *Tomorrow: A Peaceful Path To Urban Reform.* s.l.:URBED.

Salway, F. W., 1986. *Depreciation of Commercial Property,* s.l.: CALUS Research Report.

Sauer, A., 2003. *Office to Residential Conversions in London: An analysis at the strategic and the local level,* London: Master Thesis in Town and Country Planning at University College London.

Scott, P., 1996. *The Property Masters: A history of the British commercial property sector.* New York: Taylor & Francis Group.

Sigworth, E. & Wilkinson, R., 1967. Rebuilding or Renovation ?. *Urban Studies,* 4(2), pp. 399-404.

Smith, M., Whitelegg, J. & Williams, N., 1998. Materials Intensity in the Built Environment. In: *Greening the Built Environment.* London: Earthscan Publications Ltd.

The Economist, 2013. Pillow Fight - The latest solution to the housing crisis is to turn offices into flats. *The Economist*, 16th March.

The Economist, 2014. The Housing Market . Cool it. *in http://www.economist.com/news/britain/21600728-property-prices-are-rising-swiftly-bank-england-may-intervene-cool-it?zid=295&ah=0bca374e65f2354d553956ea65f756e0*, 12 April.

The Economist, 2014. The Labour Market - Working it. *in http://www.economist.com/news/britain/21594988-striking-recovery-labour-market-and-problem-mark-carney-working-it*, 25th January.

Viollet-le-Duc, E., 1854. *The Foundations of Architecture. Selections from the Dictionnaire raisonné.* New York, 1990: George Braziller.

Wheaton, W., Torto, R. & Evans, P., 1997. The cyclical behaviour of the national office market. *Journal of Real Estate Economics and Finance,* Volume 15, pp. 77-92.

Wilkinson, S., Reed, R. & Cadman, D., 2008. *Property Development.* 5th ed. New York: Routledge.

Wofford, L., 1983. *Real Estate.* New York: John Willey.

8.2 Images and Graphics Sources

Figures : 1 – 5; 19; 21; 22; 39

Physically accessed from the London Metropolitan Archive (LMA)

Catalogues, and consulted online [Accessed 04.04.2014; 05;04.2014; 06;04.2014]

< http://search.lma.gov.uk/scripts/mwimain.dll/144/LMA?LOGONFORM>

Figure 6 : [image online]Available www : [Accessed 03.04.2014]

<http://www.magnumphotos.com/image/LON9821.html#/SearchResult&FT=LON9821&SEARCH=1&VBID=2K1HZOQ8SRZJ7K>

Figure 7 : [image online] Available www : [Accessed 03.04.2014]

< http://newlandchase.com.cn/index.php/about_us_cn>

Figure 8 : [image online]Available www : [Accessed 03.04.2014]

< http://www.murphyz.co.uk/tag/building/>

Figure 9; 12 : [images online] Available www : [Accessed 15.04.2014]

<http://www.propertyweek.com/Journals/Builder_Group/Property_Week/7_May_2010/attachments/Central%20London%20Offices%20MarketView_Q12010.pdf>

Figure 10 : [image online] Available www : [Accessed 15.04.2014]
<http://www.joneslanglasalle.eu/EMEA/EN-GB/Pages/ResearchDetails.aspx?ItemID=10572>

Figure 11; 13 – 16 : [image online] (DTZ , 2013) Available www : [Accessed 15.04.2014]
<http://www.dtz.com/Global/Research/DTZ+Insight+Office+to+residential+conversion+October+2012>

Figure 17 : [image online] Available www : [Accessed 03.04.2014]
<http://www.magnumphotos.com/C.aspx?VP3=SearchResult&VBID=2K1HZOQM4TXJ1H&SMLS=1&RW=1920&RH=965>

Figure 18 : [image online] Available www: [Accessed 14.04.2014]
<http://www.trade2win.com/articles/878-trading-arcades/p/1>

Figure 19 : [image online] Available www: [Accessed 14.04.2014]
http://www.museumoflondonprints.com/image/129169/arthur-cross-fred-tibbs-emergency-water-supply-at-queen-victoria-street-1940s

Figure 20 : [image online] Available www: [Accessed 14.04.2014]
https://www.nytsyn.com/images/photos/898860.html

Figure 23; 24 : Alfred Hall Monaghan Morris (AHMM) Architects

Figures : 25 - 38; 40 - 42; 44 - 51 : Available from www: [Accessed 15.03.2013]
<http://idoxpa.westminster.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=MJCI2HRP01R00>

Figure 43 : [image online] Available www : [Accessed 14.04.2014]
<http://www.gsecg.com/granada-commercial-secondary-glazing-case-study-portland-house-victoria>

Figure 52 : Available from www: [Accessed 15.03.2013]
< http://www.shelterarchitecture.com/livebetter/wp-content/uploads/2013/10/shear-layers.jpg>

A Appendices

A.1 Adaptive Reuse Appraisal Model - Alternative Uses Selected

CUC - University College London, 2002; UCO - Town and Country Planning, 2006
SIC - Standard Industrial Classification

Group O.S	**Office Secondary - Business, Administration, Research and Services, Secondary Category**
CUC. 33	Other services activities not elsewhere classified
	SIC 93.05, UCO – A2 (Financial and Professional Services)
CUC. 34	Office machinery and computers
	SIC 30, UCO – A2 (Financial and Professional Services)
CUC. 35	Medical, precision and optical instruments, watches and clocks
	SIC 33, UCO – B1 (Business)
CUC. 36	Retail sale not in stores
	SIC 52.6, UCO – B1 (Business)
CUC. 37	Post and courier activities
	SIC 64.1, UCO – B1 (Business)
CUC. 38	Finance, insurance and real estate industry, back office
	SIC 65/70a, UCO – B1 (Business)
CUC. 39	Finance, insurance and real estate industry, principal
	SIC 65/70b, UCO – B1 (Business)
CUC. 40	Computer and related activities
	SIC 72, UCO – B1 (Business)
CUC. 41	Research and development
	SIC 73, UCO – B1 (Business)
CUC. 42	General business activities and services
	SIC 74, UCO – B1 (Business)
CUC. 43	Public administration and defence; compulsory social security
	SIC 75, UCO – B1 (Business)
CUC. 46	Social work activities in accommodation
	SIC 85.3, UCO – B1 (Business)
CUC. 47	Activities of membership organisations not elsewhere classified
	SIC 91, UCO – B1 (Business)
CUC. 48	Radio and television activities
	SIC 92.2, UCO – B1 (Business)
CUC. 50	Extraterritorial organisations and bodies
	SIC 99, UCO – B1 (Business)
Group O.P	**Office Prime - Business, Administration and Services, Prime Category**
CUC. 33	Other services activities not elsewhere classified
	SIC 93.05, UCO – A2 (Financial and Professional Services)
CUC. 34	Office machinery and computers
	SIC 30, UCO – A2 (Financial and Professional Services)
CUC. 36	Retail sale not in stores
	SIC 52.6, UCO – B1 (Business)
CUC. 39	Finance, insurance and real estate industry, principal
	SIC 65/70b, UCO – B1 (Business)
CUC. 40	Computer and related activities
	SIC 72, UCO – B1 (Business)
CUC. 41	Research and development
	SIC 73, UCO – B1 (Business)

CUC. 42	General business activities and services
	SIC 74, UCO – B1 (Business)
CUC. 43	Public administration and defence; compulsory social security
	SIC 75, UCO – B1 (Business)
CUC. 48	Radio and television activities
	SIC 92.2, UCO – B1 (Business)
CUC. 49	News agency activities
	SIC 92.4, UCO – B1 (Business)
CUC. 50	Extraterritorial organisations and bodies
	SIC 99, UCO – B1 (Business)

Group R.S **Residential Secondary - Residential, Secondary Category**

CUC. 2	Residential – multiple occupancy
	SIC 100.2, UCO – C3 (Dwelling Houses)

Group R.P **Residential Prime – Residential, Prime Category**

CUC. 2	Residential – multiple occupancy
	SIC 100.2, UCO – C3 (Dwelling Houses)
CUC. 3	Private households with employed persons
	SIC 95, UCO – C3 (Dwelling Houses)

Group H.S **Hotel Secondary - Hotels and Other Accommodations, Secondary Category**

CUC. 51	Hotels, low cost
	SIC 55.1/2a, UCO – C1 (Hotels and Hostels)
CUC. 52	Hotels, standard to luxury
	SIC 55.1/2b, UCO – (Hotels and Hostels)
CUC. 53	Higher education – residential
	SIC 80.3b, UCO – (Hotels and Hostels)

Group H.P **Hotel Prime - Hotels and Other Accommodations, Prime Category**

CUC. 52	Hotels, standard to luxury
	SIC 55.1/2b, UCO – (Hotels and Hostels)

Group RE **Retail - Retail, Leisure, Entertainment, Food and Beverage**

CUC. 5	Retail sale in non-specialised stores, large, >50 km2
	SIC 52.1b, UCO – A1 (Shops)
CUC. 7	Retail sale in specialised stores
	SIC 52.2/4.7, UCO – A1 (Shops)
CUC. 8	Activities of travel agencies and tour operators; tourist assistance activities
	SIC 63.3, UCO – A1 (Shops)
CUC. 11	Restaurants, bars, pubs, canteens
	SIC 55.3/5, UCO – A3 (Food and Drink)
CUC. 12	Food and beverage
	SIC 15, UCO – B2 (General Industry)
CUC. 32	Gambling and betting activities
	SIC 92.71, UCO – A2 (Financial and Professional Services)
CUC. 64	Other entertainment activities
	SIC 92.3, UCO – D6 (Assembly and Leisure)
CUC. 66	Physical well-being activities
	SIC 93.04, UCO – D6 (Assembly and Leisure)

A.2 Case Study Additional Images , Drawings and Diagrams

Figure 40 : Stag brewery around 1900 (DCA, 2013)

Figure 41 : Stag Brewery and Portland House during Construction (DCA, 2013)

Figure 42 : Portland House, northwest view, (DCA, 2013)

Figure 43 : Portland House, Interior view of typical floor102. *Source: www*

[102] http://www.gsecg.com/granada-commercial-secondary-glazing-case-study-portland-house-victoria

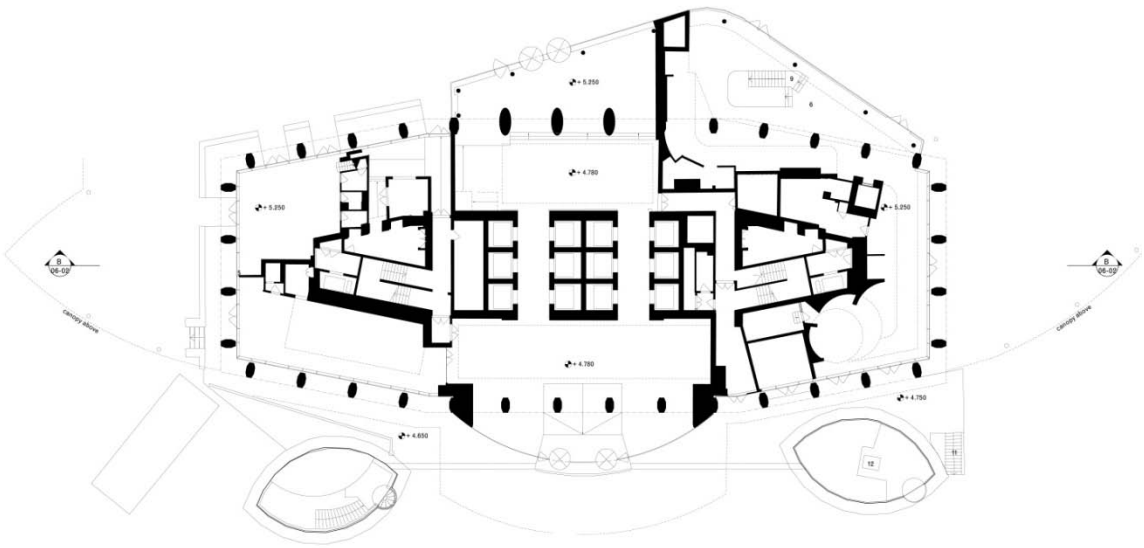


Figure 44 : Portland House, Ground Floor Plan, Existing (DCA, 2013)

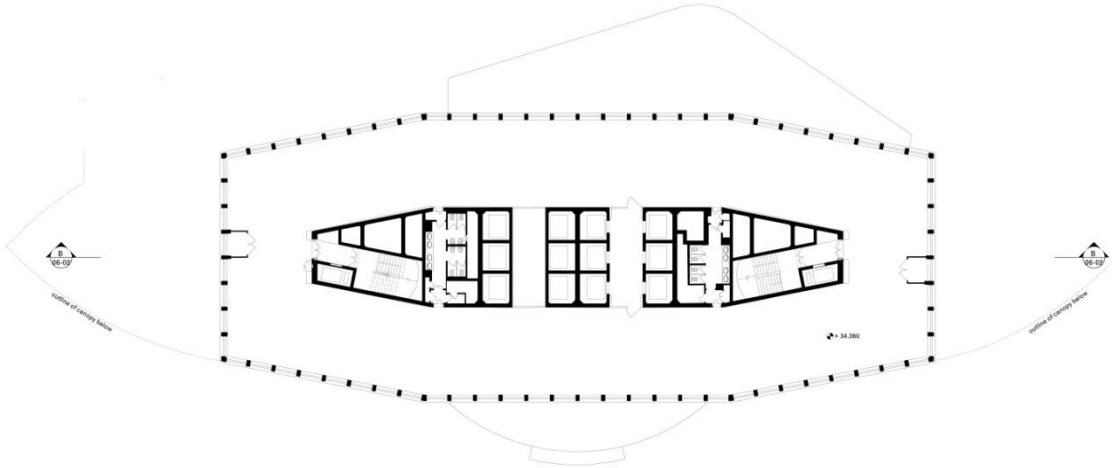


Figure 45 : Portland House, Typical Floor Plan 1, Existing (DCA, 2013)

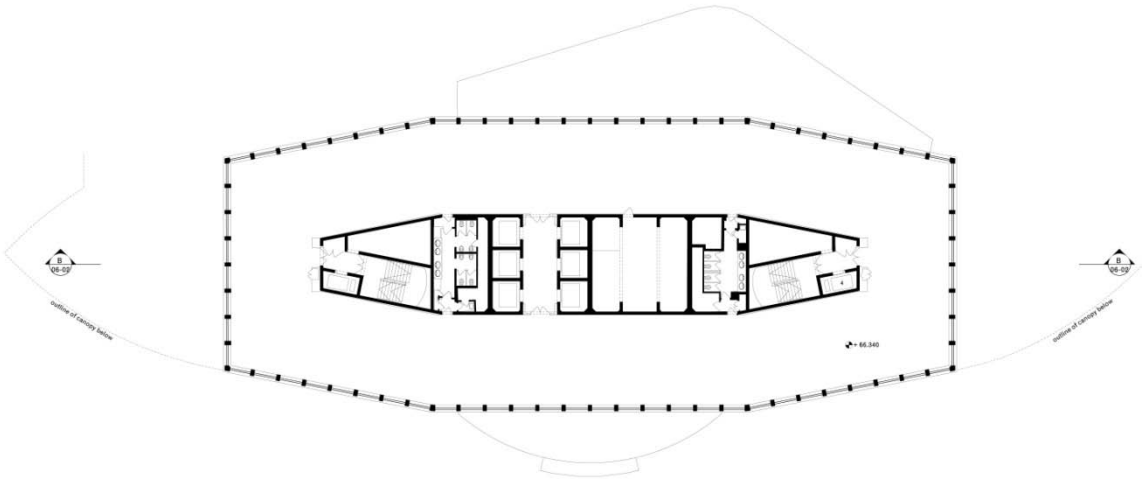


Figure 46 : Portland House, Typical Floor Plan 2, Existing (DCA, 2013)

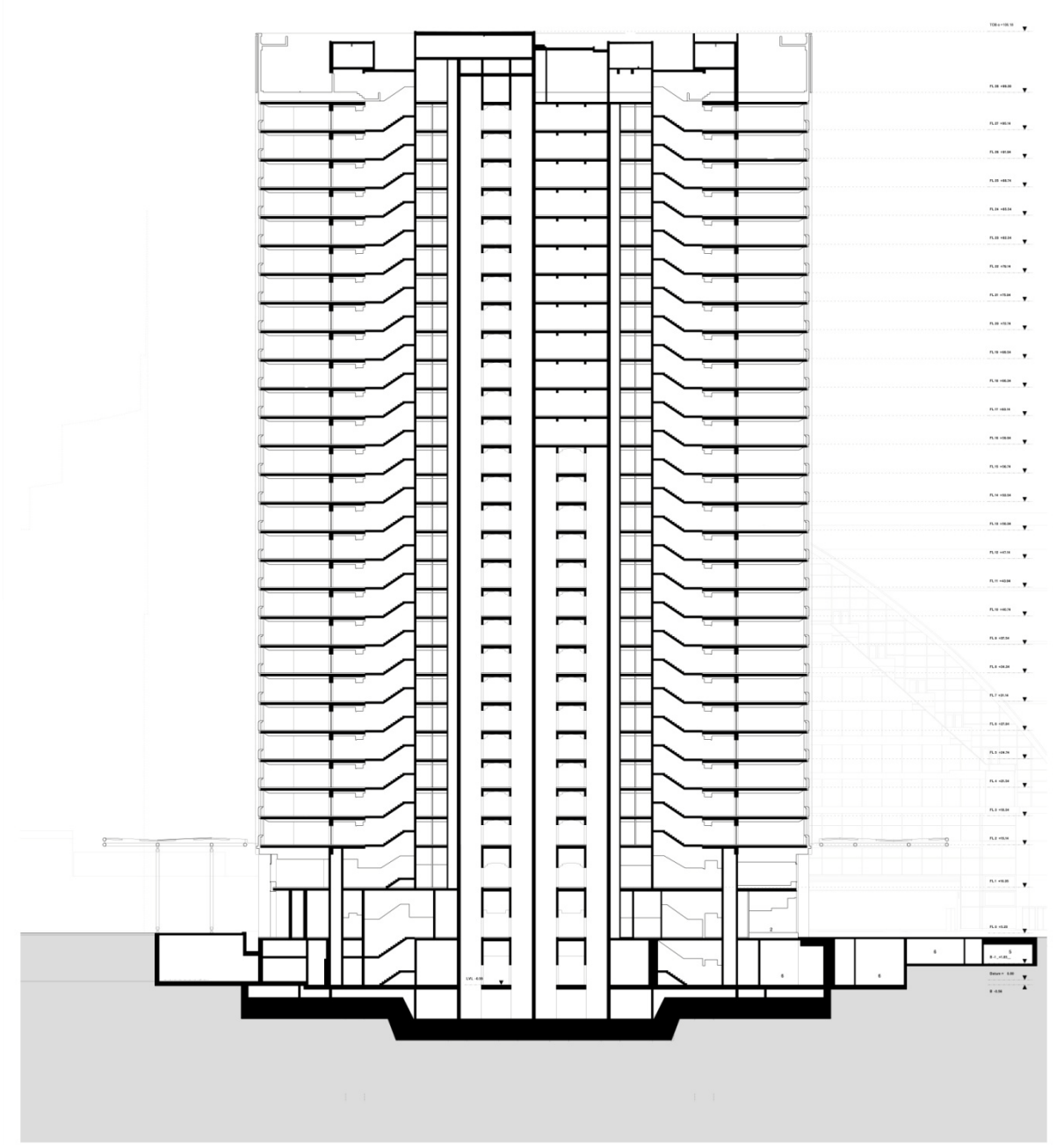


Figure 47 : Portland House, Long Section, Existing (DCA, 2013)

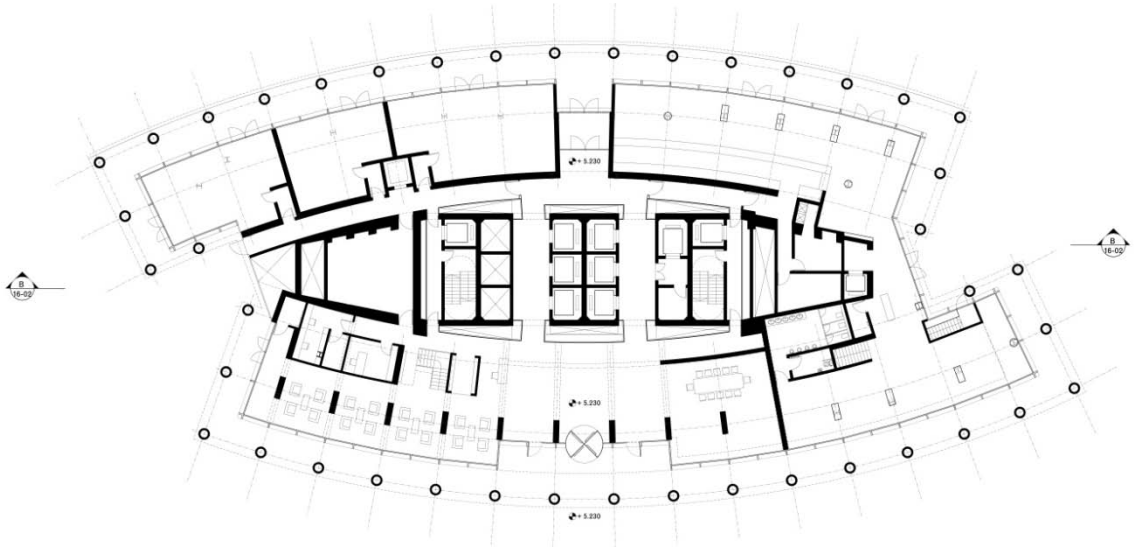


Figure 48 : Portland House, Ground Floor Plan, Proposal (DCA, 2013)

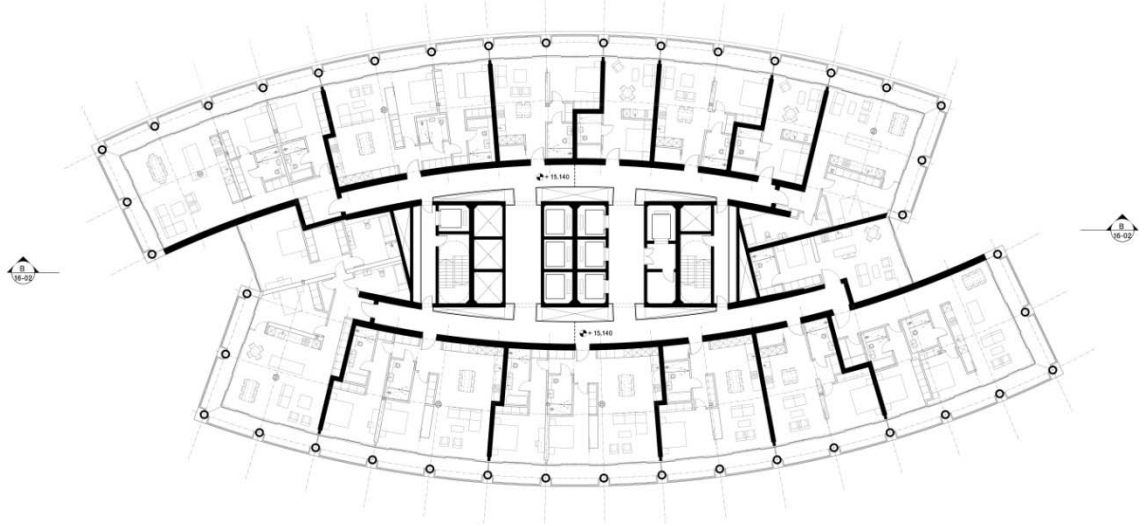


Figure 49 : Portland House, Typical Floor Plan 1, Proposal (DCA, 2013)

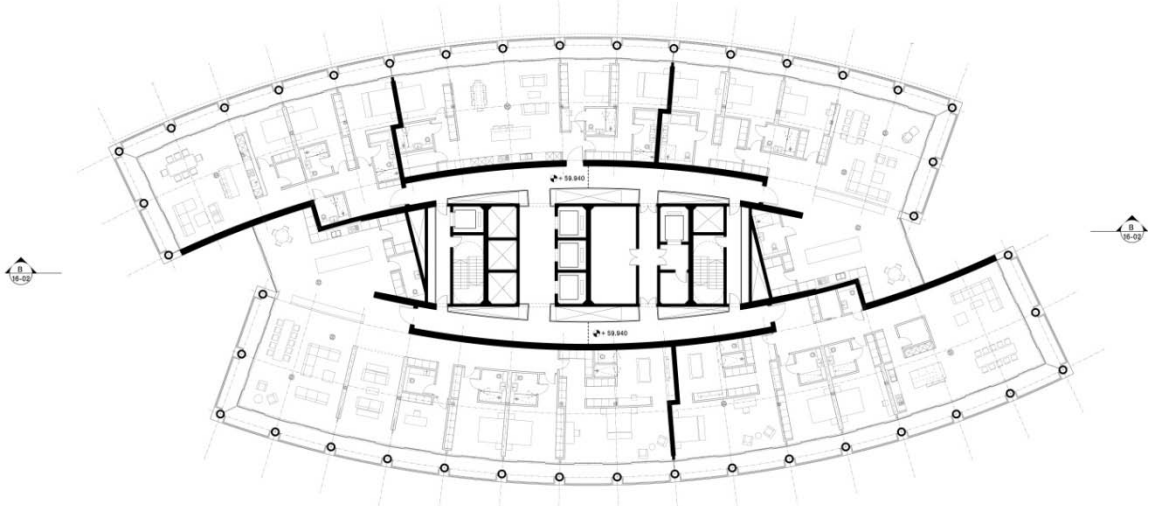


Figure 50 : Portland House, Typical Floor Plan 1, Proposal (DCA, 2013)

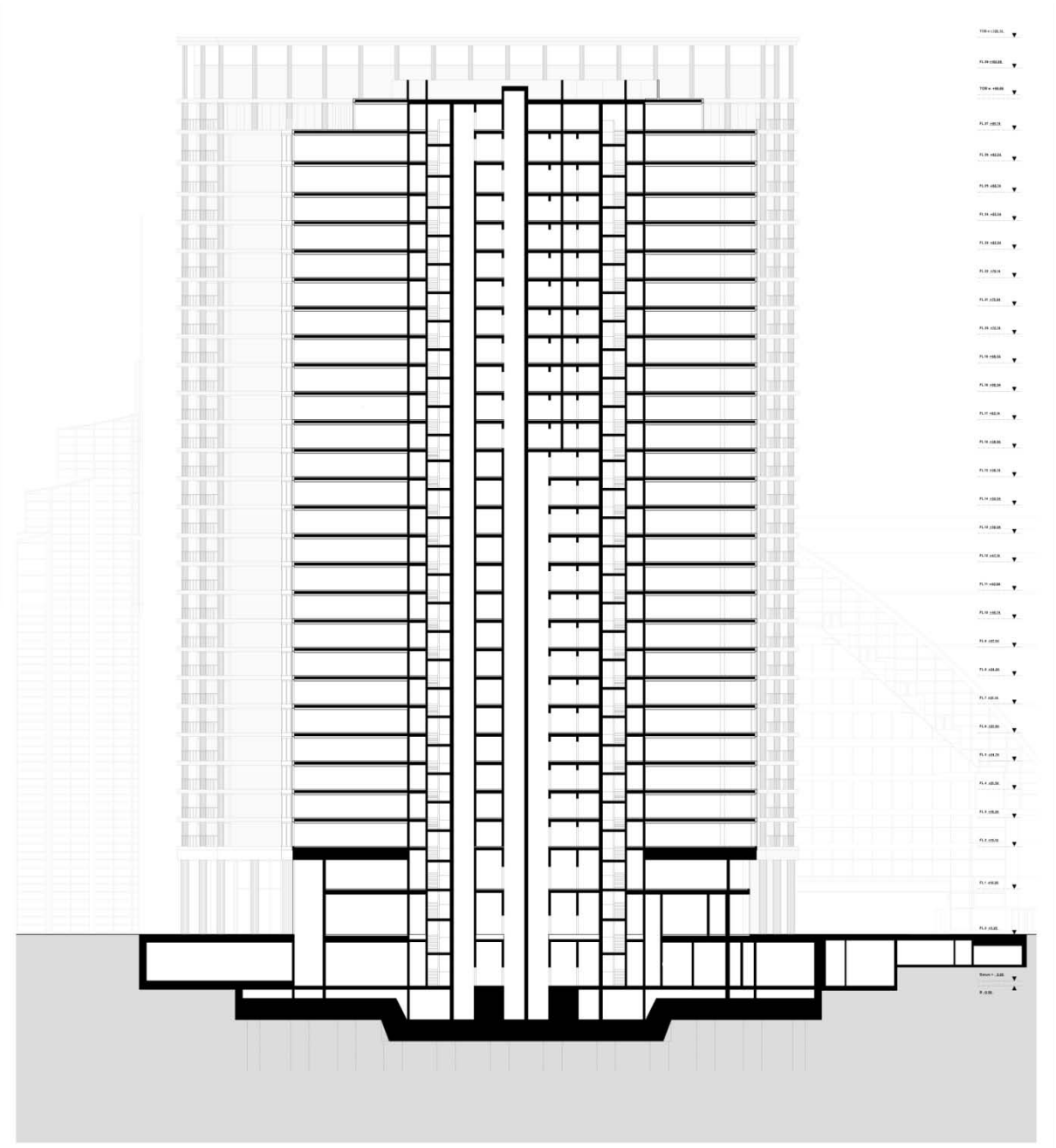


Figure 51 : Portland House, Long Section, Proposal (DCA, 2013)

A.3 Case Study Interviews

A.3.1 Questionnaire Letter of Intent Template

Emanuel Afonso dos Santos Rebelo
emanuel.rebelo@ist.utl.pt
07428837009
March 2014

Dear Mr. / Mrs. (person or firm involved)

RE : Participation in Questionnaire to Master Thesis in Architecture

My name is Emanuel Afonso Rebelo, I am a Senior Project Architect at one of the leading architectural firms in London and I was referred to you by (name of contact person). I am currently finalizing a Master Degree Dissertation in Architecture at Technical Superior Institute (IST) Lisbon, one of the largest and most reputed engineering and technology universities in Europe.

The thesis reflects on adaptive reuse of office buildings in London. The main objective is to construct a Multi Criteria Decision Analysis that can assist architects, developer´s, building owners, investors or even planners to briefly, and yet promptly, appraise the potential value of a redundant office building to be converted to other uses. The selected case study was the remarkable conversion proposal of Portland House, Bressenden Place, SW1, by Land Securities and David Chipperfield Architects.

In this sense, I would be very interested if you could participate on this short questionnaire that is being given to the different decision makers involved in the adaptive reuse, so each point of view is compared and the results confronted with the Adaptive Reuse Appraisal Model constructed.
I have attached the questionnaire to this letter for your reference.

I would greatly value any insight you could offer. I would be very grateful If you could have time to speak with me in person, over the phone, or even by email, I would very much appreciate it. Please let me know your availability in the upcoming weeks.

Thank you for your time and consideration and I look forward to hearing from you soon.
Sincerely,

Emanuel Afonso Rebelo

1. *The office sector is one of the industries that has evolved the most in the last century with office buildings radically improving as a consequence. Which aspects do you personally consider to have changed the most and which ones do you forecast to face change in the upcoming decades ?*

2. *If changes in the office sector are expected to continue, do you consider obsolescence in office buildings as something inevitable for recent developments in the next decades or are new buildings increasingly becoming better planned and more flexible?*

3. *What are the main barriers that you would remark in the adaptive reuse of obsolete office buildings to other uses ? And what were the greatest risks involved?*

4. *What are the specific requirements in your work field on the approach towards an adaptive reuse of an office building ? Where is it significantly different from an office refurbishment?*

5. *Certain aspects are determinant to the adaptability of an office building when being converted to other uses. From the locational criteria listed below please identify 3 aspects, you would first consider to evaluate the potential of their adaptive reuse.*

6. *Equally, from the physical criteria listed below, please identify 3 aspects you would first consider to evaluate the easiness of the adaptive reuse of an office building to other uses.*

7. *Do you consider that the quality of the proposal is as good and as valuable as if the site had been redeveloped ? Was redevelopment considered ?*

8. *Regarding the context of the proposal, is the Portland House clearly obsolete as offices today or is it truly a market opportunity? Have you considered other uses at all or is the prime residential the only viable use ?*

9. *What are the most negative aspects you recognize in the building as it is today and what were the main gains achieved with the proposal ?*

10. *What insights were you able to draw so far from the experience with the Portland House development , particularly in the field of adaptive reuse of obsolete office buildings ?*

A.3.2 Case Study Interview, Decision Maker : Structural Engineer

[03.04.2014]
Excerpt of the interview with Nina Tabink, Senior Structural Engineer at ARUP, London.

1. "Conversion and refurbishment of office buildings have been increasing vastly in London, in particular the ones from the 60s. There are three main reasons for that. The first one is because they are 50 years old now and there are plenty of them in Central London. The second one is because refurbishing [or converting] is cheaper, and faster, than new construction. Since the financial crisis a few years ago that refurbishing is a safer alternative and therefore more desired. Thirdly, planning permission is expected to be conceived for refurbishments, unlike new build, where the process is normally longer and more difficult."

2. "I think that for new buildings there are only two ways to go. Either they are completely specialist, designed and specified for that specific company, or they become increasingly more flexible, with better planning grids and greater ceiling heights, already thinking about their future purposes. [...] Buildings from the 60´s are flexible, in part because they are not so deep. However from the 70´s or 80´s the floor plates became so deep that it is extremely difficult to bring light and natural ventilation to the core. The trading floors in the City are an extreme example of this. The amount of heat that is generated from the inside of the building is as relevant as the temperatures outside"

3. [answered in 4.]

4. "[...] The skin is not really relevant because we can play with and change it or replace it. The bigger challenges lay on the core and the structure. [...] I think that the model you are constructing would be most helpful, in particular in the early stages of a project, and I am most interested in seeing the results. One thing we realized is the difficulty in understanding what the proposed use needs, so we know what we need to do to the existing building. We are not talking about changing the finishes, but the ceiling heights or the planning grids. We are talking about changing an entire building in order to perform better and that is a challenge for us [ARUP] since we don´t know from the start what is best for a specific use. [...] "

5. "Distance to Centre [A.1.1] ; Public Transport Access [A.1.2.1] ; Services Amenities [A.1.3.3] "

6. "Slab Height, TF [B.1.2.1] ; Building Depth [B.1.2.3] ; Column Grid [B.1.3.2]"

7. " The proposal by David Chipperfield is far more interesting than the existing building [...] and the expected building life is the same 50 years or more as if it was new. Redeveloping the site was never an option for Land Securities because the area that could have been achieved with a new

building could have never reached the present one. This is simply because planning permission would not be granted again to build that high due to its presence on the Royal Parks and since it looks down directly to Buckingham Palace Gardens".

8. " There have been multiple proposals in the past to refurbish the tower as offices but this was the first time that a conversion to residential is being proposed [...] because the market for residential is so high at the moment. The project is actually moving forward and contractors are already being appointed. [...] It is a very simple balance [to select the alternative use] between the available area, the area they can actually sell [the Net Internal Area] the construction costs and the market opportunity for that use. The best use will be the one that secures the highest profit to the developer. The profit you get from selling as apartments is much higher to rent it as offices"

9. " The façade is extremely poor, is leaking and it has no thermal performance. It has no shading, it is hot in the summer and cold in the winter. Moreover, it is already 50 years old. I personally like the look and the character of the 60´s buildings, brutal and honest, but for commercial purposes they are no longer adequate, they look rather old and outdated. The ground floor was considered just another floor without any interest. [...] All of this was improved with the proposal, except the ceiling heights [on the typical floors] which is the same 10 feet as it was. When it was built, no low ceilings were required and there was no need for raised floors since there weren't any computers at all. Once you put them in, the clear height you get is unacceptable."

10. " [...] They say that buildings are split in layers. You have the foundations, the structure, the core, the services, the façade, the fit out... Obviously, the deeper you go into those layers, the harder it becomes to change. Therefore, the key thing is to make the first layers right. Right dimensioned, right proportioned and right specified."

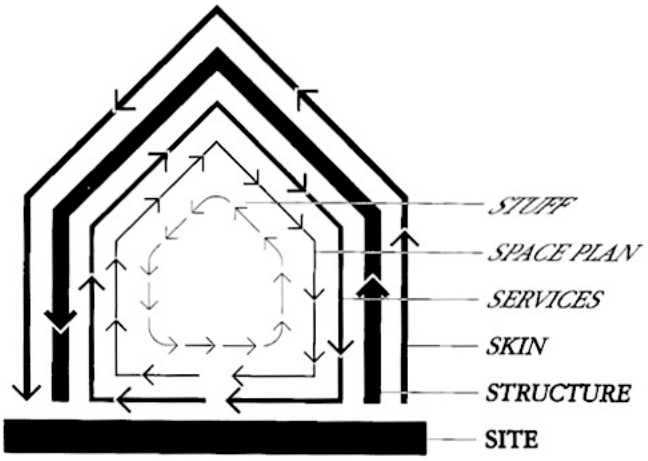


Figure 52 : Shearing Layers of Change, referred by Eng. Nina Tabink, *Source:* (Brand, 1994)

A.3.3 Case Study Interview, Decision Maker : Planning Officer

[06.04.2014]

Excerpt of the interview with Mathew Mason, Area Planning Officer at Westminster City Council, London.

1. " Large open floor plans are being required by current tenants; tenants seem to want energy efficient buildings; town centre locations are now popular ".

2. " Not sure."

3. " The deep floor plates; the lack of space; the design issues [of adapting the existing building to the preferences or requirements of the new use]

4. " Design considerations (externally); car parking and amenity space."

5. "Parking Provision [A.1.2.3]; Services Amenities [A.1.3.3]; Building Views [A.2.2]".

6. " Slab Height, TF [B.1.2.1]; Building Depth [B.1.2.3]; Daylight Factor [B.2.2.2]".

7. " In the case of Portland House, yes. The scheme provides a very high quality development, both in terms of the appearance of the building and the quality of the flats."

8. " The developer, Land Securities, would the best person to answer to that".

9. " The external appearance of the current Portland House building is very poor. The approved building will provide a much better looking building"

10. " Solar gain is an important issue; provision of outside space [e.g. balconies] can be achieved by careful design."

A.4 Case Study Location Appraisal

A.4.1 Local Values per Alternative Use

A.4.2 Performance Matrix of all Alternative Uses

Residential Secondary - Weighting Coefficients Global Values

	3rd Line	2nd Line	*Partial*	1st Line	*Total*	0 - 100	
A.1				*0,6*			
A.1.1		*0,0385*					
	1		*0,0385*		**0,0231**	2,31	*Distance to Centre*
A.1.2		*0,423*					
A.1.2.1	*0,6428*		*0,2719044*		**0,16314264**	16,314264	*Public Transport*
A.1.2.2	*0,2143*		*0,0906489*		**0,05438934**	5,438934	*Private Transport*
A.1.2.3	*0,1429*		*0,0604467*		**0,03626802**	3,626802	*Parking*
A.1.3		*0,2308*					
A.1.3.1	*0,0625*		*0,014425*		**0,008655**	0,8655	*Infrastructure*
A.1.3.2	*0,375*		*0,08655*		**0,05193**	5,193	*Cultural / Recreational*
A.1.3.3	*0,5625*		*0,129825*		**0,077895**	7,7895	*Services*
A.1.4		*0,3077*					
A.1.4.1.a	*0,28*		*0,086156*		**0,0516936**	5,16936	*Built Env. Facades*
A.1.4.1.b	*0,04*		*0,012308*		**0,0073848**	0,73848	*Built Env. Public*
A.1.4.2.a	*0,36*		*0,110772*		**0,0664632**	6,64632	*Natural Env. Parks*
A.1.4.2.b	*0,32*		*0,098464*		**0,0590784**	5,90784	*Natural Env. Trees*
A.2				*0,4*			
A.2.1		*0,5*					
A.2.1.1.a	*0,283*		*0,1415*		**0,0566**	5,66	*Street Env. Built*
A.2.1.1.b	*0,1698*		*0,0849*		**0,03396**	3,396	*Street Env. Natural*
A.2.1.2	*0,0566*		*0,0283*		**0,01132**	1,132	*Street Character*
A.2.1.3	*0,2641*		*0,13205*		**0,05282**	5,282	*Street Access*
A.2.1.4	*0,0378*		*0,0189*		**0,00756**	0,756	*Pedestrian Traffic*
A.2.1.5	*0,1887*		*0,09435*		**0,03774**	3,774	*Noise Levels*
A.2.2		*0,5*					
A.2.2.1	*0,0527*		*0,02635*		**0,01054**	1,054	*Building Presence*
A.2.2.2a	*0,2631*		*0,13155*		**0,05262**	5,262	*Build. Views Quality*
A.2.2.2b	*0,2631*		*0,13155*		**0,05262**	5,262	*Build. Views Quantity*
A.2.2.3	*0,4211*		*0,21055*		**0,08422**	8,422	*Buiding Orientation*
Total					*1*	*100*	

Residential Secondary - Weighting Coefficient Judgments and Local Values

A.1.1 Sub Criteria						Score
						100
A.1.2 Sub Criteria						
	A.1.2.1	A.1.2.2	A.1.2.3		Ranking	Score
Public Transport	Best				1st	**64,28**
Private Transport		Best			2nd	**21,43**
Parking			Best		3rd	**14,29**
Worst					4th	0
A.1.3 Sub Criteria						
	A.1.3.1	A.1.3.2	A.1.3.3		Ranking	Score
Infrastructure	Best				3rd	**6,25**
Cultural / Recreational		Best			2nd	**37,5**
Services			Best		1st	**56,25**
Worst					4th	
A.1.4 Sub Criteria						
	A.1.4.1.a	A.1.4.1.b	A.1.4.2.a	A.1.4.2.b	Ranking	Score
Built Env. Facades	Best				3rd	**28**
Built Env. Public		Best			4th	**4**
Natural Env. Parks			Best		1st	**36**
Natural Env. Trees				Best	2nd	**32**
Worst					5th	0
A.2.1 Sub Criteria						
	A.2.1.1.a	A.2.1.1.b	A.2.1.2	A.2.1.3	A.2.1.4	A.2.1.5	Ranking	Score
Street Env. Built	Best						1st	**28,3**
Street Env. Natural		Best					4th	**16,98**
Street Character			Best				5th	**5,66**
Street Access				Best			2nd	**26,41**
Pedestrian Traffic					Best		6th	**3,78**
Noise Levels						Best	3rd	**18,87**
Worst							7th	0
A.2.2 Sub Criteria						
	A.2.2.1	A.2.2.2a	A.2.2.2b	A.2.2.2			Ranking	Score
Building Presence	Best						4th	**5,27**
Build. Views Quality		Best					2nd	**26,31**
Build. Views Quantity			Best				2nd	**26,31**
Buiding Orientation				Best			1st	**42,11**
Worst							5th	0
A.1 Sub Criteria						
	A.1..1	A.1.2	A.1.3	A.1.4			Ranking	Score
Distance to Centre	Best						4t	**3,85**
Accessibility		Best					1st	**42,3**
Amenities			Best				3rd	**23,08**
Environment				Best			2nd	**30,77**
Worst							5th	0
A.2 Sub Criteria						
	A.2.1	A.2.2					Ranking	Score
Street Character	Best						1st	**50**
Building Position		Best					2nd	**50**
Worst							3rd	0
A Sub Criteria						
	A.1	A.2					Ranking	Score
Macro Location	Best						1st	**60**
Micro Location		Best					2nd	**40**
Worst							4th	0

Residential Prime - Weighting Coefficients Global Values

	3rd Line	2nd Line	*Partial*	1st Line	*Total*	0 - 100	
A.1				*0,55*			
A.1.1		*0,2609*					
	1		*0,2609*		**0,143495**	14,3495	*Distance to Centre*
A.1.2		*0,2174*					
A.1.2.1	*0,1*		*0,02174*		**0,011957**	1,1957	*Public Transport*
A.1.2.2	*0,3*		*0,06522*		**0,035871**	3,5871	*Private Transport*
A.1.2.3	*0,6*		*0,13044*		**0,071742**	7,1742	*Parking*
A.1.3		*0,1739*					
A.1.3.1	*0,0834*		*0,01450326*		**0,007976793**	0,7976793	*Infrastructure*
A.1.3.2	*0,6666*		*0,11592174*		**0,063756957**	6,3756957	*Cultural / Recreational*
A.1.3.3	*0,25*		*0,043475*		**0,02391125**	2,391125	*Services*
A.1.4		*0,3478*					
A.1.4.1.a	*0,3333*		*0,11592174*		**0,063756957**	6,3756957	*Built Env. Facades*
A.1.4.1.b	*0,0556*		*0,01933768*		**0,010635724**	1,0635724	*Built Env. Public*
A.1.4.2.a	*0,5*		*0,1739*		**0,095645**	9,5645	*Natural Env. Parks*
A.1.4.2.b	*0,1111*		*0,03864058*		**0,021252319**	2,1252319	*Natural Env. Trees*
A.2				*0,45*			
A.2.1		*0,5*					
A.2.1.1.a	*0,317*		*0,1585*		**0,071325**	7,1325	*Street Env. Built*
A.2.1.1.b	*0,2927*		*0,14635*		**0,0658575**	6,58575	*Street Env. Natural*
A.2.1.2	*0,0488*		*0,0244*		**0,01098**	1,098	*Street Character*
A.2.1.3	*0,0976*		*0,0488*		**0,02196**	2,196	*Street Access*
A.2.1.4	*0,0244*		*0,0122*		**0,00549**	0,549	*Pedestrian Traffic*
A.2.1.5	*0,2195*		*0,10975*		**0,0493875**	4,93875	*Noise Levels*
A.2.2		*0,5*					
A.2.2.1	*0,1*		*0,05*		**0,0225**	2,25	*Building Presence*
A.2.2.2a	*0,4*		*0,2*		**0,09**	9	*Build. Views Quality*
A.2.2.2b	*0,3*		*0,15*		**0,0675**	6,75	*Build. Views Quantity*
A.2.2.3	*0,2*		*0,1*		**0,045**	4,5	*Buiding Orientation*
Total					*1*	*100*	

Residential Prime - Weighting Coefficient Judgments and Local Values

A.1.1 Sub Criteria						Score
						100
A.1.2 Sub Criteria						
	A.1.2.1	A.1.2.2	A.1.2.3		Ranking	Score
Public Transport	Best				3rd	**10**
Private Transport		Best			2nd	**30**
Parking			Best		1st	**60**
Worst					4th	0
A.1.3 Sub Criteria						
	A.1.3.1	A.1.3.2	A.1.3.3		Ranking	Score
Infrastructure	Best				3rd	**8,34**
Cultural / Recreational		Best			1st	**66,66**
Services			Best		2nd	**25**
Worst					4th	0
A.1.4 Sub Criteria						
	A.1.4.1.a	A.1.4.1.b	A.1.4.2.a	A.1.4.2.b	Ranking	Score
Built Env. Facades	Best				2nd	**33,33**
Built Env. Public		Best			4th	**5,56**
Natural Env. Parks			Best		1st	**50**
Natural Env. Trees				Best	3rd	**11,11**
Worst					5th	0
A.2.1 Sub Criteria						
	A.2.1.1.a	A.2.1.1.b	A.2.1.2	A.2.1.3	A.2.1.4	A.2.1.5	Ranking	Score
Street Env. Built	Best						1st	**31,7**
Street Env. Natural		Best					2nd	**29,27**
Street Character			Best				5th	**4,88**
Street Access				Best			4th	**9,76**
Pedestrian Traffic					Best		6th	**2,44**
Noise Levels						Best	3rd	**21,95**
Worst							7th	0
A.2.2 Sub Criteria						
	A.2.2.1	A.2.2.2a	A.2.2.2b	A.2.2.2			Ranking	Score
Building Presence	Best						3rd	**10**
Build. Views Quality		Best					1st	**40**
Build. Views Quantity			Best				4th	**30**
Buiding Orientation				Best			2nd	**20**
Worst							5th	0
A.1 Sub Criteria						
	A.1..1	A.1.2	A.1.3	A.1.4			Ranking	Score
Distance to Centre	Best						2nd	**26,09**
Accessibility		Best					3rd	**21,74**
Amenities			Best				4th	**17,39**
Environment				Best			1st	**34,78**
Worst							5th	0
A.2 Sub Criteria						
	A.2.1	A.2.2					Ranking	Score
Street Character	Best						1st	**50**
Building Position		Best					2nd	**50**
Worst							3rd	0
A Sub Criteria						
	A.1	A.2					Ranking	Score
Macro Location	Best						1st	**55**
Micro Location		Best					2nd	**45**
Worst							4th	0

Hotel Secondary - Weighting Coefficients Global Values

	3rd Line	2nd Line	*Partial*	1st Line	*Total*	0 - 100	
A.1				*0,6*			
A.1.1		*0,12*					
	1		*0,12*		**0,072**	7,2	*Distance to Centre*
A.1.2		*0,36*					
A.1.2.1	*0,7*		*0,252*		**0,1512**	15,12	*Public Transport*
A.1.2.2	*0,2*		*0,072*		**0,0432**	4,32	*Private Transport*
A.1.2.3	*0,1*		*0,036*		**0,0216**	2,16	*Parking*
A.1.3		*0,28*					
A.1.3.1	*0,5*		*0,14*		**0,084**	8,4	*Infrastructure*
A.1.3.2	*0,4285*		*0,11998*		**0,071988**	7,1988	*Cultural / Recreational*
A.1.3.3	*0,0715*		*0,02002*		**0,012012**	1,2012	*Services*
A.1.4		*0,24*					
A.1.4.1.a	*0,3437*		*0,082488*		**0,0494928**	4,94928	*Built Env. Facades*
A.1.4.1.b	*0,2812*		*0,067488*		**0,0404928**	4,04928	*Built Env. Public*
A.1.4.2.a	*0,2188*		*0,052512*		**0,0315072**	3,15072	*Natural Env. Parks*
A.1.4.2.b	*0,1563*		*0,037512*		**0,0225072**	2,25072	*Natural Env. Trees*
A.2				*0,4*			
A.2.1		*0,6267*					
A.2.1.1.a	*0,2631*		*0,16488477*		**0,065953908**	6,5953908	*Street Env. Built*
A.2.1.1.b	*0,2456*		*0,15391752*		**0,061567008**	6,1567008	*Street Env. Natural*
A.2.1.2	*0,2281*		*0,14295027*		**0,057180108**	5,7180108	*Street Character*
A.2.1.3	*0,0877*		*0,05496159*		**0,021984636**	2,1984636	*Street Access*
A.2.1.4	*0,1579*		*0,09895593*		**0,039582372**	3,9582372	*Pedestrian Traffic*
A.2.1.5	*0,0176*		*0,01102992*		**0,004411968**	0,4411968	*Noise Levels*
A.2.2		*0,3733*					
A.2.2.1	*0,3846*		*0,14357118*		**0,057428472**	5,7428472	*Building Presence*
A.2.2.2a	*0,1539*		*0,05745087*		**0,022980348**	2,2980348	*Build. Views Quality*
A.2.2.2b	*0,1154*		*0,04307882*		**0,017231528**	1,7231528	*Build. Views Quantity*
A.2.2.3	*0,3461*		*0,12919913*		**0,051679652**	5,1679652	*Buiding Orientation*
Total					*1*	*100*	

Hotel Secondary - Weighting Coefficient Judgments and Local Values

A.1.1 Sub Criteria							Score
							100
A.1.2 Sub Criteria							
	A.1.2.1	A.1.2.2	A.1.2.3			Ranking	Score
Public Transport	Best					1st	**70**
Private Transport		Best				2nd	**20**
Parking			Best			3rd	**10**
Worst						4th	0
A.1.3 Sub Criteria							
	A.1.3.1	A.1.3.2	A.1.3.3			Ranking	Score
Infrastructure	Best					1st	**50**
Cultural / Recreational		Best				2nd	**42,85**
Services			Best			3rd	**7,15**
Worst						4th	0
A.1.4 Sub Criteria							
	A.1.4.1.a	A.1.4.1.b	A.1.4.2.a	A.1.4.2.b		Ranking	Score
Built Env. Facades	Best					1st	**34,37**
Built Env. Public		Best				4th	**28,12**
Natural Env. Parks			Best			2nd	**21,88**
Natural Env. Trees				Best		3rd	**15,63**
Worst						5th	0
A.2.1 Sub Criteria							
	A.2.1.1.a	A.2.1.1.b	A.2.1.2	A.2.1.3	A.2.1.4	A.2.1.5	Ranking	Score
Street Env. Built	Best						1st	**26,31**
Street Env. Natural		Best					2nd	**24,56**
Street Character			Best				3rd	**22,81**
Street Access				Best			5th	**8,77**
Pedestrian Traffic					Best		4th	**15,79**
Noise Levels						Best	6th	**1,76**
Worst							7th	0
A.2.2 Sub Criteria							
	A.2.2.1	A.2.2.2a	A.2.2.2b	A.2.2.2			Ranking	Score
Building Presence	Best						1st	**38,46**
Build. Views Quality		Best					3rd	**15,39**
Build. Views Quantity			Best				4th	**11,54**
Buiding Orientation				Best			2nd	**34,61**
Worst							4th	0
A.1 Sub Criteria							
	A.1..1	A.1.2	A.1.3	A.1.4			Ranking	Score
Distance to Centre	Best						4th	**12**
Accessibility		Best					1st	**36**
Amenities			Best				2nd	**28**
Environment				Best			3rd	**24**
Worst							5th	0
A.2 Sub Criteria							
	A.2.1	A.2.2					Ranking	Score
Street Character	Best						1st	**62,67**
Building Position		Best					2nd	**37,33**
Worst							3rd	0
A Sub Criteria							
	A.1	A.2					Ranking	Score
Macro Location	Best						1st	**60**
Micro Location		Best					2nd	**40**
Worst							3rd	0

Hotel Prime -Weighting Coefficients Global Values

	3rd Line	2nd Line	*Partial*	1st Line	*Total*	0 - 100	
A.1				*0,5867*			
A.1.1		*0,1316*					
	1		*0,1316*		**0,07720972**	7,720972	*Distance to Centre*
A.1.2		*0,2631*					
A.1.2.1	*0,0667*		*0,01754877*		**0,010295863**	1,029586336	*Public Transport*
A.1.2.2	*0,6*		*0,15786*		**0,092616462**	9,2616462	*Private Transport*
A.1.2.3	*0,3333*		*0,08769123*		**0,051448445**	5,144844464	*Parking*
A.1.3		*0,2895*					
A.1.3.1	*0,2667*		*0,07720965*		**0,045298902**	4,529890166	*Infrastructure*
A.1.3.2	*0,6666*		*0,1929807*		**0,113221777**	11,32217767	*Cultural / Recreational*
A.1.3.3	*0,0667*		*0,01930965*		**0,011328972**	1,132897166	*Services*
A.1.4		*0,3158*					
A.1.4.1.a	*0,3571*		*0,11277218*		**0,066163438**	6,616343801	*Built Env. Facades*
A.1.4.1.b	*0,0715*		*0,0225797*		**0,01324751**	1,324750999	*Built Env. Public*
A.1.4.2.a	*0,3571*		*0,11277218*		**0,066163438**	6,616343801	*Natural Env. Parks*
A.1.4.2.b	*0,2143*		*0,06767594*		**0,039705474**	3,9705474	*Natural Env. Trees*
A.2				*0,4133*			
A.2.1		*0,6*					
A.2.1.1.a	*0,2978*		*0,17868*		**0,073848444**	7,3848444	*Street Env. Built*
A.2.1.1.b	*0,2766*		*0,16596*		**0,068591268**	6,8591268	*Street Env. Natural*
A.2.1.2	*0,2553*		*0,15318*		**0,063309294**	6,3309294	*Street Character*
A.2.1.3	*0,1064*		*0,06384*		**0,026385072**	2,6385072	*Street Access*
A.2.1.4	*0,0426*		*0,02556*		**0,010563948**	1,0563948	*Pedestrian Traffic*
A.2.1.5	*0,0213*		*0,01278*		**0,005281974**	0,5281974	*Noise Levels*
A.2.2		*0,4*					
A.2.2.1	*0,4091*		*0,16364*		**0,067632412**	6,7632412	*Building Presence*
A.2.2.2a	*0,2727*		*0,10908*		**0,045082764**	4,5082764	*Build. Views Quality*
A.2.2.2b	*0,2273*		*0,09092*		**0,037577236**	3,7577236	*Build. Views Quantity*
A.2.2.3	*0,0909*		*0,03636*		**0,015027588**	1,5027588	*Buiding Orientation*
Total					*1*	*100*	

Hotel Prime - Weighting Coefficient Judgments and Local Values

A.1.1 Sub Criteria							Score
							100
A.1.2 Sub Criteria							
	A.1.2.1	A.1.2.2	A.1.2.3			Ranking	Score
Public Transport	Best					2nd	**6,67**
Private Transport		Best				1st	**60**
Parking			Best			3rd	**33,33**
Worst						4th	0
A.1.3 Sub Criteria							
	A.1.3.1	A.1.3.2	A.1.3.3			Ranking	Score
Infrastructure	Best					2nd	**26,67**
Cultural / Recreational		Best				1st	**66,66**
Services			Best			3rd	**6,67**
Worst						4th	0
A.1.4 Sub Criteria							
	A.1.4.1.a	A.1.4.1.b	A.1.4.2.a	A.1.4.2.b		Ranking	Score
Built Env. Facades	Best					2nd	**35,71**
Built Env. Public		Best				4th	**7,15**
Natural Env. Parks			Best			1st	**35,71**
Natural Env. Trees				Best		3rd	**21,43**
Worst						5th	0
A.2.1 Sub Criteria							
	A.2.1.1.a	A.2.1.1.b	A.2.1.2	A.2.1.3	A.2.1.4	A.2.1.5	Ranking	Score
Street Env. Built	Best						1st	**29,78**
Street Env. Natural		Best					2nd	**27,66**
Street Character			Best				3rd	**25,53**
Street Access				Best			4th	**10,64**
Pedestrian Traffic					Best		5th	**4,26**
Noise Levels						Best	6th	**2,13**
Worst							7th	0
A.2.2 Sub Criteria							
	A.2.2.1	A.2.2.2a	A.2.2.2b	A.2.2.2			Ranking	Score
Building Presence	Best						1st	**40,91**
Build. Views Quality		Best					2nd	**27,27**
Build. Views Quantity			Best				3rd	**22,73**
Buiding Orientation				Best			4th	**9,09**
Worst							4th	0
A.1 Sub Criteria							
	A.1..1	A.1.2	A.1.3	A.1.4			Ranking	Score
Distance to Centre	Best						1st	**13,16**
Accessibility		Best					4th	**26,31**
Amenities			Best				3rd	**28,95**
Environment				Best			2nd	**31,58**
Worst							5th	0
A.2 Sub Criteria							
	A.2.1	A.2.2					Ranking	Score
Street Character	Best						1st	**60**
Building Position		Best					2nd	**40**
Worst							4th	**0**
A Sub Criteria							
	A.1	A.2					Ranking	Score
Macro Location	Best						1st	**58,67**
Micro Location		Best					2nd	**41,33**
Worst							4th	0

Office Secondary - Weighting Coefficients Global Values

	3rd Line	2nd Line	*Partial*	1st Line	*Total*	0 - 100	
A.1				*0,55*			
A.1.1		*0,32*					
	1		*0,32*		**0,176**	17,6	*Distance to Centre*
A.1.2		*0,4*					
A.1.2.1	*0,4118*		*0,16472*		**0,090596**	9,0596	*Public Transport*
A.1.2.2	*0,2941*		*0,11764*		**0,064702**	6,4702	*Private Transport*
A.1.2.3	*0,2941*		*0,11764*		**0,064702**	6,4702	*Parking*
A.1.3		*0,16*					
A.1.3.1	*0,3333*		*0,053328*		**0,0293304**	2,93304	*Infrastructure*
A.1.3.2	*0,5333*		*0,085328*		**0,0469304**	4,69304	*Cultural / Recreational*
A.1.3.3	*0,1334*		*0,021344*		**0,0117392**	1,17392	*Services*
A.1.4		*0,12*					
A.1.4.1.a	*0,4*		*0,048*		**0,0264**	2,64	*Built Env. Facades*
A.1.4.1.b	*0,08*		*0,0096*		**0,00528**	0,528	*Built Env. Public*
A.1.4.2.a	*0,24*		*0,0288*		**0,01584**	1,584	*Natural Env. Parks*
A.1.4.2.b	*0,28*		*0,0336*		**0,01848**	1,848	*Natural Env. Trees*
A.2				*0,45*			
A.2.1		*0,6*					
A.2.1.1.a	*0,1522*		*0,09132*		**0,041094**	4,1094	*Street Env. Built*
A.2.1.1.b	*0,1304*		*0,07824*		**0,035208**	3,5208	*Street Env. Natural*
A.2.1.2	*0,2391*		*0,14346*		**0,064557**	6,4557	*Street Character*
A.2.1.3	*0,413*		*0,2478*		**0,11151**	11,151	*Street Access*
A.2.1.4	*0,0435*		*0,0261*		**0,011745**	1,1745	*Pedestrian Traffic*
A.2.1.5	*0,0218*		*0,01308*		**0,005886**	0,5886	*Noise Levels*
A.2.2		*0,4*					
A.2.2.1	*0,5*		*0,2*		**0,09**	9	*Building Presence*
A.2.2.2a	*0,1818*		*0,07272*		**0,032724**	3,2724	*Build. Views Quality*
A.2.2.2b	*0,0455*		*0,0182*		**0,00819**	0,819	*Build. Views Quantity*
A.2.2.3	*0,2727*		*0,10908*		**0,049086**	4,9086	*Buiding Orientation*
Total					*1*	*100*	

Office Secondary - Weighting Coefficient Judgments and Local Values

A.1.1 Sub Criteria						Ranking	Score
						1st	**100**
A.1.2 Sub Criteria							
	A.1.2.1	A.1.2.2	A.1.2.3			Ranking	Score
Public Transport	Best					1st	**41,18**
Private Transport		Best				2nd	**29,41**
Parking			Best			3rd	**29,41**
Worst						4th	0
A.1.3 Sub Criteria							
	A.1.3.1	A.1.3.2	A.1.3.3			Ranking	Score
Infrastructure	Best					2nd	**33,33**
Cultural / Recreational		Best				1st	**53,33**
Services			Best			3rd	**13,34**
Worst						4th	0
A.1.4 Sub Criteria							
	A.1.4.1.a	A.1.4.1.b	A.1.4.2.a	A.1.4.2.b		Ranking	Score
Built Env. Facades	Best					1st	**40**
Built Env. Public		Best				4th	**8**
Natural Env. Parks			Best			3rd	**24**
Natural Env. Trees				Best		2nd	**28**
Worst						5th	**0**
A.2.1 Sub Criteria							
	A.2.1.1.a	A.2.1.1.b	A.2.1.2	A.2.1.3	A.2.1.4	A.2.1.5	Ranking	Score
Street Env. Built	Best						3rd	**15,22**
Street Env. Natural		Best					4th	**13,04**
Street Character			Best				2nd	**23,91**
Street Access				Best			1st	**41,3**
Pedestrian Traffic					Best		5th	**4,35**
Noise Levels						Best	6th	**2,18**
Worst							7th	0
A.2.2 Sub Criteria								
	A.2.2.1	A.2.2.2a	A.2.2.2b	A.2.2.2			Ranking	Score
Building Presence	Best						1st	**50**
Build. Views Quality		Best					3rd	**18,18**
Build. Views Quantity			Best				4th	**4,55**
Buiding Orientation				Best			2nd	**27,27**
Worst							4th	0
A.1 Sub Criteria								
	A.1..1	A.1.2	A.1.3	A.1.4			Ranking	Score
Distance to Centre	Best						2nd	**32**
Accessibility		Best					1st	**40**
Amenities			Best				3rd	**16**
Environment				Best			4th	**12**
Worst							5th	**0**
A.2 Sub Criteria								
	A.2.1	A.2.2					Ranking	Score
Street Character	Best						2nd	**60**
Building Position		Best					1st	**40**
Worst							4th	**0**
A Sub Criteria								
	A.1	A.2					Ranking	Score
Macro Location	Best						1st	**55**
Micro Location		Best					2nd	**45**
Worst							4th	0

Office Prime - Weighting Coefficients Global Values

	3rd Line	2nd Line	*Partial*	1st Line	*Total*	0 - 100	
A.1				*0,6*			
A.1.1		*0,3714*					
	1		*0,3714*		**0,22284**	22,284	*Distance to Centre*
A.1.2		*0,2857*					
A.1.2.1	*0,6315*		*0,18041955*		**0,10825173**	10,825173	*Public Transport*
A.1.2.2	*0,2632*		*0,07519624*		**0,045117744**	4,5117744	*Private Transport*
A.1.2.3	*0,1053*		*0,03008421*		**0,018050526**	1,8050526	*Parking*
A.1.3		*0,1429*					
A.1.3.1	*0,2667*		*0,03811143*		**0,022866858**	2,2866858	*Infrastructure*
A.1.3.2	*0,6*		*0,08574*		**0,051444**	5,1444	*Cultural / Recreational*
A.1.3.3	*0,1333*		*0,01904857*		**0,011429142**	1,1429142	*Services*
A.1.4		*0,2*					
A.1.4.1.a	*0,5185*		*0,1037*		**0,06222**	6,222	*Built Env. Facades*
A.1.4.1.b	*0,0371*		*0,00742*		**0,004452**	0,4452	*Built Env. Public*
A.1.4.2.a	*0,3333*		*0,06666*		**0,039996**	3,9996	*Natural Env. Parks*
A.1.4.2.b	*0,1111*		*0,02222*		**0,013332**	1,3332	*Natural Env. Trees*
A.2				*0,4*			
A.2.1		*0,4*					
A.2.1.1.a	*0,3214*		*0,12856*		**0,051424**	5,1424	*Street Env. Built*
A.2.1.1.b	*0,2678*		*0,10712*		**0,042848**	4,2848	*Street Env. Natural*
A.2.1.2	*0,2321*		*0,09284*		**0,037136**	3,7136	*Street Character*
A.2.1.3	*0,1072*		*0,04288*		**0,017152**	1,7152	*Street Access*
A.2.1.4	*0,0536*		*0,02144*		**0,008576**	0,8576	*Pedestrian Traffic*
A.2.1.5	*0,0179*		*0,00716*		**0,002864**	0,2864	*Noise Levels*
A.2.2		*0,6*					
A.2.2.1	*0,5555*		*0,3333*		**0,13332**	13,332	*Building Presence*
A.2.2.2a	*0,2222*		*0,13332*		**0,053328**	5,3328	*Build. Views Quality*
A.2.2.2b	*0,0556*		*0,03336*		**0,013344**	1,3344	*Build. Views Quantity*
A.2.2.3	*0,1667*		*0,10002*		**0,040008**	4,0008	*Buiding Orientation*
Total					*1*	*100*	

Office Prime - Weighting Coefficient Judgments and Local Values

A.1.1 Sub Criteria							Score
							100
A.1.2 Sub Criteria							
	A.1.2.1	A.1.2.2	A.1.2.3			Ranking	Score
Public Transport	Best					1st	**63,15**
Private Transport		Best				2nd	**26,32**
Parking			Best			3rd	**10,53**
Worst						4th	0
A.1.3 Sub Criteria							
	A.1.3.1	A.1.3.2	A.1.3.3			Ranking	Score
Infrastructure	Best					3rd	**26,67**
Cultural / Recreational		Best				1st	**60**
Services			Best			2nd	**13,33**
Worst						4th	0
A.1.4 Sub Criteria							
	A.1.4.1.a	A.1.4.1.b	A.1.4.2.a	A.1.4.2.b		Ranking	Score
Built Env. Facades	Best					1st	**51,85**
Built Env. Public		Best				4th	**3,71**
Natural Env. Parks			Best			2nd	**33,33**
Natural Env. Trees				Best		3rd	**11,11**
Worst						5th	0
A.2.1 Sub Criteria							
	A.2.1.1.a	A.2.1.1.b	A.2.1.2	A.2.1.3	A.2.1.4	A.2.1.5	Ranking	Score
Street Env. Built	Best						1st	**32,14**
Street Env. Natural		Best					2nd	**26,78**
Street Character			Best				4th	**23,21**
Street Access				Best			3rd	**10,72**
Pedestrian Traffic					Best		5th	**5,36**
Noise Levels						Best	6th	**1,79**
Worst							7th	0
A.2.2 Sub Criteria							
	A.2.2.1	A.2.2.2a	A.2.2.2b	A.2.2.2			Ranking	Score
Building Presence	Best						1st	**55,55**
Build. Views Quality		Best					2nd	**22,22**
Build. Views Quantity			Best				4th	**5,56**
Buiding Orientation				Best			3rd	**16,67**
Worst							4th	0
A.1 Sub Criteria							
	A.1..1	A.1.2	A.1.3	A.1.4			Ranking	Score
Distance to Centre	Best						1st	**37,14**
Accessibility		Best					2nd	**28,57**
Amenities			Best				4th	**14,29**
Environment				Best			3rd	**20**
Worst							5th	0
A.2 Sub Criteria							
	A.2.1	A.2.2					Ranking	Score
Street Character	Best						2nd	**40**
Building Position		Best					1st	**60**
Worst							4th	0
A Sub Criteria							
	A.1	A.2					Ranking	Score
Macro Location	Best						1st	**60**
Micro Location		Best					2nd	**40**
Worst							4th	0

Retail - Weighting Coefficients Global Values

	3rd Line	2nd Line	*Partial*	1st Line	*Total*	0 - 100	
A.1				*0,3333*			
A.1.1		*0,1364*					
	1		*0,1364*		**0,04546212**	4,546212	*Distance to Centre*
A.1.2		*0,4545*					
A.1.2.1	*0,5*		*0,22725*		**0,075742425**	7,5742425	*Public Transport*
A.1.2.2	*0,25*		*0,113625*		**0,037871213**	3,78712125	*Private Transport*
A.1.2.3	*0,25*		*0,113625*		**0,037871213**	3,78712125	*Parking*
A.1.3		*0,0455*					
A.1.3.1	*0,3333*		*0,01516515*		**0,005054544**	0,50545445	*Infrastructure*
A.1.3.2	*0,6*		*0,0273*		**0,00909909**	0,909909	*Cultural / Recreational*
A.1.3.3	*0,0667*		*0,00303485*		**0,001011516**	0,101151551	*Services*
A.1.4		*0,3636*					
A.1.4.1.a	*0,423*		*0,1538028*		**0,051262473**	5,126247324	*Built Env. Facades*
A.1.4.1.b	*0,077*		*0,0279972*		**0,009331467**	0,933146676	*Built Env. Public*
A.1.4.2.a	*0,3077*		*0,11187972*		**0,037289511**	3,728951068	*Natural Env. Parks*
A.1.4.2.b	*0,1923*		*0,06992028*		**0,023304429**	2,330442932	*Natural Env. Trees*
A.2				*0,6667*			
A.2.1		*0,75*					
A.2.1.1.a	*0,1415*		*0,106125*		**0,070753538**	7,07535375	*Street Env. Built*
A.2.1.1.b	*0,1212*		*0,0909*		**0,06060303**	6,060303	*Street Env. Natural*
A.2.1.2	*0,2424*		*0,1818*		**0,12120606**	12,120606	*Street Character*
A.2.1.3	*0,0606*		*0,04545*		**0,030301515**	3,0301515	*Street Access*
A.2.1.4	*0,404*		*0,303*		**0,2020101**	20,20101	*Pedestrian Traffic*
A.2.1.5	*0,0303*		*0,022725*		**0,015150758**	1,51507575	*Noise Levels*
A.2.2		*0,25*					
A.2.2.1	*0,619*		*0,15475*		**0,103171825**	10,3171825	*Building Presence*
A.2.2.2a	*0,2381*		*0,059525*		**0,039685318**	3,96853175	*Build. Views Quality*
A.2.2.2b	*0,0953*		*0,023825*		**0,015884128**	1,58841275	*Build. Views Quantity*
A.2.2.3	*0,0476*		*0,0119*		**0,00793373**	0,793373	*Buiding Orientation*
Total					*1*	*100*	

Retail - Weighting Coefficient Judgments and Local Values

A.1.1 Sub Criteria							Score
							100
A.1.2 Sub Criteria							
	A.1.2.1	A.1.2.2	A.1.2.3			Ranking	Score
Public Transport	Best					1st	**50**
Private Transport		Best				2nd	**25**
Parking			Best			2nd	**25**
Worst						4th	0
A.1.3 Sub Criteria							
	A.1.3.1	A.1.3.2	A.1.3.3			Ranking	Score
Infrastructure	Best					2nd	**33,33**
Cultural / Recreational		Best				1st	**60**
Services			Best			3rd	**6,67**
Worst						4th	0
A.1.4 Sub Criteria							
	A.1.4.1.a	A.1.4.1.b	A.1.4.2.a	A.1.4.2.b		Ranking	Score
Built Env. Facades	Best					1st	**42,3**
Built Env. Public		Best				4th	**7,7**
Natural Env. Parks			Best			2nd	**30,77**
Natural Env. Trees				Best		3rd	**19,23**
Worst						5th	0
A.2.1 Sub Criteria							
	A.2.1.1.a	A.2.1.1.b	A.2.1.2	A.2.1.3	A.2.1.4	A.2.1.5	Ranking	Score
Street Env. Built	Best						3rd	**14,15**
Street Env. Natural		Best					4th	**12,12**
Street Character			Best				2nd	**24,24**
Street Access				Best			5th	**6,06**
Pedestrian Traffic					Best		1st	**40,4**
Noise Levels						Best	6th	**3,03**
Worst							7th	**0**
A.2.2 Sub Criteria							
	A.2.2.1	A.2.2.2a	A.2.2.2b	A.2.2.2			Ranking	Score
Building Presence	Best						1st	**61,9**
Build. Views Quality		Best					2nd	**23,81**
Build. Views Quantity			Best				3rd	**9,53**
Buiding Orientation				Best			4th	**4,76**
Worst							5th	0
A.1 Sub Criteria							
	A.1..1	A.1.2	A.1.3	A.1.4			Ranking	Score
Distance to Centre	Best						3rd	**13,64**
Accessibility		Best					1st	**45,45**
Amenities			Best				4th	**4,55**
Environment				Best			2nd	**36,36**
Worst							5th	0
A.2 Sub Criteria							
	A.2.1	A.2.2					Ranking	Score
Street Character	Best						1st	**75**
Building Position		Best					2nd	**25**
Worst							3rd	0
A Sub Criteria							
	A.1	A.2					Ranking	Score
Macro Location	Best						2nd	**33,33**
Micro Location		Best					1st	**66,67**
Worst							3rd	0

Locational Criteria - Case Study Judgments, Partial Values, Partial Weighting, Performance Matrix

Case Study			Office				Residential				Hotel				Retail	
Portland House, Bressenden Place			Secondary		Prime		Secondary		Prime		Secondary		Prime			
Criteria		Score	Weight	Local Value	Weight	Local Value	Weight	Local Value	Weight	Local Value	Weight	Local Value	Weight	Local Value	Weight	Local Value
A.1.1.1	Distance to Centre	**100**	0,176	17,6	0,22284	22,284	0,0231	2,31	0,143495	14,3495	0,072	7,2	0,07720972	7,720972	0,04546212	4,546212
A.1.2.1	Public Transport Access	**125**	0,090596	11,3245	0,10825173	13,53146625	0,16314264	20,39283	0,011957	1,494625	0,1512	18,9	0,010295863	1,28698292	0,075742425	9,467803125
A.1.2.2	Private Transport Access	**100**	0,064702	6,4702	0,045117744	4,5117744	0,05438934	5,438934	0,035871	3,5871	0,0432	4,32	0,092616462	9,2616462	0,037871213	3,78712125
A.1.2.3	Parking Provision	**-20**	0,064702	-1,29404	0,018050526	-0,36101052	0,03626802	-0,7253604	0,071742	-1,43484	0,0216	-0,432	0,051448445	-1,028968893	0,037871213	-0,75742425
A.1.3.1	Infrastructural Amenities	**40**	0,0293304	1,173216	0,022866858	0,91467432	0,008655	0,3462	0,007976793	0,31907172	0,084	3,36	0,045298902	1,811956066	0,005054544	0,20218178
A.1.3.2	Cultural Amenities	**120**	0,0469304	5,631648	0,051444	6,17328	0,05193	6,2316	0,063756957	7,65083484	0,071988	8,63856	0,113221777	13,5866132	0,00909909	1,0918908
A.1.3.3	Services Amenities	**100**	0,0117392	1,17392	0,011429142	1,1429142	0,077895	7,7895	0,02391125	2,391125	0,012012	1,2012	0,011328972	1,132897166	0,001011516	0,101151551
A.1.4.1.a	Built Environment (a)	**60**	0,0264	1,584	0,06222	3,7332	0,0516936	3,101616	0,063756957	3,82541742	0,0494928	2,969568	0,066163438	3,96980628	0,051262473	3,075748394
A.1.4.1.b	Built Environment (b)	**40**	0,00528	0,2112	0,004452	0,17808	0,0073848	0,295392	0,010635724	0,42542896	0,0404928	1,619712	0,01324751	0,5299004	0,009331467	0,37325867
A.1.4.2.a	Natural Environment (a)	**80**	0,01584	1,2672	0,039996	3,19968	0,0664632	5,317056	0,095645	7,6516	0,0315072	2,520576	0,066163438	5,29307504	0,037289511	2,983160854
A.1.4.2.b	Natural Environment (b)	**15**	0,01848	0,2772	0,013332	0,19998	0,0590784	0,886176	0,021252319	0,318784785	0,0225072	0,337608	0,039705474	0,59558211	0,023304429	0,34956644
A. 2.1.1.a	Street Environment (a)	**30**	0,041094	1,23282	0,051424	1,54272	0,0566	1,698	0,071325	2,13975	0,065953908	1,97861724	0,073848444	2,21545332	0,070753538	2,122606125
A. 2.1.1.b	Street Environment (b)	**-20**	0,035208	-0,70416	0,042848	-0,85696	0,03396	-0,6792	0,0658575	-1,31715	0,061567008	-1,23134016	0,068591268	-1,37182536	0,06060303	-1,2120606
A. 2.1.2	Street Position	**80**	0,064557	5,16456	0,037136	2,97088	0,01132	0,9056	0,01098	0,8784	0,057180108	4,57440864	0,063309294	5,06474352	0,12120606	9,6964848
A. 2.1.3	Street Accessibility	**100**	0,11151	11,151	0,017152	1,7152	0,05282	5,282	0,02196	2,196	0,021984636	2,1984636	0,026385072	2,6385072	0,030301515	3,0301515
A. 2.1.4	Pedestrian Traffic	**100**	0,011745	1,1745	0,008576	0,8576	0,00756	0,756	0,00549	0,549	0,039582372	3,9582372	0,010563948	1,0563948	0,2020101	20,20101
A.2.1.5	Noise Levels	**-40**	0,005886	-0,23544	0,002864	-0,11456	0,03774	-1,5096	0,0493875	-1,9755	0,004411968	-0,17647872	0,005281974	-0,21127896	0,015150758	-0,6060303
A. 2.2.1	Building Presence	**160**	0,09	14,4	0,13332	21,3312	0,01054	1,6864	0,0225	3,6	0,057428472	9,18855552	0,067632412	10,82118592	0,103171825	16,507492
A. 2.2.2 a	Building Views (a)	**140**	0,032724	4,58136	0,053328	7,46592	0,05262	7,3668	0,09	12,6	0,022980348	3,21724872	0,045082764	6,31158696	0,039685318	5,55594445
A. 2.2.2 b	Building Views (b)	**100**	0,00819	0,819	0,013344	1,3344	0,05262	5,262	0,0675	6,75	0,017231528	1,7231528	0,037577236	3,7577236	0,015884128	1,58841275
A. 2.2.3	Building Orientation	**90**	0,049086	4,41774	0,040008	3,60072	0,08422	7,5798	0,045	4,05	0,051679652	4,65116868	0,015027588	1,35248292	0,00793373	0,7140357
Global Values			**Os**	**87,420424**	**Op**	**95,35515865**	**Rs**	**79,7317436**	**Rp**	**70,04914773**	**Hs**	**80,71725752**	**Hp**	**75,79543641**	**R**	**82,81871704**
Ranking				**2nd**		**1st**		**3rd**		**4th**		**6th**		**5th**		**3rd**

A.5 Case Study Physical Appraisal

A.5.1 *Weighing Coefficient – Partial and Local Values*

A.5.2 *MACBETH Data Output - Existing Portland House*

A.5.3 *MACBETH Data Output - Proposed Portland House Adaptive Reuse*

A.5.4 *Physical Criteria - Sensibility Analysis*

Physical Criteria - Weighting Coefficients Global Values

	3rd Line	2nd Line	*Partial*	1st Line	*Total*	0 - 100	
B.1				*0,7*			
B.1.1		*0,12*					
B.1.1.1	*0,375*		*0,045*		**0,0315**	3,15	*Private External Space*
B.1.1.2	*0,125*		*0,015*		**0,0105**	1,05	*Plot Access*
B.1.1.3	*0,5*		*0,06*		**0,042**	4,2	*Parking Provision*
B.1.2		*0,44*					
B.1.2.1	*0,4615*		*0,20306*		**0,142142**	14,2142	*Slab Height, Typical Floor*
B.1.2.2	*0,077*		*0,03388*		**0,023716**	2,3716	*Slab Height, Ground Floor*
B.1.2.3	*0,4615*		*0,20306*		**0,142142**	14,2142	*Building Depth*
B.1.3		*0,44*					
B.1.3.1	*0,1579*		*0,069476*		**0,0486332**	4,86332	*Core(s) Location*
B.1.3.2	*0,3684*		*0,162096*		**0,1134672**	11,34672	*Column Grid*
B.1.3.3	*0,4737*		*0,208428*		**0,1458996**	14,58996	*Floor Plate Depth Ratio*
B.2				*0,3*			
B.2.1		*0,3333*					
B.2.1.1	*0,87*		*0,289971*		**0,0869913**	8,69913	*Slab Strength, Typical Floor*
B.2.1.2	*0,13*		*0,043329*		**0,0129987**	1,29987	*Slab Strength, Ground Floor*
B.2.2		*0,2084*					
B.2.2.1	*0,6*		*0,12504*		**0,037512**	3,7512	*Opening Ratio*
B.2.2.2	*0,4*		*0,08336*		**0,025008**	2,5008	*Daylight Factor*
B.2.3		*0,4583*			**0,13749**	13,749	*Exterior Character*
Total					1	100	

Physical Criteria - Weighting Coefficient Judgments and Local Values

B.1.1 Sub Criteria	B.1.1.1	B.1.1.2	B.1.1.3	Ranking	Score
External Space	Best			1st	**37,5**
Plot Access		Best		2nd	**12,5**
Parking Provision			Best	1st	**50**
Worst				3rd	0

B.1.2 Sub Criteria	B.1.2.1	B.1.2.2	B.1.2.3	Ranking	Score
Slab Height, T. Floor	Best			1st	**46,15**
Slab Height, G .Floor		Best		2nd	**7,7**
Building Depth			Best	3rd	**46,15**
Worst				4th	0

B.1.3 Sub Criteria	B.1.3.1	B.1.3.2	B.1.3.3	Ranking	Score
Core Location	Best			1st	**15,79**
Column Grid		Best		2nd	**36,84**
Floor Plate Depth Ratio			Best	3rd	**47,37**
Worst				4th	0

B.2.1 Sub Criteria	B.2.1.1	B.2.2.2	Ranking	Score
Slab Strength, T. Floor	Best		1st	**87**
Slab Strength, G. Floor		Best	2nd	**13**
Worst			3rd	0

B.2.2 Sub Criteria	B.2.2.1	B.2.2.2	Ranking	Score
Opening Ratio	Best		1st	**60**
Daylight Factor		Best	2nd	**40**
Worst			3rd	0

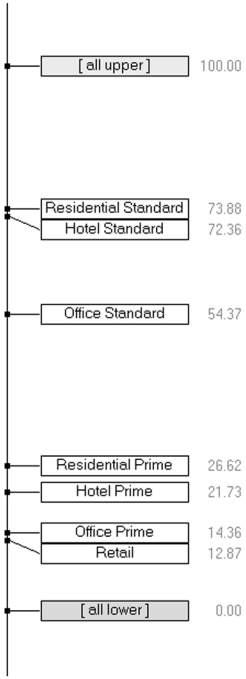
B.2.3 Sub Criteria	B.2.3	Ranking	Score
External Character	Best	1st	**100**
Worst			**0**

B.1 Sub Criteria	B.1..1	B.1.2	B.1.3	Ranking	Score
Plot	Best			1st	**12**
Size		Best		2nd	**44**
Configuration			Best	3rd	**44**
Worst				4th	0

B.2 Sub Criteria	B.2.1	B.2.2	B.2.3	Ranking	Score
Structure	Best			1st	**33,33**
Envelope		Best		2nd	**20,84**
Character			Best	3rd	**45,83**
Worst				4th	0

B Sub Criteria	B.1	B.2	Ranking	Score
Building Space	Best		1st	**70**
Building Fabric		Best	2nd	**30**
Worst			3rd	0

Options	Overall	External Space	Plot Access	Parking Provision	Slab Height, TF	Slab Height, GF	Building Depth	Core(s) Location	Column Grid	Floor Depth Ratio	SlabStrength, TF	Slab Strength, GF	Opening Ratio	Daylight Factor	Exterior Character
[all upper]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Residential Standard	73.88	0.00	155.00	84.62	114.29	175.00	150.00	100.00	135.00	-100.00	133.00	100.00	100.00	100.00	16.67
Hotel Standard	72.36	0.00	155.00	107.69	71.43	167.00	130.00	100.00	117.00	-40.00	100.00	100.00	100.00	120.00	33.33
Office Standard	54.37	0.00	155.00	69.23	-28.57	142.00	100.00	100.00	-13.00	80.00	100.00	100.00	50.00	100.00	50.00
Residential Prime	26.62	0.00	155.00	-30.77	57.14	158.00	130.00	100.00	109.00	-180.00	100.00	100.00	50.00	0.00	-50.00
Hotel Prime	21.73	0.00	155.00	107.69	-28.57	83.00	120.00	100.00	91.00	-160.00	100.00	100.00	50.00	60.00	-33.33
Office Prime	14.36	0.00	155.00	38.46	-57.14	62.00	40.00	100.00	-30.00	20.00	100.00	100.00	0.00	0.00	-16.67
Retail	12.87	0.00	125.00	30.77	-128.57	44.00	40.00	100.00	48.00	80.00	-33.00	100.00	175.00	160.00	-66.67
[all lower]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weights :		0.0315	0.0105	0.0420	0.1421	0.0237	0.1421	0.0486	0.1135	0.1460	0.0870	0.0130	0.0375	0.0250	0.1375

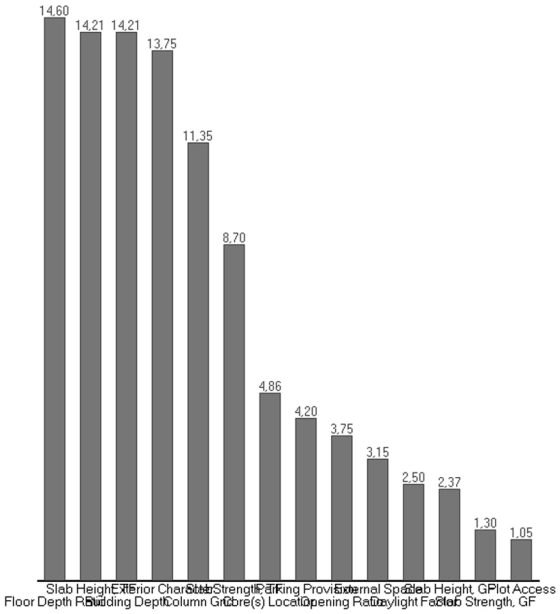


	Hotel Standard	Office Standard	Residential Standard	[all upper]	Retail	Office Prime	Hotel Prime	[all lower]	Residential Prime
Hotel Standard	=	?	?	?	?	?	▲	?	▲
Office Standard	?	=	?	?	?	▲	?	?	?
Residential Standard	?	?	=	?	?	?	?	?	▲
[all upper]	?	?	?	=	?	?	?	▲	?
Retail	?	?	?	?	=	?	?	?	?
Office Prime	?		?	?	?	=	?	?	?
Hotel Prime		?	?	?	?	?	=	?	?
[all lower]	?	?	?		?	?	?	=	?
Residential Prime		?		?	?	?	?	?	=

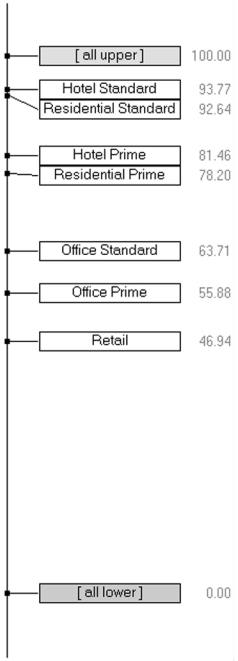
Local information	ordinal	MACBETH	constraints	cardinal
External Space	☑	☐		☐ ±0%
Plot Access	☑	☐	☐	☐ ±0%
Parking Provision	☑	☐		☐ ±0%
Slab Height, TF	☑	☐		☐ ±0%
Slab Height, GF	☑	☐		☐ ±0%
Building Depth	☑	☐		☐ ±0%
Core(s) Location	☑	☐		☐ ±0%
Column Grid	☑	☐		☐ ±0%
Floor Depth Ratio	☑	☐		☐ ±0%
SlabStrength, TF	☑	☐		☐ ±0%
Slab Strength, GF	☑			☐ ±0%
Opening Ratio	☑	☐		☐ ±0%
Daylight Factor	☑	☐		☐ ±0%
Exterior Character	☑	☐		☐ ±0%

Global information	ordinal	MACBETH	cardinal
	☑		☐ ±0%

	Current scale	MACBETH anchored	MACBETH basic
[Floor Depth Ratio]	14,60	12,62	13,00
[Slab Height, TF]	14,21	11,65	12,00
[Building Depth]	14,21	11,65	12,00
[Exterior Character]	13,75	10,67	11,00
[Column Grid]	11,35	9,71	10,00
[SlabStrength, TF]	8,70	8,74	9,00
[Core(s) Location]	4,86	7,77	8,00
[Parking Provision]	4,20	6,79	7,00
[Opening Ratio]	3,75	5,82	6,00
[External Space]	3,15	4,86	5,00
[Daylight Factor]	2,50	3,89	4,00
[Slab Height, GF]	2,37	2,91	3,00
[Slab Strength, GF]	1,30	1,95	2,00
[Plot Access]	1,05	0,97	1,00
[all lower]	0,00	0,00	0,00



Options	Overall	External Space	Plot Access	Parking Provision	Slab Height, TF	Slab Height, GF	Building Depth	Core(s) Location	Column Grid	Floor Depth Ratio	SlabStrength, TF	Slab Strength, GF	Opening Ratio	Daylight Factor	Exterior Character
[all upper]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Hotel Standard	93.77	0.00	155.00	107.69	71.43	180.00	155.56	100.00	104.76	50.00	100.00	100.00	141.18	166.67	55.17
Residential Standard	92.64	0.00	155.00	84.62	114.29	180.00	166.67	100.00	114.29	-12.50	120.00	100.00	135.29	133.33	51.72
Hotel Prime	81.46	0.00	155.00	107.69	-28.57	180.00	150.00	100.00	90.48	50.00	100.00	100.00	123.53	100.00	103.45
Residential Prime	78.20	0.00	155.00	-30.77	57.14	180.00	161.11	100.00	95.24	-12.50	100.00	100.00	123.53	33.33	96.55
Office Standard	63.71	0.00	155.00	69.23	-28.57	180.00	144.44	100.00	28.57	75.00	100.00	100.00	123.53	133.33	10.34
Office Prime	55.88	0.00	155.00	38.46	-57.14	180.00	72.22	100.00	23.81	75.00	100.00	100.00	111.76	66.67	86.21
Retail	46.94	0.00	125.00	30.77	-128.57	180.00	72.22	100.00	66.67	100.00	-20.00	100.00	188.24	216.67	65.52
[all lower]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weights :		0.0315	0.0105	0.0420	0.1421	0.0237	0.1421	0.0486	0.1135	0.1460	0.0870	0.0130	0.0375	0.0250	0.1375

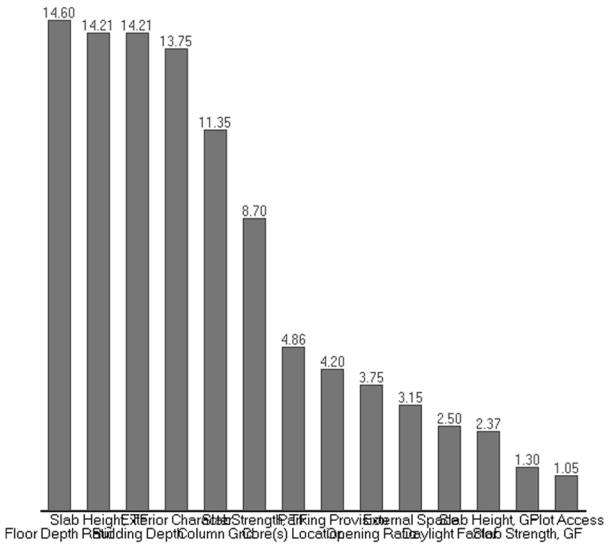


	Hotel Standard	[all upper]	Office Standard	Office Prime	Residential Standard	Residential Prime	Hotel Prime	Retail	[all lower]
Hotel Standard	=	?	?	?	?	?	?	?	▲
[all upper]	?	=	?	?	?	?	?	?	▲
Office Standard	?	?	=	?	?	?	?	?	?
Office Prime	?	?	?	=	?	?	?	?	?
Residential Standard	?	?	?	?	=	?	?	?	?
Residential Prime	?	?	?	?	?	=	?	?	?
Hotel Prime	?	?	?	?	?	?	=	?	?
Retail	?	?	?	?	?	?	?	=	?
[all lower]			?	?	?	?	?	?	=

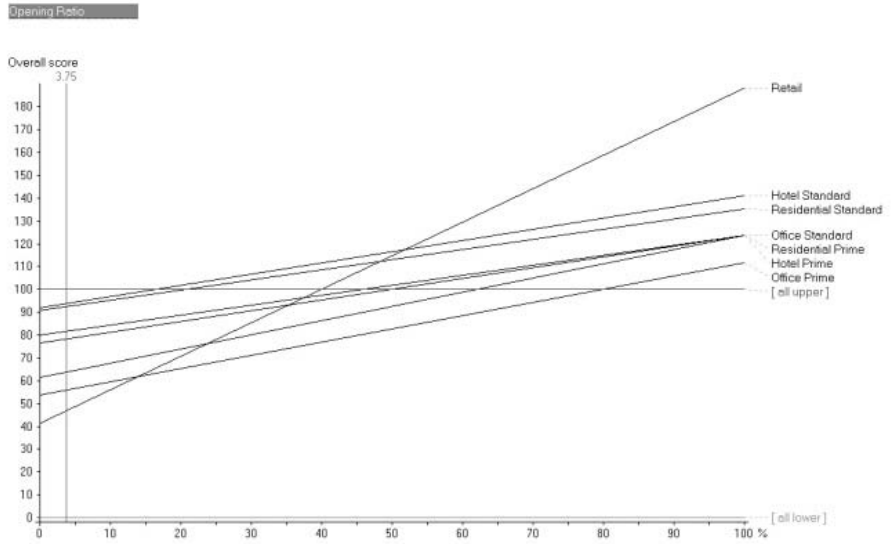
Local information	ordinal	MACBETH	constraints	cardinal
External Space	☑	☐		☐ ±0%
Plot Access	☑	☐	☐	☐ ±0%
Parking Provision	☑	☐		☐ ±0%
Slab Height, TF	☑	☐		☐ ±0%
Slab Height, GF	☑	☐		☐ ±0%
Building Depth	☑	☐		☐ ±0%
Core(s) Location	☑	☐		☐ ±0%
Column Grid	☑	☐		☐ ±0%
Floor Depth Ratio	☑	☐		☐ ±0%
SlabStrength, TF	☑	☐		☐ ±0%
Slab Strength, GF	☑			☐ ±0%
Opening Ratio	☑	☐		☐ ±0%
Daylight Factor	☑	☐		☐ ±0%
Exterior Character	☑	☐		☐ ±0%

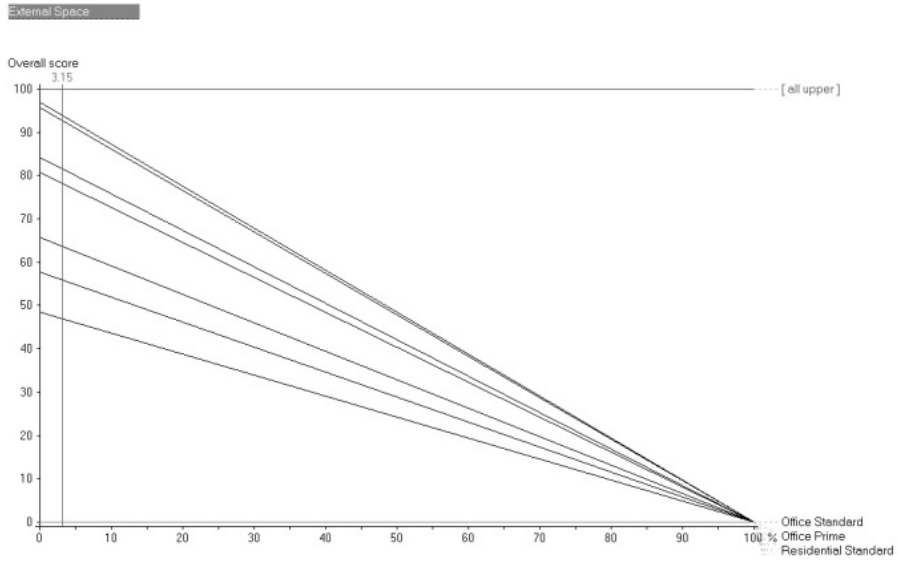
Global information	ordinal	MACBETH	cardinal
	☑		☐ ±0%

	Current scale	MACBETH anchored	MACBETH basic
[Floor Depth Ratio]	14.60	12.62	13.00
[Slab Height, TF]	14.21	11.65	12.00
[Building Depth]	14.21	11.65	12.00
[Exterior Character]	13.75	10.67	11.00
[Column Grid]	11.35	9.71	10.00
[SlabStrength, TF]	8.70	8.74	9.00
[Core(s) Location]	4.86	7.77	8.00
[Parking Provision]	4.20	6.79	7.00
[Opening Ratio]	3.75	5.82	6.00
[External Space]	3.15	4.86	5.00
[Daylight Factor]	2.50	3.89	4.00
[Slab Height, GF]	2.37	2.91	3.00
[Slab Strength, GF]	1.30	1.95	2.00
[Plot Access]	1.05	0.97	1.00
[all lower]	0.00	0.00	0.00



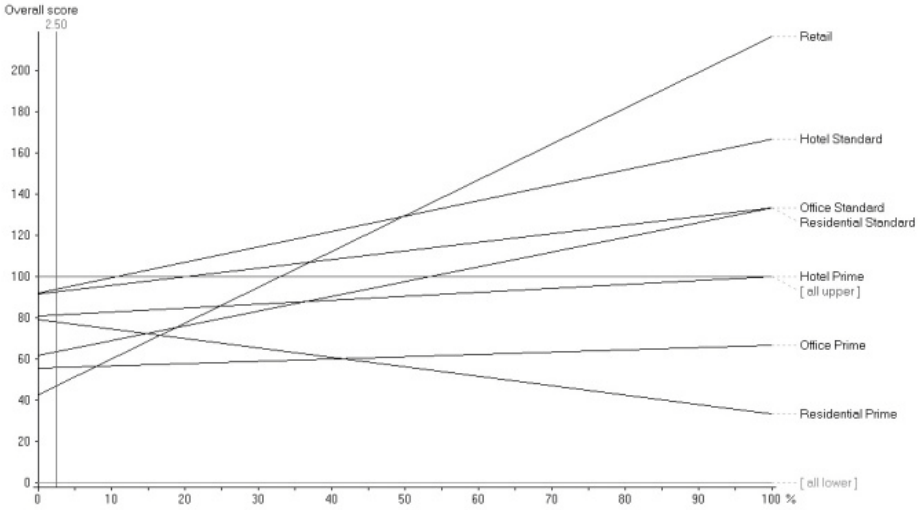
A.6.4 Physical Criteria , Sensitivity Analysis[1]



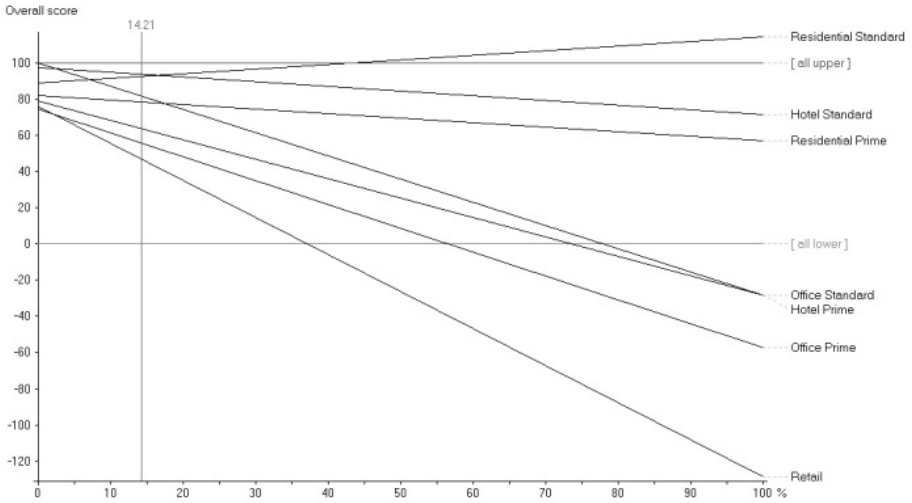


[1] Extracted from MACBETH

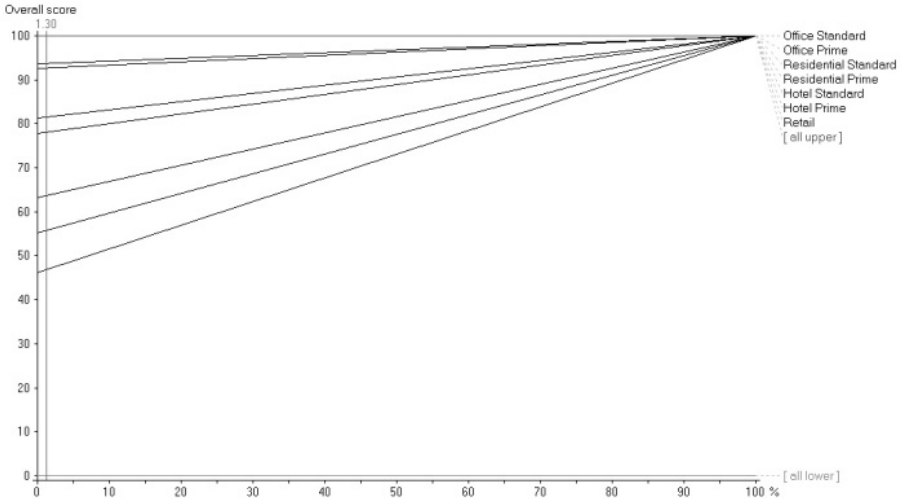
Daylight Factor



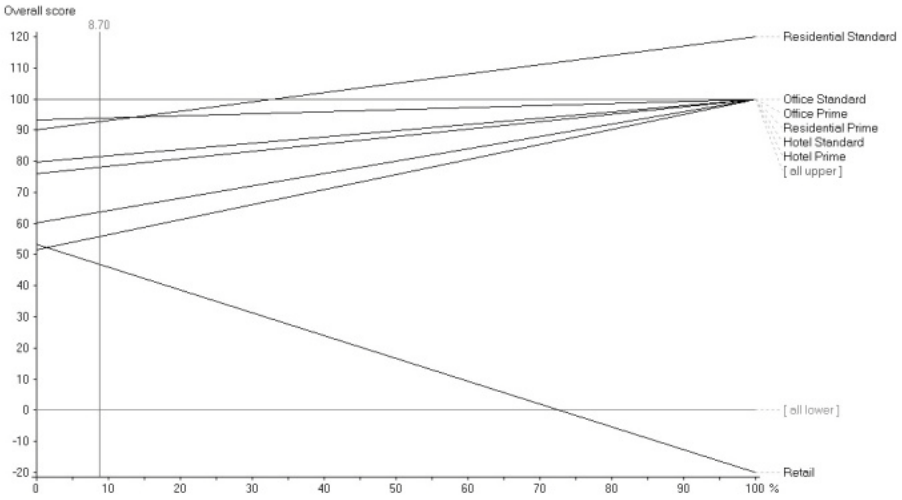
Slab Height, TF



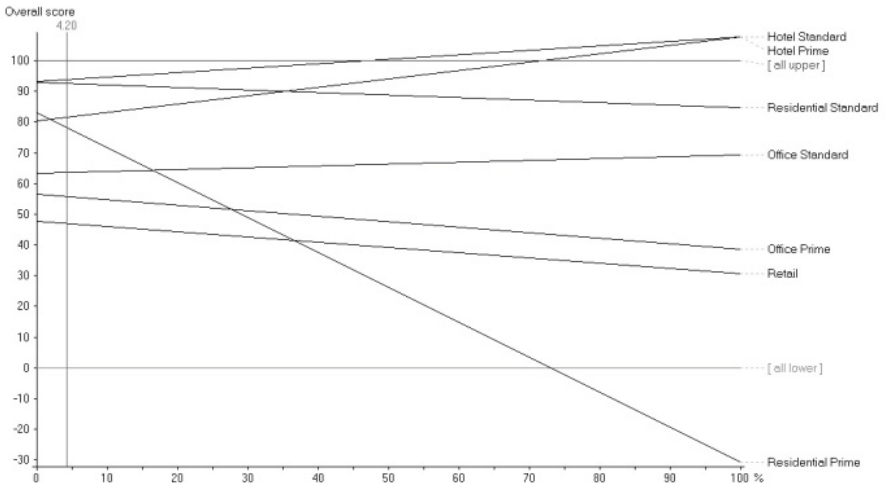
Slab Strength, GF



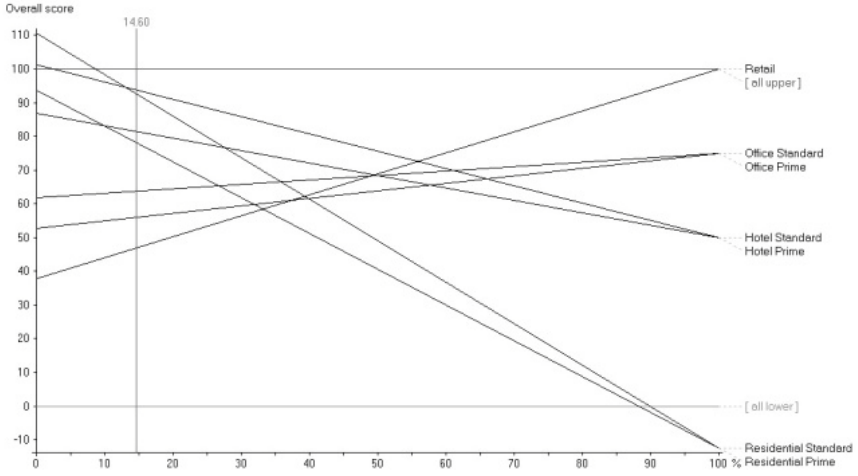
SlabStrength, TF



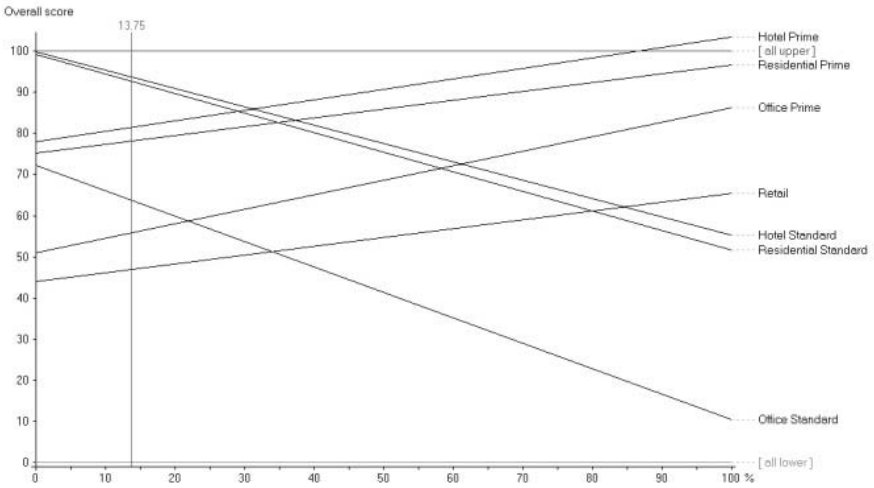
Parking Provision



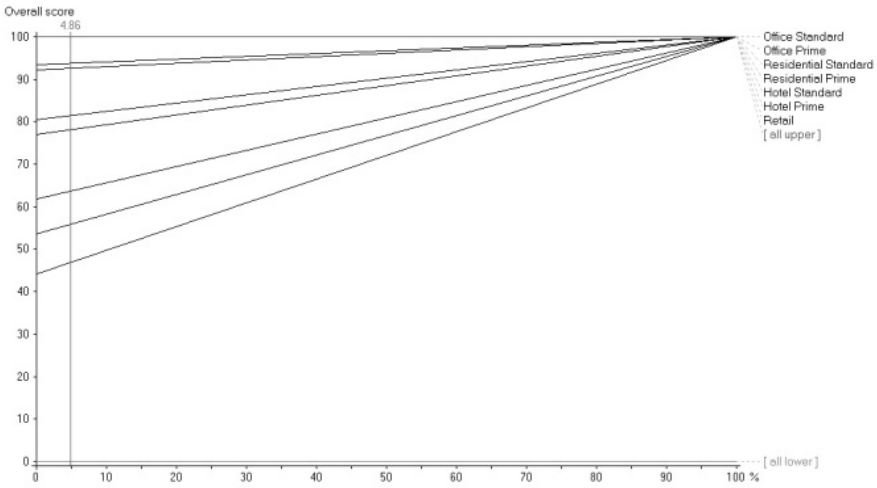
Floor Depth Ratio



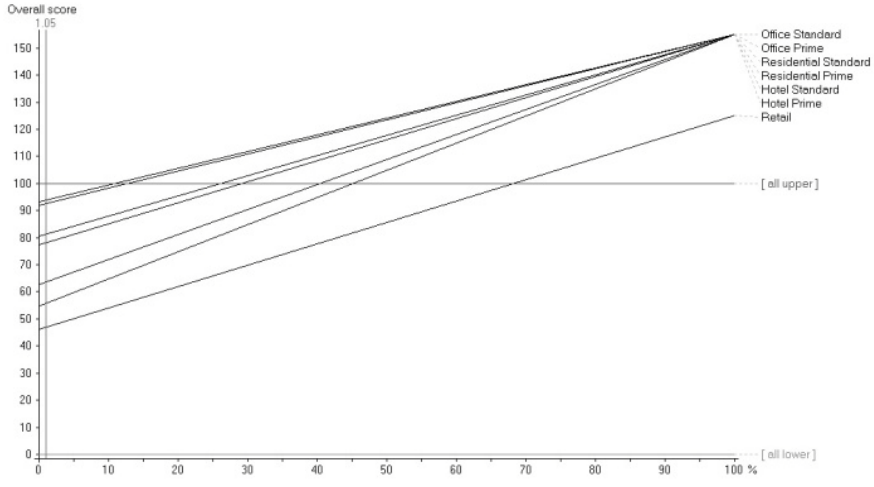
Exterior Character



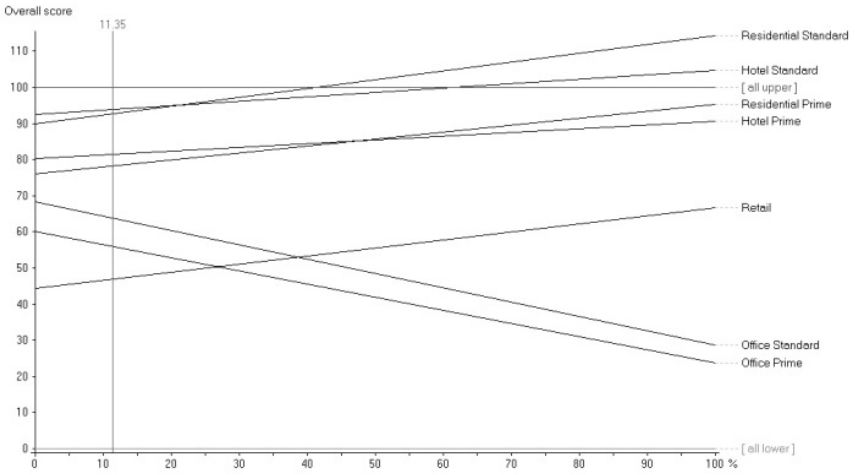
Core(s) Location



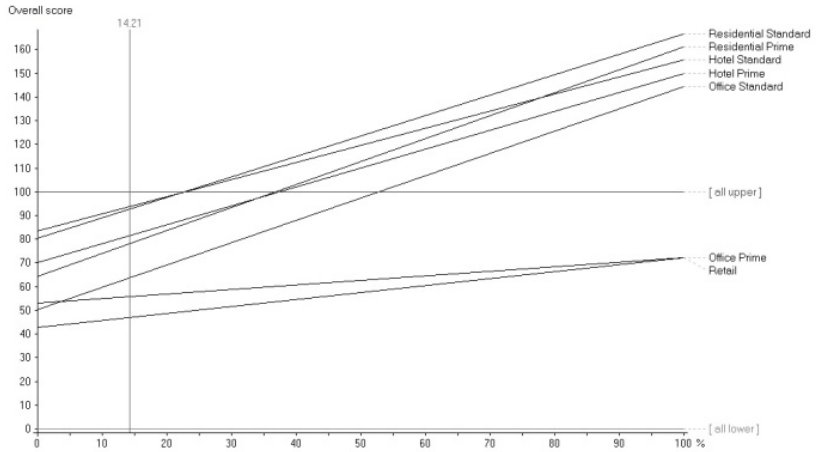
Plot Access



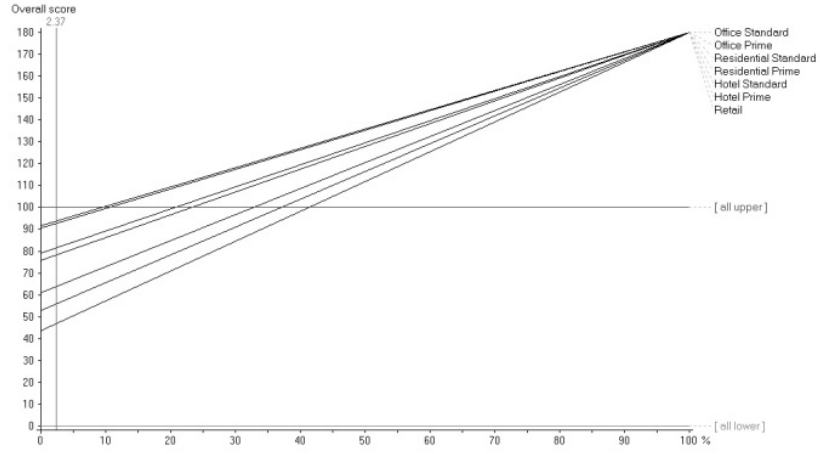
Column Grid



Building Depth



Slab Height, GF



A.6 Case Study Financial Appraisal

A.6.1 References and Sources

Inflation Rate (2013 to 2023) :
Based on Economist Intelligence Unit (2013-2018), Available from www: [Accessed 29.12.2013]
<http://pages.eiu.com/rs/eiu2/images/2012_Global_Outlook.pdf>

Value-Added Tax (VAT) (2014):
Based on HMRC (2014), Available from www: [Accessed 29.12.2013]
<http://www.hmrc.gov.uk/vat/start/introduction.htm>

Office Rental Values (2013) :
Average price per square feet, based on similar market conditions,
WEB Central London Office Market Update (October 2013), Quarter Jonas Research,
Available from www: [Accessed 08.03.2014]
<http://www.carterjonas.co.uk/~/media/Publications/WEB%20-%20Central%20London%20Office%20Market%20Update%20-%20October%20-%201013.ashx>

Residential Sale Values (2013) :
Average sale price per square feet, based on similar market conditions, Knight Frank Research (2013)
Available from www: [Accessed 08.03.2014]
<http://my.knightfrank.co.uk/research-reports/prime-central-london-sales-index.aspx>

Hotel Average Room Rate (ARR); Occupation Rates; (2013) :
Average values in Central London, Knight Frank Research (2013)
Available from www: [Accessed 08.03.2014]
<http://www.knightfrank.co.uk/resources/commercial/brochure/London_Hotel_Review.pdf>

Retail Rental Values (2013) :
Average rental price per square feet, based on similar market conditions, Knight Frank Research (2013); Available from www: [Accessed 08.03.2014]
<http://www.propertyweek.com/Journals/2013/07/01/z/y/w/CLSUMMER13_WEB.PDF>

Construction Costs, Refurbishment and Conversion of Office Buildings to other uses (2013) :
Average refurbishment / conversion cost per square feet - office buildings to other uses (2008 – 2013)
Davis Langdon Cost Model, Available from www: [Accessed 05.03.2014]
<http://www.davislangdon.co.nz/EME/Research/>

Construction Costs, New Build Prices for all uses (2013) :
Average new construction costs per square feet (2008 – 2013)
Davis Langdon Cost Model, Available from www: [Accessed 08.03.2014]
<http://www.davislangdon.co.nz/EME/Research/>

Plan Efficiency per use :
Typical % of Net Internal Area over Gross Internal Area per use on new developments.
Source : Space Management Group – Promoting Space Efficiency in Building Design, UK,
Available from www: [Accessed 08.03.2014]
<http://www.smg.ac.uk/documents/PromotingSpaceEfficiency.pdf>

Developer's Profit; Professional Fees (Architect, Structural Engineer, Quantity Surveyor, M&E Engineer, Project Architect, Others); Acquisition Costs (Stamp Duty, Agency, Legal); Legal Fees; Marketing Costs (Letting, Sale, Promotion):
Percentage over construction costs, investment costs or sale price, Source: (Ratcliffe, et al., 2006)

Planning Obligations (Section 106)
As requested by Westminster City Council to Portland House Conversion, Source: (DCA, 2013)
Available from www: [Accessed 30.03.2013]
<http://idoxpa.westminster.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=MJCI2HRP01R00>

A.6.2 Values and Assumptions

A.6.3 Discounted Cash Flows – Construction

A.6.4 Discounted Cash Flows – After Construction

A.6.5 Financial Outputs

Existing Building - Present Uses:

Present Uses	Sale / Rental Values		Gross External Area (GEA)		Gross Internal Area (GIA)		Net Internal Area (NIA)		Plan Efficiency	Refurbishment Costs		Increased Area	Development Costs	
		£/sqf (pa)	(sqm)	(sqf)	(sqm)	(sqf)	(sqm)	(sqf)	% NIA / GIA	£/sqm GIA	£/sqf GIA	sqm (GIA)	£/sqm GIA	£/sqm GIA
Office Secondary (+ Retail)	(Rent)	£40,00	41440	446060,16	38.248	411701,47	27434	295299,58	71,72662623	£0,00	£0,00	n / a	n / a	n / a
(Retail, GF + 1F)	(Rent)	£250,00	2617	28169,39	2732	29407,25	2066	22238,42	75,62225476	£0,00	£0,00	n / a	n / a	n / a
Total			44057	4093,03	40.980	441108,72	29500	317538,00	71,99					

Existing Building - Alternative Uses (by Refurbishment) :

Alternative Uses	Sale / Rental Values		Gross External Area (GEA)		Gross Internal Area (GIA)		Net Internal Area (NIA)		Plan Efficiency	Refurbishment Costs		Extension Area	New Build Costs	
		£/ sqf (pa)	(sqm)	(sqf)	(sqm)	(sqf)	(sqm)	(sqf)	% NIA / GIA	£/sqm GIA	£/sqf GIA	sqf(GIA)	£/sqm GIA	£/sqm GIA
Office Secondary (+ Retail)	(Rent)	£50,00	41440	446060,16	38.248	411701,47	32510,80	349946,25	85	£807,29	£75,00	0	0	0
Office Prime (+ Retail)	(Rent)	£65,00	41440	446060,16	38.248	411701,47	30598,40	329361,18	80	£1.345,49	£125,00	0	0	0
Resid. Secondary (+ Retail)	(Sale)	£1.000,00	41440	446060,16	38.248	411701,47	26773,60	288191,03	70	£1.076,39	£100,00	0	0	0
Resid. Prime (+ Retail)	(Sale)	£2.000,00	41440	446060,16	38.248	411701,47	24861,20	267605,96	65	£2.152,78	£200,00	0	0	0
Hotel Secondary (+ Retail)	(ARR)	£125,00	41440	446060,16	38.248	411701,47	22948,80	247020,88	60	£1.345,49	£125,00	0	0	0
Hotel Prime (+ Retail)	(ARR)	£225,00	41440	446060,16	38.248	411701,47	21036,40	226435,81	55	£1.883,68	£175,00	0	0	0
Retail, GF + 1F	(Rent)	£250,00	2617	28169,39	2.732	29407,25	819,60	8822,17	30	£1.614,59	£150,00	0	0	0
Total Floor Areas			44.057	4.093	40.980	441.109	29.500	317.538	71,99					

Proposed Building - Alternative Uses (by Adaptive Reuse) :

Alternative Uses	Sale / Rental Values		Gross External Area (GEA)		Gross Internal Area (GIA)		Net Internal Area (NIA)		Plan Efficiency	Refurbishment Costs		Extension Area	New Build Costs	
		£/ sqf (pa)	(sqm)	(sqf)	(sqm)	(sqf)	(sqm)	(sqf)	% NIA / GIA	£/sqm GIA	£/sqf GIA	sqf (GIA)	£/sqm GIA	£/sqf GIA
Office Secondary (+ Retail)	(Rent)	£60,00	52576	565928,06	49.868	536779,15	42387,80	456262,28	85	£807,29	£75,00	373.453	£1.776,05	£165,00
Office Prime (+ Retail)	(Rent)	£70,00	52576	565928,06	49868	536779,15	39894,40	429423,32	80	£1.345,49	£125,00	373.453	£2.152,78	£200,00
Resid. Secondary (+ Retail)	(Sale)	£1.500,00	52576	565928,06	49868	536779,15	34907,60	375745,41	70	£1.076,39	£100,00	373.453	£1.883,68	£175,00
Residential Prime (+ Retail)	(Sale)	£2.500,00	52576	565928,06	49868	536779,15	34120	367267,68	65	£2.152,78	£200,00	373.453	£2.960,08	£275,00
Hotel Secondary (+ Retail)	(ARR)	£150,00	52576	565928,06	49868	536779,15	29920,80	322067,49	60	£1.345,49	£125,00	373.453	£1.829,86	£170,00
Hotel Prime (+ Retail)	(ARR)	£300,00	52576	565928,06	49868	536779,15	27427,40	295228,53	55	£1.883,68	£175,00	373.453	£2.475,70	£230,00
Retail, GF + 1F	(Rent)	£275,00	1233	13272,01	3562	38341,37	1087	11700,47	30	£1.614,59	£150,00	8.934	£2.152,78	£200,00
Total Floor Areas			53809	579200,08	53430	575120,52	35207	378968,15	65,89					

Investment Main Assumptions		
Total Real estate acquision cost (Estimated, £100m to £200m)	150.000.000	
Developers Profit (% of Construction Cost)	20%	
Professional fees (% of Construction Cost)	13,50%	
Architect	5,00%	
Structural Engineer	2,00%	
Quantity Surveyor	2,00%	
M&E Engineer	1,50%	
Project Manager	2,00%	
Others	1,00%	13,50%
Acquisition costs		
Stamp duty	1,00%	
Agency	1,00%	
Legal	0,50%	2,50%
Legal Fees (% over sale price)	0,25%	
Marketing Costs (% of investment costs)		
Letting	0,75%	
Sale	0,75%	
Promotion	0,75%	2,25%
Planning Obligations - Section 1.0.6 (To all Uses)	30.630.000	

Inflation	**n**	**n+1**	**n+2**	**n+3**
Inflation Rate		2,70%	2,80%	2,40%
Inflation multiplier over n	1	1,027	1,055756	1,081094144

Office Secondary - Refurbishment of the Existing Building (Floors 3 to 30) - Construction Cashflows

Investment Cost	**n**	**n+1**	**n+2**	**n+3**	**Total**
Real Estate (Floors 3 to 30) - 93,40%	140.100.000				140.100.000
Acquisition Costs	3.502.500				3.502.500
Construction Cost	3.705.313	11.416.070	16.070.113	8.686.652	39.878.148
Developers Profit	741.063	2.283.214	3.214.023	1.737.330	7.975.630
Professional Fees	741.063	2.283.214	3.214.023	1.737.330	7.975.630
Real Estate Marketing Costs				4.487.218	4.487.218
Total Construction Cost	148.789.939	15.982.498	22.498.158	16.648.531	203.919.126
Section I.0.6 (Floors 3 to 30) - 93,40%	28.608.420				28.608.420
Total Cost	177.398.359	15.982.498	22.498.158	16.648.531	232.527.546

Construction Cost (Refurbishment Only)	**n**	**n+1**	**n+2**	**n+3**
Gross Internal Area, GIA (sq.ft)	411.701	411.701	411.701	411.701
Net Internal Area, NIA (sq.ft)	329.361			
% Financial Outputs during Construction	10,00%	30,00%	40,00%	20,00%
Refurbishment Costs (£/ GIA sq.ft)	75	77	81	88
VAT	20,0%	20,0%	20,0%	20,0%
Construction Cost	3.705.313	11.416.070	16.070.113	8.686.652

Office Prime - Refurbishment of the Existing Building (Floors 3 to 30) - Construction Cashflows

Investment Cost - Total	**n**	**n+1**	**n+2**	**n+3**	**Total**
Real Estate (Floors 3 to 30) - 93,40%	140.100.000				140.100.000
Acquisition Costs	3.502.500				3.502.500
Construction Cost	6.175.522	19.026.784	26.783.521	14.477.754	66.463.581
Developers Profit	1.235.104	3.805.357	5.356.704	2.895.551	13.292.716
Professional Fees	1.235.104	3.805.357	5.356.704	2.895.551	13.292.716
Real Estate Marketing Costs				5.324.659	5.324.659
Total Construction Cost	152.248.231	26.637.497	37.496.930	25.593.515	241.976.172
Section I.0.6 (Floors 3 to 30) - 93,40%	28.608.420				28.608.420
Total Cost	180.856.651	26.637.497	37.496.930	25.593.515	270.584.592

Construction Cost (Refurbishment Only)	n	n+1	n+2	n+3
Gross Internal Area, GIA (sq.ft)	411.701	411.701	411.701	411.701
Net Internal Area, NIA (sq.ft)	329.361			
% Financial Outputs during Construction	10,00%	30,00%	40,00%	20,00%
Refurbishment Costs (£/ GIA sq.ft)	125	128	136	147
VAT	20,0%	20,0%	20,0%	20,0%
Construction Cost	6.175.522	19.026.784	26.783.521	14.477.754

Residential Secondary - Refurbishment of the Existing Building (Floors 3 to 30) - Construction Cashflows

Investment Cost - Total	n	n+1	n+2	n+3	Total
Real Estate (Floors 3 to 30) - 93,40%	140.100.000				140.100.000
Acquisition Costs	3.502.500				3.502.500
Construction Cost	4.940.418	15.221.427	21.426.817	11.582.203	53.170.865
Developers Profit	988.084	3.044.285	4.285.363	2.316.441	10.634.173
Professional Fees	741.063	2.283.214	3.214.023	1.737.330	7.975.630
Real Estate Marketing Costs				4.846.121	4.846.121
Total Construction Cost	150.272.064	20.548.926	28.926.203	20.482.096	220.229.288
Section I.0.6 (Floors 3 to 30) - 93,40%	28.608.420				28.608.420
Total Cost	178.880.484	20.548.926	28.926.203	20.482.096	248.837.708

Construction Cost (Refurbishment Only)	n	n+1	n+2	n+3
Gross Internal Area, GIA (sq.ft)	411.701	411.701	411.701	411.701
Net Internal Area, NIA (sq.ft)	288.191			
% Financial Outputs during Construction	10,00%	30,00%	40,00%	20,00%
Refurbishment Costs (£/ GIA sq.ft)	100	103	108	117
VAT	20,0%	20,0%	20,0%	20,0%
Construction Cost	4.940.418	15.221.427	21.426.817	11.582.203

Residential Prime - Refurbishment of the Existing Building (Floors 3 to 30) - Construction Cashflows

Investment Cost - Total	n	n+1	n+2	n+3	Total
Real Estate (Floors 3 to 30) - 93,40%	140.100.000				140.100.000
Acquisition Costs	3.502.500				3.502.500
Construction Cost	9.880.835	30.442.854	42.853.634	23.164.406	106.341.729
Developers Profit	1.976.167	6.088.571	8.570.727	4.632.881	21.268.346
Professional Fees	1.235.104	3.805.357	5.356.704	2.895.551	13.292.716
Real Estate Marketing Costs				6.401.369	6.401.369
Total Construction Cost	156.694.607	40.336.781	56.781.065	37.094.207	290.906.660
Section I.0.6 (Floors 3 to 30) - 93,40%	28.608.420				28.608.420
Construction Cost	185.303.027	40.336.781	56.781.065	37.094.207	319.515.080

Construction Cost (Refurbishment Only)	n	n+1	n+2	n+3
Gross Internal Area, GIA (sq.ft)	411.701	411.701	411.701	411.701
Net Internal Area, NIA (sq.ft)	267.606			
% Financial Outputs during Construction	10,00%	30,00%	40,00%	20,00%
Refurbishment Costs (£/ GIA sq.ft)	200	205	217	234
VAT	20,0%	20,0%	20,0%	20,0%
Construction Cost	9.880.835	30.442.854	42.853.634	23.164.406

Hotel Secondary - Refurbishment of the Existing Building (Floors 3 to 30) - Construction Cashflows

Investment Cost - Total	n	n+1	n+2	n+3	Total
Real Estate (Floors 3 to 30) - 93,40%	140.100.000				140.100.000
Acquisition Costs	3.502.500				3.502.500
Construction Cost	6.175.522	19.026.784	26.783.521	14.477.754	66.463.581
Developers Profit	1.235.104	3.805.357	5.356.704	2.895.551	13.292.716
Professional Fees	741.063	2.283.214	3.214.023	1.737.330	7.975.630

Real Estate Marketing Costs				5.205.025	5.205.025
Total Construction Cost	151.754.189	25.115.354	35.354.248	24.315.660	236.539.451
Section I.0.6 (Floors 3 to 30) - 93,40%	28.608.420				28.608.420
Total Cost	180.362.609	25.115.354	35.354.248	24.315.660	265.147.871

Construction Cost (Refurbishment Only)	**n**	**n+1**	**n+2**	**n+3**
Gross Internal Area, GIA (sq.ft)	411.701	411.701	411.701	411.701
Net Internal Area, NIA (sq.ft)	247.021			
Estimated Number of Rooms	898	275		
Average Room Size (sq.ft)	275			
% Financial Outputs during Construction	10,00%	30,00%	40,00%	20,00%
Refurbishment Costs (£/ GIA sq.ft)	125	128	136	147
VAT	20,0%	20,0%	20,0%	20,0%
Construction Cost	6.175.522	19.026.784	26.783.521	14.477.754

Hotel Prime - Refurbishment of the Existing Building (Floors 3 to 30) - Construction Cashflows

Investment Cost - Total	**n**	**n+1**	**n+2**	**n+3**	**Total**
Real Estate (Floors 3 to 30) - 93,40%	140.100.000				140.100.000
Acquisition Costs	3.502.500				3.502.500
Construction Cost	8.645.731	26.637.497	37.496.930	20.268.856	93.049.013
Developers Profit	1.729.146	5.327.499	7.499.386	4.053.771	18.609.803
Professional Fees	1.235.104	3.805.357	5.356.704	2.895.551	13.292.716
Real Estate Marketing Costs				6.042.466	6.042.466
Total Construction Cost	155.212.482	35.770.353	50.353.020	33.260.643	274.596.497
Section I.0.6 (Floors 3 to 30) - 93,40%	28.608.420				28.608.420
Total Cost	183.820.902	35.770.353	50.353.020	33.260.643	303.204.917

Construction Cost	**n**	**n+1**	**n+2**	**n+3**
Gross Internal Area, GIA (sq.ft)	411.701	411.701	411.701	411.701
Net Internal Area, NIA (sq.ft)	226.436			
Estimated Number of Rooms	697	325		
Average Room Size (sq.ft)	325			
% Financial Outputs during Construction	10,00%	30,00%	40,00%	20,00%
Refurbishment Costs (£/ GIA sq.ft)	175	180	190	205
VAT	20,0%	20,0%	20,0%	20,0%
Construction Cost	8.645.731	26.637.497	37.496.930	20.268.856

Retail - Refurbishment of the Existing Building (Floors 1 to 2) - Construction Cashflows

Investment Cost - Total	**n**	**n+1**	**n+2**	**n+3**	**Total**
Real Estate (Floors 1 to 2) - 6,60%	9.900.000				9.900.000
Acquisition Costs	247.500				247.500
Construction Cost	529.330	1.630.867	2.295.730	1.240.950	5.696.878
Developers Profit	105.866	326.173	459.146	248.190	1.139.376
Professional Fees	105.866	326.173	459.146	248.190	1.139.376
Real Estate Marketing Costs				407.770	407.770
Total Construction Cost	10.888.563	2.283.214	3.214.023	2.145.101	18.530.900
Section I.0.6 (Floors 1 to 2) - 6,60%	2.021.580				2.021.580
Total Cost	12.910.143	2.283.214	3.214.023	2.145.101	20.552.480

Construction Cost (Refurbishment Only)	**n**	**n+1**	**n+2**	**n+3**
Gross Internal Area, GIA (sq.ft)	29.407	29.407	29.407	29.407
Net Internal Area, NIA (sq.ft)	8.822			
% Financial Outputs during Construction	10,00%	30,00%	40,00%	20,00%
Refurbishment Costs (£/ GIA sq.ft)	150	154	163	176
VAT	20,0%	20,0%	20,0%	20,0%
Construction Cost	529.330	1.630.867	2.295.730	1.240.950

Inflation	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Inflation Rate	3,00%	2,90%	2,90%	2,90%	2,90%	2,90%	2,90%
Inflation multiplier over n	1,113526968	1,14581925	1,179048009	1,213240401	1,248424373	1,284628679	1,321882911

Main Assumption Investment	
Property Costs	1,00%

Office Secondary - Refurbishment of the Existing Building (Floors 3 to 30) - Post Construction Cashflows

	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Construction Cost (Refurbishment Only)	203.919.126						
Net Internal Area, NIA (sq.ft)	329.361						
Assumed Rent Growth		3,50%	3,50%	3,50%	3,50%	3,50%	3,50%
Rent (sq.ft per annum)	50	52	54	55	57	59	61
Occupation rate	70,00%	90,00%	90,00%	90,00%	90,00%	90,00%	90,00%
Fixed Maintance Costs (% / Rent)	3,00%						

Cashflow Statement	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Rent	11.527.641	15.339.997	15.876.897	16.432.588	17.007.729	17.602.999	18.219.104
Maintance Costs (inflation growth)	(345.829)	(460.200)	(476.307)	(492.978)	(510.232)	(528.090)	(546.573)
Property costs	(2.039.191)	(2.039.191)	(2.039.191)	(2.039.191)	(2.039.191)	(2.039.191)	(2.039.191)
	9.142.621	12.840.606	13.361.399	13.900.419	14.458.306	15.035.718	15.633.340

Office Prime - Refurbishment of the Existing Building (Floors 3 to 30) - Post Construction Cashflows

	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Construction Cost (Refurbishment Only)	241.976.172						
Net Internal Area, NIA (sq.ft)	329.361						
Assumed Rent Growth		3,50%	3,50%	3,50%	3,50%	3,50%	3,50%
Rent (sq.ft per annum)	65	67	70	72	75	77	80
Occupation rate	70,00%	90,00%	90,00%	90,00%	90,00%	90,00%	90,00%
Fixed Maintance Costs (% / Rent)	3,00%						

Cashflow Statement	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Rent	14.985.934	19.941.996	20.639.966	21.362.365	22.110.047	22.883.899	23.684.835
Maintance Costs (inflation growth)	(449.578)	(598.260)	(619.199)	(640.871)	(663.301)	(686.517)	(710.545)
Property costs	(2.419.762)	(2.419.762)	(2.419.762)	(2.419.762)	(2.419.762)	(2.419.762)	(2.419.762)
Total	12.116.594	16.923.974	17.601.005	18.301.732	19.026.984	19.777.620	20.554.529

Residential Secondary - Refurbishment of the Existing Building (Floors 3 to 30) - Post Construction Cashflows

	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Construction Cost (Refurbishment Only)	203.919.126						
Net Internal Area, NIA (sq.ft)	288.191	708					
Sale							
% of Apartments Sold	20,00%	80,00%	0,00%	0,00%	0,00%	0,00%	0,00%
% of Apartments Unsold	80,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Sale Price (£/sq.ft) - 2013	1.000						
Sale Price (£/sq.ft)	1.114	1.146	1.179	1.213	1.248	1.285	1.322

Cashflow Statement	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Sale	64.181.697	264.171.864	0	0	0	0	0
Property costs	(1.631.353)	0	0	0	0	0	0
Total	62.550.344	264.171.864	0	0	0	0	0

Residential Prime - Refurbishment of the Existing Building (Floors 3 to 30) - Post Construction Cashflows

	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Construction Cost (Refurbishment Only)	290.906.660						
Net Internal Area, NIA (sq.ft)	267.606	1.087					
Sale							
% of Apartments Sold	20,00%	80,00%	0,00%	0,00%	0,00%	0,00%	0,00%
% of Apartments Unsold	80,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Sale Price (£/sq.ft) - 2013	2.000						
Sale Price (£/sq.ft)	2.227	2.292	2.358	2.426	2.497	2.569	2.644

Cashflow Statement	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Sale	119.194.580	490.604.891	0	0	0	0	0
Property costs	(2.327.253)	0	0	0	0	0	0
Total	116.867.327	490.604.891	0	0	0	0	0

Hotel Secondary - Refurbishment of the Existing Building (Floors 3 to 30) - Post Construction Cashflows

	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Construction Cost (Refurbishment Only)	203.919.126						
Net Internal Area, NIA (sq.ft)	247.021						
Number of Rooms	898						

Income							
Average Room Rate, ARR (2013)	125						
Average Room Rate, ARR	139	143	147	152	156	161	165
Occupation rate	60,00%	80,00%	80,00%	80,00%	80,00%	80,00%	80,00%
Nº Nights occupied, per annum	196.718	262.291	262.291	262.291	262.291	262.291	262.291
Turnover - Rooms	27.381.412	37.567.298	38.656.749	39.777.795	40.931.351	42.118.360	43.339.793
Food & beaverage, F&B (% Rooms)	30,00%	30,00%	30,00%	30,00%	30,00%	30,00%	30,00%
Turnover - F&B	8.214.424	11.270.189	11.597.025	11.933.338	12.279.405	12.635.508	13.001.938
Turnover - Other Ancillary Uses (E.g. Spa, Gym…)	2.738.141	3.756.730	3.865.675	3.977.779	4.093.135	4.211.836	4.333.979
Total Turnover	38.333.977	52.594.217	54.119.449	55.688.913	57.303.891	58.965.704	60.675.710
Gross Margin F&B + Other (%)	50,00%	50,00%	50,00%	50,00%	50,00%	50,00%	50,00%
Gross Margin F&B + Other	5.476.282	7.513.460	7.731.350	7.955.559	8.186.270	8.423.672	8.667.959
Expenditures							
Payroll (30% Rooms Turnover)	8.214.424	8.452.642	8.697.769	8.950.004	9.209.554	9.476.631	9.751.453
Operational Expenses							
Fixed (50% of Food and Beverage Turnover)	4.107.212	4.226.321	4.348.884	4.475.002	4.604.777	4.738.316	4.875.727
Variable (50% of Other Ancillary Uses Turnover)	1.369.071	1.878.365	1.932.837	1.988.890	2.046.568	2.105.918	2.166.990

Cashflow Statement	**n+4**	**n+5**	**n+6**	**n+7**	**n+8**	**n+9**	**n+10**
Turnover - Rooms	27.381.412	37.567.298	38.656.749	39.777.795	40.931.351	42.118.360	43.339.793
Gross Margin F&B + Others	5.476.282	7.513.460	7.731.350	7.955.559	8.186.270	8.423.672	8.667.959
Payroll	(8.214.424)	(8.452.642)	(8.697.769)	(8.950.004)	(9.209.554)	(9.476.631)	(9.751.453)
Operational Expenses							
Fixed	(4.107.212)	(4.226.321)	(4.348.884)	(4.475.002)	(4.604.777)	(4.738.316)	(4.875.727)
Variable	(1.369.071)	(1.878.365)	(1.932.837)	(1.988.890)	(2.046.568)	(2.105.918)	(2.166.990)
Total	19.166.989	30.523.429	31.408.609	32.319.458	33.256.723	34.221.168	35.213.582

Hotel Prime - Refurbishment of the Existing Building (Floors 3 to 30) - Post Construction Cashflows

	n+4	**n+5**	**n+6**	**n+7**	**n+8**	**n+9**	**n+10**
Construction Cost (Refurbishment Only)	203.919.126						
Net Internal Area, NIA (sq.ft)	226.436						
Nr Rooms	697						
Income							
Average Room Rate, ARR (2013)	225						
Average Room Rate, ARR	251	258	265	273	281	289	297
Occupation rate	60,00%	80,00%	80,00%	80,00%	80,00%	80,00%	80,00%
Nº Nights occupied, per annum	152.583	203.444	203.444	203.444	203.444	203.444	203.444
Turnover - Rooms	38.228.664	52.449.727	53.970.769	55.535.921	57.146.463	58.803.711	60.509.018
Food & Beaverage, F&B (% Rooms)	40,00%	40,00%	40,00%	40,00%	40,00%	40,00%	40,00%
Turnover - F&B	15.291.466	20.979.891	21.588.308	22.214.369	22.858.585	23.521.484	24.203.607
Turnover - Other Ancillary Uses (E.g. Spa, Gym…)	3.822.866	5.244.973	5.397.077	5.553.592	5.714.646	5.880.371	6.050.902
Total Turnover	57.342.996	78.674.591	80.956.154	83.303.882	85.719.695	88.205.566	90.763.527
Gross Margin F&B + Other (%)	60,00%	60,00%	60,00%	60,00%	60,00%	60,00%	60,00%
Gross Margin F&B + Other	11.468.599	15.734.918	16.191.231	16.660.776	17.143.939	17.641.113	18.152.705
Expenditures							
Payroll (30% Rooms Turnover)	11.468.599	11.801.189	12.143.423	12.495.582	12.857.954	13.230.835	13.614.529
Operational Expenses							
Fixed (10% of Total Turnover)	5.734.300	5.900.594	6.071.712	6.247.791	6.428.977	6.615.417	6.807.265
Variable (30% of Total Turnover)	17.202.899	23.602.377	24.286.846	24.991.165	25.715.908	26.461.670	27.229.058

Cashflow Statement	**n+4**	**n+5**	**n+6**	**n+7**	**n+8**	**n+9**	**n+10**
Turnover - Rooms	38.228.664	52.449.727	53.970.769	55.535.921	57.146.463	58.803.711	60.509.018
Gross Margin F&B + Others	11.468.599	15.734.918	16.191.231	16.660.776	17.143.939	17.641.113	18.152.705
Payroll	(11.468.599)	(11.801.189)	(12.143.423)	(12.495.582)	(12.857.954)	(13.230.835)	(13.614.529)
Operational Expenses							
Fixed	(5.734.300)	(5.900.594)	(6.071.712)	(6.247.791)	(6.428.977)	(6.615.417)	(6.807.265)
Variable	(17.202.899)	(23.602.377)	(24.286.846)	(24.991.165)	(25.715.908)	(26.461.670)	(27.229.058)
Total	15.291.466	26.880.485	27.660.019	28.462.160	29.287.562	30.136.902	31.010.872

Retail - Refurbishment of the Existing Building (Floors 1 to 2) - Post Construction Cashflows

	n+4	**n+5**	**n+6**	**n+7**	**n+8**	**n+9**	**n+10**
Construction Cost (Refurbishment Only)	18.530.900						
Net Internal Area, NIA (sq.ft)	8.822						
Assumed Rent Growth		3,50%	3,50%	3,50%	3,50%	3,50%	3,50%
Rent (sq.ft per annum)	250	259	268	277	287	297	307
Occupation Rate	75,00%	95,00%	95,00%	95,00%	95,00%	95,00%	95,00%
Fixed Maintance Costs (% / Rent) incluinding periodic refurbisment)	10,00%						

Cashflow Statement	**n+4**	**n+5**	**n+6**	**n+7**	**n+8**	**n+9**	**n+10**
Rent	1.654.158	2.168.601	2.244.502	2.323.059	2.404.366	2.488.519	2.575.617
Maintance Costs (inflation growth)	(165.416)	(216.860)	(224.450)	(232.306)	(240.437)	(248.852)	(257.562)
Property costs	(185.309)	(185.309)	(185.309)	(185.309)	(185.309)	(185.309)	(185.309)
Total	1.303.433	1.766.432	1.834.743	1.905.444	1.978.621	2.054.358	2.132.747

Investment Output - Refurbishment of the Existing Building Only

	Investment Costs	Projected Cash Flows	Residual Value	Net Present Value
Office Secondary (Floors 3 to 30)	(223.722.679)	54.564.145	93.140.722	(76.017.813)
Office Prime (Floors 3 to 30)	(256.480.571)	71.888.880	122.460.310	(62.131.381)
Residential Secondary (Floors 3 to 30)	(237.761.776)	225.767.302	0	(11.994.474)
Residential Prime (Floors 3 to 30)	(298.597.859)	419.798.419	0	121.200.560
Hotel Secondary (Floors 3 to 30)	(251.800.872)	124.910.265	209.796.400	82.905.793
Hotel Prime (Floors 3 to 30)	(284.558.763)	108.835.137	184.757.386	9.033.760
Retail (Floors 1 to 2)	(19.356.449)	7.512.826	12.706.534	862.910

			1	2	4	4	5	6	7	8	9	10	10
Cash Flows	**Discount Rate (Yield)**	**n**	**n+1**	**n+2**	**n+3**	**n+4**	**n+5**	**n+6**	**n+7**	**n+8**	**n+9**	**n+10**	**Residual Value**
Office Secondary (Floors 3 to 30)	8,00%	(177.398.359)	(15.982.498)	(22.498.158)	(16.648.531)	9.142.621	12.840.606	13.361.399	13.900.419	14.458.306	15.035.718	15.633.340	201.083.833
Office Prime (Floors 3 to 30)	8,00%	(180.856.651)	(26.637.497)	(37.496.930)	(25.593.515)	12.116.594	16.923.974	17.601.005	18.301.732	19.026.984	19.777.620	20.554.529	264.382.625
Residential Secondary (Floors 3 to 30)	8,00%	(178.880.484)	(20.548.926)	(28.926.203)	(20.482.096)	62.550.344	264.171.864	0	0	0	0	0	0
Residential Prime (Floors 3 to 30)	8,00%	(185.303.027)	(40.336.781)	(56.781.065)	(37.094.207)	116.867.327	490.604.891	0	0	0	0	0	0
Hotel Secondary (Floors 3 to 30)	8,00%	(180.362.609)	(25.115.354)	(35.354.248)	(24.315.660)	19.166.989	30.523.429	31.408.609	32.319.458	33.256.723	34.221.168	35.213.582	452.934.692
Hotel Prime (Floors 3 to 30)	8,00%	(183.820.902)	(35.770.353)	(50.353.020)	(33.260.643)	15.291.466	26.880.485	27.660.019	28.462.160	29.287.562	30.136.902	31.010.872	398.877.339
Retail (Floors 1 to 2)	8,00%	(12.910.143)	(2.283.214)	(3.214.023)	(2.145.101)	1.303.433	1.766.432	1.834.743	1.905.444	1.978.621	2.054.358	2.132.747	27.432.454
Net Present Value of Cash Flows	**Net Present Value**	**n**	**n+1**	**n+2**	**n+3**	**n+4**	**n+5**	**n+6**	**n+7**	**n+8**	**n+9**	**n+10**	**Residual Value**
Office Secondary (Floors 3 to 30)	(76.017.813)	(177.398.359)	(14.798.609)	(19.288.544)	(12.237.167)	6.720.099	8.739.100	8.419.948	8.110.761	7.811.373	7.521.602	7.241.261	93.140.722
Office Prime (Floors 3 to 30)	(62.131.381)	(180.856.651)	(24.664.349)	(32.147.573)	(18.811.997)	8.906.058	11.518.173	11.091.619	10.678.885	10.279.688	9.893.734	9.520.724	122.460.310
Residential Secondary (Floors 3 to 30)	(11.994.474)	(178.880.484)	(19.026.784)	(24.799.557)	(15.054.952)	45.976.370	179.790.932	0	0	0	0	0	0
Residential Prime (Floors 3 to 30)	121.200.560	(185.303.027)	(37.348.871)	(48.680.611)	(27.265.350)	85.900.974	333.897.445	0	0	0	0	0	0
Hotel Secondary (Floors 3 to 30)	82.905.793	(180.362.609)	(23.254.958)	(30.310.569)	(17.872.736)	14.088.309	20.773.733	19.792.751	18.858.094	17.967.572	17.119.104	16.310.702	209.796.400
Hotel Prime (Floors 3 to 30)	9.033.760	(183.820.902)	(33.120.697)	(43.169.599)	(24.447.566)	11.239.684	18.294.406	17.430.504	16.607.397	15.823.159	15.075.954	14.364.034	184.757.386
Retail (Floors 1 to 2)	57.527	(12.910.143)	(2.114.087)	(2.755.506)	(1.576.713)	958.062	1.202.204	1.156.199	1.111.809	1.068.987	1.027.691	987.874	12.706.534

Total Net Present Values, Alternative Use Scenarios (Refurbishement of the Existing Building Only)

% of Uses							Mixed Use
Primary Use							
Office Secondary (Floors 3 to 30)	100%						
Office Prime (Floors 3 to 30)		100,00%					20%
Residential Secondary (Floors 3 to 30)			100%				
Residential Prime (Floors 3 to 30)				100,00%			50%
Hotel Secondary (Floors 3 to 30)					100,00%		30%
Hotel Prime (Floors 3 to 30)						100,00%	
Ancillary Use							
Retail (Floors 1 to 2)	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%
Total Net Present Values							
Primary Use							
Office Secondary (Floors 3 to 30)	(76.017.813)	0	0	0	0	0	0
Office Prime (Floors 3 to 30)	0	(62.131.381)	0	0	0	0	(12.426.276)
Residential Secondary (Floors 3 to 30)	0	0	(11.994.474)	0	0	0	0
Residential Prime (Floors 3 to 30)	0	0	0	121.200.560	0	0	60.600.280
Hotel Secondary (Floors 3 to 30)	0	0	0	0	82.905.793	0	24.871.738
Hotel Prime (Floors 3 to 30)	0	0	0	0	0	9.033.760	0
Ancillary Use							
Retail (Floors 1 to 2)	862.910	862.910	862.910	862.910	862.910	862.910	862.910
Total	**(75.154.902)**	**(61.268.470)**	**(11.131.563)**	**122.063.470**	**83.768.703**	**9.896.671**	**73.908.652**
(IRR)	**5,71%**	**6,39%**	**6,78%**	**17,60%**	**10,05%**	**8,23%**	

Investment Main Assumptions		
Total Real estate acquision cost (Estimated, £100m to £200m)	150.000.000	
Developers Profit (% of Construction Cost)	20%	
Professional fees (% of Construction Cost)	13,50%	
Architect	5,00%	
Structural Engineer	2,00%	
Quantity Surveyor	2,00%	
M&E Engineer	1,50%	
Project Manager	2,00%	
Others	1,00%	13,50%
Acquisition costs		
Stamp duty	1,00%	
Agency	1,00%	
Legal	0,50%	2,50%
Legal Fees (% over sale price)	0,25%	
Marketing Costs (% of investment costs)		
Letting	0,75%	
Sale	0,75%	
Promotion	0,75%	2,25%
Planning Obligations - Section 1.0.6 (To all Uses)	30.630.000	

Inflation	**n**	**n+1**	**n+2**	**n+3**
Inflation Rate		2,70%	2,80%	2,40%
Inflation multiplier over n	1	1,027	1,055756	1,081094144

Office Secondary - Adaptive Reuse of the Existing Building (Floors 3 to 30) - Construction Cashflows

Investment Cost	**n**	**n+1**	**n+2**	**n+3**	**Total**
Real Estate (Floors 3 to 30) - 93,40%	140.100.000				140.100.000
Acquisition Costs	3.502.500				3.502.500
Total Construction Cost	7.738.611	23.842.660	33.562.708	18.142.224	83.286.202
Developers Profit	1.547.722	4.768.532	6.712.542	3.628.445	16.657.240
Professional Fees	1.547.722	4.768.532	6.712.542	3.628.445	16.657.240
Real Estate Marketing Costs				5.854.572	5.854.572
Total Construction Cost	154.436.555	33.379.724	46.987.791	31.253.685	266.057.755
Section I.0.6 (Floors 3 to 30) - 93,40%	28.608.420				28.608.420
Total Cost	183.044.975	33.379.724	46.987.791	31.253.685	294.666.175

Construction Cost (Adaptive Reuse of Existing Building)	**n**	**n+1**	**n+2**	**n+3**
Total Gross Internal Area, GIA (sq.ft)	411.701	411.701	411.701	411.701
Total Net Internal Area, NIA (sq.ft)	329.361	329.361	329.361	329.361
Extension Area only, GIA (sq.ft)	373.453	373.453	373.453	373.453
% Financial Outputs during Construction	10,00%	30,00%	40,00%	20,00%
Refurbishment Costs (£/ GIA sq.ft)	75	77	81	88
New Build Costs, for Extension Area (£/ GIA sq.ft)	165	169	179	193
VAT	20,0%	20,0%	20,0%	20,0%
Total Construction Cost	7.738.611	23.842.660	33.562.708	18.142.224

Office Prime - Adaptive Reuse of the Existing Building (Floors 3 to 30) - Construction Cashflows

Investment Cost - Total	**n**	**n+1**	**n+2**	**n+3**	**Total**
Real Estate (Floors 3 to 30) - 93,40%	140.100.000				140.100.000
Acquisition Costs	3.502.500				3.502.500
Total Construction Cost	9.536.603	29.382.275	41.360.684	22.357.397	102.636.959
Developers Profit	1.907.321	5.876.455	8.272.137	4.471.479	20.527.392
Professional Fees	1.907.321	5.876.455	8.272.137	4.471.479	20.527.392
Real Estate Marketing Costs				6.464.120	6.464.120
Total Construction Cost	156.953.745	41.135.185	57.904.958	37.764.476	293.758.363
Section I.0.6 (Floors 3 to 30) - 93,40%	28.608.420				28.608.420
Total Cost	185.562.165	41.135.185	57.904.958	37.764.476	322.366.783

Construction Cost (Adaptive Reuse of Existing Building)	n	n+1	n+2	n+3
Total Gross Internal Area, GIA (sq.ft)	411.701	411.701	411.701	411.701
Total Net Internal Area, NIA (sq.ft)	329.361	329.361	329.361	329.361
Extension Area only, GIA (sq.ft)	373.453	373.453	373.453	373.453
% Financial Outputs during Construction	10,00%	30,00%	40,00%	20,00%
Refurbishment Costs (£/ GIA sq.ft)	125	128	136	147
New Build Costs, for Extension Area (£/ GIA sq.ft)	200	205	217	234
VAT	20,0%	20,0%	20,0%	20,0%
Total Construction Cost	9.536.603	29.382.275	41.360.684	22.357.397

Residential Secondary - Adaptive Reuse of Existing Building (Floors 3 to 30) - Construction Cashflows

Investment Cost - Total	n	n+1	n+2	n+3	Total
Real Estate (Floors 3 to 30) - 93,40%	140.100.000				140.100.000
Acquisition Costs	3.502.500				3.502.500
Total Construction Cost	8.301.499	25.576.918	36.003.980	19.461.846	89.344.243
Developers Profit	1.660.300	5.115.384	7.200.796	3.892.369	17.868.849
Professional Fees	1.547.722	4.768.532	6.712.542	3.628.445	16.657.240
Real Estate Marketing Costs				6.018.139	6.018.139
Total Construction Cost	155.112.021	35.460.834	49.917.317	33.000.798	273.490.970
Section I.0.6 (Floors 3 to 30) - 93,40%	28.608.420				28.608.420
Total Cost	183.720.441	35.460.834	49.917.317	33.000.798	302.099.390

Construction Cost (Adaptive Reuse of Existing Building)	n	n+1	n+2	n+3
Total Gross Internal Area, GIA (sq.ft)	411.701	411.701	411.701	411.701
Total Net Internal Area, NIA (sq.ft)	288.191	288.191	288.191	288.191
Extension Area only, GIA (sq.ft)	373.453	373.453	373.453	373.453
% Financial Outputs during Construction	10,00%	30,00%	40,00%	20,00%
Refurbishment Costs (£/ GIA sq.ft)	100	103	108	117
New Build Costs, for Extension Area (£/ GIA sq.ft)	175	180	190	205
VAT	20,0%	20,0%	20,0%	20,0%
Total Construction Cost	8.301.499	25.576.918	36.003.980	19.461.846

Residential Prime - Adaptive Reuse of the Existing Building (Floors 3 to 30) - Construction Cashflows

Investment Cost - Total	n	n+1	n+2	n+3	Total
Real Estate (Floors 3 to 30) - 93,40%	140.100.000				140.100.000
Acquisition Costs	3.502.500				3.502.500
Total Construction Cost	13.241.917	40.798.345	57.430.797	31.044.049	142.515.107
Developers Profit	2.648.383	8.159.669	11.486.159	6.208.810	28.503.021
Professional Fees	1.907.321	5.876.455	8.272.137	4.471.479	20.527.392
Real Estate Marketing Costs				7.540.830	7.540.830
Total Construction Cost	161.400.121	54.834.469	77.189.093	49.265.169	342.688.851
Section I.0.6 (Floors 3 to 30) - 93,40%	28.608.420				28.608.420
Construction Cost	190.008.541	54.834.469	77.189.093	49.265.169	371.297.271

Construction Cost (Adaptive Reuse of Existing Building)	n	n+1	n+2	n+3
Total Gross Internal Area, GIA (sq.ft)	411.701	411.701	411.701	411.701
Total Net Internal Area, NIA (sq.ft)	267.606	267.606	267.606	267.606
Extension Area only, GIA (sq.ft)	373.453	373.453	373.453	373.453
% Financial Outputs during Construction	10,00%	30,00%	40,00%	20,00%
Refurbishment Costs (£/ GIA sq.ft)	200	205	217	234
New Build Costs, for Extension Area (£/ GIA sq.ft)	275	282	298	322
VAT	20,0%	20,0%	20,0%	20,0%
Total Construction Cost	13.241.917	40.798.345	57.430.797	31.044.049

Hotel Secondary - Adaptive Reuse of the Existing Building (Floors 3 to 30) - Construction Cashflows

Investment Cost - Total	n	n+1	n+2	n+3	Total
Real Estate (Floors 3 to 30) - 93,40%	140.100.000				140.100.000
Acquisition Costs	3.502.500				3.502.500
Total Construction Cost	8.192.171	25.240.078	35.529.819	19.205.540	88.167.608
Developers Profit	1.638.434	5.048.016	7.105.964	3.841.108	17.633.522
Professional Fees	1.547.722	4.768.532	6.712.542	3.628.445	16.657.240

Real Estate Marketing Costs				5.986.370	5.986.370
Total Construction Cost	154.980.827	35.056.626	49.348.324	32.661.462	272.047.239
Section I.0.6 (Floors 3 to 30) - 93,40%	28.608.420				28.608.420
Total Cost	183.589.247	35.056.626	49.348.324	32.661.462	300.655.659

Construction Cost (Adaptive Reuse of Existing Building)	**n**	**n+1**	**n+2**	**n+3**
Total Gross Internal Area, GIA (sq.ft)	411.701	411.701	411.701	411.701
Total Net Internal Area, NIA (sq.ft)	247.021	247.021	247.021	247.021
Extension Area only, GIA (sq.ft)	373.453	373.453	373.453	373.453
Estimated Number of Rooms	898			
Average Room Size (sq.ft)	275			
% Financial Outputs during Construction	10,00%	30,00%	40,00%	20,00%
Refurbishment Costs (£/ GIA sq.ft)	125	128	136	147
New Build Costs, for Extension Area (£/ GIA sq.ft)	170	175	184	199
VAT	20,0%	20,0%	20,0%	20,0%
Total Construction Cost	8.192.171	25.240.078	35.529.819	19.205.540

Hotel Prime - Adaptive Reuse of the Existing Building (Floors 3 to 30) - Construction Cashflows

Investment Cost - Total	**n**	**n+1**	**n+2**	**n+3**	**Total**
Real Estate (Floors 3 to 30) - 93,40%	140.100.000				140.100.000
Acquisition Costs	3.502.500				3.502.500
Total Construction Cost	11.110.524	34.231.524	48.186.849	26.047.260	119.576.157
Developers Profit	2.222.105	6.846.305	9.637.370	5.209.452	23.915.231
Professional Fees	1.907.321	5.876.455	8.272.137	4.471.479	20.527.392
Real Estate Marketing Costs				6.921.479	6.921.479
Total Construction Cost	158.842.449	46.954.284	66.096.356	42.649.670	314.542.759
Section I.0.6 (Floors 3 to 30) - 93,40%	28.608.420				28.608.420
Total Cost	187.450.869	46.954.284	66.096.356	42.649.670	343.151.179

Construction Cost (Adaptive Reuse of Existing Building)	**n**	**n+1**	**n+2**	**n+3**
Total Gross Internal Area, GIA (sq.ft)	411.701	411.701	411.701	411.701
Total Net Internal Area, NIA (sq.ft)	226.436	226.436	226.436	226.436
Extension Area only, GIA (sq.ft)	373.453	373.453	373.453	373.453
Estimated Number of Rooms	697			
Average Room Size (sq.ft)	325			
% Financial Outputs during Construction	10,00%	30,00%	40,00%	20,00%
Refurbishment Costs (£/ GIA sq.ft)	175	180	190	205
New Build Costs, for Extension Area (£/ GIA sq.ft)	230	236	249	270
VAT	20,0%	20,0%	20,0%	20,0%
Total Construction Cost	11.110.524	34.231.524	48.186.849	26.047.260

Retail - Adaptive Reuse of the Existing Building (Floors 1 to 2) - Construction Cashflows

Investment Cost - Total	**n**	**n+1**	**n+2**	**n+3**	**Total**
Real Estate (Floors 1 to 2) - 6,60%	9.900.000				9.900.000
Acquisition Costs	247.500				247.500
Total Construction Cost	582.935	1.796.023	2.528.217	1.366.620	6.273.795
Developers Profit	116.587	359.205	505.643	273.324	1.254.759
Professional Fees	116.587	359.205	505.643	273.324	1.254.759
Real Estate Marketing Costs				425.943	425.943
Total Construction Cost	10.963.609	2.514.433	3.539.503	2.339.211	19.356.756
Section I.0.6 (Floors 1 to 2) - 6,60%	2.021.580				2.021.580
Total Cost	12.985.189	2.514.433	3.539.503	2.339.211	21.378.336

Construction Cost (Adaptive Reuse of Existing Building)	**n**	**n+1**	**n+2**	**n+3**
Total Gross Internal Area, GIA (sq.ft)	29.407	29.407	29.407	29.407
Total Net Internal Area, NIA (sq.ft)	8.822	8.822	8.822	8.822
Extension Area only, GIA (sq.ft)	8.934	8.934	8.934	8.934
% Financial Outputs during Construction	10,00%	30,00%	40,00%	20,00%
Refurbishment Costs (£/ GIA sq.ft)	150	154	163	176
New Build Costs, for Extension Area (£/ GIA sq.ft)	200	205	217	234
VAT	20,0%	20,0%	20,0%	20,0%
Total Construction Cost	582.935	1.796.023	2.528.217	1.366.620

Inflation	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Inflation Rate	3,00%	2,90%	2,90%	2,90%	2,90%	2,90%	2,90%
Inflation multiplier over n	1,113526968	1,14581925	1,179048009	1,213240401	1,248424373	1,284628679	1,321882911
Main Assumption Investment							
Property Costs	1,00%						

Office Secondary - Adaptive Reuse of the Existing Building (Floors 3 to 30) - Post Construction Cashflows

	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Construction Cost (Refurbishment Only)	266.057.755						
Net Internal Area, NIA (sq.ft)	329.361						
Assumed Rent Growth		3,50%	3,50%	3,50%	3,50%	3,50%	3,50%
Rent (sq.ft per annum)	60	62	64	67	69	71	74
Occupation rate	70,00%	90,00%	90,00%	90,00%	90,00%	90,00%	90,00%
Fixed Maintance Costs (% / Rent)	3,00%						

Cashflow Statement	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Rent	13.833.169	18.407.996	19.052.276	19.719.106	20.409.274	21.123.599	21.862.925
Maintance Costs (inflation growth)	(414.995)	(552.240)	(571.568)	(591.573)	(612.278)	(633.708)	(655.888)
Property costs	(2.660.578)	(2.660.578)	(2.660.578)	(2.660.578)	(2.660.578)	(2.660.578)	(2.660.578)
	10.757.597	15.195.179	15.820.130	16.466.955	17.136.419	17.829.314	18.546.460

Office Prime - Adaptive Reuse of the Existing Building (Floors 3 to 30) - Post Construction Cashflows

	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Construction Cost (Refurbishment Only)	293.758.363						
Net Internal Area, NIA (sq.ft)	329.361						
Assumed Rent Growth		3,50%	3,50%	3,50%	3,50%	3,50%	3,50%
Rent (sq.ft per annum)	70	72	75	78	80	83	86
Occupation rate	70,00%	90,00%	90,00%	90,00%	90,00%	90,00%	90,00%
Fixed Maintance Costs (% / Rent)	3,00%						

Cashflow Statement	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Rent	16.138.698	21.475.996	22.227.655	23.005.623	23.810.820	24.644.199	25.506.746
Maintance Costs (inflation growth)	(484.161)	(644.280)	(666.830)	(690.169)	(714.325)	(739.326)	(765.202)
Property costs	(2.937.584)	(2.937.584)	(2.937.584)	(2.937.584)	(2.937.584)	(2.937.584)	(2.937.584)
Total	12.716.953	17.894.132	18.623.242	19.377.871	20.158.912	20.967.289	21.803.960

Residential Secondary - Adaptive Reuse of the Existing Building (Floors 3 to 30) - Post Construction Cashflows

	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Construction Cost (Refurbishment Only)	266.057.755						
Net Internal Area, NIA (sq.ft)	288.191	923					
Sale							
% of Apartments Sold	20,00%	80,00%	0,00%	0,00%	0,00%	0,00%	0,00%
% of Apartments Unsold	80,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Sale Price (£/sq.ft) - 2013	1.500						
Sale Price (£/sq.ft)	1.670	1.719	1.769	1.820	1.873	1.927	1.983

Cashflow Statement	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Sale	96.272.545	396.257.797	0	0	0	0	0
Property costs	(2.128.462)	0	0	0	0	0	0
Total	94.144.083	396.257.797	0	0	0	0	0

Residential Prime - Adaptive Reuse of the Existing Building (Floors 3 to 30) - Post Construction Cashflows

	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Construction Cost (Refurbishment Only)	342.688.851						
Net Internal Area, NIA (sq.ft)	267.606	1.281					
Sale							
% of Apartments Sold	20,00%	80,00%	0,00%	0,00%	0,00%	0,00%	0,00%
% of Apartments Unsold	80,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Sale Price (£/sq.ft) - 2013	2.500						
Sale Price (£/sq.ft)	2.784	2.865	2.948	3.033	3.121	3.212	3.305

Cashflow Statement	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Sale	148.993.225	613.256.114	0	0	0	0	0
Property costs	(2.741.511)	0	0	0	0	0	0
Total	146.251.714	613.256.114	0	0	0	0	0

Hotel Secondary - Adaptive Reuse of the Existing Building (Floors 3 to 30) - Post Construction Cashflows

	n+4	n+5	n+6	n+7	n+8	n+9	n+10
Construction Cost (Refurbishment Only)	266.057.755						
Net Internal Area, NIA (sq.ft)	247.021						
Number of Rooms	898						

Income							
Average Room Rate, ARR (2013)	150						
Average Room Rate, ARR	167	172	177	182	187	193	198
Occupation rate	60,00%	80,00%	80,00%	80,00%	80,00%	80,00%	80,00%
Nº Nights occupied, per annum	196.718	262.291	262.291	262.291	262.291	262.291	262.291
Turnover - Rooms	32.857.695	45.080.757	46.388.099	47.733.354	49.117.621	50.542.032	52.007.751
Food & beaverage, F&B (% Rooms)	30,00%	30,00%	30,00%	30,00%	30,00%	30,00%	30,00%
Turnover - F&B	9.857.308	13.524.227	13.916.430	14.320.006	14.735.286	15.162.610	15.602.325
Turnover - Other Ancillary Uses (E.g. Spa, Gym…)	3.285.769	4.508.076	4.638.810	4.773.335	4.911.762	5.054.203	5.200.775
Total Turnover	46.000.773	63.113.060	64.943.339	66.826.696	68.764.670	70.758.845	72.810.852
Gross Margin F&B + Other (%)	50,00%	50,00%	50,00%	50,00%	50,00%	50,00%	50,00%
Gross Margin F&B + Other	6.571.539	9.016.151	9.277.620	9.546.671	9.823.524	10.108.406	10.401.550
Expenditures							
Payroll (30% Rooms Turnover)	9.857.308	10.143.170	10.437.322	10.740.005	11.051.465	11.371.957	11.701.744
Operational Expenses							
Fixed (50% of Food and Beverage Turnover)	4.928.654	5.071.585	5.218.661	5.370.002	5.525.732	5.685.979	5.850.872
Variable (50% of Other Ancillary Uses Turnover)	1.642.885	2.254.038	2.319.405	2.386.668	2.455.881	2.527.102	2.600.388

Cashflow Statement	**n+4**	**n+5**	**n+6**	**n+7**	**n+8**	**n+9**	**n+10**
Turnover - Rooms	32.857.695	45.080.757	46.388.099	47.733.354	49.117.621	50.542.032	52.007.751
Gross Margin F&B + Others	6.571.539	9.016.151	9.277.620	9.546.671	9.823.524	10.108.406	10.401.550
Payroll	(9.857.308)	(10.143.170)	(10.437.322)	(10.740.005)	(11.051.465)	(11.371.957)	(11.701.744)
Operational Expenses							
Fixed	(4.928.654)	(5.071.585)	(5.218.661)	(5.370.002)	(5.525.732)	(5.685.979)	(5.850.872)
Variable	(1.642.885)	(2.254.038)	(2.319.405)	(2.386.668)	(2.455.881)	(2.527.102)	(2.600.388)
Total	23.000.386	36.628.115	37.690.330	38.783.350	39.908.067	41.065.401	42.256.298

Hotel Prime - Adaptive Reuse of the Existing Building (Floors 3 to 30) - Post Construction Cashflows

	n+4	**n+5**	**n+6**	**n+7**	**n+8**	**n+9**	**n+10**
Construction Cost (Refurbishment Only)	266.057.755						
Net Internal Area, NIA (sq.ft)	226.436						
Nr Rooms	697						
Income							
Average Room Rate, ARR (2013)	300						
Average Room Rate, ARR	334	344	354	364	375	385	397
Occupation rate	60,00%	80,00%	80,00%	80,00%	80,00%	80,00%	80,00%
Nº Nights occupied, per annum	152.583	203.444	203.444	203.444	203.444	203.444	203.444
Turnover - Rooms	50.971.552	69.932.969	71.961.025	74.047.895	76.195.284	78.404.947	80.678.691
Food & Beaverage, F&B (% Rooms)	40,00%	40,00%	40,00%	40,00%	40,00%	40,00%	40,00%
Turnover - F&B	20.388.621	27.973.188	28.784.410	29.619.158	30.478.114	31.361.979	32.271.476
Turnover - Other Ancillary Uses (E.g. Spa, Gym…)	5.097.155	6.993.297	7.196.103	7.404.790	7.619.528	7.840.495	8.067.869
Total Turnover	76.457.328	104.899.454	107.941.538	111.071.843	114.292.926	117.607.421	121.018.036
Gross Margin F&B + Other (%)	60,00%	60,00%	60,00%	60,00%	60,00%	60,00%	60,00%
Gross Margin F&B + Other	15.291.466	20.979.891	21.588.308	22.214.369	22.858.585	23.521.484	24.203.607
Expenditures							
Payroll (30% Rooms Turnover)	15.291.466	15.734.918	16.191.231	16.660.776	17.143.939	17.641.113	18.152.705
Operational Expenses							
Fixed (10% of Total Turnover)	7.645.733	7.867.459	8.095.615	8.330.388	8.571.969	8.820.557	9.076.353
Variable (30% of Total Turnover)	22.937.198	31.469.836	32.382.461	33.321.553	34.287.878	35.282.226	36.305.411

Cashflow Statement	**n+4**	**n+5**	**n+6**	**n+7**	**n+8**	**n+9**	**n+10**
Turnover - Rooms	50.971.552	69.932.969	71.961.025	74.047.895	76.195.284	78.404.947	80.678.691
Gross Margin F&B + Others	15.291.466	20.979.891	21.588.308	22.214.369	22.858.585	23.521.484	24.203.607
Payroll	(15.291.466)	(15.734.918)	(16.191.231)	(16.660.776)	(17.143.939)	(17.641.113)	(18.152.705)
Operational Expenses							
Fixed	(7.645.733)	(7.867.459)	(8.095.615)	(8.330.388)	(8.571.969)	(8.820.557)	(9.076.353)
Variable	(22.937.198)	(31.469.836)	(32.382.461)	(33.321.553)	(34.287.878)	(35.282.226)	(36.305.411)
Total	20.388.621	35.840.647	36.880.026	37.949.546	39.050.083	40.182.536	41.347.829

Retail - Adaptive Reuse of the Existing Building (Floors 1 to 2) - Post Construction Cashflows

	n+4	**n+5**	**n+6**	**n+7**	**n+8**	**n+9**	**n+10**
Construction Cost (Refurbishment Only)	19.356.756						
Net Internal Area, NIA (sq.ft)	8.822						
Assumed Rent Growth		3,50%	3,50%	3,50%	3,50%	3,50%	3,50%
Rent (sq.ft per annum)	275	285	295	305	316	327	338
Occupation Rate	75,00%	95,00%	95,00%	95,00%	95,00%	95,00%	95,00%
Fixed Maintance Costs (% / Rent) incluinding periodic refurbisment)	10,00%						

Cashflow Statement	**n+4**	**n+5**	**n+6**	**n+7**	**n+8**	**n+9**	**n+10**
Rent	1.819.573	2.385.461	2.468.952	2.555.365	2.644.803	2.737.371	2.833.179
Maintance Costs (inflation growth)	(181.957)	(238.546)	(246.895)	(255.537)	(264.480)	(273.737)	(283.318)
Property costs	(193.568)	(193.568)	(193.568)	(193.568)	(193.568)	(193.568)	(193.568)
Total	1.444.049	1.953.347	2.028.489	2.106.261	2.186.755	2.270.066	2.356.294

Investment Output - Refurbishment of the Existing Building Only

	Investment Costs	Projected Cash Flows	Residual Value	Net Present Value
Office Secondary (Floors 3 to 30)	(277.208.975)	64.594.383	110.496.584	(102.118.008)
Office Prime (Floors 3 to 30)	(301.052.484)	76.047.939	129.904.204	(95.100.341)
Residential Secondary (Floors 3 to 30)	(283.607.172)	338.885.110	0	55.277.938
Residential Prime (Floors 3 to 30)	(343.169.772)	524.871.182	0	181.701.410
Hotel Secondary (Floors 3 to 30)	(282.364.469)	149.892.317	251.755.680	119.283.528
Hotel Prime (Floors 3 to 30)	(318.942.810)	145.113.517	246.343.181	72.513.887
Retail (Floors 1 to 2)	(20.067.311)	8.306.564	14.038.388	2.277.641

			1	2	4	4	5	6	7	8	9	10	10
Cash Flows	**Discount Rate (Yield)**	**n**	**n+1**	**n+2**	**n+3**	**n+4**	**n+5**	**n+6**	**n+7**	**n+8**	**n+9**	**n+10**	**Residual Value**
Office Secondary (Floors 3 to 30)	8,00%	(183.044.975)	(33.379.724)	(46.987.791)	(31.253.685)	10.757.597	15.195.179	15.820.130	16.466.955	17.136.419	17.829.314	18.546.460	238.553.838
Office Prime (Floors 3 to 30)	8,00%	(185.562.165)	(41.135.185)	(57.904.958)	(37.764.476)	12.716.953	17.894.132	18.623.242	19.377.871	20.158.912	20.967.289	21.803.960	280.453.434
Residential Secondary (Floors 3 to 30)	8,00%	(183.720.441)	(35.460.834)	(49.917.317)	(33.000.798)	94.144.083	396.257.797	0	0	0	0	0	0
Residential Prime (Floors 3 to 30)	8,00%	(190.008.541)	(54.834.469)	(77.189.093)	(49.265.169)	146.251.714	613.256.114	0	0	0	0	0	0
Hotel Secondary (Floors 3 to 30)	8,00%	(183.589.247)	(35.056.626)	(49.348.324)	(32.661.462)	23.000.386	36.628.115	37.690.330	38.783.350	39.908.067	41.065.401	42.256.298	543.521.631
Hotel Prime (Floors 3 to 30)	8,00%	(187.450.869)	(46.954.284)	(66.096.356)	(42.649.670)	20.388.621	35.840.647	36.880.026	37.949.546	39.050.083	40.182.536	41.347.829	531.836.452
Retail (Floors 1 to 2)	8,00%	(12.985.189)	(2.514.433)	(3.539.503)	(2.339.211)	1.444.049	1.953.347	2.028.489	2.106.261	2.186.755	2.270.066	2.356.294	30.307.827

Net Present Value of Cash Flows	**Net Present Value**	**n**	**n+1**	**n+2**	**n+3**	**n+4**	**n+5**	**n+6**	**n+7**	**n+8**	**n+9**	**n+10**	**Residual Value**
Office Secondary (Floors 3 to 30)	(102.118.008)	(183.044.975)	(30.907.151)	(40.284.458)	(22.972.391)	7.907.155	10.341.583	9.969.366	9.608.310	9.258.274	8.919.096	8.590.599	110.496.584
Office Prime (Floors 3 to 30)	(95.100.341)	(185.562.165)	(38.088.134)	(49.644.168)	(27.758.017)	9.347.340	12.178.446	11.735.802	11.306.802	10.891.233	10.488.865	10.099.452	129.904.204
Residential Secondary (Floors 3 to 30)	55.277.938	(183.720.441)	(32.834.105)	(42.796.054)	(24.256.572)	69.198.712	269.686.398	0	0	0	0	0	0
Residential Prime (Floors 3 to 30)	181.701.410	(190.008.541)	(50.772.656)	(66.177.206)	(36.211.370)	107.499.376	417.371.806	0	0	0	0	0	0
Hotel Secondary (Floors 3 to 30)	119.283.528	(183.589.247)	(32.459.839)	(42.308.234)	(24.007.149)	16.905.971	24.928.480	23.751.302	22.629.712	21.561.087	20.542.925	19.572.842	251.755.680
Hotel Prime (Floors 3 to 30)	72.513.887	(187.450.869)	(43.476.189)	(56.666.972)	(31.348.781)	14.986.245	24.392.542	23.240.672	22.143.196	21.097.545	20.101.272	19.152.045	246.343.181
Retail (Floors 1 to 2)	151.843	(12.985.189)	(2.328.178)	(3.034.553)	(1.719.390)	1.061.419	1.329.415	1.278.292	1.228.983	1.181.436	1.135.598	1.091.420	14.038.388

Total Net Present Values, Alternative Use Scenarios (Refurbishement of the Existing Building Only)

% of Uses							Mixed Use
Primary Use							
Office Secondary (Floors 3 to 30)	100%						
Office Prime (Floors 3 to 30)		100,00%					20%
Residential Secondary (Floors 3 to 30)			100%				
Residential Prime (Floors 3 to 30)				100,00%			50%
Hotel Secondary (Floors 3 to 30)					100,00%		30%
Hotel Prime (Floors 3 to 30)						100,00%	
Ancillary Use							
Retail (Floors 1 to 2)	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%
Total Net Present Values							
Primary Use							
Office Secondary (Floors 3 to 30)	(102.118.008)	0	0	0	0	0	0
Office Prime (Floors 3 to 30)	0	(95.100.341)	0	0	0	0	(19.020.068)
Residential Secondary (Floors 3 to 30)	0	0	55.277.938	0	0	0	0
Residential Prime (Floors 3 to 30)	0	0	0	181.701.410	0	0	90.850.705
Hotel Secondary (Floors 3 to 30)	0	0	0	0	119.283.528	0	35.785.058
Hotel Prime (Floors 3 to 30)	0	0	0	0	0	72.513.887	0
Ancillary Use							
Retail (Floors 1 to 2)	2.277.641	2.277.641	2.277.641	2.277.641	2.277.641	2.277.641	2.277.641
Total	**(99.840.367)**	**(92.822.700)**	**57.555.578**	**183.979.051**	**121.561.169**	**74.791.528**	**109.893.336**