University of Salford MANCHESTER

School of the Built Environment

Understanding the role of Building Regulation costs in the Irish housing crisis

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ABSTRACT

This thesis examines the proportional impact that building regulation costs have on house construction costs in Ireland and considers how they affect development viability, purchaser affordability and housing supply in the housing market. It also considers whether their impact can be regarded as a significant contributing factor to the Irish housing crisis.

Through a literature review connecting the research issue with broader contexts and theories on housing provision, the study identifies issues such as planning system failures, poor land management, infrastructure deficits and credit access challenges, as the most widely considered factors contributing to the Irish housing crisis. It also establishes that building regulation costs are not considered to be one of the main contributing factors.

Pragmatism and pluralism are identified as the main philosophical positions from which to justify a tailored multi method data collection and analysis approach, whereby building regulations data, collected in a documents contents analysis is combined with cost data obtained from an instrumental case study of a recently completed housing development project. The combined data is analysed to identify the proportional cost of building regulations contained within the overall cost to construct and develop a typical estate built house.

The research contributes to knowledge, by providing insights to practitioners, academics and industry observers, who are struggling to understand why it is more difficult to deliver viable and affordable housing today than in previous years. This is achieved through findings which identify that since building regulations were first introduced in Ireland in 1991, building regulations costs have been responsible for increasing the cost to 'construct and develop' the case study house, by '46% and 33%' respectively. The findings also illustrates the gradual way in which building regulations costs have accumulated over time and demonstrates how viability and affordability are seriously challenged by their effect.

Key words: building regulation costs, housing supply, viability, affordability, housing crisis, Ireland

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ABBREVIATIONS

ABP	An Bord Pleanála
ACDs	Acceptable Construction Details
AHBs	Approved Housing Bodies
APEC	Asia Pacific Economic Cooperation
ASVM	Acceptable Solutions and Verification Methods
BCAR	Building Control (Amendment) Regulations (2014)
BCMS	Building Control Management System
BER	Building Energy Rating
BRAB	Building Regulations Advisory Body
BS	British Standard
BSI	British Standards Institute
CALF	Capital Advanced leasing Facility
CAS	Capital Assistance Scheme
CBI	Central Bank of Ireland
CDP	County Development Plan
CEB	Council of Europe Development Bank
CIF	Construction Industry Federation
CM	Construction Manager
CPI	Consumer Price Index
CSO	Central Statistics Office
CVR	Cost Value Reconciliation
DEAP	Dwelling Energy Assessment Procedure
DEHLG	Department of Environment, Heritage and Local Government
DFHERIS	Department for Further and Higher Education, Research, Innovation and Science
DHPLG	Department of Housing, Planning and Local Government
DHLGH	Department of Housing, Local Government and Heritage
DPER	Department of Public Expenditure and Reform
EEC	European Economic Community
EEAP	Energy Efficiency Action Plan
EED	Energy Efficiency Directive
E,H&S	Environment, Health and Safety

EI	Engineers Ireland
EIB	European Investment Bank
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Certification
ESB	Electricity Supply Board
ESRI	Economic and Social Research Institution
EU	European Union
Excl	Excluding
FTB	First Time Buyers
GABC	Global Alliance for Buildings and Construction
GNI	Gross National Income
GNP	Gross National Product
GDA	Greater Dublin Area
GDP	Gross Domestic Product
GDV	Gross Development Value
GOV	Government
HAP	Housing Assistance Payment
HBCI	House Building Cost Index
HEIs	Higher Education Institutes
hENs	Harmonised European Standards
HFA	Housing Finance Agency
HI	Historical Institutionalism
HSA	Health and Safety Authority
HUD	US Department of Housing and Urban Development
H&S	Health and Safety
ICC	International Code Council
ICSH	Irish Council for Social Housing
IHA	Irish Housing Agency
IMF	International Monetary Fund
INF	Inspection Notification Framework
IGEES	Irish Government Economic and Evaluation Service
IP	Inspection Plan
LAP	Local Area Plan
LTI	Loan to Income ratio
LTV	Loan to Value ratio

I.S	Irish Standard
LAs	Local Authorities
NBA	National Building Agency
MBS	Mortgage Backed Securities
M&E	Mechanical and Electrical
MMC	Modern Methods of Construction
NAMA	National Asset Management Agency
NEEAP	National Energy Efficiency Action Plan
NPF	National Planning Framework
NSBE	National Standard Building Elements
NSO	National Statistics Office (UK)
NTMA	National Treasury Management Agency
NZEB	Near Zero Energy Building
OPR	Office of the Planning Regulator
P.A	Per Annum
P.I	Professional Indemnity
PII	Property Industry Ireland
PRS	Private Rental Sector
PSCS	Project Supervisor for Construction Stage
PSDP	Project Supervisor for Design Process
PUS	Public Utility Society
PWC	Public Works Contracts
QAHE	Quality Assurance Agency for Higher Education
QS	Quantity Surveyor
Q1	Quarter 1
RAS	Rental Accommodation Supplement
REITs	Real Estate Investment Trusts
RIA	Regulatory Impact Analysis
RIAI	Royal Institute of Architects Ireland
RICS	Royal Institute of Chartered Surveyors
RSES	Regional Spatial and Economic Strategy
SCSI	Society of Chartered Surveyors Ireland
SHCEP	Social Housing Current Expenditure Programme
SHD	Strategic Housing Development
SHIP	Social Housing Investment Programme

S.I.	Statutory Instrument
SM	Site Manager
SME	Small and Medium Firms
SO	Safety Officer
TGDs	Technical Guidance Documents
TT	Turner & Townsend
UNFCC	United Nations Convention on Climate Change
UOA	Unit of Analysis
USA	United States of America
USD	United States Dollar
VAT	Value Added Tax

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DECLARATION

I declare that to the best of my knowledge, that the work presented in this thesis is original and my own work. I also declare that this thesis or no part thereof has been submitted to another university or academic institution in pursuit of another academic degree or qualification. Other data sources or information used in this research study has been clearly acknowledged and referenced.

CHAPTER 1:

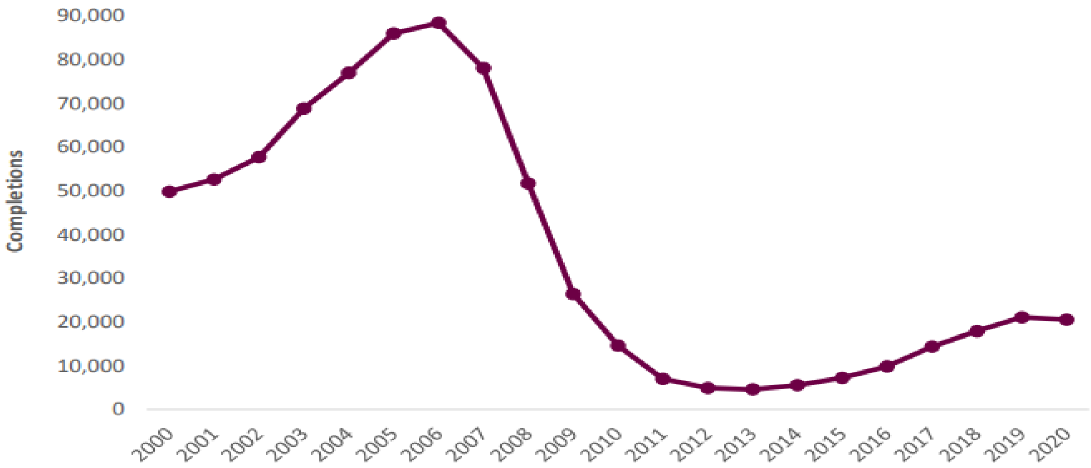
1. THESIS INTRODUCTION

1.1 Introduction

Contemporary media reports, industry discourse and academic literature, broadly suggest that there has been a housing crisis in Ireland since 2013. A housing crisis can be reasonably assumed to exist when there is a prolonged and growing scarcity of affordable housing and a chronic imbalance between demand and supply of housing (McQuinn, 2021). According to Nowlan (2016) and Scuffil (2022), there have been numerous housing crises in Ireland and particularly in Dublin, going back to the early 1900s. For the most part, the underlying problems behind those previous housing crisis were centred around public health concerns, overcrowding and under supply; apart from the housing arrears crisis from 2008, which was essentially a function of the collapse in house prices. Following in the aftermath of the 2007 financial crisis and Ireland's house price crash, the Irish economy started to recover from around 2014. The recovery was closely followed by an increased demand for new housing, but at that same time and since, house building has not nearly kept pace (Breen & Reidy, 2021). It was recently estimated by the Irish Central bank that in the period between 2011 and 2019, the demand for housing averaged at approximately 27,000 units per annum, while in the same period, house completions averaged only 10,500 per annum (Hynes et al, 2021).

Assisted by a number of government initiatives, national housing completions rose to just over 20,000 units in 2021 and approximately 26,000 in 2022. However, those improved output statistics have to be gauged against current annual housing demand estimates, which according to various housing analysts are currently running at between 33,000 units (DHLGH, 2021) and 49,000 units (Lyons 2021). Figure 1.1 is a graphical representation of the number of house completions achieved in Ireland between the years 2000 and 2020. The graph illustrates the modest but insufficient supply growth trajectory that has been evident since 2015. This mismatch between housing demand and housing supply can only beg the question of, why is it so?

Figure 1.1 Dwellings Delivered in Ireland in years 2000 to 2020 Source CSO 2022



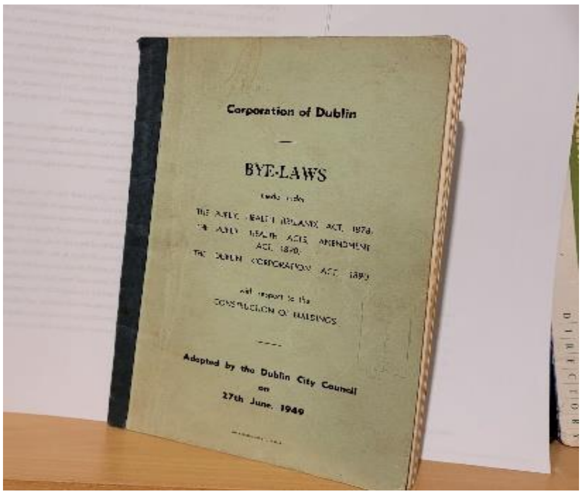
Almost ten years into the housing crisis, there is weekly if not daily analysis on the issues involved. A common message emanating from that analysis, is that an under supply of new housing is at the root of the problem. Another observation is that there appears to be a confluence of systemic issues that have combined to exacerbate that under supply problem. These appear to be quite complex, whereby for instance, an intervention directed in one area can quite possibly unbalance other parts of the housing system. Preliminary reviews of the literature, carried out in advance of this study, suggested that opinions on the weight attributable to the various contributing factors are disparate. In this regard, authors such as Lennon & Waldron (2019) focus on and are inclined to elevate problems in the planning system as the key issue, while Byrne (2019) and Byrne & Norris (2019) suggest that issues surrounding neoliberal policies and financialisaton of the housing market are of most significance. Elsewhere McQuinn et al (2021) strongly argues that strict banking rules and access to credit are the critical lubricators of housing market activity. In other academic analysis, including Lyons (2017), the impact of credit conditions and their role as a housing supply and demand lever is further underlined. Various reports emanating from property industry sources, such as the Society of Chartered Surveyors (SCSI), have touched on high housing delivery costs and viability challenges as key reasons for weaker than expected housing output.

Few arguments can be put against the importance attached to the contributing factors highlighted by the aforementioned researchers, because a chronic version of any of those issues, even in isolation would most likely be enough to significantly affect housing supply. The preliminary literature reviews also identified that apart from property industry reports on viability and affordability issues, very few research studies appeared to attach much weight to the significance of high construction costs. There is even less commentary to be found on the proportion of construction costs that have accumulated as a result of the introduction and ongoing improvements in building regulations standards.

1.2 Are building regulations costs a contributing factor to the Irish housing crisis

Irish building regulations including Technical Guidance Documents (TGDs) were first published in December 1991 and officially replaced all versions of Building Byelaws in Ireland on 1st June 1992 (O'Cofaigh, 1993). Up to this time, most Irish local authorities put little or no input into building control matters, but where they did, their requirements were generally based on and referred to Dublin Corporation's Building Byelaws published in 1949 (Keane pp. 179 (2003). This is a short 76 page document containing 113 conditions (Walsh, 2009).

Figure 1.2 The Corporation of Dublin Byelaws 1949



The 1991 building control acts, building regulations and TGDs set out an entirely new system to regulate building practice and to improve building standards. And, since they were first published, have undergone numerous revisions. The TGDs are currently an expansive series of documents in 12 parts, supported by numerous ancillary documents, mandatory codes of practices, European construction products standards and technical specifications, national standards and NSAI Agrément controls.

Figure 1.3 The Technical Guidance Documents (TGDs)

This research study seeks to add a further dimension to knowledge on the factors and complexities of the Irish housing crisis, by making a case that, as a result of best intentioned policies to continuously improve building standards, unintended consequences have arisen, whereby house building costs have significantly outpaced construction labour and material inflation and housing consumer earnings, to such an extent that viability and affordability levels in the Irish housing market have been structurally undermined.

This research study focuses on the effect that the introduction and continuous improvements in building regulation standards have brought to bear on housing delivery output and whether this facet of construction can be considered as a significant contributing factor to the housing crisis in Ireland. It is envisaged that by evaluating how much building costs have proportionally increased over time as a result of improvements in building regulations and building control standards, that their impact on development viability and purchaser affordability can be assessed. In this way the research seeks to establish whether building regulations related costs have such a sufficient proportional impact that they are one of the several contributing factors that currently undermine the market's ability to deliver much needed housing.

1.3 The research problem

According to Creswell (2005), value cannot be placed on the importance of a research study without firstly providing a clear understanding of the research problem and why the inquiry was conducted. In this research, building regulation costs and their proportional impact in the construction and development cost of a typical estate built house has been identified as a practice based problem. The high cost of building regulations as a proportion to the other construction and development costs, results in development viability problems, translating to affordability problems, which weakens demand and ultimately leads to an undermining of the housing sectors ability to supply new homes. The undersupply of new homes is at the root of the Irish housing crisis. This study assesses the importance of this problem, insofar as how it can be shown to affect viability and affordability. It is not the intention of the research to solve the viability problem or to advocate for the redaction of building regulations, but rather to shine a light for policy makers, industry, housing analysts, academia and others, on the embeddedness and significance of high building regulations costs in the housing system.

The ways in which we engage with and think about problems can directly influence our ability to resolve them. Only by diagnosing and trying to understand the background of a problem can we hope to solve it or identify ways to compensate and live with its effects. It is intended that the findings of this research will go some way to broadening our understanding and situational awareness of a structural imbalance between house building costs and house prices and to illustrate how the development of this condition has contributed to the enduring nature of the Irish housing crisis. It is further intended that the identification of this problem will ultimately lead, through further consideration and research, to ways to ameliorate and counterbalance the effects.

Ellis & Levy (2008), suggest that the way of addressing the value of a research study is by clearly identifying the research problem, describing its background and explaining what drew you to the issue. The researcher is a housing sector practitioner with over 40 years experience in the construction industry. During this time, the researcher has the benefit of having worked for more than 10 years under the building bye-law system and then for the following 30 plus years under the current building regulations system. During those periods, the researcher has observed first-hand, how the building bye law system operated, the impact of the change over from byelaws to the current building regulations system and 30 plus years of updates and modernisation of the current building regulations system. Throughout this time the researcher has observed gradual and occasionally punctuated accumulations in the amount of time, resources, costs and complexities to construction works and procedures, arising from building regulations. The researcher has also noted and would argue that because of the mainly gradual or stealth nature of these accumulations, that their impact has been habitually ignored, gone unnoticed or that there is a genuine lack of awareness that building regulations costs do actually impact on housing viability and affordability.

1.4 Justification for this research

1.4.1 Macro-economic impact of the housing crisis

As early as in 2015, Nowlan cautioned that if the then recently unveiled housing crisis was allowed to continue, it will have major ramifications for Ireland's economic competitiveness, evolving demographics, homelessness and the maintenance of a healthy functioning society (Nowlan, 2015a). By 2019 McQuinn et al confirmed that accumulating pent up demand and projected continuation of undersupply was having serious social, political, and economic implications for the country (McQuinn et al, 2019). More recently, in a strategic policy report on housing, prepared for the office of the Taoiseach (Irish Prime Minister), a central message was delivered that bold action was urgently needed to fix Ireland's dysfunctional housing system in order to deliver affordable homes (NESC, 2020). A snapshot report for the Irish parliamentary budget office, PBO (2021) singled out the housing crisis as the most important and urgent social issue facing the country at that point in time.

In a survey of members of the Irish American Chamber of Commerce in November 2022, over one third of US multinational companies in Ireland stated that housing shortages were seen as the number one infrastructural deficit and the most important issue influencing their decisions on future expansion in Ireland. To put this survey statement into context, it should be noted that, there are over 900 US Companies in Ireland, directly employing almost 200,000 people and spending over €20 billion per annum in the economy. US companies also invest approximately €6.5 billion on new capital investments in Ireland every year. (Amcham, 2022).

US multinationals are not alone in their concerns about housing shortages, as according to the Dublin Chamber of Commerce, in November 2022, approximately 75% of their member firms said that affordable housing and rental costs for staff were the main challenges faced by their businesses (Collins, 2022). The Chamber's concerns are not solely related to the cost of housing, but the lack of it, and the effect this has of squeezing existing and potential workers out of Dublin. That view is echoed by the Irish SME Association, who claim that this problem also exists for businesses outside Dublin and especially those in and around Ireland's regional cities and large towns. Both organisations state that the housing crisis is having the effect of stymying business expansion, driving up wages and affecting productivity by increasing commuter times.

1.4.2 Societal impact of the housing crisis

Data taken from four Irish Census between 2002 and 2016 suggests that the average age at which home ownership became the majority tenure categorisation has gradually risen from age 27 in 2002 to age 35 in 2016 (CSO, 2016). Those statistics provide evidence to suggest that affordability challenges are undermining the capacity of younger households to own their own homes. According to a KPMG (2021) study on housing targets, there were almost 460,000 adults aged 18 or over recorded as living with a parent in the 2016 census. Of these young adults, approximately 61% were already in the labour force. It can reasonably be expected that when the 2022 census information are fully analysed that the data will unveil a deterioration in this statistic (Hynes et al, 2021). The KPMG report also considers that overcrowding, homelessness and refugee provision are areas where housing needs will continue to grow and it also warns that pent up demand from years of under supply will continue to add pressure to the system, delaying household formations. From a rental perspective, the Irish Housing Agency highlighted in June 2019 there were 68,500 households on rental support or waiting to be housed in Ireland (IHA, 2019).

According to figures released by the Irish Department of Housing in January 2023, the number of people in Ireland experiencing homelessness and living in emergency accommodation stood at 11,754 persons, up from 9,150 in January 2022 (Holland, 2023). This figure does not include rough sleepers, women in domestic violence refuge centres, or those availing of refugee and asylum provision. The figure includes 3,431 children, which has risen from just below 3,000 in April 2022 (Mooney, 2022). Article 27 of the UN Convention on the Rights of the Child (1989), states that every child is entitled to a standard of living adequate to the child’s physical, mental, spiritual, moral and social development. Insofar as the Irish housing crisis is concerned, it is difficult to accept the extent to which this undisputable right is not being delivered on.

1.4.3 Previous calls for research into building regulations costs

Apart from limited research studies provided by the SCSI and other industry bodies, about the impact of high housing delivery costs on housing viability, there is very little to connect the proportional impact of building regulations with the Irish housing crisis or international affordability crises generally. However, there have been exceptions, coming in the form of calls for research in the area, notably from comments in research papers or media articles by Irish academics such as Nowlan, Lyons, Healy and Goldrick Kelly. It was argued in Nowlan

(2015), that the Irish house building sector works to the highest building standards in Europe. But in stating this, he also cautioned that it cannot be considered to be only a blessing, because standards need to reflect no more than what we can afford to pay for them. Lyons (2015), acknowledged that building regulations are a factor of high construction costs and also suggested that future building regulations should undergo cost benefit analysis before enacting. Lyons (2016) then suggested that there was no clear explanation why construction costs in Ireland are high and called for a 'transparent analysis of construction costs now, compared to 10, 20 and 30 years ago'. In response to claims by Irish house builders that construction and development costs are key constraints to output (Healy and Goldrick Kelly, 2018) called for more empirical evidence to test these claims. In Lyons (2021), it was also suggested that policy makers should undertake an audit of construction in Ireland in order to develop targets to reduce costs. This research study intends to go some of the way to answering these calls.

1.5 The research strategy

This research study examines how building regulations costs as a proportion of the total cost to deliver a modern estate built house, have gradually accumulated to such an extent that they undermine development viability and purchaser affordability to such an extent, that they can be considered to be a significant contributing factor to housing supply shortages, which are at the root of the Irish housing crisis. By combining data collected in a contents analysis of key building regulations documents with real construction cost data information collected in an instrumental case study on a typical estate built 3 bedroom semi-detached house, it is possible to evaluate how construction and development costs have increased over time, as a result of the introduction of and ongoing improvements in building regulations and building control standards. By evaluating and analysing the proportional effects of building regulations costs on the construction and development costs of the case study house over horizontal time horizons and cross sectional regional locations it is possible to illustrate their wide effect on development viability and purchaser affordability.

1.5.1 Pilot study

Previous research carried out in a pilot study in 2016 under Module 5 of the Professional Doctorate programme, examined the challenges that construction companies and construction management practitioners encountered due to accumulated government interventions in the construction process over the preceding 25 years. This research looked at the impact on managerial and administrative costs brought about due to increased complexity of building regulations, standards and processes required by government bodies. Based on a case study of a publicly funded student apartment project, it was found that management and other indirect costs on the project were 80% higher than if the project had been delivered in 1991. Data from the findings contained in that study and background literature review information has been updated and utilised in this wider study.

1.5.2 Research methodology

The link between the theoretical basis and empirical research parts of this research is substantiated in a dedicated methodology and methods chapter (3). Grix (2021, pp.103) suggests that the purpose of a separate theoretical chapter in a dissertation is to give a simplified sense of order to the empirical parts of the study, by avoiding the process of weaving in and out between the two parts. Authors on academical research methods, such as Saunders et al (2016. pp. 122-124) claim that it is through the medium of a researcher's assumptions and approach to knowledge, reality and values, that they approach theory development and problem solving, ultimately arriving at a choice of data collection methods. The way in which that process unfolds is described by Saunders in a research onion illustration, as outlined and discussed in Figure 3.2 and section 3.2.2 of chapter 3. Through such an introspection and based on the research aims and objectives, this research considered various research strategies, before deciding on documents contents analysis and instrumental case study analysis as the most practical and effective research methods for use in the investigation. Perry (1998) emphasizes that once the most effective research method has been established, then data collection and analysis should be structured around the research problem. Using Saunders and Perry's guiding principles, the data collection and analysis process in this research, focuses on the research problem, systematically proceeding in stages and steps to meet the desired outcoming of achieving the research aim.

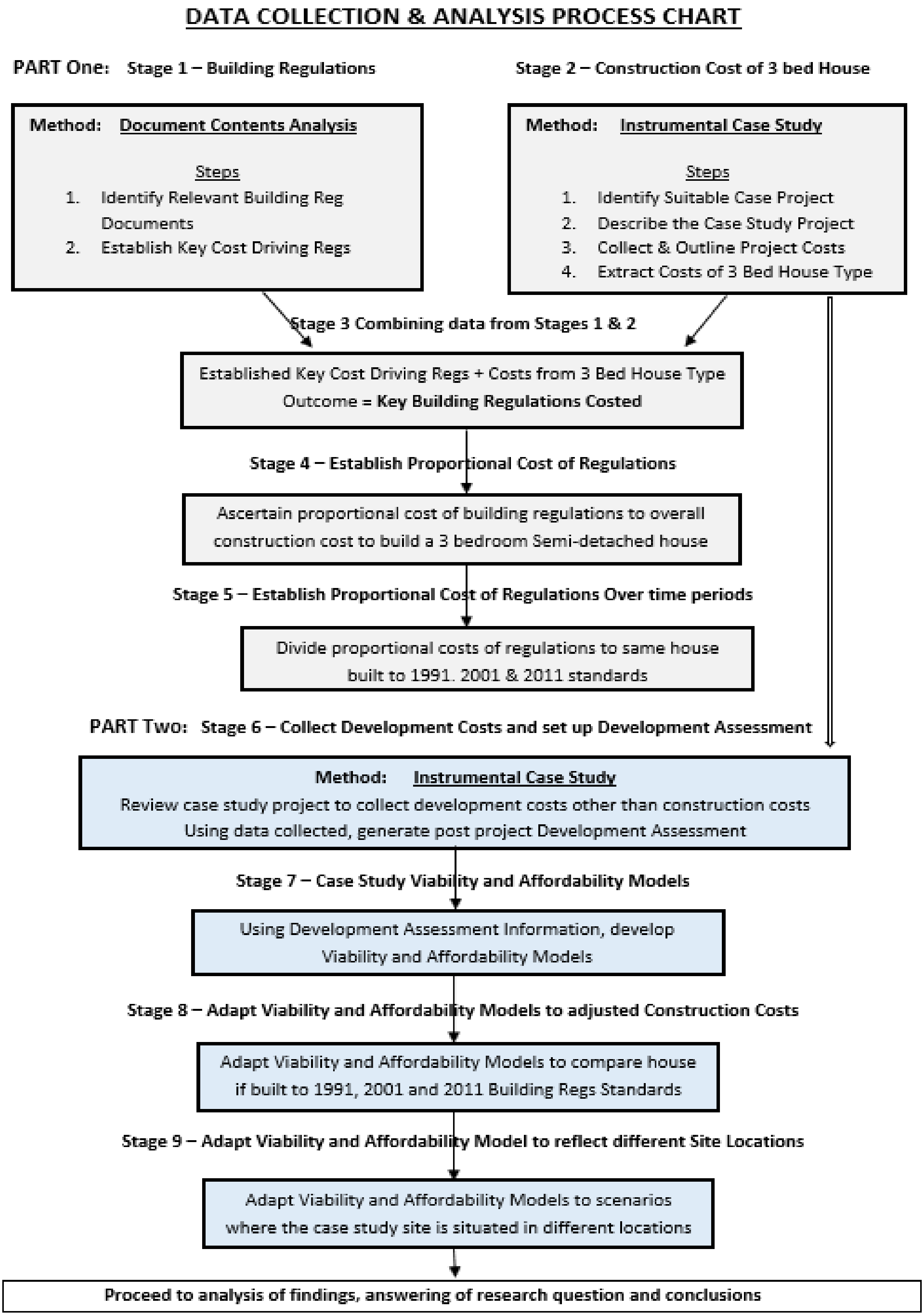
Data for this research investigation is gathered from two main sources. The first data source comes from statutory building regulations documents, and the second source comes in the form of cost data obtained from a live residential development project, located in the Greater Dublin area. The data collection and analysis process is structured into 2 parts, combining 9 stages. The process is outlined in Figure 1.4.

Part 1 of the process will collect data from building regulations documents and separately from an instrumental case study of a live residential development project, located in the

Greater Dublin area. Once the data has been collected and formulated into the required order, it will then be combined, to establish the proportional cost of building regulations, in the net construction cost of a typical estate built 3 bedroom semi-detached house, built in 2021. This exercise will then be repeated, to establish the proportional cost of building regulations, if the same house, was built to 2011, 2001 or 1991 building regulations standards.

In Part 2 of the process, the proportional cost of building regulations is assessed as a proportion of the overall gross development costs. The results of this separate exercise are used to assess the impact of the proportional cost of building regulations on development viability and purchaser affordability, for the case study house, if built to 2021, 2011, 2001 and 1991 standards. The development cost exercise is then repeated, to consider the sensitivities of development viability and purchaser affordability, were the case study house to be situated in a different location. The locations chosen are based in adjacent regions, one in a Dublin suburb and the other just outside of the Greater Dublin area influence.

Figure 1.4 Data Collection & Analysis Process Chart



1.5.3 Positionality

According to McNiff (2013), researchers needs to explain to their readers at the outset, how they position themselves within their research field and in this regard, it is important to make clear whether they regard themselves as participants, observers, outside researchers, or insider researchers. An outside researcher would for instance, see themselves as primarily external to the organisational in which they are looking into, in order to gain insights and source data. Whereas an inside researcher may be an employee within the organisation with privileged access to peers, documents and other sometimes sensitive information (Boylan, 2020, pp.140). At the outset, an insider researcher may also benefit from an intrinsic understanding of the workings of the organisation, including power relationships, protocols, and company jargon (Coughlin and Brannick, 2014). In relation to this research study, especially insofar as the gathering of cost data and other information from the instrumental case study element is concerned, the researcher can be considered an insider.

An important element of this research is that it casts a critical eye on the impact that building regulations costs may unintentionally have on the Irish housing delivery system. On first impression a reader might understandably interpret this as meaning that the researcher is opposed to building regulations and the need for ongoing advancements in this area of housing. This is not so. It is the researcher's view that building regulations are welcome and necessary to amongst other things, provide for the health, safety, wellbeing and higher living standards of people in and around buildings. However, appropriate and balanced regulation is also a desirable feature of a properly functioning modern housing market.

1.5.4 Research limits and delimits

Limitations in a research study may not be within the researcher's control, but delimitations which are based on matters which are excluded from the research, generally are (Perry, 1998). A key purpose of outlining the limits and delimits of a research study is to communicate the boundaries of the research to the reader. Research limits and delimits are discussed in section 3.2.8 of the methodology and methods chapter. Table 1.1 outlines the key boundaries of the research. Its purpose is to clarify for readers, the boundaries of the research in relation to subject matter, units of analysis (UOA), location of UOA, time period applicable to data findings, time horizons and key exclusions.

Table 1.1 Key boundaries of the research

1	Subject Matter	Proportional cost of building regulations on housing construction and development costs
2	Units of Analysis (UOA)	Suite of building regulations TGDs and ancillary documents, including ACDs, Irish Water COPs and technical standards, National rules for electrical installations and the health and safety in construction regulations
3	Instrument - used to understand the UOA	Case study of a typical estate built 3 bedroom semi-detached house, constructed in a 12 month period between March 2021 and March 2022.
4	Location of UOAs	34 house development situated in the Greater Dublin Area (GDA), Ireland
5	Period during which the data collection and analysis process was carried out	March 2021 to September 2022
6	Time Horizons	UOA – sub-analysed into 10 year time periods, between 1991 and 2021, based on the decade that a regulation was first published or updated.
7	Cross sectional horizons	1. Site located in the GDA – case study 2. Dublin suburb location 3. Outside of GDA location
8	Key delimits of research boundaries	Development design standards, published in local authority development plans
		Apartment and Duplex Construction
		The macro-economic effects of the Covid crisis and the war in Europe
		Construction Inflation – labour and materials costs
		Measures to reduce the impact of building regulations costs

1.5.5 Rationale for case studying a typical estate bult 3 bedroom semi-detached house

In data compiled by OCED (2020) on international housing markets and residential stock by dwelling type, it was found that semi-detached housing was the most common dwelling type in Ireland, accounting for just over 50% of all housing stock. The prevalence of semi-detached dwellings and their continued preference in the new homes market is reflected by the Irish Central Statistics Office (CSO) who up until 2016, have based their official construction cost monitoring of building material costs and construction industry labour costs on a basket of materials, representative of a typical 3 bedroom, 2 storey local authority house. In recent studies by the Society of Chartered Surveyors to evaluate viability and affordability on new housing developments in Ireland, (SCSI, 2016 and 2020), housing delivery costs were based on a typical estate built, 3 bedroom semi-detached house. In a recent prebudget submission by the Irish House Builders Association (IHBA (2020), a typical 3 bedroom estate built house was also used in examples of the effect of government policies on housing affordability.

In the literature review chapter, data from the above referenced CSO inflation cost monitor and SCSI housing cost reports are combined in a meta-analysis exercise to measure the difference between reported construction inflation and construction cost increases in a typical 3 bedroom house, to compare and triangulate with the findings of the data collection and analysis of this research.

1.6 Value of the research

1.6.1 Contribution to knowledge

The findings from this research will add to practice and theory based knowledge in the built environment field. Firstly, it will shine a light for practitioners, academics and industry observers, who are struggling to understand why it is more difficult to deliver viable and affordable housing today than it was in previous years. The power to understand those reasons is provided by an academically robust study into the impact of building regulations on housing delivery costs, presented on a proportional basis and which will also be based on the most common house type in Ireland. The findings will also illustrate the manner in which the proportional cost of building regulations has and continues to gradually increase over time and the way in which the proportional percentage cost impacts on development viability and purchaser affordability assessments over a range of scenarios.

The research will also contribute to research theory knowledge by establishing a mixed method research approach, through the combined use of documents contents analysis and instrumental case study methods by following the data collection and analysis stages and steps illustrated in the process chart contained in Figure 4.1

1.6.2 Contribution to the existing body of literature

The literature review identifies a number of housing sector issues that have been identified in academic papers, industry reports and discourse as contributing to the Irish housing crisis and while doing so uncovers what if anything has been published to associate building regulations costs with housing supply shortages. This facilitates the study, to compare and contrast the research with what has already been written on the subject. The research outcome facilitates an important addition to the literature, because it introduces broadly generalisable, original research in an area of the housing sector, concerned with building regulations, costs. viability, affordability and housing supply, which are at the root of the Irish housing crisis and other international housing challenges.

1.7 Reflective practice

The professional doctorate programme in the built environment school at Salford University encourages research students from practice backgrounds to make maximum use of their existing knowledge. Through learning modules on reflective thought, as defined by Dewey (1933), tacit and empirical knowledge transfer, as exposited by Polanyi (1958) and reflective learning cycle approaches developed by Kolb (1984), professional doctorate students are encouraged to approach research work as scholarly practitioners. This research advantage is put to use in the course of this study, mainly through a working familiarity with the data and information which is collected, analysed and interpreted.

It was through a learning module assignment on ‘critical reflections on practice’ in 2015, that the identified practice problem first came into focus. Around this time, the company that the author was employed with, had just commenced construction works on a new residential development of approximately 50 houses. Following the 2008 housing crash, this new residential development project was one of the first bank funded housing developments to be built just outside of Dublin City. The development was also taking place nearly 9 years since the author had previously commenced work on a new housing project. Under these circumstances, the author was surprised how far building regulations and their associated costs had progressed, despite the fact that there had been very little residential development work carried out in Ireland over the preceding 10 years. Following this realisation and the critical reflection assignment, plus an earlier workshop presentation on case study research for practitioners, presented by Dr Rod Gameson on 03.10.2015, seeds of thought started to develop that a practice problem existed around building regulations costs and that perhaps the best approach to researching this issue was through examining its effects on a very typical case basis. Dr Gameson's presentation also happened to occur around the same time that the author attended 10 days of workshops on building regulations, run by the Irish Construction Industry Federation. It was a confluence of these four events, which stimulated the reflection process that eventually led to the research design for this thesis.

1.8 Why a professional doctorate

The subject of knowledge development has a very long history and is complex. The philosophical study of knowledge, otherwise referred to as Epistemology, is generally divided into two chronological periods: classical and modern. Since the time of the ancient Greeks, philosophers such as Plato have developed various schools of thought as to how knowledge is derived and how it should be suitably classified. In modern epistemology, much of which was founded on a philosophic revival in the sixteenth century, the earliest aims were to address one or other forms of scepticism. The intellectual background was provided through rationalist and empiricist concepts espoused in the ideas of Renee Descartes (1596-1650) and John Locke (1632-1704) (Knight & Turnbull, 2008). Later post-modernism and especially positivist research ontologies brought forward a more widespread belief that it is only through progressive rationalist understandings of observation and the use of scientific measurement that facts can be proven and therefore knowledge created (Ryan, 2018).

More recently, Gibbons et al (1994) sets out how new forms of knowledge production has emerged since the middle of the last century, based on context driven, problem solving aims. Eraut (1994) characterises professional knowledge according to type, mode and context. This helps to interpret for us the combination of ways and competency levels in which practice knowledge can be created and acquired. Their seminal work also distinguished between theory building & testing research, and context driven research, through the lens of conceptual differences and the researcher's role as neutral, active or reflexive observer. Using this approach, they also distinguish knowledge production into either Mode 1 knowledge, based on scientific or academic theory constructs or Mode 2 knowledge, based on improving practice or discipline based knowledge through inquiry. Mode 1 knowledge production would be closer aligned to the end product associated with a traditional PhD research, while Mode 2 would be closer associated with context driven, practice based knowledge expected to be generated by a professional doctorate research (Smith, 2009). This interpretation is supported by Bourner et al, 2001 and Trafford & Leshem, 2008, who claim that professional doctorates are expected to investigate issues that are perceived to exist within professional practice. Smith (op cit) adds that the outcomes from professional doctorates should also be such that they add to or build upon the knowledge that already exists in practice. In accordance with those guidances, the intention of this doctorate research will be to make a research based contribution to existing knowledge and practice. Accumulating building regulations costs is an issue identified by this practice researcher, working ‘in the arena’, as being worthy of academic research.

The researcher has over 43 years practice based experience in the construction industry. This experience spans across the 30 year longitudinal time horizons covered in the research study and importantly, also comprises over 10 years working experience in advance of that period. The researcher’s practice experience includes working as a chartered architectural technologists and as a chartered quantity surveyor on residential sector and wider construction industry sector projects. The researcher has also gained practice based experience working as a site manager, construction manager and development director on a number of residential development projects. By virtue of the scope of interdisciplinary practice based experience, gathered by the researcher, it can be firmly stated that the researcher comes from an appropriate background wherein a contextual understanding of the research problem exists. Also, because this research study heavily relies on the identification, interpretation and input of data and information requiring interdisciplinary knowledge such as quantity surveying, architectural technology, project management and development management, it may not be possible to carry out the proposed research other than through a robust professional doctorate study.

The relationship between building regulations costs and viability is an under-researched topic, possibly because of the multi-practice nature and complexity of the issue. With the benefits of this contextual based experience, a keen interest in academic research and a wish to make a contribution to knowledge, it is the researcher’s respectful but duly considered view that the most appropriate way to research the issue is through the medium of a case study, conducted by an experienced practitioner, who has observed the phenomena over time. Also of major importance is that the practitioner researcher will have privileged access to the live case study data required to complete the study.

Given the nature of professional doctorate studies, and the often mid to late mid-career candidate entry, QAHE (2020), underlines that a professional doctorate researcher must reengage with research methodologies and acquire research skills through taught modules at the initial stages of a programme of study. As part of the Built Environment Professional Doctorate Programme at Salford University, the practitioner researcher has undergone a comprehensive structured programme involving lectures, seminars and academic writing modules. This has provided the requisite research skills and knowledge to produce an original contribution to knowledge in a practice based field.

1.9 Research Aim, Objectives, and Questions

The relationship between the research aim and objectives and the research questions, ensures that the research develops from a general to a specific inquiry (McCann, 2019). According to Trafford & Leshem (2008), the research aim should provide readers with a statement that enables them to understand the central focus of the research and from here the research objectives provide an underlayer of granularity. The research questions make explicit what it is that needs to be answered, in order to provide the final step from general to specific.

This research study intends to contribute to resolving current and future housing crises in Ireland and other developed countries by raising awareness to building regulations costs and ongoing demands for higher standards in house building, as creating an unintended underlying structural issue that impacts development viability and housing supply.

1.9.1 Research Aim

The aim of this research is to explore how gradually accumulating building regulation costs have increased housing delivery costs, in order to understand the extent that this phenomenon has on development viability and purchaser affordability issues at the heart of the Irish Housing Crisis.

1.9.2 Research Objectives

1. To identify and understand the range of issues contributing to the Irish Housing crisis.
2. To ascertain from a review of literature if building regulations costs are considered as a significant contributing factor to the Irish housing crisis.
3. To assess the impact of Irish building regulations costs on residential development viability and purchaser affordability.

4. To position the findings of the research with existing knowledge and literature on building regulation costs and the Irish housing crises.

1.9.3 Research Questions

1. What issues can be identified in the review of existing literature as contributing factors to the Irish Housing Crisis?
2. Have building regulations costs been directly identified as a contributing factor in the literature?
3. Can building regulations costs be indirectly identified in the literature as a contributing factor to increased housing construction costs?
4. Can building regulations specific to housing be identified and then assessed for their proportional impact on the construction costs of a typical estate built house, using live cost data?
5. Are building regulations costs a significant proportion of the overall cost to construct a typical estate built 3-bedroom semi-detached house?
6. Since Irish building regulations were first introduced in 1991 have their impact on overall construction costs gradually accumulated?
7. What is the current position of residential development viability and how does the current position compare to scenarios where accumulated building regulations costs are factored out of the cost base?
8. What is the current position of new homes purchaser affordability and how does the current position compare to scenarios where accumulated building regulations costs are factored out of the cost base?
9. What would be the effect on development viability and purchaser affordability if the case study development site was situated in alternative locations?
10. How does the findings of this research add to the existing knowledge and literature on buildings regulations and the Irish housing crisis?

1.10 Thesis structure

Chapter 1 (Introduction) introduces the background and justification for the research. It also contextualises how the researcher has become aware of an apparent practice problem. It then summarises a proposed research strategy and touches on work to be brought forward from a recent pilot study. The perceived value of the research, the researcher's positionality and the research aim, objectives and questions are also outlined.

Chapter 2 (Literature Review) is intended to act as a general investigation of existing literature on various integral themes and peripheral areas, which can be brought together to capture and create an understanding of a broad subject matter (Oliver, 2012). The themes are generally around the housing market, housing crises and building regulations issues in Ireland and internationally. Conclusions from the review will be used to uncover an appropriate underlying theory for the research and to inform the responses to 3 research questions, which will be used to address the first 2 research objectives.

Chapter 3 (Methodology and Methods) starts by outlining the researcher's assumptions and approaches as to the nature of knowledge and by defining the philosophical positions taken up by the research. In considering and discussing theory development in approaches to methodological choice, this chapter also describes how Historical Institutionalism emerges as an effective theory to underpin the research. This is explained in the context of how building regulations can be regarded as rules or institutions, undergoing continuous and incremental changes in path dependant processes, where critical junctures arising in the shape of dramatic or episodic events in our history represent the trigger which act to bring about formative policy decisions which create the path dependant processes. This chapter will then explain the rationale for the research methodology and use of abduction and mixed methods approaches. The Methods and Methodology chapter also sets out a justification for the choice of documents contents analysis and instrumental case study analysis as the most practical and effective research methods for use in the investigation. The chapter also outlines the limits and delimits of the study and ends by discussing the various ethical considerations to be managed in the execution of the research.

Chapter 4 (Data Collection and Analysis) will describe from where and how the data is collected and analysed. It also explains how data from building regulations TGDs and associated ancillary documents are identified as the main unit of analysis (UOA) and why and how a case study housing development project is chosen and utilised as a suitable instrument from which to cost and analyse the UOA. This analysis process establishes the proportional cost of building regulations contained within the construction and development costs of the case study house, which is then further analysed through two dimensions. The first dimension is over 3 periodic longitudinal time horizons and the second dimension is across 3 adjacent regional locations areas. The results of these series of analysis will allow the following findings chapter to consider development viability and purchaser affordability across various spectrums.

Chapter 5 (Discussion on findings from the Data Analysis) is presented in two parts. The first part addresses the 10 research questions, chosen to meet the ends of the 4 research objectives, set out to achieve the research aim. The second part focusses on the main primary findings identified in the data analysis and literature review chapters. It also highlights and reviews a number of secondary findings that have been identified.

Chapter 6 (Research Conclusions) summarises the outcomes from the preceding chapters and emphasises the key findings that underline how the research aim has been achieved. This is followed by a synopsis of the implications of the research findings and potential contributions to practice and theory based knowledge and how the research adds to the existing literature on building regulations and the Irish housing crisis. The conclusions chapter also explains why the findings of this research can be considered to be transferable to other international jurisdictions. Finally, the chapter outlines areas where the potential exists for further research to build upon this research.

CHAPTER 2

REVIEW OF LITERATURE

2.1 Introduction

In the introduction chapter of this research study, it is argued that under supply of housing to the market is the root cause of the Irish housing crisis and housing viability crises worldwide. It is also suggested that there are a number of recognised related systemic factors and other less acknowledged or latent structural factors, such as building regulations costs, which contribute to the under supply phenomenon. This chapter aims to identify and overview those factors through a review of existing literature and discourse on Ireland's housing market, housing markets in other jurisdictions and the implementation of building control regulations in Ireland and internationally.

The review opens by considering the complexity of current house price theories and how these relate to basic supply and demand laws. It then focuses on various key elements that combine to make up the Irish housing market in its current form. This involves reviewing the Irish construction industry, government's role in influencing the market and the macroeconomic importance of housing markets. This part of the review then looks at supply side components of the market such as land availability, the Irish planning system and credit supply. The review then considers some wider components such as the financialisation of housing, before embarking on an assessment of the importance of first and second time buyers, the second hand market and the rental market. Staying with the Irish housing market, the review sets out a periodic progression overview of housing supply in Ireland from 1922 until the present. It then reflects on housing demand, prices, viability and affordability issues. The review of Ireland's housing market closes with an overview and discussion of the effects of the current housing crisis.

The next part of the literature review considers the prevalence of housing crises, more commonly referred to as housing affordability crises in other national jurisdictions. Here the review looks at housing affordability issues in OECD countries, and particularly those identified in english speaking economies in North America, the UK, the EU and Oceania. This part of the review also considers housing affordability in developing countries and how these can relate to different issues. With the purpose of identifying transferability of findings and conclusions in a national based study rooted in housing costs, the literature review also seeks to compare international construction costs and housing provision structures and looks at international recognition of the rights of individuals to adequate housing.

The final parts of the literature review concentrate on various aspects of building regulations, from a historical, national and international perspective. A key purpose of this focus is to further establish the degree to which findings from a national based cost study may be transferable to other international jurisdictions. Another purpose of focussing on these aspects of building regulations is to seek to uncover a relevant theoretical framework that conceptualises and underpins the proposed inquiry, which seeks to explain why and how building regulations have become and will continue to be a significant influence on building processes, building costs and house prices.

The discussion on building regulations starts by overviewing historical accounts of references and implementation of building regulations in parts of the world through major time periods in human history, starting from the classical era and concluding in the contemporary. The next part focusses on the evolution of modern building regulations in Ireland, commencing at the time of transition from regional building byelaws to national building regulations in 1991. The review then looks at the influence of EU building standards policy initiates on member state building regulations policies, including Ireland. The literature review ends with an overview of the current status of building control systems and standards in various countries and regions around the world, before ending with a chapter summary which concludes by underpinning the study and data collection process with an underlying theory.

2.2 The housing market in Ireland

2.2.1 House price theory

The basic law of supply and demand is principled on the theory that when demand for a good or service is high, then its price will rise, and supply will increase (Ball et al, 2010). Alternatively, when there is a large supply of a good or service then demand will fall, and the price will go down. In this way, supply and demand interact or work against each other until they reach a point whereby the equilibrium price is achieved. This is the price achieved when supply is equal to demand (Prentice, 2020). The reality according to Maclennan & Moore (1997) is that economic theory is no different for housing than it is for other markets, in which case; the market will only supply housing for the effective demand, where the equilibrium price paid meets the necessary delivery costs plus profit. Lyons & Monert (2021) agrees with Maclennan & Moore that the elasticity or responsiveness of housing supply to shifts in demand is not determined by prices alone, but also by the ratio of prices to costs. This will mean that new housing supply will not be delivered until it is viable to do so.

In a typical house sale transaction, there is a buyer and a seller. The buyer placing an offer on the house and the seller having made the decision to either reject or accept the offer. This looks like a very straight forward process, but for many reasons engagement in the housing market is far more complicated (Norris & Byrne, 2020). Not least, when societal needs cannot be achieved at the equilibrium market price (Maclennan & Moore, op cit) and the provision of social homes must be provided or made attractive in some way (Cahill, 2014). While in the private housing market it can generally be assumed that when there are more buyers than sellers that prices will rise, it cannot also be assumed that supply will swiftly respond to meet that price rise. According to Lyons & Monert (op cit) an important asymmetry also exists in housing supply when downward shifts in demand occurs; as with existing immobile housing stocks, a fall in demand will mostly be met by a fall in prices rather than a reduction in quantities.

Following is a review of some of the key areas of the housing sector, from which the intention is to uncover why supply is not responding quickly enough to demand and the needs of society.

2.2.2 Key elements of the Irish housing market

The global economic crash of 2008 generated an increased focus on the importance of understanding housing markets and housing as a contributor to macroeconomic fluctuations (Lyons & Muellbauer, 2013). Housing is central to our economic fortunes and is the most important consumption good in developed economies (Lyons, 2015). In an export driven open economy such as Ireland’s, a dysfunctional housing system can place a drag on economic development and damage society (Norris & Byrne, 2019), in various ways, such as by creating homelessness for individuals and families, adding to household overcrowding and thereby deferring new household formations, preventing emigrants from returning home (McNeive, 2020) and creating obstacles to domestic migration and immigration. Nowlan (2015a), also refers to the effects of a dysfunctional housing system on our social wellbeing, where for instance children or young adults have to deal with homelessness or overcrowding, with no place to do homework, study, exercise or to have some privacy and the follow on effects that this can have on their future lives. Nowlan also points to the importance of a proper functioning housing market to a country's international competitiveness and ability to attract international investment and jobs. The following sections 2.2.2.1 to 2.2.2.11 discuss a number of the key components of the Irish housing market and housing markets generally.

2.2.2.1 The Irish construction industry

The global financial crash of 2007 had a devastating effect on the Irish economy and particularly on the Irish construction and residential property markets. Following a 7 year period of unprecedented growth in residential construction activity in the period between 2000 to 2007, the Irish construction industry abruptly descended into a sharp decline. According to the Society of Chartered Surveyors Ireland (SCSI & DKM, 2014) output in the Irish construction sector in 2007 stood at almost €40 Billion, representing 25% of Gross National Product (GNP). It is generally considered that the optimal proportion of construction output relative to GNP in a stable economy should be in or around 12% (Bruce Show, 2014). It was only to be expected that an adjustment in construction output was due to happen from 2007 onwards, but with the onset of the global finance crisis, any possibility of a soft landing, quickly evaporated.

Table 2.1 illustrates the output performance of the Irish construction industry, since 2000, the year, which Irish economists generally refer to as the beginning of the Irish housing bubble (Sweeney, 2019). The famed Celtic Tiger period of more balanced economic growth between 1994 – 2000 led into what Sweeney describes as a period of artificial growth, assisted by unsustainable pro-cyclical policies based largely on domestically generated impetus, low eurozone interest rates and poor financial regulation.

Table 2.1 Construction Output in years 2000 to 2021 Source: CSO Publications

Year	Construction Output Volume - indices	Persons Employed in Construction	Number of House Completions
2000	100.0	166,200	49,812
2001	103.4	180,000	52,602
2002	105.5	182,200	57,695
2003	111.5	191,400	68,819
2004	123.6	206,000	76,954
2005	139.2	242,400	86,189
2006	144.9	262,700	88,187
2007	125.1	277,000	78,027
2008	88.8	233,100	51,724
2009	56.1	155,400	26,420
2010	38.8	125,300	14,602
2011	32.6	105,700	10,480
2012	22.9	89,351	8,488
2013	25.5	91,122	8,301
2014	28.0	99,860	11,016
2015	29.8	125,900	12,666
2016	37.0	136,900	14,932
2017	43.5	147,400	19,271
2018	44.8	145,700	18,072
2019	51.6	149,300	21,087
2020	41.1	135,200	20,526
2021	37.7	158,400	20,433

In the measurement of construction output, Table 2.1 identifies the year 2000 as the base year with an index value of 100. The Table then clearly demonstrates that from 2000 to 2006 output in construction grew by almost 45%, while at the same time housing output grew by 77%. Persons employed in construction over the same period grew by over 100,000 or 60%. Following this 7 year period of growth, it can then be seen that in 2008 construction activity sharply declined from an index high of 144.9 down to 88.8 before descending to just below 23.0 by 2012. From 2013 onwards it shows that construction activity started to grow again, but at very modest levels, reaching an index level of 51.6, before dropping off again in the years 2020 and 2021, because of a partial shutdown in the Irish construction industry due to the Covid19 crisis. Commenting on the CSO output data (SCSI, 2015) notes that in monetary terms construction output in 2014 stood at just less than €9.0 billion. This compared to just over €40 billion in 2007. SCSI also noted that as a proportion of GNP, construction output was less than 6%, which is 50% of the desired output level of a stable economy. As one might expect, falls in construction output were reflected in government capital spending programmes during these same years. In 2006 capital spending stood at almost €9.0 Billion or

6 % of GNP. In 2012 capital spending stood at less than €3.0 Billion or 2.5% of GNP (SCSI, op cit).

Table 2.1 also illustrates the impact that fluctuations in construction activity had on construction employment over the same periods. The data shows that in the 'bubble' period between 2000 and 2007, construction jobs increased by over 110,000 or 67%, rising from 166,000 to 277,000, despite construction output increasing by only 25% in the same period. We also see that in the period from 2007 to 2012, employment in construction fell from a high of 277,000 jobs to just over 89,000, representing a drop of almost 190,000 jobs or 68%. From 2013, employment levels in construction started to grow again and have continued to gradually increase, rising to a figure of 158,400 in 2021. This figure represents 6.4% of the overall number of persons employed in the economy (CIF, 2022) and is a percentage increase of 77% on the 2012 employment levels.

According to CIF (2022), the economic impact of the construction industry is considerably bigger in the overall national economy than the initial or net amounts spent directly on construction. The reason for this is that when construction firms do business through their supply chains, these supply chain businesses then also contribute to the wider economy in a multiplier effect, as wages and profits generated in those companies are spent. In an assessment of the economic impact multipliers for construction, carried out on behalf of the CIF by Ernst & Young in 2022, it was estimated, after all direct and indirect impacts are considered, that for every €1.0 million spent on direct construction activity in 2021, there were extra over contributions across the economy resulting in an additional 8.9 full-time jobs, an additional €0.66 million in wages and profit and €0.16 million in tax revenues to the Irish exchequer (CIF, 2022). Using these measurements, the CIF suggests that the industry supports approximately 290,000 jobs across the overall economy, which is equivalent to over 11.5% of the entire national workforce.

The fortunes of the housing sector division of the Irish construction industry have in many ways mirrored those of the overall industry, however it was this branch of the industry that saw the best and worst of the boom bust cycles (SCSI/DKM, 2014). In Table 2.1 it shows that the number of house completions in the bubble period between 2000 and 2007 plus 2008 was over 610,000. This equates to an average annual completions rate of almost 68,000 per annum, culminating in a high of almost 90,000 units in 2007. Following the global financial crisis, and in the following 5 year period from 2009 to 2013, approximately 68,000 units were built in total, equating to an annual average completions rate of 13,600. From 2014 when housing completions started to increase once again, the numbers rose from 11,016 in 2014 to a high of 20,526 achieved in 2020. This means that since 2014 the number of house completions achieved has totalled 138,003 over 8 years, which averages out at 17,250 per annum.

In 2022, the sentiment of commentors and the industry in general could be described as being one of subdued optimism that output will continue to grow marginally, despite the prevailing international uncertainties. This cautious optimism is supported by a sense of direction and purpose on the back of published government plans to navigate the Irish economy over the next ten years (Aecom, 2022). For instance, in 2022 the annual exchequer budget has pledged €11.1 billion in capital investment spending (Linesight, 2021), a figure which includes €3.5 billion, to be allocated to the provision of housing, which is the biggest allowance directed to housing in the history of the state (Aecom, op cit). Other medium term plans published by government indicating their strong commitment to prioritise capital investment over the next decade include the National Development Plan 2021 – 2030, the Climate Action Plan 2021 and the Housing for All Plan, published in 2021. Together these plans set out Ireland's overarching strategy to invest in infrastructure, climate change measures and housing provision. Planned investment in infrastructure includes commitments to improve public water, wastewater, electricity and transport provision. Climate change measures include plans to support energy retrofits in homes across the country, to target emission reductions. Under the energy retrofit plan, the government hopes to achieve up to 75,000 BER B2 equivalent home upgrades annually by 2030. Home retrofits will include the installation of heat pumps, photovoltaic panels, electrical car charging facilities and envelope insulation upgrades.

Tempering the afore mentioned subdued optimism in the Irish Construction industry's short and medium term prospects are acknowledgements of the many operational challenges that currently exist. Following the perfect storm of Brexit, Covid19 and more recently, the emergence of the war in Ukraine and serious threat that the global economy is moving towards a period of recession, the industry has and continues to face difficulties in the task of re-kickstarting operations that had been forced to lock down for large parts of 2020 and 2021. The combination of these storms has amongst other things, created major difficulties for builders attempts to secure and pay escalating prices for scarce imported products, such as timber, steel and plastic goods (Linesight, 2022). As price takers in the market for building materials, the industry has no power to influence supply prices (Breen & Reidy, 2021). In

2022 the CSO reported that the Irish construction industry employed just over 158,400 or 6.4% of all persons in employment and is therefore one of the most labour intensive forms of economic activity. Concerns over the comparatively low numbers of school leavers entering apprenticeships and the ageing of the current workforce, weighs heavy on the sector, especially following an exodus of foreign workers subsequent to the housing bubble crash in 2007 and again during the Covid19 lockdown (CIF, 2022). Other national based issues such as inflation, planning complexities, zoned land supply uncertainties, infrastructural deficits, project viability issues and building regulation related costs are discussed in the following sections.

2.2.2.2 Macroeconomic importance of the housing market

Between mid-2007 and early 2009, the global financial crisis and almost simultaneous decline in worldwide housing markets, served to demonstrate how macro-economic conditions and national housing market stability are systemically linked (McCarthy & McQuinn, 2014). The global financial crisis is generally referred to as the period when global financial markets and world banking systems came under extreme pressure, initially due to a sudden downturn in the US housing market. The downturn in what was considered at the time to be a rather remote segment of the US lending market, acted as a catalyst that spread from the United States to the rest of the world, through its systemic linkages to the worldwide financial system (Ramskogler, 2015). A major impact of the crisis saw numerous national banks incurring unsustainable losses causing them to rely heavily on government support to avoid bankruptcy. As several major advanced economies experienced the deepest recessions since the Great Depression of the 1930s, many millions of peoples lost their jobs (RBA, 2022). Unemployment in the US reached 10% and it is estimated that almost 3.8 million US citizens lost their homes (Dharmasankar & Mazumder, 2016). Similar unemployment rates were experienced in Ireland and many parts of the EU (CSO, 2017). Recovery from the crisis was very much slower than previous recessions and the after-effects are still felt by many people.

In the years leading up to the crisis, economic conditions in the US and other advanced economies including the UK and Ireland were very favourable. Economic growth was positive and rates of unemployment, inflation and interest were low. In this environment investment in residential property grew, as did house prices. Encouraged by the expectation that property prices would continue to rise, many households and investors in the US started to borrow excessively and, in many cases, imprudently to purchase houses (RBA, 2022). Similar expectations led households, investors and property developers in European countries such as Ireland, Spain, Poland and Iceland to follow suit (Baudino et al, 2022). Buoyed by a widespread presumption that favourable conditions would continue and good profitable returns, US banks and other lenders continued to extend ever larger numbers of home loans to borrowers, without closely assessing their ability to make repayments if their economic circumstances turned. Additionally, lenders in the US took a view that their risks were entirely minimised because of their ability to bundle and sell on the loans as mortgage backed securities (MBS). Investors who bought MBSs mistakenly thought that they were purchasing assets of very low risk, believing that even if some of the loans in the bundles defaulted that the rest would continue to be repaid. The investors affected included US banks as well as banks from the UK, Europe and Asia (RBA, 2022).

Although not directly affected by US based MBC products, the Irish banking sector entered a deep financial crisis and became submerged into the global financial crisis, mainly due to a combination of macroeconomic developments, short sighted fiscal policies, poor financial regulation and risky lending. The plight of the banking sector was made even more complicated by a complete asset price and housing market collapse, the unfortunate result of an increasing connection with residential real estate by banks, developers and households (Baudino et al, 2022). According to O'Neill (2013), in 2007, the housing sector in Ireland accounted for over 15% of GNP, which is well above the international average for a healthy and sectoral balanced economy. As a result, of this economic sectoral imbalance, Ireland became one of the OECD economies worst affected by the global financial crisis (Norris & Coates, 2014). It followed that in 2010, Ireland temporarily lost its economic and financial independence (McQuinn, 2017), when the so called 'Troika ' provided loans to the Irish Government totalling €67 billion Euros, over 3 years (IMF, 2018). Using expertise gained in similar crisis experienced in Latin America, the Troika headed by the IMF conditionally mobilised funds and oversight to stabilize the collapsed Irish banking system, restore confidence needed to recover the economy and resume the flow of credit needed by companies to start growing again.

While the foregoing is a recount of how an unstable housing market can contribute to the economic insolvency of an OECD economy, in the face of a global economic shock, it is also worth considering ways in which a stable housing market can indirectly support an economy. In their prebudget submission to the minister for finance in 2021, the Irish House Builders

Association (IHBA) commissioned a report which stated that for every 1,000 new dwellings delivered by the sector, there is an average contribution to the exchequer of €115 million. Using government statistics for the number of dwellings registered as completed in 2019, which was approximately 21,500, then the contribution to state revenues in that year was in excess of €2.50 billion, which was equivalent to 4.2% of total exchequer revenues of €58.3 billion (Revenue, 2019).

According to Byrne et al (2020), consumer spending accounts for half of gross national income (GNI) in Ireland. In the UK, consumer spending in 2021 accounted for 59% of GDP (House of Commons Library, 2021). Many analysts including Bostic et al, (2009) suggest that in general, consumer spending confidence is more sensitive to changes in householders perceptions of their housing wealth rather than financial wealth. Campbell & Cocco (2007) find that in the UK this trait is most applicable to older and more affluent homeowners, because younger cohorts of the population are more likely to be renters. McCarthy & McQuinn's (2014) perspective is that housing wealth perceptions influences the balance between householder spending, deleveraging and precautionary saving. In their assessment they note that in 2014 estimates indicated that over 400,000 Irish properties were in negative equity. From this information and survey findings they suggest that many of the households effected were actively seeking to reduce their mortgages and levels of personal debt at the expense of spending to aid economic recovery. Separately, it is noted that renters reduce their levels of spending when disposable income is squeezed because of high rents. In an Irish household budget survey carried out in 2010, housing made up the largest share of expenditure, coming in at almost 25%. The next highest spending category was food at 16% (Lyons, 2017).

2.2.2.3 Government's role in the housing market

As previously noted, household spending on housing and the housing market generally, play important roles on many levels in society and in macroeconomics (Byrne, 2020). As a sector that provides essential shelter for people, within a market influenced by short term business cycles and long term economic growth patterns (Somerville, 1999), it is not surprising that the housing market is significantly influenced by government policies. Those policies result in market interventions primarily focused on determining credit conditions, social housing provision and housing supply (Lyons, 2017). To do this governments use taxation and levies together with subsidies and grants to calibrate stability and to create the required conditions

(Nowlan, 2015a). Government land management, national planning objectives and building standards policies also play an important role in determining the fortunes of the housing market. Another factor not to be forgotten is that the housing sector is widely considered by governments to be one of their essential cash cows. According to Nowlan (2017), the rapid evaporation of revenues from the housing market was one of the primary causes of the dramatic collapse in Ireland's public finances when the global financial crisis hit in 2008.

In most parts of western Europe there was sustained direct government intervention in housing systems during the post war period (Forrest & Hirayama, 2015). In Ireland this saw the continuation of a major social housing programme started in the 1930s, intended to provide alternative housing for tenement dwellers (Kelly, 2019). From around 1980 onwards this policy shifted towards a more neoliberal focused policy of promoting private home ownership through private sector housing (Byrne, 2020). In the midst of this current housing crisis, it appears that policy in the 2020s has once again shifted back to direct government participation in the delivery of social housing, as evidenced in Housing for All: A new Housing Plan for Ireland (2021).

Providing new homes in urban settings is very complex. This complexity is not made any easier by virtue of the many sub-markets to consider and also the influence of up to 12 government agencies that have an input into the housing market system (Nowlan, 2015). Commenting on the lack of joined up thinking in the makeup of government policy, Dunne & Sirr (2012) put forward that, government in Ireland do not consider the housing market when framing overall macroeconomic strategy. This is supported by Nowlan (2015a), who also suggests that the over-riding housing policy, post the financial crisis is to take a wishful wait and see approach, in the hope that market forces will rescue the growing supply shortage situation. Lyons (2016) suggests that the only clear government policy on the housing market in 2105 is that macro prudential lending rules will place a lid on rising house prices. All three opinions were either incorrect or acted upon, when in May 2016, the first cabinet minister for housing was established. Despite this new role however, many commentators continue to argue that the legacy of having to accommodate input from so many government agencies continues to hamper integrated housing policies that join up the dots. Parlon (2022) considers that systematic inertia is the greatest challenge that the house building sector faces in the delivery of housing and infrastructure provision. Parlon claims that while central governments and the political system appear to understand the need for urgent action, this view does not appear to be shared by the administrative levels below, where state agencies, public utilities and local government do not express the same sense of earnestness.

An interesting concept put forward by Sirr & Dunne (2012) is that the housing market is too diverse to be spoken of or considered as just one single entity. On the basis of this concept, they are critical of commentators and academics for believing that we know enough to holistically theorise about the market in general, regularly forgetting that there are markets within the market, by other names. These are submarkets of different locations, different buyer types, markets concerned with building types, such as Georgian buildings, markets based on different consumers, markets based on rental income and so forth. In this context it is worthy of acknowledgment that considerable variation is necessary in government policy and that its role in supporting or controlling the housing market can be very complex. Lawlor (2020) raises another concern, which focuses on government's limited capacity to manage a market whose product is a long term proposition. Lawlor's contention is that in a system of government where ministerial office is temporary in nature, there is little incentive for policy makers to promote long term strategic thinking, that will be credited to the next government in power. Lawler's concerns are quite practical ones, but thankfully they can be allayed, due to the foresight of previous administrations to pioneer the creation three separate government strategies, which fall under current and future Housing Minister's brief. These strategies are contained in the Housing for All Plan, the National Development Plan and the National Climate Strategy.

In an EU Alert Mechanism report, published in November 2022, it was noted that house price growth in Ireland continues to outpace income growth, but that the rate is not as much as is seen in other member states (EC, 2022d). The report also suggests that demographic growth is a key factor in Irish housing supply shortages, which are creating social problems due to a lack of accommodation. Another key take out from the report was that the Irish banking system will not be affected by the supply/demand imbalance in the same way that it was in 2008. This begs a question as to whether EU policymakers and national governments consider that battening down the bank system is more important than creating the conditions for increases in housing supply and better social conditions for citizens (Burke-Kennedy, 2022).

2.2.2.4 Land supply

The first building block in the supply of new homes is land. The suitability of land for the provision of new homes is dependent on a diverse range of geographical factors along with zoning, environmental considerations, planning regulations and the availability of infrastructure, such as water, wastewater treatment, energy and transport (Breen & Reidy, 2021). Apart from its suitability, the supply of land can depend on decisions of landowners whether to hold, sell or develop their land (NESC, 2018). Almost without exception, housing development schemes can only be delivered on lands that are zoned for residential use. All zoned land started out having some other use, such as farming, before it was zoned (Kelly, 2021a). Residential zoning is invariably targeted into cities and large towns by civic planning departments. According to the OECD (2018) cities are home to more than 50% of the world's population and are the main engines of economic growth and employment. One of the primary strategies of the Irish National Planning Framework (NFP) is to discourage urban sprawl by encouraging compact development and to deliver greater proportions of residential development into the states five cities and then to the large and smaller towns and villages (NPF pp.139, 2018). An objective of the NPF is to target 50% of overall national growth between now and 2040 into the cities. This objective is the nucleus of the overarching approach and justification for local authority (LA) land use zoning objectives.

In economic studies, land is identified along with capital and labour as a factor of production. It is also considered as a scarce or limited resource, an attribute regarded as its main economic benefit (Investopedia, 2022). In this regard, the question of whether a parcel of land is zoned, will have the effect of further adding or subtracting to its measure of scarcity, economic value and saleability (Kelly, 2021a). Land zoning is a legal process where local authorities regulate and designate permitted uses to particular areas of land in cities, towns and villages within their administrative areas (Galligan, 1997). According to Nowlan (2015a), one of the downsides to the system of land zoning is that it invariably places a monopolistic advantage on the landowner. This advantage is used to best effect when the zoned land is brought to the market by the landowner as speculator, through competitive bidding procedures. Apart from legislation in 2018 permitting local authorities (LAs) to draw up vacant site registers and to apply a 7% annual levy on sites contained on that register, there has been very little in the way of incentivising landowners to release residential zoned land to the market (Kelly, 2021) or to spread the windfall gains made by landowners.

In Ireland, the way in which local authorities decide when and how much land to zone for residential or other uses is a complex system, that continues to evolve (Tomaney & Moore-Cherry, 2018) . Through a framework of national and regional planning guidelines, local authorities in Ireland are given housing provision targets intended to inform them of the amount of land required to be zoned for residential development use in their county development plans (Housing for All, 2021). This housing target information is then used by LA forward-planners as the basis for allocating zoning to locations in cities, towns and villages based on quantitative and qualitative considerations. The result of this process is referred to as the housing core strategy provision (O'Neill, 2013). The requirement for core strategy provisions in county development plans in Ireland were first introduced under section 7 of the Planning and Development Act 2010. It is argued by O'Neill that prior to the introduction of core strategy provisions that land use zoning was excessively politicised and developer led, invariably resulting in an oversupply of zoned land, with many houses being built in locations where people do not want to live. Healy & McGoldrick (2018), carry this argument further by contesting that prior to core strategies, forward planning for housing needs by local authorities were investment led processes, for profit rather than for social and citizen need objectives. O'Neill also contends that in the absence of robust funding mechanisms for LAs, land zoning for residential purposes was viewed by them as a revenue generating measure, through development contribution payments and economic activity generation.

There are counter arguments to the views of O'Neill and Healy & McGoldrick in relation to the extent to which LAs utilise land zoning to their own benefit. Those counter arguments are raised mainly by industry practitioners in discourses, some relating to a recent wave of residential land de-zonings currently sweeping the country, but particularly in Dublin City and the region commonly referred to as the Greater Dublin Area (GDA). The dezoning measures are based on housing target figures handed down to LAs by government through the National Planning Framework (NPF). Evidencing the scale of dezoning, one LA in the GDA is currently involved in five separate judicial reviews following the adoption of their new county development plan in November 2021 (Irish Times, 2022). In a submission document to another LA in the GDA currently at draft stage in the making of their new county development plan, MacDonald (2022) warns that their draft plan is based on unsound demographic projections and also demonstrates a lack of understanding of the real levels of housing demand in the county. MacDonald also stresses a concern that in quantifying the amount of land to be zoned for residential development, the LA is assuming that practically all of that land will be developed during the life of the plan. He argues that the LA is taking no account of the fact that a high proportion of zoned land will not be built on during the life of the plan for various reasons. On this point it is noted that zoned land may continue to lie fallow because no account has been made of who the stakeholders may be, if there are practical livelihood considerations or whether a parcel of land has particular viability issues.

In order to build houses on zoned land, that land must also be fully serviced and connected to physical as well as social infrastructure capable of supporting its intended use. Following the 2008 crash, Ireland’s failure to invest in infrastructure capacity especially local and arterial water supply and wastewater drainage schemes has created a major structural deficit in this area (Nowlan, 2015a). According to a report on infrastructure investment in Ireland published in 2017 by the Irish Construction Federation (CIF, 2017), Ireland spent the least amount on capital investment in 2015 among all 28 countries in the EU. The average spend of the EU28 was 2.9% of GDP, whereas Ireland spent just 1.7% of GDP. This percentage rose to just 1.9% in 2016 and approximately 2% in 2017. The speed at which this deficit is currently being addressed may have been compromised somewhat by the unintended consequences of timing of earlier government decisions, as outlined in the 2007 Water Services Act, to create a dedicated state owned water utility authority. Irish Water was established in 2014, bringing together the management of water and wastewater services of 31 local authorities under one national service (Irish Water, 2022). All capital investment in this area is also managed by Irish Water, which not unsurprisingly has struggled with the enormous responsibility and task of taking over the management of water services from a standing start.

Land market activity slowed down considerably in Ireland and elsewhere during the Covid 19 lockdown periods in 2020 and 2021 (English et al, 2021). Infrastructure provision to zoned lands also suffered in the period (Parlon, 2020). English also notes that while transactions in Ireland have picked up considerably since the last quarter of 2021, the medium to long term trend, notwithstanding Covid lockdowns, has been down in recent years. This, English considers is strongly linked to high development costs and a lack of suitable serviced sites. It is estimated by Lisney (2021) that in 2021 residential land transactions accounted for just over 50% of all land sales in the Irish development land market. This is down from averages seen in the previous four years, when the proportion was closer to 65% of the market. In Ireland, turnover in development land sales in 2021 has been largely concentrated in the Greater Dublin, commuter belt area, which saw approximately €350 million or 80% of total activity. The Greater Dublin Commuter belt area generally comprises of Dublin City and County, and the neighbouring Counties of Kildare, Meath, and Wicklow. The other 20% of transaction are mostly contained in the combined totals for the main regional Cities of Cork, Limerick and Galway.

Residential property developers consider land to be one of the key raw materials in their supply chain (Lyons, 2015a). Developers acquire land for their projects from either, market or off market transactions (CBRE, 2020). It can be said that potential residential development land will normally come to the market in one of the following three forms.

1. Unzoned Strategic land banks which due to their location and proximity to social and physical infrastructure are likely to be zoned in future county development plans.
2. Lands zoned for residential use.
3. Lands with planning permission.

Each one of the above presents different product characteristics for the purchaser, much like other raw materials. For instance, concrete can be brought into a development project, ready mixed or more cheaply in the form of its constituent ingredients of sand, gravel and cement, whereupon it will take work, plant, space and time to turn it into concrete. In much the same way as the concrete analogy, the land-form categories 1-3 as noted above, bring different time, energy, and risk conditions into the process of procuring land for future development. According to Lisney (2021) and (Cushman & Wakefield, 2021), there continues to be high demand and much higher prices paid for ‘shovel ready’ sites with extant planning permissions. This they note, reflects a de-risking of delays and costs associated with procuring sites with planning permission. Cushman & Wakefield also suggest that developers are taking more time to consider the purchase of sites without extant planning permissions. This they believe is because of imminent regulatory changes and various policy announcements concerning for instance, proposals to double the percentage of social and affordable houses in any future developments. Cushman & Wakefield support their arguments with findings showing that in 2021 almost 68% of land transactions were in relation to sites with some form of planning permission attached. The other 32% were related to sites without the benefit of planning permission.

According to Lisney (2021) vendors of land in Ireland and the UK mainly comprise of private individuals, investment companies and REIT type property funds. Due to leverage level concerns held by the Irish Central Bank, leverage limits of not greater than 50% are set to be imposed on Irish domiciled property funds (Central Bank of Ireland, 2021). It is anticipated that this measure along with an expected backlog of transactions due to Covid restrictions and uncertainties, will help to bring about an improvement on the levels of residential development land coming to the market in 2023 and beyond (Lisney op cit), however, following the delisting of Hibernia REIT from the Irish stock exchange in 2022, there is in 2022 only one remaining REIT trading on the exchange (Ohle, 2022). According to Demographia (2022), academic research now links declining housing affordability with stronger regulation on land use. This is most particular to urban containment, which it says can produce significantly higher development costs. In a study on ‘rethinking urban sprawl’, the OECD (2018) has concluded that urban growth boundaries must be situated to accommodate sufficient competitively priced land for urban expansion. This they argue, is required so that house prices can be kept from rising disproportionately to incomes.

2.2.2.5 The planning system

National planning systems play an important role in society. Their main purpose is to ensure that the right development takes place in the right place at the right time (OPR, 2021). Features within the Irish planning system include the making of development plans, the planning applications and appeals process, enforcement systems and exemption policies (Keane, 2003). The planning system also plays an important role in forward planning. This involves identifying and preparing the groundwork for future growth target areas through the creation and linking up of future social, environmental, infrastructural and transport strategies, as well as identifying existing developed areas in need of renewal or enhancement. Future planning is also key in identifying places, amenities, structures and habitats that need to be protected (DHLGH, 2022).

The first serious attempts to introduce planning in Ireland was the Town and Regional Planning Act of 1934 and a follow on amendment Act in 1939 (Scannell, 1995). Under these acts it was up to the individual local authorities to decide for themselves whether or not to adopt the provisions and therefore, it was not until October 1964 that effective planning controls were introduced in Ireland This was when the then extensive provisions of the Local Government Planning and Development 1963 Act came into force (Galligan, 1997). This act was followed by a considerable number of planning regulations together with several new and amending acts. In 2000, all of these planning laws were repealed and or simultaneously consolidated into the Planning and Development Act 2000. Despite a further number of changes and additions to planning law in Ireland, mainly through the introduction of regulations, this 2000 Act is still referred today as the principal planning act.

In 2018, the Irish Government published the National Planning Framework (NPF) This 20 plus year plan is now the overarching policy and planning framework for the entire country, replacing the previous National Spatial Strategy (O'Leary, 2018). Under the NPF, forward planning is organised through a hierarchy of plans, starting with the National Development Plan (NDP), which directs the Regional Spatial and Economic Strategy (RSES), which must be followed by County Development Plans (CDP), which then sets guidelines for Local Area Plans (LAP) (OPR, 2021).

According to O'Leary (2018), the Irish planning system has heretofore been victim to government policy weakness favouring vested interests that pays little benefit to growing national productivity. Lennon & Waldron (2019) echo those sentiments in their treatise, titled de-democratising the Irish planning system. Wherein, they examine how a development lobby group may have successfully captured the policy formulation agenda by achieving the 'institutionalisation of a streamlined fast-track planning procedure' on large scale residential developments of 100 units or more. Lennon & Waldron claim that by using tactical arguments, conflating collective good with planning efficiency, lobbyist groups have successfully swayed policy to embed marketized views into the planning system, at the expense of democratic participation. O'Neill (2013) also expresses concerns on the influence of private self interest groups on planning policies, when referring to a potential to depoliticise contentious zoning through the introduction of the national plan hierarchy and provisions for evidence based core strategies under the Planning and Development Act 2010.

While it is correct that public decisions on the provision of infrastructure, planning permissions and land zoning can confer somewhat disproportionate benefits on the owners of land and developers, a somewhat counter view is provided by Nowlan (2015a). He argues that Ireland has one of the most comprehensive and anti-development planning systems in the world. He further suggests that there is no coherent land management system and no coordinated strategy to ensure that physical infrastructure is provided in lockstep with planning. Nowlan also criticises how when infrastructure such as utility services eventual comes on stream, that it is the early bird developer who carries the unbalanced proportion of their installation costs. Here Nowlan appears to infer a distinction between the business of developers, speculators and incidental landowners.

In relation to Ireland's comprehensive and arguably anti-development planning system, Larkin (2021) in discussion on a recent draft development plan policy published by Dublin City Council (DCC) takes a somewhat similar view to Nowlan. The DCC policy, which states that developers in the city will no longer be allowed to develop apartment projects that are solely built for the rental market, will according to Larkin, effectively prevent new stock coming to the market. This he adds, will only increase property prices further and restrict the availability of rental property. The key point to his argument is that in most parts of Dublin City, apartment development is only viable, when it is developed on the basis that the market value is equal to the capitalised rental value over 15 or 20 years. What this means is, that in many parts of Dublin City and especially outside of Dublin City, it is not possible to sell an apartment for what it costs to build that apartment. Although the City councillors who are responsible for setting the policy may be acting with the best of intentions, it is obvious to others, such as Larkin, that under the prevailing circumstances, this policy may in fact be an anti-development measure. Development control approaches, such as the one taken by the Dublin City planners, shows that while the planning system can prevent undesired development from taking place, it lacks the ability to ensure that the desired development takes place (NESC, 2018).

In a literature review on the determinants of housing supply, Lyons (2015), cites the findings of an examination of land-use regulation, in California by Quigley & Raphael (2005). Interpreting feedback from urban land-use officials, using hundreds of samples, they found that in cities with stricter land use regulations there was evidence that fewer new homes were built and that higher house prices resulted. Lyons also points to other research carried out by Ihlanfeldt (2007) and Glaeser & Ward (2009) in Florida and Boston respectively, which also found that land restrictions can significantly hamper new development. The Irish House Builders Association (IHBA) are the main representative body for residential developers in Ireland. Through annual pre-budget submissions and ongoing media campaigns, this body has continuously argued that the Irish planning process is badly in need of reform (IHBA, 2021). Among their concerns are the length of time it can take for projects to work their way through the planning system and the prevalence of judicial reviews, which are now considered by many operators in the property industry to be part of the planning process (PII, 2021). For example, according to Linesight (2021), out of a total number of 49 Strategic Housing Development (SHD) projects granted planning permission in 2021, 23 of these are currently being judicially reviewed by third parties. SHDs were a special category of development introduced under Planning and Development Regulation S.I 271 of 2017. Under this category, planning applications for housing developments of more than 100 units or student accommodation containing more than 200 bed spaces, could be made directly to the Irish planning appeals board, An Bord Pleanála, (ABP), thereby by-passing the planning authority.

Other emerging issues of concern for Irish house builders in relation to the planning system include a widespread practice of dezoning residentially land (IHBA, 2022), on foot of guidelines issued to planning authorities by the Office of the Planning Regulator (OPR). The OPR was established by the Minister for Housing in 2019. The guidelines relate to requirements of the NPF strategy that the quantity of zoned land in an administrative area must be reflective of population projections and the future housing needs of the area. The population projections are prescribed by the NFP and RSES based on census data and these figures are incorporated into the CDPs core strategy calculations together with a permitted headroom of 25% (DLRCC, 2022). KPMG (2021) contend that the prescribed target population figures, are not based on demand, but outdated underestimates and also that the permitted 25% headroom is unrealistically low. Property Industry Ireland argue that in their experience of the planning system it is generally less than 50% of residentially zoned lands that is developed in the life of any development plan (Duffy, 2021). On this point, KPMG (op cit) recommend that a more realistic view of how much housing land will actually be developed in a single development plan period is needed and that core strategies cannot be allowed to detract from longer term housing strategies that go beyond current CDP cycles.

According to Lennon & Waldron (2019), the vast majority of house builders, developers and real estate investors consider that the Irish planning system imposes too many direct and indirect costs on the development process. They also argue that the Irish planning process is rife with uncertainty, cost, bureaucracy and delays, which can push time sensitive economically viable projects into unviable projects, thereby undermining supply. Lennon & Waldon suggest that the development sector identifies the planning system as the key barrier to housing supply and would like to see planning reforms that will facilitate development and not just fix the planning system itself. The question must now be raised, as to whether for developers, the Irish planning system is an arena of gamble as opposed to one where risks can be managed. Beesley (2022) does not entirely disagree with such a question. His take is that planning risk is a standalone agenda item, situated at the very top of investor’s deliberations.

If a development site cannot realistically plan for getting beyond planning, then there is no discussion to be had on costs, values or returns.

2.2.2.6 The supply of credit

2.2.2.6.1 The macro prudential rules

Lyons & Muellbauer (2015) claim that in the run up to the housing crash of 2008, house price growth was almost entirely down to the easing of credit conditions. They also argue that interest rates along with credit conditions are the key factors determining equilibrium in the housing market. Their arguments have the agreement of the Central Bank of Ireland (CBI), because when the CBI decided in 2015 to introduce a series of macro prudential lending policies and rules, they stated that they were in the interests of safeguarding the structural financial stability of the Irish banking system and price control of the Irish housing market (McQuinn et al, 2021). The ways in which the macro prudential measures protect the banking and housing systems are that they firstly protect the banking sector from economic or financial shocks by increasing the resilience of the banks and borrowers alike; they then also dampen down pro-cyclical credit cycles and house prices thereby avoiding future credit based house price spirals (Donnery, 2021).

When the 2015 macro prudential lending rules were introduced, they set loan to value (LTV) rules stipulating that mortgage borrowers were required to have a minimum deposit of 10% in the case of first-time buyers, 20% in the case of second time buyers and 30% for buy to let investors. Besides setting LTV ratios, the new rules also targeted measures in relation to loan to income (LTI) ratios. The LTI ratios limited the amount of money a person or couple could borrow to a maximum of 3.5 times their gross income. Ireland was not alone as having introduced measures of this kind into the mortgage market (Central Bank, 2021), because following the financial crisis in 2008 many EU countries including the UK had decided to introduce similar measures. According to the ECB, the average LTI ratio in EU countries in 2022 is 4.4 times the gross income, up from 4.0 times, in 2016 (ECB, 2022). In the UK, the average LTI ratio is currently set at 4.5 times the gross income (Fitch ratings, 2022). By comparison to the macro prudential measures implemented in the UK and other EU countries, Ireland’s metrics are viewed by many as challenging and in the outlier range. McQuinn et al (2021) explain how differences between the LTV and LTI limits in Ireland and elsewhere can easily result in circumstances where a loan application to an Irish financial institution can be rejected on the basis that it does not meet the macro prudential criteria and is therefore deemed a high credit risk, even though the same application will in many cases comfortably meet the criteria in the UK and in other national jurisdictions.

Another example of how the macro prudential rules can influence the housing market are to be found in Kelly and Mazza (2019), where they assert that the rules which have had the effect of reducing the volume of lending in the mortgage market, have in turn led to a transfer in demand between homeownership and rental markets. In support of this argument, Breen & Reidy (2021) suggest that an unintended consequence of the strict macro prudential rules in Ireland has been that demand for dwellings has by necessity transferred from the owner occupier market to the rental market. They argue that this channelling into the rental market occurs when households cannot obtain the lending support required to buy their own home. They also conclude that this has the effect of substantially pushing up rents and that substantial rental price inflation causes house prices to rise. This dynamic is exemplified by the fact that in spite of the macro prudential rules keeping a lid on house prices, average rental prices in Ireland currently exceed the peak rents experienced prior to the global financial crisis and housing crisis in 2008.

According to Barrington (2021), there is a clear conflict of objectives at play between the desire of European and national central banks to protect the financial system as a priority and the desire of citizens that the financial system exists to serve people. Barrington argues that the central banks mission to protect the financial system is creating too much difficulty for the housing market and is a root cause of the housing affordability problem. He further claims that there is clear evidence to show that Ireland's mortgage lending ratios have priced standard wage earners out of the housing market and that it has gone past the time to reflect.

In Ireland where LTI borrowing ratios have been set at 3.5 times a households gross income level for 7 years, between 2015 and 2022, the main retail banks have used that time to gradually re-build cash reserves depleted during the financial crash. Following a comprehensive review of these and other circumstances, the Irish Central Bank (ICB) recently announced a loosening of LTI borrowing limits (ICB, 2022). The new measures increase the LTI ratio limits from 3.5 to 4 times a households salary and take effect in January 2023. This move to ease the flow of mortgage credit by the ICB, although welcomed by many in the property industry, comes nearly 10 years since concerns began to surface in relation to the imminence of a housing crisis in Ireland. The new measures also provide that LTV ratios for second and subsequent buyers will change from 80% to 90%.

2.2.2.6.2 Competition in the mortgage market

According to Switcher.ie (2022), there are eight main mortgage lenders in Ireland. By comparison, according to uswitch.com (2022), there are currently over ninety mortgage lenders competing for business in the UK mortgage market. Of those eight Irish mortgage lenders, four are non-bank lenders and the other four are retail banks. Non-bank mortgage lenders in Ireland get their funds from financial market based sources, leaving them exposed to interest rate volatility, whereas the retail banks are mainly funded by customer deposits, which according to Weston (2022), there are excess levels of, at this time. Business with non-bank lenders in Ireland is generally carried out through mortgage brokers and they are required to operate under the same financial consumer protection rules and conduct as retail banks. According to Arthur Cox (2022), at the end of 2021, non-bank mortgage lenders held 14% of all primary dwelling mortgages in Ireland and since 2018 they have being gradually increasing their market share. Their presence in the market is said to play an important role in driving competition.

Following the 2008 crash and subsequent financial system rescue, which involved a strategic downsizing and recapitalisation of the Irish banks, share prices and confidence in Irish banking structures continued to wane and more conservative banking approaches were adopted. These included a focus on prudential liquidity plans aimed at reducing the banks reliance on short-term financial markets and central bank funding (Baudino et al, 2020). A founding stone of those plans was to set variable interest rates at levels high enough to facilitate capitalisation for as long as possible before market competition meant otherwise. Up to May 2022, Ireland’s average interest rate of 2.73% was the second highest in Europe, where only Greece has a higher average interest rate. In the euro area, the average interest rate in the same month was 1.76% (Taggart, 2022).

According to Weston (op cit), recent average interest rates in Ireland would have been much higher, if the Belgium KBC bank and Nat West owned Ulster bank had not kept the Irish mortgage market on its toes. Unfortunately, both KBC and Ulster bank are now exiting the Irish market after 40 and 160 years in the market respectively. These follow previous recent high profiles exits by Bank of Scotland/Halifax, Danske Bank and Rabobank (Cassidy, 2022). However, recent entries into the Irish market by two non-bank mortgage lenders, Dilosk owned ICS Mortgages and Finance Ireland, are beginning to have a counterbalancing effect to some degree. But, just as the European Central Bank have started a series of interest rate hikes, it can only be hoped that the four non-bank lenders will continue to shake the market by offering alternative innovative products to the main retail banks, AIB, Bank of Ireland, EBS and Permanent TSB (Weston op cit).

2.2.2.7 Housing is an asset

Many industry analysists consider that housing markets are further complicated by the nature of the end product and the numerous categorisations of the product in practical terms. Part of this complexity is the housing markets unique role as a supplier of asset goods and shelter (Lyons, 2016). Nowlan (2018) tells us that as an asset class, housing has a unique collection of characteristics in terms of its lumpiness, durability, high cost of production, high transfer costs and lengthy delivery time. He also notes how for many people, housing can have deep cultural and semiotic resonances of social status, identity, family and place of being. Lyons (2017) describes housing as a composite good or end product that has a number of purposes. But it is its durability as a product that influences the nature of its demand. Meaning that a house does not just fulfil a service of providing shelter, but it also provides owners with the potential to accumulate capital gains by holding the property as a tangible asset. In some situations, a house can also be considered as a luxury good. This will depend on many factors, including location, design, size, quality of finish and the desire of the elasticity of demand vis a vis wealthy individuals (Caserta, 2008).

Housing has traditionally constituted a significant portion of Irish households asset holdings. (McCarthy & Quinn 2014) and (Lyons, 2017). This tradition has been underpinned by successive Irish government policies, which have encouraged home ownership rates in Ireland to steadily increase since the first quarter of the twentieth century (Norris, 2013). In 1970 it was estimated that almost 71% of Irish households were homeowners, compared to 50% in the UK and 35% in Sweden. By 1991, home ownership had risen to 80% in Ireland, compared to 65% and 39% in the UK and Sweden respectively. Norris suggests that Ireland's high home ownership rates are routinely associated with cultural factors relating to a post-colonial insecurity mindset and a natural order inspired by government policies. Some analysts claim that homeownership is a catalyst for fostering community spirit and the creation of better places to live. According to DiPasquale & Glaeser (1999), homeownership incentives citizens to promote and subsidise community and local government initiatives that will enhance the locality where their home is situated. Dipasquale also suggests that improvements in community quality are then capitalised in the value of the homes in the immediate vicinity.

2.2.2.8 Financialisaton of the housing market

Financialisation of the housing market is a term generally used to describe the role that housing plays as a commodity rather than a provider of shelter. According to Byrne (2020) the financialisation of housing is largely responsible for the corresponding decline in rates of homeownership and growth of the private rental sector. Healy & McGoldrick (2018) claim that one of the main consequences of housing market financialisation is that housing provision decisions are largely determined on investment yields instead of hearth and home considerations. In a study on the financialisation of residential property markets in Europe, Gabor & Kohl (2022) state that according to Preqin data, there was more than 4000 institutional investors directing upwards of USD $3.6 trillion to European real estate in 2021. The analysis shows that the main institutional investors in European residential estate included, private and public pension funds, insurance companies, banks, sovereign wealth funds, and asset managers. According to Breen & Reidy (2021) in the period between 2017 and 2019, almost 80% of residential development finance in Ireland was provided by international debt and equity.

In 2021, the multi-family private rental market became the most active property investment class in Ireland, with many investors re-allocating from the more traditional retail and office funds. It follows that over 50% of overall investment transactions in the Dublin property market were multi-family, private rental sector (PRS) deals. This involved the sale of over 4000 units, across 27 transactions. According to Cushman & Wakefield (2021) most of the investment backing developments in the Dublin PRS market are from overseas capital based sources, accounting for almost two thirds of the market. Significant players in this market come in the form of Real Estate Investment Trusts (REITs).

In the face of suggestions by Gabor & Kohl (op cit) for European legislation to encourage institutional investment in residential markets, are a number of political groups and commentators in Ireland and elsewhere who argue against what they consider to be benign taxation treatment enjoyed by REITs and other institutional players in the PRS sector. They also argue that the PRS sector plays a major role in adding to the rental traps and ‘generation rent’, citing that profit driven institutional investors leave less properties to be sold as single family dwellings on the open market. Their views are counter argued by recognized property professionals such as MacDonald (2021), who explains that by supplying accommodation in the middle to upper ends of the market, PRS providers are actually freeing up space in the lower end of the market. There are merits in both sets of arguments, but in any event, the Irish government decided in May 2021, in a King Solomon type move, to introduce measures under section 28 of the Planning and Development Act to deal with what they refer to as 'the issue of institutional investors crowding buyers out of the market' For the moment, these measures only effect housing estates and it remains to be seen if apartment developments will be brought into the mix (Fitzmaurice, 2022).

The issues surrounding PRS providers may be more complex than the headline arguments about favourable fiscal treatments, crowding out buyers or how the sector fills an essential supply side void. For instance, and as previously discussed, Breen & Reidy (2021) argue that macro prudential rules which restrict mortgage lending levels to aspiring homeowners are another key factor in attracting PRS investment. They claim that because a household's loan to value borrowing level is limited to 3.5 times the borrowers gross income, that it limits the number of households that can attain sufficient finance required to buy a home. This has the effect of transferring demand from the owner occupier market to the rental property market. Breen & Reidy argue that the channelling of demand to the rental market gives rise to attracting higher levels of investment from PRS players, who can participate in the market despite strict lending rules, because they or their tenants are not directly affected by them.

Interestingly Byrne (2021) notes that large numbers of property consultants are of the opinion that the PRS sector is largely countercyclical in nature and can therefore continue to invest and build residential developments over longer time horizons including during periods of economic downturn. Byrne also suggests that under the right conditions PRS sectors possess further counter cyclicality attributes enabling them to intensify output during periods of declined economic activity. This contribution by Byrne, puts a strong case to caution potential populist government policies putting restrictions in place that could have the effect of driving PRS investment out of the state. Also, because government capital expenditure in housing is in itself cyclical, any counter cyclical investment in housing can only provide positive outcomes to housing completion statistics, economic activity and exchequer returns.

Developed in the USA over 50 years ago, REITs have effectively introduced a version of the stock market for housing. According to Browne et al (2013. pp.27) the product offered by REITs has the potential to greatly change globalised investment in and financialisation of worldwide housing markets. According to Revenue.ie, under Part 25A of the Taxes Consolidation Act 1997, REITS are not subject to corporation tax or chargeable to tax on gains from the disposal of rental assets or the proceeds of their rental business. Instead, it is the investor that is taxed on the distributions that they receive.

Many people will be familiar with a financialisation of the housing market that saw mortgage backed securities involving the practice of pooling together collections of residential and commercial mortgages as financial investment products (Fligstein & Roehrkasse, 2016). In a study on the impact on struggling mortgage holders in the aftermath of the 2008 financial crash, Waldon (2016) explains how a crisis originating in global markets and mortgage market financialisation was responsible for considerable unreported damage to the quality of life for thousands of struggling borrowers who chose to meet their repayment commitments above others. Using a conceptualised framework on a continuum for measuring mortgage stress, Waldron's research considers how borrowers committed to paying down mortgages despite being trapped in negative equity, falling income, rising unemployment and a wider economic recession. The study also considers householders experiences in manging their mortgage commitments to the detriment of experiencing life below poverty levels, inability to meet unexpected expenses and facing into structural arrears on other commitments etc.

Gabor & Kohl (2022) note that in response to the financialisation of housing across Europe, citizens in cities from 'Berlin to Dublin and Madrid' are mobilising to put pressure on their governments to take actions, such as the putting in place of strong rent control measures. They also note that many citizen groups and political parties across Europe believe that very radical reform measures should be brought in, to increase the provision of social housing and to effectively de-financialise the housing market, for the common good.

2.2.2.9 The first time home buyer market

According to Paris (2007), in the period between the 1930s and 1980s, most first time buyers (FTB) in Ireland and the UK were council tenants or children of council tenants purchasing their homes directly from the council. Changes in the nature and composition of FTBs since then has seen children from owner occupier families purchasing new homes on the open market. Paris also notes that in recent years, as a percentage of the overall market, FTBs have declined in the UK and Ireland, as increasing proportions of home sales are to second time buyers, investors and holiday home purchasers. Despite this decline, the FTBs market is considered as the wind that drives the housing market. According to Duffy (2021), in the year to May 2021, almost €12 billion worth of mortgage approvals were issued in Ireland. Of that figure over €6.5 billion or 55% were issued to FTBs. Insofar as housing markets are concerned, the FTB is the important starting point in demographic analysis projections and it is understood that over time, this cohort also provides the substantial numbers in future cohorts of second time buyers, holiday home buyers, private rental investors and right sizers (Berson, 1997).

In a pre-budget submission to government, the IHBA (2020), argued that FTBs are the engine of the housing market and that their participation is felt especially in the new homes markets. FTBs are generally the target of government schemes and grants aimed at boosting the market (O'Brien & Jamie, 2011). An example of such schemes is the current 'help to buy' (HTB) tax refund scheme, which was introduced by the Irish Government in January 2017. The scheme is designed to help FTBs raise a deposit to buy a newly built home. In this scheme, borrowers can claim a tax rebate of 10% of the value of the property up to a maximum amount of €30,000 (Citizens Information, 2022). FTBs participation in the second-hand market is also important, where they are responsible for the take-up of a substantial number of existing homes occupied by cohorts such as empty nesters who may wish to trade down to a smaller and more comfortable new home. In this way, FTBs unlock the potential for a range of other new home purchasers.

Despite their obvious importance to the market, FTBs don't always get things their own way. In a recent submission to the Minister for Housing, PII (2021) highlighted some important inequities that befall FTBs. They noted that because of government's previous failure to resource investment in essential infrastructure, FTBs are invariably forced to bear the full initial cost of new infrastructure that ultimately benefits the rest of community. This occurs when developers are required to install necessary off site infrastructure in order to service a development, the cost of which is passed on to the new home purchaser. They also pay for infrastructure upkeep and improvements through development contributions and in some cases special levies on specific projects like light rail and relief roads. PII also note that because new homes are built to such high specifications, including near zero energy standards, the increase in cost means that the current macro prudential rules go far beyond that which previous generations had to contend with. PII say that this is leading to a new 'Locked Out Generation', who do not qualify for social housing and are being forced to compete in a rental market spiralling in cost (PII, 2021a).

Apart from the HTB tax refund scheme noted above, efforts by government to improve the lot of FTBs also include a slightly lower stamp duty rate than currently exists when buying a second hand home. This is achieved because stamp duty is not charged on the VAT proportion of the new house price (Revenue.ie, 2022). We are also seeing evidence of how Irish planning codes are being shaped to ringfence newly built residential units for FTBs, through the provisions of Section 47 of the Planning and Development Act 2000, which was implemented by the Minister of Housing in May 2021. Under this provision the Minister has issued guidance to planning authorities to regulate and restrict the end use of a new dwelling, from commercial institutional investors to owner occupation.

2.2.2.10 The second time and subsequent home buyer market

According to data published by the CSO in May 2022, former owner occupiers take up the largest share of the housing market, accounting for around 44% of total transactions made in quarter 4 of 2021. This compares with FTBs who accounted for 27% of the market in the same quarter. Right sizers and right sizing have become terms used to describe a cohort of home purchasers whose buying decisions are based on their desire to change where they live, based on their evolving needs and changes in lifestyle (Palmer Smith, 2022). The term was originally developed to reflect housing market participants trading down from family homes to apartment living at some time after their children had been reared and flown the nest. Right sizers can have very different motives and preferences in their choice of accommodation ranging from energy efficiency, security, sense of wellness, community, location, low maintenance and less upkeep. This buyer continues to evolve as an important participant in the market and developers are becoming more and more interested in responding to their needs.

2.2.2.10 The second hand home market

The second hand home market in Ireland is much bigger than the new homes market. It also has many different aspects to it that first time buyers and many second time buyers must consider before entering (Keenan, 2018). Those considerations are very wide and can be down to motivations concerned with availability, price, location, character, comfort, and maintenance. According to Murray (2022), house sale files returned to Revenue in February 2022 show that of 3584 dwellings registered as having been sold on the Irish Market, only 548 or 15% were new builds. In an overview of the Irish housing market, data collected by

Breen & Reidy (2021) shows that in the 5 year period between 2016 and 2020, the percentage of new home sales within the overall home sales market was on average 21%.

Breen and Reidy also refer to the price premium attaching to new house sales. On this, they have suggested that in the period between 2014 and 2020, the price of new builds have increased by 10% per annum, whereas existing dwellings have only increased by 5% p.a. According to MacCoille (2021), premiums for newly built homes are only a recent phenomenon and that up until the early 2000s new build prices were similar to those for existing stock homes. This premium cost is, according to the IHBA (op cit) a function of the additional cost to provide the levels of quality and building standards now demanded of a new home. MacCoille (op cit) argues that new homes are a considerably better product than second hand properties, pointing out factors such as higher energy ratings enforced by regulations. Others such as Keenan (2018) suggests that the premium today will obviously be higher than it was 10 or even 5 years ago, due to the ongoing improvements to energy and home heating standards. Experience of the premium level will be different for every location, but according to agents operating in the location of the proposed case study development, the premium there is around 20%. In more central locations in Dublin, where character and charm are factors, a period built house with poor BER ratings but many craftmanship features of previous times, could be expected to command equal or higher prices than a similar sized property built to modern standards (Keenan, op cit).

Location will also be an important consideration for those considering a new or second hand home option. Keenan notes that many purchasers elevate access to established social infrastructure such as schools, churches, restaurants, shops and retail outlets and that others may consider access to amenities such as parks, coastal and riverside locations as of high importance. In many cases, part of the downside to purchasing a new home is that a resident may have to live adjacent to a live building site for several months, even years. However, Hardy (2019) suggests that second hand properties come with higher maintenance costs and are less comfortable.

Most literature and discourse on housing markets and house prices are in general focussed on supply issues concerning new homes. But according to earlier research by Berg (2002) and even as recently as Gray (2013) house price dynamics are primarily determined by urban systems and the linkages between cities, towns and their hinterlands. This argument highlights the importance of the second hand homes market. Urban systems theory is based on national geographic collections of urban areas that are interdependent through social and economic reliance and exchanges. Gray says that national urban systems are complex hierarchies of cities and towns arranged by size and function. Nodes within urban systems are further ranked by their hierarchy of influence, through spatial interaction, transport links and polycentric nature. Through this lens Gray and Berg establish that ripple effects in house prices can be identified shifting out from the urban centres. Gray, notes that house price rises first appearing in London, spreads out from the southeast and then on to the rest of the country. Dublin and Paris, which in terms of their monocentric hierarchy of influence over the rest of their countries follow similar ripple effect patterns as those identified in the UK. Germany on the other hand shows multiple ripple effects more characteristic of polycentric hierarchies of influence. This is considered to be because industry is spread more evenly throughout the regions. Berg (2002) considers that house price increases in Stockholm sends out ripple effects to the surrounding areas and hinterland, which are eventually transmitted to other regions in Sweden.

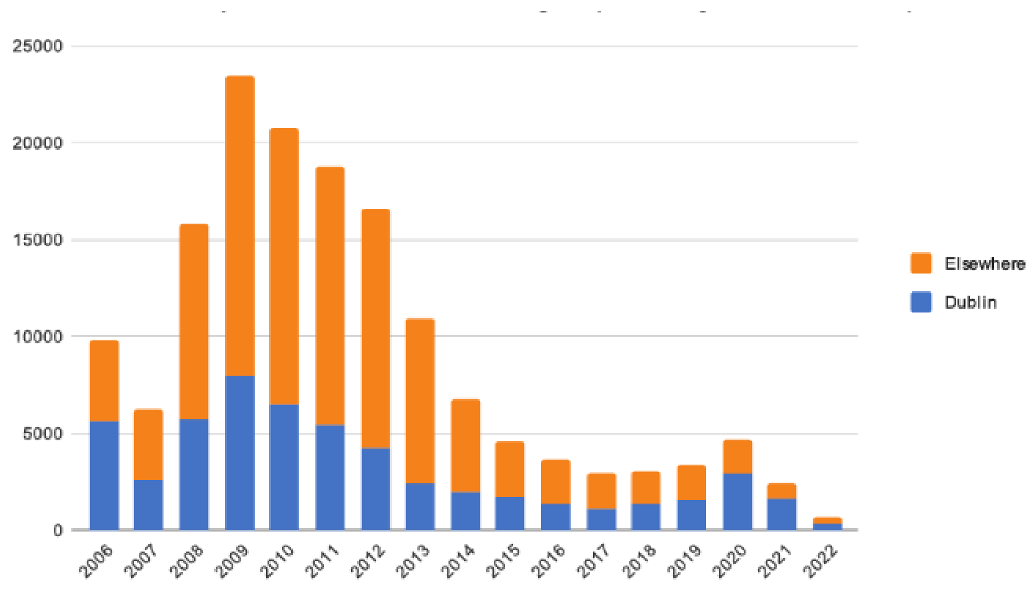
2.2.2.12 The rental market

Immediately following the Irish housing market collapse, the number of properties registered countrywide, as available to rent, climbed to almost 24,000 units in Quarter 3 of 2009, which included around 8,000 units in the Dublin City area. By contrast, the number of properties available for rent in Ireland in Quarter 3 of 2022 was less than 1,000 units, of which less than 300 were situated in Dublin. (Daft, 2022). It may be reasonable to suggest that in 2009 there was too much supply and too little demand for rental property and therefore, that year may not be a useful benchmark for comparison, however it is still worthy of note, that since the 2009 peak in supply, the availability of rental homes has fallen by over 96% in 13 years.

It may be more relevant to compare the scarcity of rental accommodation in 2022 with the last time, Ireland had a serious rental crisis, which was in 2007. This was just at the height of the housing bubble, less than 12 months before the housing market collapse. At the time, demand for rental accommodation, particularly in Dublin, was at an all-time high. But, instead of the mainly export led economic growth experienced during the earlier Celtic Tiger years, demand for accommodation in 2007 was more domestic driven. Malzubris (2008) considered at the time, that much of Ireland’s demand for rental accommodation was driven by demographic forces. While citing Ireland’s relatively young and growing population, he also noted that low unemployment and recent rapid growth in disposable income had added fuel to the demand. Data supplied by CSO (2010) supports Malzubris point concerning a rapid growth in disposable income in the preceding years, as according to the CSO, disposable income per person in the state grew by 56% in the 7 year period between 2000 and 2007. According to PRTB (2013), rapid rent price growth and demand for accommodation in 2007 was further exacerbated by considerable net inflows of returning emigrants and immigrant workers.

In the context of those background factors driving demand in 2007, the number of units available to rent in Ireland was just below 6,000 units nationally, including around 2,200 in Dublin. The above figures are illustrated in Figure 2.1 below, where we can also compare the post financial crisis supply levels, vis a vis the record high of over 23,000 vacancies in 2009 to the record low of less than 1,000 in 2022. In a simple comparison it is clear that the number of properties to let in 2022 is less than 17% of the number that was available in 2007 and less than 4% of what was available in 2009. If we consider that the population of Ireland has increased by 21% between the Census carried out in 2006 and the most recent census of 2022 (CSO, 2006) and (CSO, 2022a), then in real terms the supply of rental accommodation in 2022 is less than 14% of the supply available in 2006 on a per capita basis.

Figure 2.1 Residential Properties Available to Rent in Ireland 2006 to 2022 Source: Daft.ie



Lyons (2017) estimated that by 2017 rents had risen higher than they were in the period just before the property bubble burst in 2007. Following on from that position (PBO, 2021) suggests that in 2020, rents had exceeded pre-crises levels by 40% in Dublin and by 20% in the rest of the country. Putting context on those statistics, Lyons (2021) tells us that in 2021 only one-sixth of rental households in greater Dublin can afford to pay the €1,640 monthly average rent that investors require to break even on an apartment unit with a €400,000 build cost at prevailing yields. In Breen & Reidy (2021) it is argued that barriers to homeownership only serve to amplify rental demand. They also claim that at least 50% of Irish households in the rental market are unable to afford the median price of a house in Dublin. Current market predictions offer no comfort of the situation easing, as according to a survey by the society of chartered surveyors Ireland, almost 90% of its estate agent members expect house prices to increase by a further 5 – 7% by Quarter 1 in 2023 (SCSI, 2022). According to PBO (2021) cumulative deficits in new dwelling completions have intensified rent costs which have more than doubled since 2011.

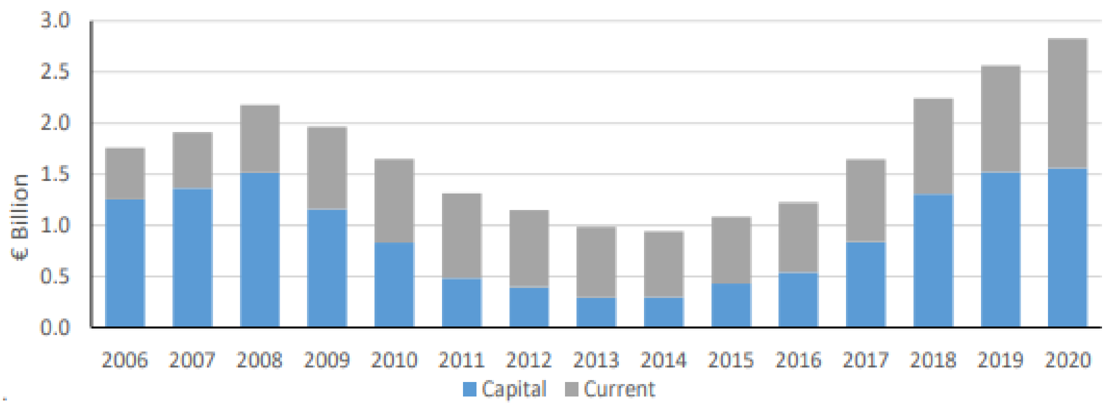
2.2.2.13 Social housing

Social housing is provided to low income households that cannot access housing by private means (McGauran & O’Connell, 2014). The Irish Housing Act of 1966 referred to social housing as accommodation provided by local authorities (LA), approved housing bodies (AHB) or housing associations, which are independent not-for-profit housing providers. Norris & Hayden (2018) explain social housing in Ireland, as rented accommodation provided at below-market or subsidised rents by a public or non-profit sector provider, allocated on the basis of need. On this basis, social housing is largely provided by the Irish state through current and capital expenditure programmes. Under the umbrella of government housing support programmes, the funding is largely channelled to LAs and AHBs through a range of delivery mechanisms (O’Callaghan & Farrell, 2020). In Ireland there are several key bodies that play central roles in social housing. These bodies include the LAs, AHBs, the Department of Housing (DHPLG), the Housing Agency (HA), the Housing Finance Agency (HFA) and the Irish Council for Social Housing (ICSH).

AHBs are independent, not-for-profit organisations that manage and provide affordable rental accommodation to households who are unable to pay private market rents (Breen & Reidy, 2021). AHBs also provide affordable housing to groups such as homeless people and the elderly. According to CSO (2017), there were 546 AHBs registered with the DHPLG in December 2017, of which 251 were active and in control of a combined housing stock of over 30,000 units. Taking data published by the DHPLG, Breen & Reidy (2021) illustrate that in the 5 year period spanning between 2016 and 2021, there were approximately 34,000 social housing units delivered, of which approximately 31% were provided by AHBs. According to figures obtained from the 2016 census, there were just over 143,000 dwellings rented from LAs and the number of dwellings rented from other sources including AHBs were approximately 327,000 (CSO, 2022). These numbers indicate that of the total housing stock of 2,003,645 dwellings in Ireland, almost half a million or 25% were rented. Of the almost half million rented dwellings, approximately 170,000 or 34% of them were let by LAs and AHBs under social housing provisions.

Malone (2021) tells us that in the wake of the financial crisis, due to austerity measures, government expenditure on housing fell from €2.2 billion in 2008 to less than €1.0 billion by 2014. Of this reduction in spending, the largest decrease was in capital expenditure, which had fallen from €1.2 billion to less than €300 million. Figure 2.2 below, outlines the composition of capital and current spending on social housing in Ireland for the period between 2006 and 2020. It shows that by 2020 spending on housing had recovered, rising to €2.8 billion and that when this amount is apportioned between capital and current expenditure it splits approximately into €1.6 and €1.2 billion each respectively. This statistic illustrates to us that current expenditure on housing, referred to by government as the 'Social Housing Current Expenditure Programme' (SHCEP). is now a far higher proportion of the overall spend than it was previously. More recent figures released by the Department of Housing indicate that housing related expenditure increased to just under €3.1 billion in 2021. In this figure the proportion attributed to capital expenditure was just over €1.8 billion or 60% of the total spend.

Figure 2.2 Public Expenditure on Housing 2006 to 2020 Source: Breen & Reidy 2021



The range of capital funding measures include programmes for the construction of new dwellings by LAs and AHBs, as well as the acquisition of new and existing dwellings from private housing providers. Capital funding is channelled to LAs and AHBs through a variety of schemes, each having a specific role and delivery mechanism. These schemes include, the Social Housing Investment Programme (SHIP), the Capital Advanced leasing Facility (CALF), and the Capital Assistance Scheme (CAS), (Gov.ie, 2022).

CALF is the most common form of support provided to AHBs. It works as a capital assistance scheme whereby up to 30% of the capital cost of a new development or acquisition is provided by way of a long term loan, with the rest of the finance required to be sourced by the AHB. The balance funds are normally sourced through the Housing Finance Agency (HFA). The HFA was established as a state owned finance company in 1982, operating under the aegis of the Minister for Housing and exists to provide loan finance to LAs, AHBs and Higher Education Institutions (HEIs) for housing and related purposes covered by the Housing Acts (HFA, 2022). The HFA is self-financing and raises its funds on the domestic and international capital markets mainly through the National Treasury Management Agency (NTMA), the European Investment Bank (EIB) and the Council of Europe Development Bank (CEB). According to HFA (2022) a small margin is added to the cost of funds loaned out, to cover administration costs. In the 2021 annual report of the HFA, it states that the value of its loan book to LAs, AHBs and HEIs on 31.12.20 was almost €5.3 billion, up from €4.73 billion in 2019.

The long term leasing of dwelling units by LAs and AHBs is facilitated under the SHCEP. This arrangement allows LAs and AHBs to recover the balance between rental income they receive from tenants and the higher amounts paid out to private landlords to lease dwellings. Other measures covered by the SHCEP include the Housing Assistance Payment (HAP) and the Rental Accommodation Supplement (RAS). These are housing support schemes that provide rent payment supplements to low income households who are not renting from their LA or from an AHB. These schemes have different assessment rules such as means testing requirements. Based on the housing expenditure figures released for 2021, the Irish Exchequer is now spending almost €1.30 billion per annum on the SHCEP (Breen & Reidy, 2021). Using national data obtained from the Irish Census in 2016, Breen & Reidy also estimate that in 2021, approximately 26% of households in the rental sector were in receipt of some form of government housing support.

In recent decades, the provision of social housing through capital expenditure has been strongly correlated with macro-economic cycles. In general, this has meant that in periods of high economic growth, social housing provision has increased and in periods of economic downturn, capital investment in social housing has fallen away (Malone, 2021). One downside of this is that the exchequer invariably pays more for social housing than it would like to, because, it is during periods of high economic growth that the capital cost to provide housing inflates. Norris and Byrne (2016) suggest that historically Irish Governments did not allow this overpaying condition to arise, because in past downturns, social housing construction was used as a counterbalance to the cyclical housing market and rising unemployment.

In a comparison of international social housing supply models by Norris & Byrne (2017), the authors draw on two forms of social rental market structures as defined by Kemeny (1995). The two systems are referred to as the ‘Dualistic’ and ‘Unitary’ rental structures. Norris & Byrnes descriptions of the Dualistic system reflects large elements of Ireland’s rental market structure, where according to Stephens (2017) the private profit orientated, unregulated rental sector creates acute affordability problems, which ultimately leads to a need for a safety net, not-for-profit public rental sector. Breen & Reidy (2021) further suggest that in the Dualistic system, the publicly funded social rental sector conversely serves to provide protection from competition to the private rental sector. They suggest that this happens because in the Dualist structure there are income based restrictions placed on access to social housing and limitations placed on AHBs and LAs by government subsidies.

In a Unitary structure, social housing is made more accessible to broader cohorts of society and a wider range of income groups, thereby placing the social rental sector as an attractive alternative housing choice for more people and creating an element of competition with the private rental sector. According to Breen & Reidy (op cit), the Unitary system delivers subsidies to public cost rental providers and regulation to the PRS sector, the effects of which makes for a closer integration of price levels and standards in the two markets. They further suggest that as the social cost rental sector continues to mature and become more and more accessible to a wider range of income groups, this then puts downward pressure on private rents. A corollary of this is believed to be a decrease in investors and developers expectations about future rental growth and house prices generally, which in turn suppresses optimistic bids on land, thereby also reducing site costs. According to Stephens (op cit) part of the advantages attached to the Unitary system is that AHBs can become progressively less reliant on LAs, thereby enabling them to bring a more counter cyclical element to their end of the rental market.

Breen & Reidy (op cit) suggest, there is no doubting that pro-cyclical spending policies seriously undermine long term sustainable and timely delivery of social housing. Policies in other EU states, such as in Austria, create the conditions where Unitary structures and cost rental models for social housing are cornerstones of their housing system (Norris & Byrne, 2017). Studies show that following analysis of the impact of the global financial crisis in Austria, that the Unitary structure might be viewed as a desirable future policy path in Ireland, that could eventually overcome pro-cyclicality and affordability issues in social housing provision.

2.2.3 Housing supply

2.2.3.1 Housing supply 1922 to 1960

Since the foundation of the Irish state, successive government housing strategies have been aimed at stimulating private and social housing production (Norris & Fahey, 2011). When the new state was established in 1922, its financial position was precarious and this remained the position for decades to follow (Ferriter, 2004). Faced with this reality, but at the same time aware of the scale of housing needs in the country, the early governments adopted policies involving subsidies and grants, as well as direct investment in housing production. In Dublin, the housing situation was especially desperate, where following years of decay and neglect, a housing inquiry in 1913 reported that almost 60,000 people or 20% of the city's population urgently required rehousing. Rather than taking a single focus approach, of targeting the delivery of public housing over private housing, the government sought to encourage both, where possible, by supporting hybrid forms of residential development (McManus, 1996).

Under the fledgling government's hybrid development policy, referred to as the 'Reserved Areas' on public land strategy, there were two important actors. The first actor was a municipal authority, such as Dublin Corporation (now Dublin City Council), who took the role of social housing provider, as well as land developer. The second actor, working in cooperation with the authority was a private building cooperative body, referred to as a Public Utility Society (PUS) (Megan, 1963). According to Kelly (2019) government supports to PUSs initially funded up to one-sixth of the build costs and by the early 1960s, up to 30% of the cost to build a standard suburban home could be recouped. McManus (1996) tells us that the lands on which PUSs developed, were usually leased from the municipal authorities and that some of these lands benefited from rates remissions. PUS developments also benefited from reduced statutory fees. On these point, Norris (2013) argues that the levels of home ownership subsidisation in Ireland at the time were so universal and generous that they equated to a regime of socialised home ownership. According to McManus up to 400 PUSs were established between 1920 and 1960, few of which had philanthropic intent and the vast majority of the dwellings built by them went for sale to home buyers.

The first major ‘Reserved Areas’ scheme was developed in Marino, Dublin in 1925. This project would have been seen at the time as a blueprint for the government’s Hybrid housing policy, because it also involved the development of social housing on a large unreserved area by Dublin Corporation. Funding by central government to municipal authorities such as Dublin Corporation at the time for the provision of urban and rural social housing came in the form of grants, which according to Norris (2003), was set at one-sixth of the build cost. Norris also comments that the generosity of the one-sixth proportion was controversial at the time, because it was set at the same level as the subsidies paid to the private PUSs. This was argued by many at the time to be grossly unfair, considering the state of Dublin’s slum housing and the urgent need to re-house the poorer citizens living in them. An argument that was countered by government, on practical rather than ideological grounds, claiming that all boats would rise by the generation of construction employment and income from private sector sources.

After the 1932 general election in Ireland, there was a change of government and with it a sizable increase in grant levels for LA social housing provision. The new administration also established measures which enabled central government to borrow from commercial sources, which could be lent on to LAs for social house building (Norris, 2013). Figure 2.3 below outlines the number of dwellings completed in Ireland in the decades between the 1920s and the 1980s. It indicates that during the 3 decades up to the end of the 1940s that over 150,000 dwellings were built in total. This averages out at a very low output of approximately 5,000 units per annum, albeit starting from an extremely low number built in the 1920s. Norris & Winston (2002) tell us that even though 150,000 dwellings were built in that 30 year period, the national housing stock in Ireland actually fell by 20,000 dwellings between 1911 and 1946. This claim is supported by DEHLG (2002) as illustrated in Figure 2.4 below. Factors influencing the decline include rural dwelling abandonment due to emigration, the clearance of urban slums and the demolition of other unfit dwellings by LAs.

Figure 2.3 Dwellings Built in Ireland from 1920s to 1980s Source: DEHLG (2002)

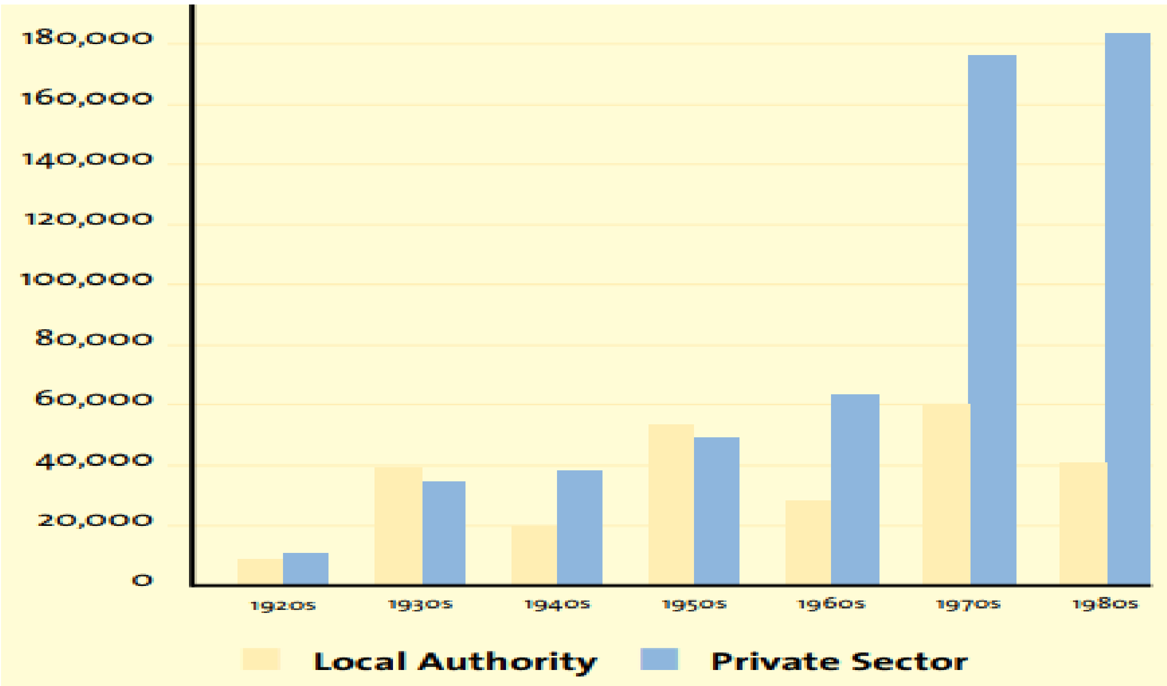
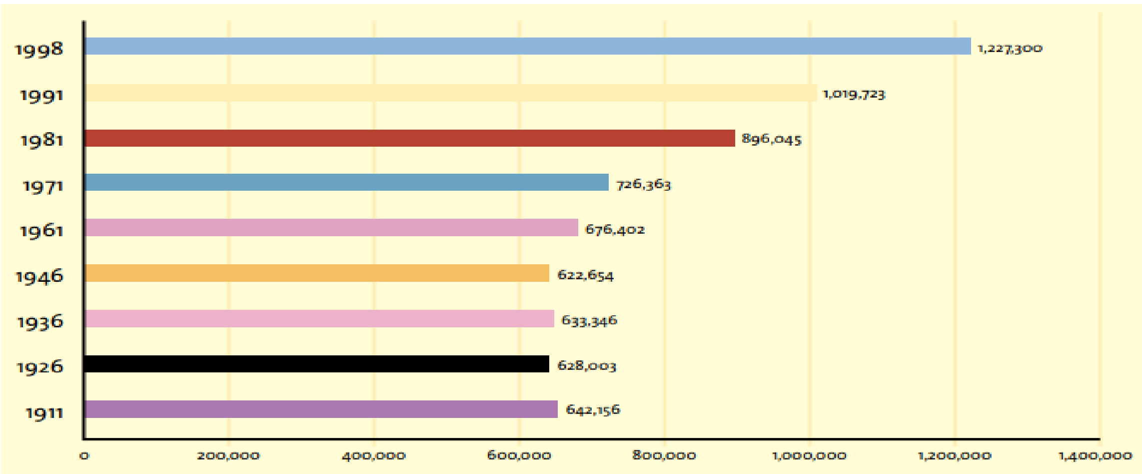


Figure 2.4 Number of Dwellings in Ireland 1911 to 1998 Source: DEHLG (2002)



Kenna (2011) tells us that by the 1960s private house building had significantly overtaken LA social house building. Kelly's view is supported in Figure 2.3. This change of primacy from public to private house building took place in the context of the state's encouragement of skilled workers to stay in Ireland or to return home, in order to staff new industries established under government foreign direct investment programmes at the time (Fitzgerald, 2007).

2.2.3.2 Housing supply 1960 to 1980

In June 1963, two separate tenement buildings collapsed in Dublin, within weeks of each other, killing 2 elderly residents and 2 young girls, who just happened to be walking by (DCC, 2022). Following an inquiry into the collapse and triggered by public demands, the National Building Agency (NBA) was established. This new housing body was tasked with delivering new homes for Dublin's citizens, big and fast, in order to finally complete the task of slum clearance, which had slipped down the governments priorities list. Assessments carried out under the 1966 Housing Act found that almost 60,000 new homes were required to replace slum dwellings and address overcrowding related problems in Dublin, Cork, Limerick and Waterford (Kenna, op cit). This led to a renewed and ambitious social housing building programme, which carried through to the late 1970s (Kelly, 2019). According to a government White Paper – Housing in the Seventies (1969), over 57,000 homes were built over the previous 5 years, plus a further 47,000 reconstructed (Kenna, op cit). Figure 2.3 above suggests that of the 57,000 house completions between 1964 and 1969 as cited by Kenna, substantially less than half of these were social houses. Figure 2.3 indicates that in the 1960s less than 30,000 social houses were provided country wide, which was about half the number built in the 1950s. In fact, the impact on social housing supply, resulting from the actions taken following the 1963 Dublin tenement buildings collapse were not fully evident until the 1970s, when almost 60,000 social housing units were built. As well as highlighting the change that took place in the 1960s, when private house building overtook social house building for the first time, Figure 3 also demonstrates the scale of the difference between private and social housing output in the 1970s and 1980s, when in that 20 year period, approximately 100,000 social houses were built, compared to over 350,000 private houses.

Under the 1936 Labourers Act and the subsequent 1966 Housing Act, the sale of LA homes to occupiers under tenant purchase schemes was greatly encouraged, and as a result, almost two thirds of all council houses built in Ireland are now privately owned (Norris, 2013). Even today, that statistic generates a range of diverse views among senior administrators working in the social housing sector. For some it is viewed as one of the biggest policy errors ever made by the state and for others it seen as the right policy for the time, claiming that its positive improving influence on areas with high concentrations of social housing, far out weighted the alternative (Kelly, op cit). Driven by generous subsidisation, Irish home ownership rates rose to above 70% in the 1970s, rising to 80% by 1991 (Norris, op cit). By comparison, home ownership levels in the UK in the 1970s stood at approximately 65%. The implications of what was a two-thirds transfer from LA dwellings to private dwellings would if incorporated into Figure 2.3 above, indicate that in reality there has been more private houses delivered in Ireland during each decade, since the formation of the state in 1922.

By the end of the 1970s, Ireland's status as a home ownership society was well established, and it was in this context, as well as the deep recession in the 1980s that supports to private housing were wound down. At the same time, growing concerns were also being expressed in government circles that current levels of social house building were no longer sustainable and that future housing policy required a new approach of disengagement, thereby allowing the market and the construction industry to deliver housing for the general population (Kenna, 2011). According to Norris (2013) this time saw the transition of Ireland's housing supply system from a socialised to a marketized policy regime.

2.2.3.3 Housing supply 1980 to 2000 – including the Celtic Tiger Period

For many Irish people, the 1980s are collectively remembered as a decade of deep recession, which saw unemployment rise sharply and the states investment in social housing markedly decline. According to Fahey et al (2011), it was when the economy stagnated during the mid-1980s, that a new age for social housing in Ireland came about, marked by the start of a definitive retrenchment of the sector. Governments response to the recession at the time was to focus on reducing capital spending and social housing was one of the sectors targeted and severely cut back (Lima & Xerez, 2021). According to Norris & Fahy (2011) the number of new social house builds fell from 7,002 units in 1984 to less than 800 in 1989. Also, by the end of the decade, central government had abolished housing development loans and replaced them with capital grants, meaning that social housing finance had been completely centralised. Local governments were therefore no longer able to borrow from banks or use other debt sources to fund social house building (Byrne & Norris, 2019).

By 1993 unemployment levels in Ireland had risen to almost 17%, but from this very low point, economic conditions began to improve and the second half of the 1990s witnessed an exceptional period for the Irish economy, which experienced average GNP growth in excess of 8% and unemployment dipped to below 4% by the end of 1999 (Duffy, 2002). At the same time, interest rates were in decline and demographics pressures spurred by a rise in younger age group headship rates, were responsible for a steady rise in housing output. Table 2.2 below illustrates a relatively steady rise in the numbers of houses delivered from 1990 straight through until 1999. It also shows that by 1999 the output of private and social housing units had increased by around two and a half times what they were in 1991. When compared to the data illustrated in Figure 2.3, it can also be established that the overall housing output in the 1990s decade was around 305,000 units. This number is approximately 20% higher than each of the previous two decades.

Table 2.2 Number of Private and Social Dwellings Built between 1990 to 1999 Source: DEHLG

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Private	18,536	18,472	20,582	18,901	23,188	26,204	29,732	35,054	38,693	42,624	271,986
Social	1,503	1,761	1,992	2,458	3,742	4,853	4,490	3,973	3,767	4,292	32,831
Total	20,039	20,233	22,574	21,359	26,930	31,057	34,222	39,027	42,460	46,916	304,817

By comparison with previous decades, as indicated in Figure 2.3, housing output from 1994 to 1999 was particularly impressive. This period coincided with the era commonly referred to as the Celtic Tiger Years which spanned from 1993 to 2001. During that eight year Celtic Tiger period, Ireland's economy grew by over 8% per annum, a rate, which according to Fitzgerald (2007) had no precedent. Driven by a confluence of positive circumstances, including the stimulus effect of billions in European subsidies, through the structural and cohesion funds and the inflow of foreign investments, attracted by Ireland's exceptionally low 12.5% corporation tax (Norris & Coates, 2014), it is said that growth in this period was based on sustainable economic principles.

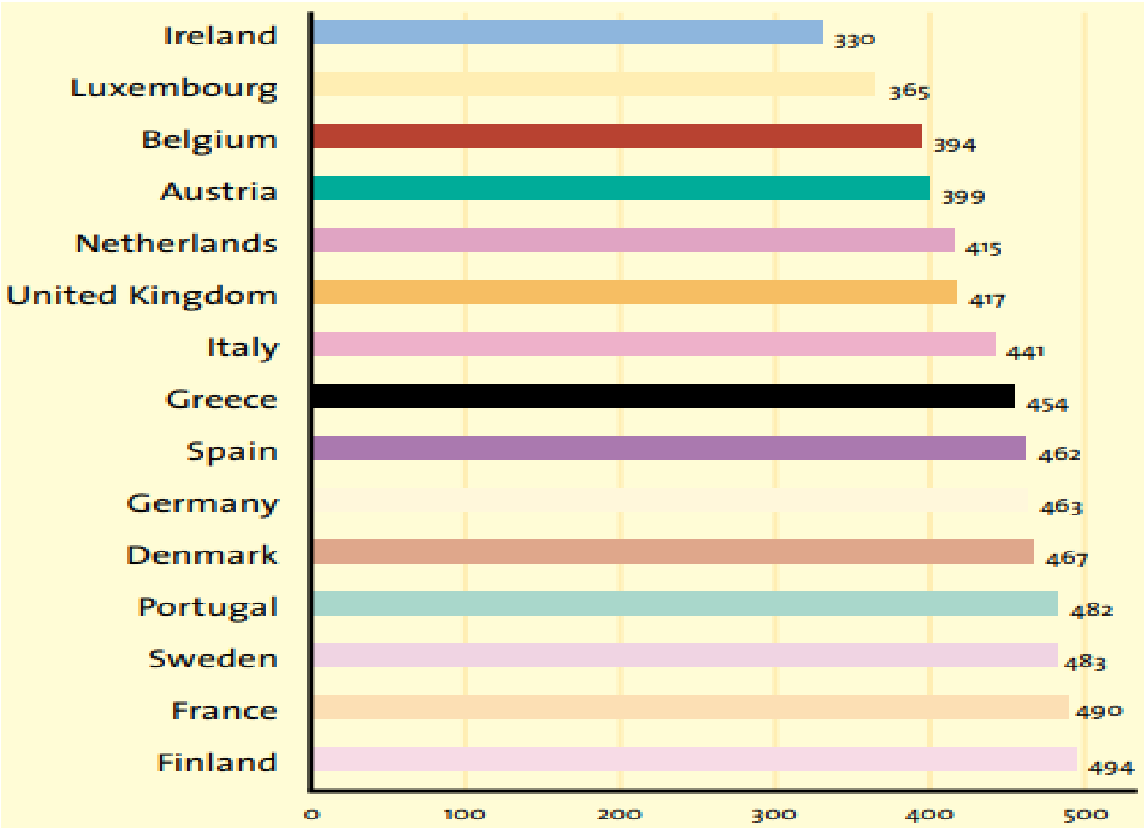
Many economists believe that the Celtic Tiger period owes much to the availability and timing of the inflow of structural and cohesive funds, which the state is no longer eligible to receive. According to Barry et al (2001), Ireland received approximately €5.50 billion in funding under the 1994 to 1999 Structural Funding Programme. Sweeney (2019) suggests that the nature of EU oversight in targeting how the structural funding was spent, added to the economic value of the funds. The threshold set by the EU for states to qualify for structural and cohesion funding, is that gross national income (GNI) must be below 90% of the EU average (ECA, 2019). Ireland's GNI per capita overtook that of the UK in 1996 and the EU average shortly after that (McAleese, 2000). According to the World Bank (2022), Ireland's GNI currently stands at $79,490, which is the second highest GNI of all 27 member states in the EU, where the average GNI stands at €48,451. Ireland is therefore considered by the EU to be one of the more developed economies and no longer eligible to receive money from the fund (DPER, 2022).

The Celtic Tiger years also saw the arrival of almost 300 mainly high industrial projects (Fitzgerald, op cit), which contributed to an upturn in Irish labour productivity by almost 46%. Encouraged by the availability of jobs, many people who had previously been outside of the labour force, such as the unemployed, students and women were now in paid employment. A significant number of those who had been forced to emigrate during the 1980s also came back into the workforce. McAleese (2000) estimates that in the 6 year period between 1993 and 1999, around 415,000 additional jobs were created. This was equivalent to a 35% increase in employment nationally. Increased tax revenues provided by those additional jobs also helped to facilitate a doubling in the output of social housing building during the period, as indicated in Table 2.2. The Table also shows that overall housing output doubled, rising from around 23,000 units per annum in 1992 to almost 47,000 units per annum in 1999. This surge in employment levels also saw increased spending in the domestic economy. Encouraged by a buoyant economy, increases in real disposable income, low interest rates and poor financial regulation, consumer borrowing levels grew exponentially. This eventually led to a rising demand for housing and a housing bubble that emerged in the period 2000 to 2008 (Norris & Coates, 2014).

2.2.3.4 Housing supply 2000 to 2008 – the Irish housing bubble period

Sustained by exceptional economic growth rates experienced in the 1990s, Ireland’s debt to GDP ratio in 2000 stood at 47%, which was well below the EU average and much lower than previous ratios of over 100%, experienced in the late 1980s (McAleese, 2000). Pre-millennium, Ireland’s household formation rate had also reduced from above 4 persons per household, in the mid-1960s, to just below 3 persons per household by 2002 (Conefrey & Staunton, 2019). But in spite of the increases in housing output since the 1960s and subsequent reduction in household formation levels, the number of dwellings per inhabitant in Ireland was still very low, compared to the other 15 EU member states (Norris & Winston, 2002). This is illustrated in Figure 2.5 below, which shows that the number of dwellings per 1000 inhabitants stood at 330, compared to 417 in the UK and an EU average of 437 dwellings. Norris & Winston also noted at that time, that the stock of dwellings in Ireland was substantially younger than those in the rest of the EU. Irish housing stock was also distinguishable by high numbers of terraced, semi-detached and detached houses, in contrast to many other EU states, where apartments make up a large proportion of dwellings stock.

Figure 2.5 Dwellings per 1000 inhabitants in EU states in 2002 Source: DEHLG (2002)



Ireland's economic fortunes continued well into the early years of the noughties decade. The combined influence of low household formation levels and the extended period of economic growth, provided by 7 years of the Celtic Tiger era, was a catalyst to further increase demand for new housing from a young and growing population. According to Eurostat (2021), Ireland boasts the youngest population of all 27 EU states and has done so for the past number of decades. This combination amongst other factors, saw house building output expand exponentially between the years 2000 and 2008, as supply stepped up to meet demand. Helped by low interest rates, plus an expansion of credit influenced by light touch financial regulation, repayments for house buyers remained low, even though house prices grew fast. It was in this context that housing output increased from a substantial and unprecedented number of 46,916 units in 1999 to just under 90,000 units in 2006.

Table 2.3   Number of Housing Units Built between years 2000 and 2008   Source: CSO

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Total Units	49,831	52,602	57,695	68,819	76,954	85,957	88,419	78,027	51,724	610,028

Table 2.3 above, outlines the number of housing units built per annum in Ireland during the period between years 2000 and 2008. It shows that during the 9 year period when the Irish housing boom was in full swing, just over 610,000 housing units were delivered into the national housing stock. This equates to almost 68,000 units per annum in that period and to over 82,000 units per annum during a peak 4 year period from 2004 to 2007 (McQuinn, 2017). It is instructive that despite Ireland's 2021 GDP having rebounded to more than 30% above what it was before the crash in 2007 (Macrotrends, 2022), that housing output in 2022 is, as indicated in Table 2.4, currently delivering approximately 25% of what was built in 2007.

2.2.3.5 Housing supply 2008 to 2022 – post financial crisis to present

In the immediate aftermath of the 2008 global financial crisis, the Irish economy descended into a deep recession, with growing unemployment and a resumption of emigration, at levels last seen in the 1980s. Exchequer balances, which for most of the previous 10 years had been in surplus, fell sharply into deficit, recording minus 19% in 2009, which according to Norris & Coates (2014), was the biggest contraction in any developed economy since the Great Economic Depression. With the Irish banking system in meltdown, mortgage lending dried up and by 2010 house prices had fallen by over 50%. By 2013, housing output had dropped by over 90% (Lennon & Waldron, 2019). Housing output figures contained in Tables 2.3 and 2.4 show that house completions fell from almost 90,000 units in 2006 to just over 4,500 units in 2013 (CSO data, 2022). In the years immediately following the housing crash, it was generally considered by commentators and policy makers that Ireland had enough houses to go around. However, because many of the houses built during the bubble period were located in parts of the country where people did not want to live (O'Callaghan et al, 2014), some analysts had started to raise concerns from around 2012 that there was the potential for future housing supply shortages unless output picked up.

In early 2014, the first signs of a re-emergence of residential development activity were identified in some parts of Dublin. Boosted by the reappearance of modest second hand house price increases and the prospect of house price inflation, residential development was starting to get underway again, but was confined to more affluent parts of the capital city, where viability and high end market affordability could synchronise (Lyons, 2016). Driven by a pent up and growing demand, bolstered by the headwind of a recovering economy and renewed employment growth, housing supply continued to increase in the following years but only gradually. Despite rising house prices, Table 2.4, illustrates that, in the 4 year period up to 2016, annual housing output averaged less than 7,000 units. In 2017, there was a notable increase in supply and by 2019 output exceeded 20,000 for the first time in 10 years.

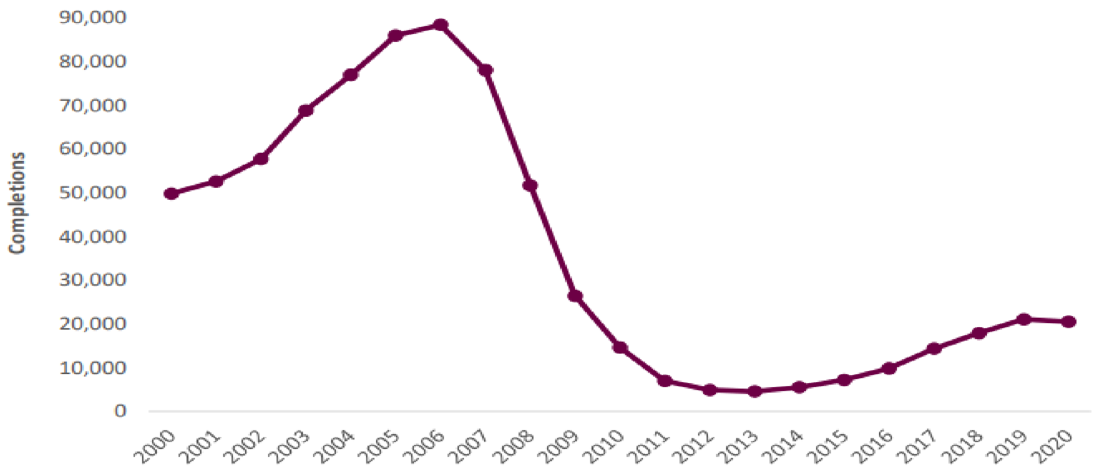
Table 2.4 Number of Housing Units Built between years 2009 and 2021 Source: CSO

Year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Total Units	26,420	10,480	6,994	4,911	4,575	5,518	7,219	9,852
Year	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Total**	
Total Units	14,329	17,903	21,049	20,526	20,433	23,000 *estimate*	192,209	

According to a Kennedy & Myers (2019) paper for the Central Bank of Ireland, housing output levels were considered to be less than half of what was required to meet demand. Around this time also, Ernst & Young, (2020) noted that output had been largely concentrated in Dublin and its commuter belt region, plus the cities of Cork, Limerick and Galway. This was pointed to as clear evidence that viability and affordability were an obstacle to supplying the market in locations outside of these regions. Although, Lyons (2015) and Nowlan (2015) plus other papers by these authors and others had alluded extensively to supply side issues including viability as reasons why supply had not responded to emerging housing demand, reaction was relatively muted. An SCSI (2016a) report on the real cost of new house delivery also warned policy makers at the time that housing supply was unlikely to ramp up if developers could not make ends meet. Table 2.4 also illustrates that since 2019, house completions have remained at just over 20,000 units for each year.

Figure 2.6 below is a graph illustration of the number of house completions achieved in Ireland between the years 2000 and 2020. The graph clearly illustrates a volatile curve in housing supply since 2000, which traces the contrasting trajectories of the housing bubble and the housing crash periods with the more recent years of modest supply growth. In an analysis of housing completions using figures published by the CSO between 2015 and 2020, Linesight (2021) estimate that of the circa 97,000 units completed, approximately 15% were apartments, 55% were estate built houses and 30% were one off single houses.

Figure 2.6 New Dwellings built in Ireland in years 2000 to 2020 Source CSO 2022



To place further context on the graph shown in Figure 2.6, it is of considerable importance that the CBI estimates that between the years 2011 and 2019, the annual demand for housing in the state averaged approximately 27,000 units (Hynes et al, 2021). The CBI also surmised that during the same period, the number of units that were actually built, averaged at around 10,500 per annum, which corresponds with CSO data contained in Table 2.4 above. When added together, the Central Bank figures suggest a cumulative shortfall in house completions of almost 150,000 units over that recent 9 year period. As Hynes suggests, this cumulative shortfall is substantial and will have to be retrospectively met before the supply deficit is resolved. More recent CSO data, as contained in Table 2.4 on new housing completions in 2020, 2021 and estimated for 2022 would suggest that the shortfall is now closer to 170,000 units.

Healy & Goldrick Kelly (2018) and Nowlan (2015) tell us that there is no silver bullet or short-term solution to resolving the supply and demand mismatch. They argue that a lack of investment in infrastructure since 2008 and social housing since the mid-1990s have created deficits that will take many years to balance out. In their annual report on the performance and future projections for the Irish construction industry, Linesight (2021) caution of large backlogs in the output of Irish utilities companies, such as Irish Water and ESB Networks. Their assessment is that because buildings cannot be commissioned until they receive water and power, that ongoing deficits in the performance of these essential utilities due to under investment are and will continue to impact on supply, regardless of housing market demands and societal need. According to the IHBA (2020) the lack of investment in Irish Water since its establishment in 2014 is one of the biggest challenges to residential supply and viability.

Kennedy & Myers (2019) explain that a home is a durable good that takes a considerable amount of time and effort to build. The delivery process is prone to delays especially if the wider systems supporting production are suppressed for any reason or length of time. On this point, Nowlan (2020) further explains that even though it may take only a little more than 12 months in construction time to build a residential development of approximately 30 units, that on average it takes developers in Ireland roughly 5 years from when they first identify a potential site to delivery of the first house on that site. He goes on to argue that apart from public utility capacity concerns, other obstacles to supply include issues such as an apparent anti-development planning system, funding complications, taxation merry-go-rounds and the absence of a state land management system. Regarding land management system deficiencies, Nowlan also warns that infrastructure provision in Ireland is not managed to enable timely and coordinated supply of service roads and utilities with balanced cost distribution. This issue is also discussed in (Nowlan, 2015a) and (Lyons, 2017). In a policy paper to recommend approaches to correct what it refers to as Ireland's broken housing system, the National Economic and Social Council, wrote of the link between poor housing supply and weaknesses in the states approach to the delivery of infrastructure. This paper is particularly critical of the way in which infrastructure delivery in the recent past has been 'pro-cyclical' with very little delivery in periods of fiscal crisis (NESC, 2018).

In a spending review paper written on behalf of the Irish Department of Public Expenditure and Reform, Breen & Reidy (2021) concluded that the critical supply side factors in relation to housing delivery or lack of, are several fold and include: delivery costs and overall construction activity, the cost of materials and land, the relationship between planning permissions and actual house commencements and finally public investment in social housing. On the matter of increased building costs, they highlight inflation, increased energy ratings, fire detailing and Irish water connection charges as the main issues. While many of the issues affecting housing delivery put forward by Breen & Reidy may be correct, they may not take full account of the cost issues. For instance, issues discussed in earlier sections of this literature review raise time and expense features affecting housing delivery, associated with infrastructure capacities, planning matters, development finance, land taxes, and wider building regulations requirements current and legacy. Together, the combination and confluence of issues give a sense of the complexity resting on the housing supply challenge and the housing crisis in general.

2.2.3.6 Obsolescence in the national housing stock

According to Fitzgerald (2005) obsolescence in national housing stock can be explained as the number of dwellings that disappear between censuses. Dwellings can disappear due to reconversions or demolition works carried out to make way for new denser development and some can go into abandonment and non-inhabitable condition purely because of their location. Evaluating data derived from the 1991, 1996 and 2002 census results and CSO house building data, Fitzgerald estimates that obsolescence or depreciation in housing stock in those periods fluctuated at between 0.4% and 0.8% each year, which averaged out at approximately 8,000 units per annum. Crunching data numbers taken from the census of 2016, Sirr (2016) estimates that between 2011 and 2016, the average annual number of dwellings in Ireland that fell into obsolescence was just under 6,400 units. In a comparison of obsolescence rates between countries, Sirr suggests that the international norm stands at about 0.5% per annum of total housing stock. Currently Irish obsolescence rates are below 0.5% of total housing stock, which can be mainly explained by the fact that dwellings in Ireland are relatively newer than in other countries. McCarthy (2019) argues that the rates for housing obsolescence in Ireland are commonly overestimated at between 6,000 to 16,000 units per annum. He also questions the way in which the rates are estimated but singles out Fitzgerald’s approach as the most practical and easily understood method. Examining the 2016 census data at more local levels, McCarthy’s view is that a considerable number of the dwellings that go into obsolescence, do so in rural areas or locations where they do not need to be replaced. And therefore, by McCarthys calculations, the number of dwellings needed to cover for obsolescence is closer to 3,000 units per annum.

According to CSO housing supply data, over 1.1 million new dwellings have been developed in the 32 year period, between 1990 and 2022. Table 2.5 below is a summary of the figures contained in Tables, 2.2, 2.3 and 2.4.

Table 2.5 Number of Dwellings Built in periods between 1990 and 2022 Source: CSO

	Period	Period Label	No of Units	Average per annum
1	1990 to 1999	Mainly Celtic Tiger	304,817	30,482
2	2000 to 2008	House Bubble	610,028	67,781
3	2009 to 2022	Celtic Pheonix	192,209	13,729
	Total		**1,107,054**	**33,547**

If we adjust the data contained in Table 2.5 to reflect the suggestions of Fitzgerald, Sirr and McCarthy, then the total number of dwellings added to our housing stock will be reduced to reflect net increase estimates. Assuming that Fitzgerald's analysis, was based on an older housing stock than was available in later years, it is proposed that for the period 1990 to 1999, an obsolescence rate can be reasonably assumed at 8,000 units per annum. For the period 2000 to 2008 it is proposed that Sirr's estimate of 6,400 obsolescent units can be considered appropriate, as this amount is lower and a more recent estimate than Fitzgerald's, which may also reflect the increased newer housing stock in the period. Finally, for the period 2009 and 2022, it is proposed that the average between Sirr's estimate of 6,400 units and McCarthys estimate of 3,000 units is applied. This equates to 4,700 per annum.

Table 2.6 New Dwellings added to housing stock between 1990 and 2022 Source: CSO

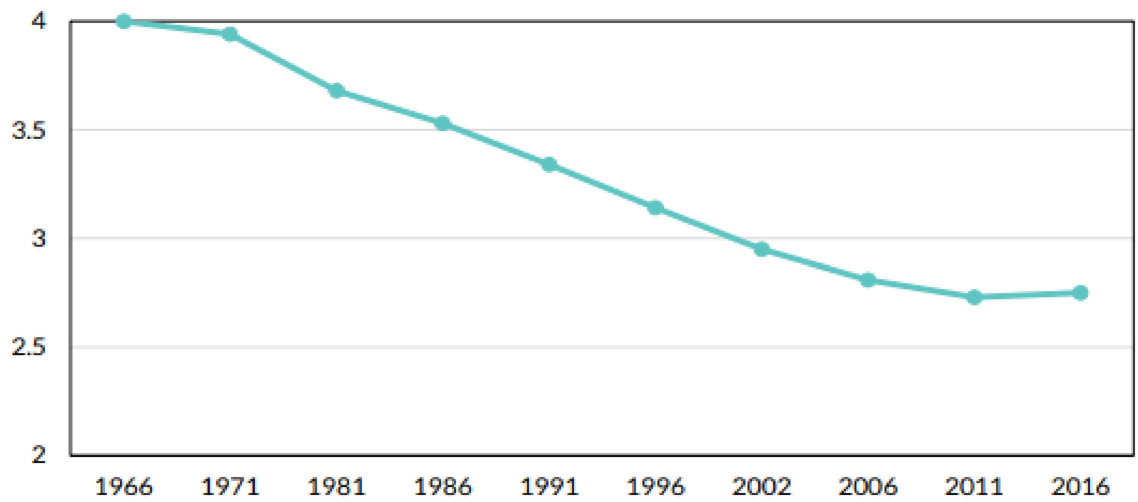
	Period	Average No of Units built per annum	Estimate Obsolescent Units per annum	Adjusted Average per Annum
1	1990 to 1999	30,482	8,000	22,482
2	2000 to 2008	67,781	6,400	61,381
3	2009 to 2022	13,729	4,700	9,029
	Total	**1,107,054**	**203,400**	**903,654**

The adjustments to the CSO data to take account of obsolescence estimates shows that the net increase to Ireland's housing stock over the 33 year period was closer to 903,654, which represents a reduction of approximately 18% on the published data for additional house numbers. The average annual number of units added to the national housing stock levels was 27,383 units as compared to the average number of house completions of 33,547 as indicated in Table 2.5. This is an average difference of 6,164 units per annum. Implications for the lack of accountability of dwelling obsolescence in contrasting housing output with housing needs, comes further into perspective in a review of housing demand.

2.2.4 Housing demand

Current industry discourse and publications offer a broad range of viewpoints on the key drivers of demand in the Irish housing market, each appearing to elevate the importance of one factor over others. However, what may initially read as subjective analysis can on closer examination be explainable by the context and time period in which the study or observation was carried out. Evolving issues, contexts and changing circumstances are increasing adding to the complexity of housing demand analysis and initial viewpoints on the relevant weight to be accorded to the various factors are changeable. In a paper written on the effect of vacant dwellings on Irish housing stocks, Fitzgerald (2006) suggested that demographics are a primary driver of housing demand, especially changes in headship rates and the number of newly forming households. He also pointed to a tendency towards smaller household formations and the impact of dwelling obsolescence rates. Duffy et al (2014) and Conefrey & Staunton (2019) also suggest that demographics are the key driver of housing demand, pinpointing strong population growth, particularly in household formation age groups as the number one demographic factor. They also agree with Fitzgerald that Ireland is trending towards smaller household sizes, comparable to those in other EU countries. Figure 2.7 below tracks the decline in persons per household over 50 years in Ireland up to the census of 2016.

Figure 2.7 Decline in persons per household over 50 years to 2016 Source: Conefrey & Staunton



Writing on the perspectives of first time buyers in the Irish and UK housing markets, O'Brien & Jamei (2017) consider demographics alongside increased economic activity and the availability of credit as the main components behind recent surges in demand for new homes. Following on from O'Brien & Jamie, and 5 years deeper into the Irish housing crisis, Hynes et al (2021) also consider demographics as one of the key factors driving housing demand in Ireland. But, apart from acknowledging the significance of household formation sizes and age groups, Hynes also delve into a number of other key sub variables within demographics, including areas such as migration, fertility and mortality rates. They also consider how acceleration in demand is strongly linked to economic expansion resulting in employment growth and higher income levels. Here they refer to the influence of increased economic activity since 2017, referred to by some industry commentators as the Celtic Pheonix era, where steady growth in employment and income levels have coincided with an inflow of immigrants and returning emigrants. Note is also made of the extent to which demand has grown due to the backlog of previous unmet demand.

Whether it has to do with personal financial circumstances or because of the length of time it takes to purchase a home, the vast majority of immigrants into Ireland or to anywhere else will initially have to rely on the rental market to provide accommodation. As discussed in section 2.2.2.12, availability levels of accommodation in the Irish rental market are at chronic crisis levels. Figure 2.1 illustrates how, due to very high levels of demand and very low supply levels that there are less than 300 units available to rent in Dublin city. A recent report by RTE, (2020) on the effect that economic prosperity and increased job numbers have on housing demand, put this problem into context. In this report RTE cautioned that since 2015, office space sufficient in size to cater for up to 100,000 office workers had been built in Dublin, while only 3,000 apartments had been delivered in the same period. Based on an EU average of 2.3 persons per household, 100,000 new employees in the city of Dublin would be expected to place a demand for an addition 43,000 dwellings. Almost all of the workers filling those office positions will have required either rental or owner occupation accommodation in or around Dublin City.

According to Hynes et al (2021) there were almost 460,000 adults aged 18 or over recorded as living with a parent in the 2016 census. Of these approximately 61% were already in the labour force. Based on earlier discussions in this review on housing supply, it can reasonably be expected that when the 2022 census information are fully analysed, that the data will unveil a deterioration in this statistic. According to Eurostat (2020), a person can be considered to be living in an overcrowded household if that household does not contain a minimum number of rooms equivalent to – one room for the household, plus one room per couple; one room for each single adult aged 18 plus; one room per pair of same gender single people aged 12 to 17 years; one room for each single person aged between 12 to 17 years and one room per pair of children under 12 years. A similar metric for determining overcrowding in housing is outlined in section 63 of the Irish Housing Act of 1966. From a rental perspective, the Housing Agency (2019) noted in June 2019 that there were 68,500 households on rental support or waiting to be housed in Ireland. In a country with a young and growing population, demographic demand for new homes will not diminish in the short to medium term time horizons, unless it is met by supply. One consequence of Ireland's failure to meet short and medium term housing demand is that the political and economic narrative has changed from one describing the situation as a housing demand problem to a societal need crisis.

Prior to the 2008 financial crash, a households ability to access credit in Ireland was generally connected to the prevailing levels of economic activity, security of employment and net disposable income (Lyons & Muellbauer, 2015). However, since 2015, when macro prudential lending rules were introduced in Ireland, the UK and the EU as a demand control lever, the conditions under which home purchasers can gain access to credit now also involves assessment under a series of stress test type ratios. For instance, under the macro prudential lending measures, mortgage borrowers are required to provide minimum deposits through LTV ratios and to demonstrate earnings capacity through LTI ratio rules. In Ireland the loan to income ratio is set at 3.5 times a households gross income. The macro prudential rules are discussed in greater detail in section 2.2.2.6.1 above. Since their introduction, the macro prudential rules have been positively received by some, but not so positively by others, particularly those concerned with the delivery of housing. Irish property industry practitioners have argued that while it is reasonable that a mechanism should be available to limit the housing markets tendency to overheat, the loan to income ratio of 3.5 times a households gross income is seriously restricting demand for new homes and therefore undermining supply. It is further argued that under the prevailing market conditions, the measures simply transfer demand from owner occupation markets to the rental market (Breen & Reidy, 2021)

There are a range of housing demand estimates for the number of new dwelling units per annum required to be delivered in Ireland over the next 10 years. These are produced by various government funded institutions, professional bodies and academics. According to ESRI (2018), the estimated number of units required is within the range of 26,000 to 33,000 units per annum, up to 2030. Their range variance of 7,000 units was determined on a baseline estimate adjusted to low and high inward migration scenarios. It was noted in section 2.2.3.5 above that the Central Bank of Ireland (CBI) estimated that housing demand between 2011 and 2019 was approximately 27,000 units per annum. It was also noted that this requirement was undersupplied by 16,500 units per annum, on average, over the same period. More recently the CBI have projected that between 28,000 to 34,000 units will be required per annum between 2020 and 2030 (Bergin & Garcia-Rodriguez, 2020). Similar to the ESRI, they have projected a range variance of approximately 6,000 units, determined on a baseline estimate adjusted to low and high inward migration scenarios. According to SCSI/PwC (2021), the CBI’s demand projections for the first 2 years of the 2020s will have been undersupplied by at least 13,000 units per annum, by the end of 2022, adding further to pent up demand pressures. Lyons (2021) estimates that demand will be much higher than the ranges projected by the ESRI and the Central Bank. Using projections that provides for falling household sizes, cumulative undersupply and existing housing stock obsolescence rates, Lyons estimates that the number of dwellings required between 2022 and 2030 will be closer to 50,000 units per annum.

Notwithstanding the demand projections put forth by the CBI, it is argued by the ESRI, Lyons and others, including Farrell (2022), that developers will be unable to meet those requirements unless policymakers confront the many issues, some politically unpopular, which are delaying and in some cases stopping development plans in their tracks. One of the issues raised by Farrell refers to local authorities under assessing housing needs in CDPs, leading to the dezoning of residential land, even though new populations figures obtained in Census 2022 are considerably more than previous population projections. Farrell also raises issues on pervasive objections to housing developments by alliances of interests and restrictions put in place by some local authorities limiting buy to let developments. He also cautions against calls by some, for greater oversight and limits to be placed on the returns made by overseas and institutional investment funds. Discussion in earlier sections 2.2.2.4, 2.2.2.5 and 2.2.2.7 above, throw some light on the background behind Farrells concerns.

Table 2.7 Household needs to reflect population increase since 2011 Source: Census 2022

	Census Year	Population	Average Increase per annum	Housing need at household formation level of 2.5
1	2011	4,588,252		
2	2016	4,761,865	34,723	13,889
3	2022	5,123,536	60,279	24,112
	Change 2011 - 2022	**535,284**	**48,662**	**19,465**

Using population data published by the CSO arising out of the 2022 Ireland Census, Table 2.7 translates the recorded growth in population into housing need figures, based on a formation rate level of 2.5 persons per household. Since the previous census in 2016, Ireland's population has increased by 361,671 to 5,123,536 inhabitants. This is the largest increase in population since the 1851 census (PBO, 2021) and averages out at an annual population growth rate of 60,279 over each of the past 6 years. By taking the annual growth rate of 60,279 and dividing it by 2.5, it can be established that on average, in the region of 24,112 dwellings were required to be built per annum in Ireland just to meet population growth. It therefore follows that when demographic factors, and previous pent up demand from years of under supply, as identified by Hynes (op cit) are to be factored in, at say 170,000 units delivered over 10 years, then the actual demand going forward increases to approximately 41,000 units per annum. When housing stock obsolescence is factored in at approximately 4,700 units per annum, as analysed in Table 2.6 above, then according to this literature review, the estimated annual structural demand for new housing is closer to 46,000 units per annum. This assessment is more in keeping with the projections of Lyons (2021) than those of the CBI or ESRI.

Referring to sharp increases in house prices of over 14% nationally in 2021, Dempsey (2022a) suggests that increases of this magnitude are reflective of an even further swelling of demand, exasperated by the legacy of undersupply and a surge of pandemic savings. According to PBO (2021), low consumer spending experienced during the Covid lockdown periods has left households savings unusually high. While current and looming ECB rate rises are expected to have a downward effect on demand in the new homes market, they will have no similar effects on housing needs, which will continue to grow. As such, the market demand for new homes will more than likely transfer across to the already over strained rental market and further increase the numbers of people needing social housing or housing supports.

Regardless of the reasons for the mismatch between supply and demand of housing in Ireland, the overwhelming evidence is that due to a decade of undersupply, there is a structural deficit of homes resulting in a housing need and pent up demand for approximately 200,000 new dwellings. A measured approach to increasing housing supply to 33,000 units per annum to the year 2040, as targeted by the governments ‘Housing for All’ initiative may eventually adjust and even start to level out the current upward trajectory of housing under supply, but this plan is unlikely to resolve the housing crisis any time soon.

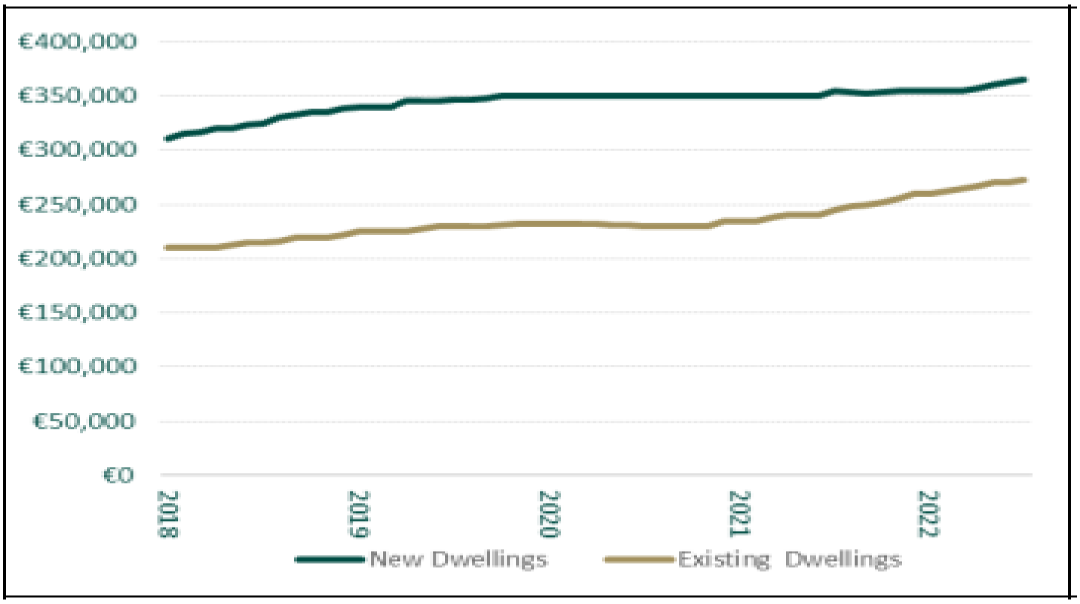
2.2.5 House prices, viability and affordability

2.2.5.1 House prices

In the early years of the 1990s Ireland started to experience very strong house price growth (Lyons, 2015). Malzubris (2008) explains that from 1993 when the Celtic Tiger period was just starting, right up until 2006 when the Irish housing bubble reached its peak, that the average price of a typical house in Ireland rose by 340% in nominal terms and 300% in real terms. This equated to an average house price increase of approximately 20% per annum over 13 years. Figure 2.9 below contains a graphically illustration of the fluctuating comparison of Irish house prices between 1960 and 2020. This illustration highlights the dramatic rise, fall and rise again in house prices in the most recent 30 years period between 1990 and 2020. To compare Irish house price movements for that period with other OECD countries, the review identified research carried out by McQuinn (2017), which noted that data collected by the Federal Reserve Bank of Dallas, since 1975 on house price fluctuations for 22 OECD countries, illustrates how Ireland registered the largest increase in house prices between 1995 and 2007. McQuinn also points to data from the same source, which establishes that in the aftermath of the financial crisis, in the period between 2008 and 2013, Ireland registered the largest decrease in house prices in comparison to the same 22 OECD countries, when prices fell by over 54% nationally.

There is general agreement among commentators that house prices in Ireland, started to rise again during 2013 and from that point, steady high single digit annual price growth provided an impetus for developers to gradually resume development work. McQuinn (op cit) suggests that by 2017 house prices had risen to almost 70% of what they were in 2007 and according to Lyons (2017) rents had climbed above what they were in 2007. More recently PBO (2021) has reported that Irish house prices increased by over 85% between 2013 and 2020. Breen & Reidy (2021) offer a further breakdown on this increase, suggesting that over the same period, the price of second hand properties have increased by 5% per annum, while new dwellings have increased by 10% per annum. This brings the literature review back to the variation between new and second hand house prices, where it was previously noted that according to MacCoille (2021), premiums for newly built homes are only a recent phenomenon and a reflection of the difference required to provide greater levels of quality and standards in new homes. Figure 2.8 illustrates the degree of divergence between the price of new and second hand homes as interpreted by the CSO in September 2022. Contrary to the claims of Breen & Reidy, the illustrations in Figure 2.8 appear to suggest that over the past 4 year period the overall rate of price increase for new and second hand have been relatively similar.

Figure 2.8 New and Second Hand Median House Prices 2018 to 2022 Source: CSO



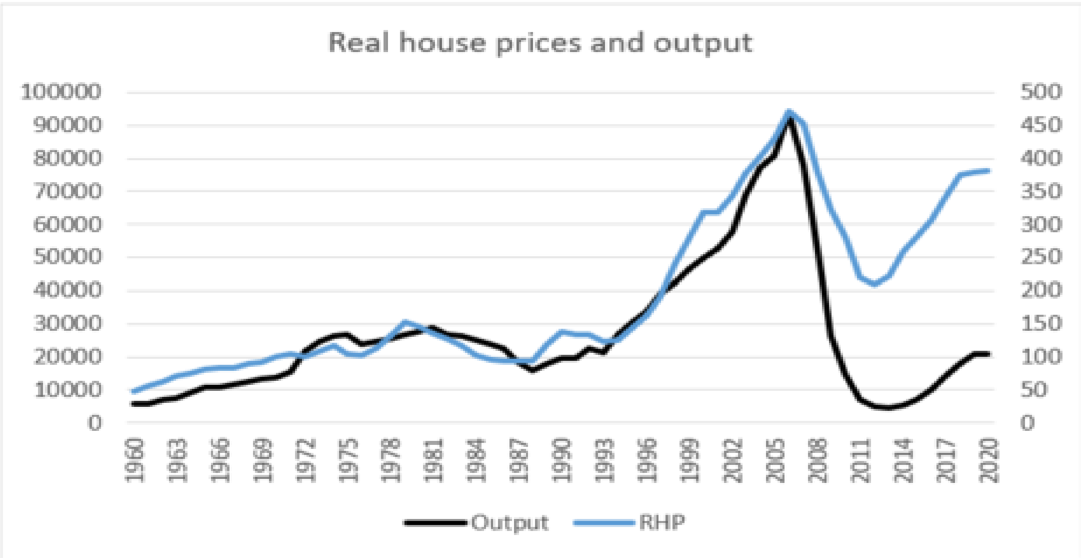
According to McQuinn (2017), the main factors determining house prices are a combination of credit conditions, demographics, disposable income, the cost of land, the cost of building and the general state of the economy. Nowlan (2017) argues that mortgage rules imposed by the Irish Central Bank in 2015 are effectively a framework for controlling house prices in the low to mid-tier priced range. This view had been previously suggested by Lyons (2016) and is supported by Ernst & Young (2020) and in studies on housing delivery costs carried out by SCSI (2016) and (2021). In a recent study on the interactions of house prices, credit and the elasticity of supply, Lyons & Monert (2021) conclude that clear evidence exists in the Irish housing market that supply has and will continue to respond to house price increases. They also note that the level of supply responsiveness can vary over time due to the effect of other housing supply factors including credit conditions. In that context they note that the 2015 macro prudential mortgage rules play a significant role in limiting house price increases, achieved by keeping a lid on what prospective purchasers have an ability to borrow and therefore pay for a new home.

According to recent Daft.ie Q3 reports in 2021 and 2022, average Irish house prices increased by 9% and 8% per annum respectively. Those price increases have assisted in improving project viability levels, which appear to have assisted in the most recent modest increases in supply, especially in locations outside of Dublin and the regional cities.

2.2.5.2 Development viability

According to SCSI (2020), the margin by which sale prices exceed total development costs will determine whether a project is viability. Therefore, a development can be considered to be viable when it makes commercial sense to proceed. If the market sale price is below the cost of production, then either of two things must happen – either the market sale price must rise, or the cost of production must fall. To ensure that private sector housing is delivered to the market, residential development projects have to be viable, which also means that the delivered units have to achieve affordability levels sufficient to attract a minimum number of potential house buyers or renter households (Breen & Reidy, 2021). The practical expression of this basic market reality is clearly illustrated in Figure 2.9, which demonstrates the close relationship over time between house prices and house production output.

Figure 2.9 Fluctuating Comparison of House Prices and Industry Output Source CSO 2021



Of considerable importance in any viability and affordability synchronisation equation will be the influence of site location, as land costs can vary greatly from one location to another. A development located in a more desirable location will target and attract more affluent purchasers, thereby securing higher sale prices. At the same time, site purchase costs in more affluent locations will be higher than average and consequently raise overall development costs (SCSI, 2017). At the opposite end of the market, where sites may be located in less sought after locations, values will be lower than the average, but viability is more likely to be challenging. Despite the fact that site cost values decrease somewhat in line with house prices in such locations, the other development costs do not and apart from possible reductions in specification costs, the other construction costs, including fees, levies and public utility costs will cost the same on a low end development as they will on a high end one (SCSI, op cit).

Following the housing bubble collapse in 2008, it was generally acknowledged that the new homes market was unlikely to recover until after the emergence of second hand house price increases and prospects of further house price inflation (Lyons, 2016). By 2015 waiting lists for social housing provision in Ireland were climbing, while at the same time housing supply output failed to surpass 7,500 units per annum. It was at this point in time that concerns began to emerge from within the industry and property commentators that project viability issues may be at the heart of the slow housing recovery. According to Nowlan (2015), citing information contained in contemporaneous housing market reports, only 37% of Dublin's 102 micro housing markets were capable of meeting project viability criteria at that point in time.

Following on from the observations of Lyons and Nowlan, and amidst other commentary made without the benefit of credible development cost data, the Society of Chartered Surveyors Ireland, published a report in 2016 on the real cost of new house delivery. This study identified serious development viability and purchaser affordability issues based on member surveyed data on the delivery costs to develop an estate built 3 bedroom semi-detached house. The delivery cost data was collected by SCSI members as encountered on a number of live housing developments of 30 units or more, based in the greater Dublin area. The report listed 5 recommendations to policy makers, which focussed on reducing VAT, development levies and finance costs, while also increasing the supply of land and applying cost benefit analysis in the assessment of future building regulations. The overall findings in the SCSI (2016) report on the issues of viability and affordability provided further if indirect support to the previously expressed concerns of Lyons, Nowlan and others. The underlying message of the SCSI report suggested that unless house prices continued to rise, the private housing market would be unable to respond to what will eventually result in an enduring housing supply crisis. Conversely, the report also suggests that if house prices rise by too much, then current purchaser affordability issues will be exacerbated. The report concluded by recommending that action should be taken by policy makers to either reduce house delivery costs or to provide stimulus measures that would aid purchaser affordability. In its closing summary, the SCSI 2016 report also suggested that a loosening of the 2015 macro prudential lending rules was required to allow new home purchasers to borrow more.

According to Lyons & Muellbauer (2013), house price inflation and the easy availability of credit were the twin engines that led to the housing bubble crash and as a result, future policy makers will be reluctant to interfere with the housing market system in ways that are likely to stoke those two conditions. On this suggestion, it would appear unlikely that the CBI will be recommending a relaxation of the macro prudential rules to any great extent, if this action is likely to contribute to an imminent overheating of the housing market. According to O'Brien & Jamie (2017) mortgage lending rules in the UK allow new house purchasers to borrow up to 4.5 times their combined salary. If the Irish Central Bank were to follow the UK lead and raise LTI borrowing ratios from 3.5 to 4.5, this would significantly increase the borrowing capacity of new home purchasers, leading to a substantial number of additional home buyers into the market, prepared to pay more and compete for a new home. This would assist in increasing house prices and stretch the margins between gross development costs and gross development values, thereby improving development viability. Industry players such as the IHBA and PII strongly argue that by setting LTI limits closer to the UK ratio that it would have the beneficial effect of closer aligning development viability and purchaser affordability (IHBA, 2021) and (PII, 2021). It is also suggested that such an alignment would ultimately help to create the conditions necessary to increase supply, as, encouraged by margins more reflective of the risks involved and engagement in a market of capacitated purchasers, developers and funders would be more inclined to commence projects. In agreement with Lyons & Muellbauer (op cit), McQuinn (2017) suggests that moves to raise the LTI lending ratios to any great extent is unlikely to occur, as it would be seen as a highly charged political decision. Similarly, the VAT rate on new houses in the UK is zero, while in Ireland the rate is 13.5% (Nowlan 2015). A reduction in VAT would also be politically difficult, as this is a significant source of tax revenue for government and would be viewed as a gift to developers by left wing groups, commentators and politicians.

In 2020, the SCSI published an updated version of the 2016 real cost of house delivery report. This later report repeated the 2016 warnings that issues affecting viability and affordability will continue to restrain housing delivery unless they are addressed. The 2020 report also acknowledged government supply side stimulus actions that had been taken since the previous report in 2016. These included a 'help to buy' tax subsidy scheme. Both reports repeated previous recommendations for a loosening of macro prudential lending rules and the introduction of measures to reduce costs (SCSI, 2016) and (SCSI, 2020).

In 2017 the SCSI published a separate report on the real cost of apartment delivery. This document focussed on development costs, viability and market conditions for buy to sell and buy to rent apartment developments projects in the Dublin area. The contents and analysis of the report were based on the costs to deliver a 2 bedroom apartment, using data collected from 28 apartment schemes, by chartered quantity surveyor members. Apartment delivery costs were also sub distributed into 3 categories depending on location. The 3 categories were Suburban low rise, Suburban medium rise and Urban medium rise. The main findings of the report was that viability could only be achieved in a Category 1 – Suburban low rise delivery. On the other end of the scale, the study found that a typical Category 3 – Urban medium rise apartment had a viability gap deficit of between 24% to 28% of the required sale price. In their analysis they found that in 2017 the net construction cost of a modest sized apartment could range from between €155,000 to €255,000 depending on design and car parking strategy. They also identified that site purchase costs ranged from between €33,000 and €125,000 per apartment depending on site location. More recent analysis by Lyons (2021) on the viability and affordability of new apartment delivery in the greater Dublin area suggests that only one sixth of renter households can afford to pay the €1,640 monthly rent that a PRS or investor landlord would require to break even on an apartment with a €400,000 build cost.

In a later report by Ernst & Young (2019) on the viability and affordability of developing apartments in Cork City, Ireland's second largest city. The authors summarise that unless ways can be found to address the viability gap that currently exists, there is unlikely to be any apartments built in the Cork City area for sale to the private market. They also warn that the build to let market is almost equally as challenging, due to high delivery costs and the high rentals levels that are required in order to make the projects viable. Breen & Reidy (2021) summing up of the rental market viability conundrum is as simple as it is true. They suggest that supply will continue to be constrained if high input costs continue to excessively impact on the rate of return and ergo the rent levels required to attract investment.

2.2.5.2.1 Development costs

The overall cost to build a residential dwelling is of major importance in the determination of how many housing completions will be achieved nationally in any particular period. This is because, the costs have an overarching effect on both the viability of development from the perspective of the developer and on the affordability of the dwelling from the point of view of the end purchaser (Kennedy & Myers, 2019). The tool for pre-determining development costs and estimating whether a development may or may not prove to be viable is the Development Appraisal (Calder & Austin-Crowe, 1983). The development appraisal brings together a combination of project variables into an evaluation process, based on financial information, some of which will be known and some estimated. When a project has been completed, the developer will then determine the accuracy of the pre-development appraisal with actual cost and sales outcome figures to determine the success or otherwise of the venture. Calder & Austin-Crowe refer to this process as the post development cost assessment.

In separate reports, delving into viability and affordability issues in the Irish housing market, SCSI (2016) and SCSI (2021), suggest that property cost consultants generally analyse housing development costs into 2 main elements, which they describe as hard costs and soft costs. Hard costs are regarded as the construction costs while soft costs are all the other costs that go into a development. Ernst & Young (2019) consider that it is most important that development costs are broken down in this way, as amongst other things, it enables industry and property institutions to convey helicopter views to policy makers and non-expert commentators of the proportional break-down between direct and indirect costs in residential developments analysis.

2.2.5.2.2 Hard and soft development costs

Ernst & Young, (2019), describe hard costs as essentially referring to construction costs, which capture site supervision, labour, materials, tools and plant. SCSI (2017) describes hard costs as the actual bricks and mortar costs, while soft costs are those that capture everything else, including land costs, development levies, public utility charges, design and legal fees, finance costs, taxes and developer’s margin.

A slightly broader look at hard costs on a housing development informs us that they include all construction works from foundations to roof completion and include house exteriors, estate roads, site services and public space completion (SCSI, 2016). The house structure would normally encompass strip foundations, underfloor services and floor structures, timber frame or solid concrete block walls, wall plaster, insulated cavities and external brick or rendered block walls, double or triple glazed windows, eaves and rainwater systems, roof insulation, trusses & finishes, internal and external doors, architraves and skirting boards and such. Fitted kitchens, sanitaryware, ironmongery, wardrobes and staircase structures would also be included in hard costs, which would also include the electrical system, solar panels, car charging and mechanical installations, combining air to water heat pump systems, hot and cold water plumbing systems and heat distribution through radiators and a heat recovery system (SCSI, 2020). Hard costs can vary between housing projects depending on factors such as, interior specification choices and exterior finishes selections, like the extent of brickwork, stone or render finish on facades. Quality range and price options on components such as kitchens, wardrobes, sanitaryware and staircases can also influence the level of hard costs, as will the choice of heating systems and renewable technologies (SCSI, 2016).

Soft costs will also vary between housing developments, depending on the project location, size, complexity and such (Ernst & Young, 2019). A broad overview of the elements captured in soft costs are outlined in the SCSI and Ernst Young reports as previously referenced. They establish that soft costs include a number of elements, which are outlined as follows; land costs, which can vary significantly between different urban or suburban site locations and which are also impacted by whether the land is serviceable, zoned or has planning permission at time of purchase. Financing costs, which comprise of the interest and arrangement fees payable on the funding raised to finance the development. Professional fees, which cover full project design, certification and supervision fees, through the employment of professional planners, architects, civil and structural engineers, building services engineers, landscape designers, statutory health and safety supervisors, quantity surveyors, environmental and archaeological consultants. Conveyancing costs which include sales agents and vendor solicitor fees. Marketing costs, which include showhouse fit-out costs, interior design and sale advertisement. Public utility charges, which mainly comprise of charges and surety deposits paid to semi-state bodies such as ESB Networks and Irish Water for connections to the electrical power grid, watermain services and wastewater systems. Local Authority charges which will include capital contributions, planning fees, road opening licences and cash deposits, plus social housing contributions due under Part V of the 2000 planning and development act. Developers margin will cover the developers business investment return, development risk, overheads and other input costs including land acquisition costs and interest to private equity investors. Bank funders generally require a minimum development margin of 15% of Gross Development Value (GDV) to be contained in a development feasibility (Ernst & Young, 2019). VAT on the sale of a new house is generally the final soft cost to be added.

An interesting observation drawn from the previously referred SCSI and Ernst Young reports on housing and apartment delivery is that in most cases, the split between hard and soft cost on a project is close to 50:50, with soft costs generally showing as slightly higher of the two.

According to the SCSI (2020), the percentage split between hard cost and soft cost in a typical housing development in 2016 and 2020 were 45:55 and 48:52 respectively. In their analysis, it is suggested that in the four year period, hard costs increased by 19% while soft costs increased by only 7% over the same period. They also found that the most significant increases were associated with external works such as drainage, water connections, paving and landscape costs. They also identified changes in internal detailing within house structures, arising out of fire regulations, as increasing costs.

In a separate study by the SCSI on the costs to deliver apartments, SCSI (2021) suggests that the percentage split between hard cost and soft costs in a typical apartment development in 2016 and 2020 were 43:57 and 47:53 respectively. In this report the SCSI also suggests that in the 4 year period between 2016 and 2020, construction inflation and Part L NZEB regulations are the primary drivers of an average increase in typical apartment building costs of around 14%. Estimates on the average increase in soft costs on a typical apartment development over the same period were not outlined, but increases in development contributions of between 18% and 42% in the Dublin area were noted. In another study on viability and affordability of apartment building in Cork City, Ernst and Young (2019) establish that hard costs typically account for 48% to 56% of the overall cost of a development, while soft costs account for 44% to 56%. They argue that the higher percentage of hard costs in apartments compared to houses can be attributed to construction regulations and minimum design standards in apartments.

The main focus of attention in the 2016 and 2017 versions of the SCSI reports and the Ernst Young 2019 report concentrated on the soft cost proportion of overall development costs. They argued and perhaps rightly so, that when an average new house purchaser commits to buying their home, the fact that less than half of the price that they pay may only be attributable to the hard costs is not generally understood. Cost reduction recommendations in those earlier reports were primarily aimed at reducing VAT and development levies. They also called for measures to be introduced that would improve the planning system and increase the supply of fully serviced zoned land. Other actions advocated for, included the establishment of a state run development finance bank, to help reduce development funding costs. The reports also cautioned that, while maintaining high standards, methods must be found to reduce construction costs. Other literature on development costs, such as (Lyons, 2015) also focus most attention on soft costs and recommendations for lowering soft costs on residential developments. Their recommendations are mainly concentrated on the impact that reductions in VAT, Stamp Duty, Part V social housing levies and development contribution charges would bring. Lyons (2015), SCSI (2016) and Ernst & Young (2019) also acknowledge that building regulations are a factor of high construction costs and that future building regulations should undergo cost benefit analysis before enacting. Apart from these recommendations and suggestions in Nowlan (2017), there appears to be little other discourse in the literature on the impact that ongoing improvements in building regulations may have on the cost base of housing delivery.

2.2.5.2.3 House construction costs

According to Lyons & Monert (2021), average house prices and average prices paid for development land in Ireland in 2020 are lower than they were at the peak of the housing bubble in 2007, by approximately 20% and 40% respectively. At the same time however, they estimate that since 2007 housing construction costs have increased by around 80%. This suggests that house construction costs have increased by 6.2% per annum on average over that 13 year period, while house prices cost less than they did 13 years ago, albeit at the peak of a housing bubble. According to recent literature and industry commentary, such as the aforementioned SCSI, Ernst & Young, Lyons and Nowlan, concerning ongoing increases in construction costs, it appears that the most commonly put forward reasons for the increases are inflation, market driven finishes enhancements and building standards. A review and comparison of data contained in a number of reports published by government agencies and industry sources is undertaken below. It is anticipated that the review will assist in throwing some light as to the proportional contributions made to house construction costs by those reasons suggested above. The data used is a mixture of annual building costs statistics gathered by the CSO and industry generated housing cost data gathered by the SCSI.

Since the early 1970s, the principal monitor of housing construction costs in Ireland and the annual changes to those costs, has been the House Building Cost Index (HBCI), published by the Irish Central Statistics Office (CSO). The HBCI monitor is an index based tracker of building material costs and construction industry labour costs including insurance and VAT. The costs are based on a basket of materials representative of a typical 3 bedroom, 2 storey LA house. This index was produced by Dublin City Council on behalf of the DEHLG until 2006, when the method of assessing material costs was changed from pricing a basket of goods to movements on the wholesale price index. According to (CSO, 2021), the new index maintains continuity with the previous one. In 2016 the CSO transferred the HBCI data into the Capital Goods in Building and Construction subcomponent of the Wholesale Price Index of Building and Construction Materials (CSO, 2022b). This is now the go to source for CSO generated construction cost inflation data. Table 2.8 below, outlines the percentage movements of house construction costs, according to the CSO, in three 10 year periods between 1991 and 2021,. The index and percentages in Table 2.8 are extrapolated from the HBCI and Capital Goods in Building and Construction data Tables published on the CSO website. According to that data, house building cost inflation has been approximately 48% over the 30 year period between 1991 to 2021.

Table 2.8 Construction Inflation Cost Monitoring 1991 to 2021 Sourced: CSO

Year	Index	Goss Percentage Increase since 1991	Percentage Increase between 10 year Periods	Annual % increase in 10 year Periods
1991	100.00	0	0	0
2001	161.50	61.5%	61.5%	6.1%
2011	203.10	103.1%	25.8%	2.6%
2021	247.90	147.9%	22.1%	2.2%

Because the CSO input cost index only factors the cost of labour and materials, Lyons (2015) refers to it as a narrow measurement of costs, which dramatically understates the cost pressures faced by those that deliver housing. As well as excluding the soft costs associated with housing delivery, the CSO index does not consider any changes to the basket of costs, such as those required by new regulations or otherwise.

More recently, alternative and more detailed analysis on house construction costs has been published in SCSI (2016) and (2020) and in reports published by Ernst & Young (2019) and (2020) on behalf of the IHBA. Unlike the purely index based data published by the CSO, the SCSI studies and particularly SCSI (2020) provide recently collected, average cost breakdowns of all input costs involved in the delivery of a 3 bedroomed semi-detached house. The report is described by the SCSI as providing credible market placed data on house construction costs, informed through cost data gathered by Chartered Quantity Surveyors members from 30 housing development sites in the greater Dublin area. Each of the 30 sites contributing to the report had a minimum of 35 units and the average gross internal floor area of the houses was 114 square metres. The data for the SCSI report was collected during Q1 and Q2 in 2020. The report also states that the average construction costs are based on projects which did not experience significant adverse or abnormal conditions which could have constrained delivery costs. Due to an increased emphasis in development plans and forward planning policies earmarking sites that align more favourably with sequential development and compact growth strategies, brownfield developments with site abnormalities appear to be more prevalent than in previous times. It could therefore be assumed that the report's use of the word 'significant' may be somewhat nuanced. Apart from abnormal costs, which the report authors suggest can amount to as high as €15,000 per house in some cases. The impact of Covid19 was another uncaptured cost.

Table 2.9 below, outlines the elemental costs breakdown for the typical 3 bedroom semi-detached house as extrapolated from the SCSI report. The are 8 elements outlined in Table 2.9, the contents of which, are not consistent with the national standard building elements (NSBE) matrix. The NSBE are based on internal construction cost measurement standards endorsed by the SCSI, the RICS and other international based property institutions RICS/SCSI (2020).

Table 2.9 3 Bedroom Semi-Detach House Elemental Cost Breakdown Source SCSI (2020)

	Element	**Cost Excl Vat**	**Cost per Sq.M**	**% Of Total**
1	Substructure	13,041	114.4	7.3%
2	Superstructure	56,047	491.6	31.3%
3	Completions	21,173	185.7	11.8%
4	Finishes	13,700	120.2	7.7%
5	Built-in Fittings	6,227	54.6	3.5%
6	Building Services	28,646	251.3	16.0%
7	Siteworks within House Curtilage	12,241	107.4	6.8%
8	Site Development Works	27,826	244.1	15.6%
	Total Construction Costs (EX VAT)	€178,901	€1,569.3	100.0%

The total net construction costs in Table 2.9 amount to €178,901 and represent the hard costs portion of the overall development cost to deliver the house to market. The SCSI (2020) report also gathered and analysed the soft costs contributing to the overall development cost of the house. These came in at €192,410 and when added together, the total delivery cost of the typical 3 bedroom semi-detached house was €371,311. In a similar study carried out in 2016, the SCSI reported that the overall cost to deliver the same 3 bedroom house was €330,493. This represented an increase of €40,8118 or 12.4% in overall delivery costs over 4 years. Table 2.10 outlines an analysis of the construction cost element comparisons.

Table 2.10 Elemental Comparison between SCSI 2016 and 2021 Cost Reports Source: SCSI

	Typical 3 Bedroom Semi - Detached House Element	Cost Excl Vat 2016	Cost Excl Vat 2020	Difference %
1	Substructure	13,354	13,041	-2.3%
2	Superstructure	48,560	56,047	15.4%
3	Completions	18,210	21,173	16.3%
4	Finishes	12,140	13,700	12.9%
5	Built-in Fittings	5,100	6,227	22.1%
6	Building Services	24,887	28,646	15.1%
7	Siteworks within House Curtilage	10,000	12,241	22.4%
8	Site Development Works	18,100	27,826	53.7%
	Total Construction Costs (EX VAT)	€150,251	€178,901	19.1%

The comparison in Table 2.10 shows that in the 4 year period between the two SCSI reports that construction costs increased by nearly €29,000 or 19%, which averages at close to 5% per annum. The most significant increase is in site development costs, which increased by approximately 54%. The SCSI reported that this increase was mostly because of higher costs associated with water connections, drainage, paving and landscape works. Other notable increases occurred in the superstructure and building services elements, which saw higher construction costs of €7,487 and €3,759 respectively. It was suggested that the main reasons for higher superstructure costs were related to changes in internal fire safety detailing plus general labour and material price inflation. No specific reasons were given in the report for the almost 15% increase in building services costs, but a wider look at building regulations literature shows that updated regulations associated with rules for electrical installations, plus Part L, Conservation of Fuel & Energy and Part F, Ventilation may have been responsible for much of the higher building services costs. Increased costs associated with completions, internal finishes and building fittings of 16%, 13% and 22% respectively are generally explainable by an increase in the level of finishing to new houses to make them more desirable to home purchasers.

The SCSI also produce an annual house rebuilding cost calculator, for use as a house insurance rebuild costs indicator. This guide is published and updated on an annual basis on SCSI.ie and offers a matrix of indicative all-in rebuilding costs for 6 house types across 7 regional locations throughout Ireland. The all-in costs, which includes for both hard and soft costs are provided on a cost per square metre basis. According to the most recent version of this data, published in September 2021, the all in insurance rebuilding costs, to replace a 3 bedroom semi-detached house, measuring 98 square metres in Dublin city and its commuter belt, would be between €223,930 and €268,030. By comparison, the all-in development costs, inclusive of both hard and soft costs of the new 3 Bedroom semi-detached house of 114 square metres as contained in SCSI (2021) is quoted at €371,311.

2.2.5.2.4 Building regulations costs

Building regulations are the legal requirements set for the design and construction of new buildings including residential dwellings. They provide minimum standards for the health, safety and welfare of people, conservation of fuel and energy, and access for all people including those with disabilities, in and around buildings (Ernst & Young, 2019). The regulations are issued under statutory instruments with accompanying technical guidance documents under provisions contained in the Planning and Development Acts 1990 to 2022. The Technical Guidance Documents (TGDs) come in 12 parts according to function. Adherence with the guidance contained in the TGDs indicates prima facie evidence of building regulations compliance (O'Cofaigh, 1993). Prior to the establishment of building regulations and the release of TGDs in 1991, building control and standards in Ireland were generally based on Dublin Corporation's Building Byelaws (1949). The cost of building regulations can therefore be assessed as constituting the difference between the mix of functional, performance and prescriptive requirements as set out in the Byelaws and the TGDs.

According to Nowlan (2017), the Irish house building sector works to the highest building standards in Europe. However, Nowlan adds that this cannot be considered to be only a blessing, because he argues, standards need to reflect what we can afford to pay. In explanation of this contention, he uses an analogy between a Ford Cortina and an Audi A8, stating that in most cases our housing needs, say for a transient single person or couple occupant, may be the equivalent of the Cortina, but in every instance, on the insistence of Irish policy makers, the specification must match that of an Audi A8.

In the previous discussion on house construction costs, it was noted that up until very recently, the CSO Construction Inflation Cost Monitoring Index was the principal monitor of housing construction costs in Ireland. It was also highlighted how since 2016 the SCSI has issued two detailed reports on house construction costs, which have facilitated a more meaningful comparison for increased cost analysis purposes. In Table 2.8 above, this study analysed data found on the CSO website and formulated it to show the average annual construction inflation rates from 1991 to 2021. In Table 2.10 above, this study also gathered data from SCSI housing delivery cost reports published in 2016 and 2020, which aimed at illustrating the rate of cost increases over the 4 year period between them. It is now proposed that by comparing the rate of construction inflation declared by the CSO with the rate of construction cost increase findings of the SCSI, that an approximate measure of the cost of building regulations costs over that period can be identified. Table 2.11 below, shows us that comparison. Using the SCSI 2016 construction costs for a typical 3 bedroom semi-detached house as the baseline figure, the CSO and SCSI percentage increases between then and 2020 are compared. The Table shows a difference of €15,428 between construction cost inflation and the actual increased costs incurred over the 4 year period. The difference of 10.3% over 4 years or 2.6% per annum is over double the reported rate of construction cost inflation.

Table 2.11 SCSI v CSO Data Comparison of Cost Increase and Inflation Source: SCSI and CSO

	Data Base	Baseline 2016	Cost in 2020	Cost Increase over 4 years	Difference %
1	SCSI Based Construction Costs	€150,251	€178,901	€28,650	19.1%
2	CSO Construction Cost Inflation Monitor	€150,251	€163,473	€13,222	8.8%
	Difference		€15,428	€15,428	10.3%

Drawing from data published by the SCSI and the CSO, (Lyons, 2015) advises that as house prices fell by a half during the period 2008 to 2013, the costs to build a 3 bedroom semi-detached house rose by one third, mainly driven by building standards and regulatory change. The relevance of a mismatch between house price falls and delivery cost rises came to light around 2014 when concerns emerged that supply would struggle to meet demand. Lyons suggested at that time that there was a clear need for an audit of house building costs to show where regulations can be reviewed or even reformed to reduce costs. According to IHBA (2020), the house building sector has borne cost increases year on year, through the continuing introduction of building regulations such as NZEB, which provide higher energy standards, but come at a cost. In response to previous claims by Irish house builders that construction and development costs are key constraints to output (Healy and Goldrick Kelly, 2018) also called for more empirical evidence to test these claims.

2.2.5.3 Purchaser affordability

Issues surrounding viability, centre around the gap between delivery costs, house prices and affordability in the market. What affordability in the market means, can have different interpretations, but at its simplest, it can be appraised by an analysis of the house price to household income ratio and the rent price to income ratio (Healy & McGoldrick Kelly, 2018). In the case of house price to household income, this ratio is assessed based on a purchasers ability to meet bank lenders requirements (IHBA, 2020). In turn, banks lenders requirements are tied to the Irish Central banks macro prudential lending policies and rules. As discussed in section 2.2.2.6.1 above, the macro prudential rules were introduced in 2015 to safeguard the financial stability of the Irish banking system and to act as a house price control mechanism in the housing market (McQuinn et al, 2021). Under the 2015 macro prudential lending rules, limits were set in relation to LTI ratios, whereby the amount of money an individual or couple could borrow was not permitted to exceed 3.5 times their combined gross income. The CBI claims that an important aspect of the macroprudential rules is that they act to deter house price growth over and above that of income growth (Donnery, 2021). In this way, the rules aspire to promote purchaser affordability over the longer term.

In relation to rent price to income ratios, there are a number of opinions as to what the rental affordability threshold level should be. According to SGS (2021), the internationally accepted threshold for rental affordability is reached when a low to medium income household spends more than 30% of their income on rent. Breen & Reidy (2021) consider that the affordability threshold is reached when 35% of a households income is spent on rent. On the other hand, Healy and McGoldrick Kelly (2018) argue that the threshold should not necessary be struck as a single cut off limit, because rent poverty affects households in different ways, depending on a number of factors, such as a households stage of life, and whether or not a household is one of high income earners and so on. For instance, a high income household may have an ability to sustain rent to income levels of 40% or more without undue cutbacks in other living costs. However, as the cost of housing is for most people the biggest single item in the household budget, then the share of net income that it consumes is important from a personal, social and macroeconomic perspective (Corrigan et al, 2019). Also, a key factor in a households choice of where to live will more often than not be based on affordability.

In a report prepared to evaluate the viability and affordability of new housing developments in the greater Dublin area, SCSI (2020), assessed the affordability status of a typical couple earning a combined salary of €88,000 based on the average market price of €375,500 for a typical 3 bedroom semi-detached house. By applying the 2015 central bank lending rules criteria for FTBs requiring a 10% deposit and a loan to income ratio of 3.5, they found an affordability shortfall of €29,950. The breakdown of this calculation is as set out in Table 2.12.

Table 2.12 Affordability Scenario in Greater Dublin Area Source: SCSI (2020)

1	Average price of 3 Bed Semi-detached house in Dublin	€375,500
2	Deposit Requirement @ 10% of price	-€37,550
3	Mortgage Borrowing limit of 3.5 times €88,000	- €308,000
4	Affordability Shortfall	-€29,950

The SCSI carried out a similar affordability assessment in 2016 using the same central bank FTB criterion. That assessment reported an affordability shortfall challenge of -€36,500. A comparison between the 2016 and 2020 assessments indicates a welcome improvement in the affordability shortfall, suggesting that house price growth has not out-run income growth. But even allowing for this improvement, it remains to be seen what effect if any it will have on housing supply. In a separate report by the SCSI (2021), which evaluated the viability and affordability of new apartment developments in the greater Dublin area, one of the conclusions were that the delivery of affordable apartments is even more challenging than delivering affordable houses. The report found that in order for a couple to purchase a standard 2 bedroom apartment in a medium rise development, they would be required to provide a deposit of around €57,000 and to demonstrate a combined salary of over €145,000. According to the report, only 14% of households in Ireland have a combined salary of over €100,000.

Data taken from the last four published Irish Census have shown a steady increase in the average age at which home ownership became the majority tenure categorisation, rising from age 27 in 2002, to 28 in 2006, to 32 in 2011 (Breen & Reidy, 2021) and to 35 in 2016 (CSO, 2016). Those statistics provide evidence to suggest that home ownership affordability challenges have undermined the capacity of young households to own their own homes and that while the macroprudential rules may well be achieving their primary objective, there are a sheaf of consequences effecting sections of Irish society and the economy. The CBI recently announced a loosening of the 2015 macro prudential lending rules, which will reset the LTI ratio limits from 3.5 to 4 times a households gross salary. The change is due to take effect from January 2023 (ICB, 2022). This move to ease the flow of mortgage credit by the CBI will clearly assist in bridging the affordability gap. However, it should be acknowledged that the new limits are still 10 to 12.5% below UK and average EU LTI limits respectively. Moreover, average Irish house prices have according to Daft.ie Q3 reports (2021) and (2022), increased by almost 20%, since the SCSI 2020 assessments were carried out, while income growth has remained in single digits.

The preceding analysis on house prices, development viability and purchaser affordability would suggest that if all other housing market issues such as planning, infrastructure and land supply constraints could be greatly improved upon and eventually stabilised, then it will still be necessary for house prices, viability and affordability to be brought into a state of harmonisation before the housing market can once again operate as a properly functioning production system. In this regard it would appear that house prices will increase if macro prudential limits are loosened, whereupon supply will respond. If house prices are allowed to increase, there may be scenarios where for instance, currently unviable borderline residential developments will become viable and make commercial sense. To complete the circle, purchaser affordability can also be better achieved if macroprudential rules are loosened and supplemented by government supports to purchasers. Insofar as development costs, house construction costs and building regulations costs are concerned, the path towards a properly functioning housing supply system, will be greatly assisted, if the somewhat less publicised issue of housing delivery costs are acknowledged by policy makers and focus placed on ways to ameliorate or counter the problem with greater government supports.

2.3 The housing crisis in Ireland

2.3.1 Background to the housing crisis

In the decade leading up to the 2008 financial crash, Ireland’s economy experienced a combination of continuous income growth, ease of access to mortgage credit and benign monetary conditions linked to weak financial regulation and to the country’s entry into the single European currency in 1999. The foregoing confluence of influences led to a substantial increase in demand and significant increase in supply of new housing, which also saw double digit house price increases between 2000 and 2007 (McCarthy & Quinn 2014). When the global financial crisis happened in 2008 and the Irish housing market crashed, the effect on the housing sector and the market generally could only be described as a crisis, particularly for those on the supply side of the market and for owners of property who were suddenly thrown into negative equity. A home or any property is considered to be in negative equity when the market value of the property falls below the outstanding mortgage amount that is secured on it (Lloyds Bank, 2022).

2.3.2 The arrears crisis

Fahy et al (2018) referred to the 2008 housing market crash in Ireland as the 'Arrears Crisis'. In a study to compare the composition of borrowers in mortgage arrears pre and post the financial crisis, Fahy found that sudden mass unemployment and geographic variations were key catalysts for households falling into arrears post 2008. Unable to sell their properties for anywhere near what they had paid for them, many homeowners and private investors with a need or purpose to dispose of their property were unable to do so, with a ripple effect which caused the housing market to stall (Waldron, 2016). It was in the face of the Arrears Crisis and simultaneous collapse in government finances that apart from the construction of one off rural dwellings, housing delivery practically stalled for the best part of a decade.

2.3.3 Emergence of the housing supply crisis

According to Nowlan (2016), there have been housing crises of one form or another in Ireland and particularly in Dublin, at least once in every 20 years, since 1880. Much of the current literature and industry discourse in general suggests that industry analysts began to recognise from around 2013 that a different type of housing crisis, based on undersupply was emerging in the aftermath of the arrears crisis. Despite this recognition, reaction was slow and somewhat ineffective. Unlike the arrears crisis, the emerging housing crisis in 2013 was driven by development viability issues and purchaser affordability constraints (Breen & Reidy, 2021).

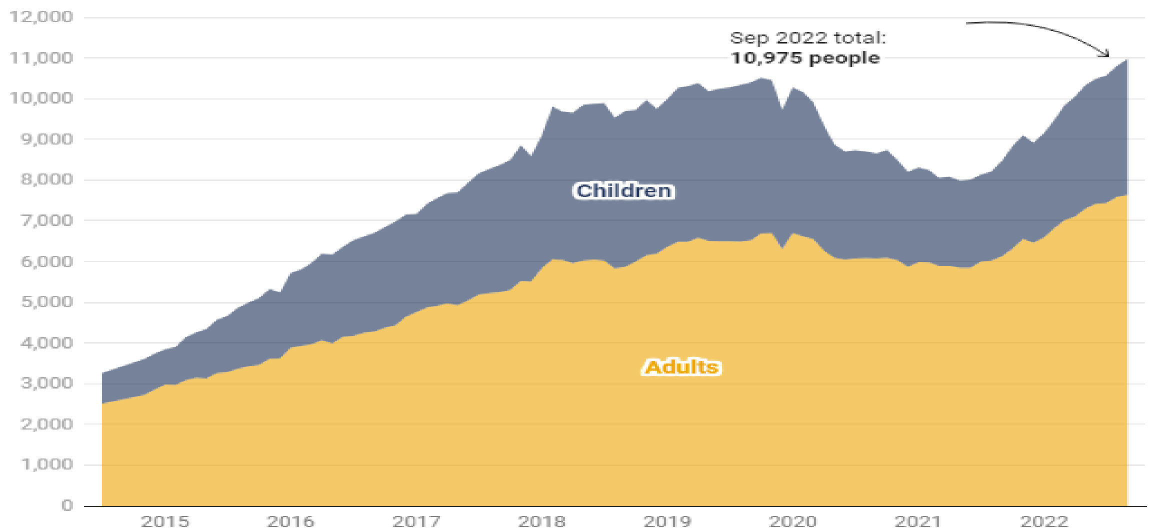
Insofar as the core issue of the current Irish housing crisis is a lack of supply, Breen & Reidy analysed that it brought to bear a number of serious issues for Irish society and the economy, including an increase in homelessness, household overcrowding and pressure on Ireland's international competitiveness. Rising house prices and rents were seen to have an effect on wage inflation and a lack of accommodation for key workers was also proving to be a distinct disincentive to inward investment. A healthy functioning society depends on having in place certain key fundamentals, one of which is the availability of adequate and affordable housing for citizens. Nowlan (2015) had previously warned of the impending issues now noted by

Breen & Reidy, and also highlighted the impact that a slowdown in the creation of personal wealth can have on the domestic economy vis a vis spending confidence. Nowlan also referred to inequalities in relation to peoples need for personal space as well as their concerns for shelter and the effect that being rent trapped or staying on as a late empty nester can have on the wellbeing of young people and host households in general.

2.3.4 Inadequate housing and homelessness

Based on data compiled by the Department of Housing and Focus Ireland, Figure 2.10 charts the growth of homelessness in Ireland from July 2014 to September 2022. As illustrated in the chart, the number of people experiencing homelessness in Ireland in September 2022, and currently living in emergency accommodation stood at just over 10,970 persons. This figure does not include rough sleepers, women in domestic violence refuge centres, or those availing of refugee and asylum provision. The figure includes approximately 3,300 children belonging to homeless households (McGreevey & Power, 2022). In a study paper on the impact of homelessness and inadequate housing on childrens health, Crushell & Shelley (2019) point to the fact that the published number of homeless children, only represents the situation on a particular date. They go on to explain that when some of those children eventually move into stable situations, they are generally replaced by other children whose households has become homeless. As a result, the total number of children who experience homelessness in any particular year is higher than the reported figures on any given date.

Figure 2.10 Homeless People in Emergency Accommodation 2014 to 2022 Source: Mooney (2022)



In a position paper on the impact of homelessness and inadequate housing on children, published by the Irish Faculties of Paediatrics and Public Health Medicine, Crushell & Shelley (2019) claim that homelessness and inadequate housing has been shown to cause difficulties for children in their relationships with parents, while also giving rise to higher than normal rates of emotional, mental health and behavioural problems. They also found that children subjected to homelessness and inadequate housing had lower levels of academic achievement. Disadvantaged children also tend to gain less access to development opportunities and experience poor nutrition and suffer from obesity. Article 27 of the UN Convention on the rights of the child (1989), which was ratified by Ireland in 1992, states that every child is entitled to a standard of living adequate to the child's physical, mental, spiritual moral and social development. Insofar as the Irish housing crisis is concerned, it is difficult for child welfare organisations and the public to accept the extent to which this undisputable right has not been delivered on.

2.3.5 Ramifications for social housing

Ongoing increases in the cost of housing delivery also has ramifications for the provision of social housing, which ultimately falls to the state. Capital spending and current expenditure in social housing supports to the Irish rental sector places great pressure on the capacity of the exchequer, by diverting scarce resources from other worthy spending areas (Breen & Reidy, 2021). High residential design standards and building regulations combine to increase the costs to be paid from the exchequer for the delivery of social housing.

2.3.6 The speed of housing delivery

NESC (2018) tells us that the housing market can be a risky and unstable business environment for developers. They also suggest that while the risk bearing capacity of some developers can change quite quickly, their raw materials and supply chain components, such as suitable land and the construction assembly business is very slow moving. In this regard supply cannot be guaranteed to meet the ambitious business plan models targeted by sustainable development companies or to expeditiously respond to housing demand or the needs of society (Nowlan, 2015). It was previously noted that new homes are durable goods which can take a considerable amount of time and effort to build (Kennedy & Myers, 2019) and that the delivery process is prone to delays especially if the wider systems supporting production are suppressed for any reason or length of time. Nowlan (2020) explains that even though it may take a little more than 12 months in construction time to build a residential development of approximately 30 units, that on average it takes developers in Ireland roughly 5 years from when they first identify a potential site to delivery of the first house on that site. When or if policy makers eventually identify the silver bullet that will fix Ireland's broken housing system, it will take a considerable amount of time for the current supply demand mismatch to reach an acceptable level.

2.4 Housing crises in other national jurisdictions

In a critical commentary on global urban housing, (Wetzstein, 2017) wrote of an emerging global crisis of housing affordability and urban housing supply. The commentary added that the global housing crisis was due to the fact that in most urban centres across the developed and developing world, accommodation related household expenses were rising faster than incomes and wage increases. In support of Wetzstein, a later analysis by Fields & Hodkinson (2018) on international housing policy failures, considered that rapid increases in housing costs relative to incomes had made housing unaffordable for urban dwellers, leading to rising levels of residential instability for low income households on a global scale. They also held that this was an enduring global crisis, consistent with capitalist imperative economics, leaving a trail of tenant displacement, evictions, homelessness and substandard conditions.

2.4.1 Housing affordability in a range of OCED Countries

Evidence has emerged that many developed countries around the world are currently experiencing national or regional housing shortages, as confirmed by studies emanating from established international organisations, such as the UN, OCED, IMF and the World Bank (Demographia, 2020). In their annual survey of 92 metropolitan markets in 8 OECD countries for housing affordability, Demographia (2022) reports that housing affordability is severely challenged in 52% and seriously challenged in a further 37% of the housing markets surveyed. Their report notes that housing supply and acute affordability challenges are most severe in international cities such as Hong Kong, Sydney, Vancouver and Auckland, where respectively, median house prices are 23, 15, 13 and 11 times the median household annual pre-tax income. Demographia considers that a rate of 3 times or less, house price : income is representative of affordable housing in any location. The affordability rate applied to Ireland in the report is 5.7. This rating is based on data collected for the Dublin region. Table 2.13 below sets out the affordability classification ratings established in the report and Table 2.14 sets out housing affordability ratings per nation studied.

Table 2.13 Housing Affordability Ratings **Source: Demographia**

Housing Affordability Rating	Median Multiple
Affordable	3.0 and under
Moderately Unaffordable	3.1 to 4.0
Seriously Unaffordable	4.1 to 5.0
Severely Unaffordable	5.1 and over

Table 2.14 Housing Affordability Ratings by Selected Nations **Source: Demographia**

Nation	Affordability 3.0 & under	Moderately Unaffordable	Seriously Unaffordable	Severely Unaffordable	Metropolitan Market Total	National Median
USA	1	9	19	27	56	**5.0**
UK	0	1	9	11	21	**5.1**
Ireland	0	0	0	1	1	**5.7**
Singapore	0	0	0	1	1	**5.8**
Canada	0	2	0	4	6	**6.0**
Australia	0	0	0	5	5	**8.0**
N. Zealand	0	0	0	1	1	**11.2**
H. Kong	0	0	0	1	1	**23.2**
Total	**1**	**12**	**28**	**51**	**92**	**5.2**

Perhaps, the key statistic in Table 2.14 is that the international average of house price / income rate is 5.2. This rate sits within the highest category of severely unaffordable. Another key stat is that only one of the metropolitan markets studied actually rated below the affordability threshold of 3.0. This strongly suggests that there is a critical housing affordability problem in developed economies or that Demographia has set the housing affordability threshold bar very high.

2.4.2 Housing affordability in the USA

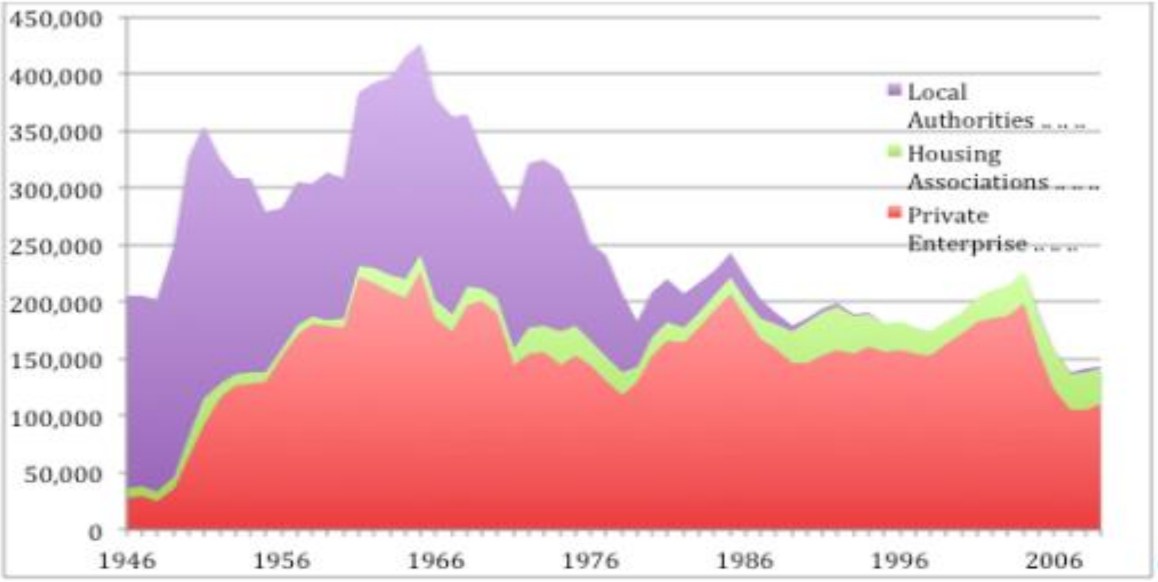
According to the Demographia report the single metropolitan area with an affordability threshold rating below 3.0 is the US city of Pittsburgh in Pennsylvania, where the house price / income ratio is 2.7. Table 2.14 also shows that of the 56 metropolitan areas analysed in the US, 27 or almost half of them have been rated as severely unaffordable. Of those 27 metropolitan areas, California has 4 of the 5 highest unaffordable markets relative to income, the worst of which is San Jose, where the median multiple is 12.6. The other Californian cities are San Francisco, Los Angeles and San Diego with ratings of 11.8, 10.7 and 10.1 respectively. Other severely unaffordable markets in the US are located in metropolitan areas such as Miami, Seattle, Denver, New York and Boston, ranging in ratings from 8.1 to 7.0. In their argument that land use restrictions and other policy-driven barriers are at the heart of severe unaffordability and housing supply issues in global cities, Lyons and Monert (2021) claim that new home numbers in New York are running at less than half the numbers that were built each year in the 1960s, despite population figures having increased by approximately one third since then. By comparison, in the rust belt city of Pittsburgh where the housing market is most affordable, population levels in the metropolitan area have fallen from a high of about 1.84 million in 1969 to just less than 1.70 million people in 2022 (Macrotrends, 2022a).

2.4.3 Housing affordability in the UK

Insofar as the UK is concerned, none of the metropolitan areas analysed in the Demographia report fell within the affordable threshold of 3.0 and only one was considered to fall within the category of moderately unaffordable. This was the city of Glasgow, which according to the report has a median multiple of 3.8. Unsurprisingly, the metropolitan area of London is considered the most unaffordable UK location with a median house price to household income multiple of 8.0. According to the UK national statistics office, in March 2021 the property price to average earnings ratio in London City itself was 40.0 and since then, house price growth has continued to outstrip wages (Elliot, 2022). Other metropolitan areas in the UK categorised in the severely unaffordable bracket are largely located in Southern regions, which include, Bournemouth & Dorsett, Bristol & Bath, Plymouth & Devon and Swindon & Wiltshire.

Focusing on the extreme housing affordability crisis gripping London, Edwards (2016) blames the situation there, as arising from the falling share of the social product that is wages and salaries vis a vis their proportion of the financialised high value asset of housing. Edwards also argues that in the previous four decades of neo-liberalist policies of monetarism, privatisation and financial de-regulation, when non-market housing were most needed to counter balance their effects, that social housing supply channels have actually eroded. Figure 2.11 below, illustrates the annual completion of dwellings by developer type in the UK between 1946 and 2012. There are two clear observations in this graphic illustration. The first one is that by the mid-2000s, housing delivery numbers in the UK were less than 50% of what they were in the mid-1960s. Housing output figures for 2020, published by the UK Office of National Statistics show no significant changes to this ratio (ONS, 2023). The second clear observation is that the proportion of LA built houses more or less ceased in the early 1990s. This particular observation provides a useful means to compare dwelling completions in Ireland for the same period, which also saw a significant winding down of LA house building.

Figure 2.11 Annual completion of dwellings by developer type in the UK between 1946 and 2012 Source: Edwards



Edwards stresses that in the UK generally, housing stock has grown much more slowly than market demand or population growth. This is particularly evident in England and especially so in Southern parts. As London's economic activity and population continues to grow, it does so out of synch with its housing capacity. Apart from the challenges this places on future economic growth for the city, it especially affects present and future low and middle income households depending on London for employment. This is because they will continue to be unable to afford to buy or rent homes within commuting distance of their place of employment. Edwards warns that on current trajectories, relationships between social housing, private rental tenancy and mortgage financed owner occupation in London may not be sustainable. Paradoxically referring to London as a wealth and poverty making machine, he suggests that a unified coalition or social movement for change may already be emerging. According to a report on the shortage of housing in England by Shelter & KPMG (2014) it is claimed that in recent years, the UK housing market has been delivering at least 100,000 fewer homes than is needed. Describing the housing sector as broken, the report emphasises that the non-market sector must be re-invigorated, as the current market led approach is not serving to house the population.

2.4.4 Housing affordability in the EU

Inchauste et al (2018) claims that housing is considered the most pressing economic, social and political issue in many EU countries and is most problematic in cities. One of their key arguments is that when construction costs increase, supply declines and when new construction does not keep up with demand in metropolitan areas, affordability suffers. Housing Europe (2019) warns that housing crises across Europe and elsewhere are a reality and very much at the heart of a growing social divide. Deficits in infrastructure investment, social housing and less than fully audited policy driven initiates have put restraints on housing supply and created barriers to affordability for middle income market participants. As a result, international house prices have steadying increased while housing output has fallen (Lyons and Monert, 2021). A lack of investment in non-market housing since the global financial crisis in 2008 has only made things more difficult (Euractiv, 2020). This was previously raised by Habitat (2015) in a European housing review article, which reported limited or in some cases a complete lack of new social housing in some EU states.

Habitat (2015) also raised worries about a deficit in house building generally vis a vis growing housing demand and severely unaffordable housing in EU cities, where house price to household income ratios in metropolitan areas such as Paris, Stockholm, Zagreb, Riga and Budapest range from between 10.0 to 20.6. According to Housing Europa (2019), the crisis in Europe is hardest felt in capital cities, such as Athens, Berlin, Copenhagen and Prague, where the ratio of income to the proportion spent on housing is highest, especially amongst the lowest earning percentiles, where the multiple is greater than 40%. Approaches to the measurement of housing affordability vary between housing research institutions, as for instance, according to McKinsey Global Institute (2014), a households housing costs affordability threshold is between 30 to 40% of gross income spent on housing, leaving 60 to 70% of income to spend on food, education, healthcare and other expenses. According to the OECD (2019), Eurostat rates households spending over 40% of income on housing as existing above the ‘overburden rate’. In the US, the Department of Housing and Urban Development (HUD) consider the overburden rate threshold to be reached if a household spends in excess of 30% of income on housing (Habitat, 2022).

2.4.5 Housing affordability in Canada, Australia, New Zealand and Hong Kong

Table 2.14 identifies that 4 of the 6 Canadian metropolitan markets analysed for affordability in the Demographia report are considered severely unaffordable. Of these, Vancouver was rated as the least affordable with a 13.3 median multiple rating. This rating is the third highest of the entire 92 global markets reviewed. Vancouver is closely followed by Toronto where the rating ratio stands at 10.5. The other 2 metropolitan areas with severely unaffordable ratings were Montreal and Ottawa at 6.1 and 5.4 respectively. According to Andrle et al (2019), recent policies pursued by the Canadian government to improve affordability, such as the relaxation of macro-prudential borrowing limits have only served to increase house prices and thereby increase the proportion of income spent by households on housing.

All 5 metropolitan housing markets in Australia, and the Auckland housing market in New Zealand are categorised by Demographia as severely unaffordable and are positioned in the top 25% of least affordable cities. Sydney, which has a house price to household income ratio of 15.3, is the second most unaffordable metropolitan area on the globe, closely followed by Melbourne where the ratio is 12.1. Adelaide, Brisbane and Perth have median multiples of 7.1 to 8.0. Auckland in New Zealand, which can be considered reasonably comparable with Dublin in Ireland in terms of population and various economic and political characteristics, has a median multiple of 11.2, which suggests that housing is almost twice as unaffordable as Dublin. The Demographia report considers that the most unaffordable metropolitan area worldwide is Hong Kong.

2.4.6 Housing affordability in the developing world

According to the OECD (2005), there is no established convention for the designation of developed and developing countries in the United Nations system. For the purposes of this part of the discussion, developing countries can generally be taken as relating to those nations that don’t participate with or form part of the list of 38 OECD countries. Quite apart from economic perspectives, housing affordability, especially in developing countries also means physical adequateness and fitness for human habitation. Habitat (2022) estimates that between 40% to 75% of the populations of cities in the developing world are housed in grossly substandard housing settlements with very basic services. They also suggest that almost 900 million people worldwide live under these conditions and worse. Almost 60% of urban populations in Sub-Saharan Africa are estimated to live in slum conditions. This percentage is estimated to be around 30% in Asian cities and slightly below that in Latin American and Caribbean countries.

Referring to the region most populated by developing countries as the global south, Florida & Schneider (2018) tell us that the most unaffordable cities in the world as far as their inhabitants are concerned, are cities such as Hanoi, Mumbai, Buenos Aires, Rio de Janeiro and Caracas. In these cities it is estimated that housing costs can exceed 200% and 300% of average national incomes. Unaffordability can also manifest in developing countries through a phenomena referred to as urbanisation without economic growth. This occurs when people continually migrate from villages and rural areas into under industrialised urban areas in search of a better life (Habitat, 2022).

2.4.7 An international housing affordability crisis

Fields & Hodkinson argue that rather than representing a watershed point for neoliberal policies, the post 2008 financial crisis era has in fact witnessed a global intensification of neoliberalism, embracing global financial landlords amongst other housing financialisation policies. This argument is supported by Mari (2020), who claims that institutional landlords did not exist in the single-family rental market in the USA until after the ‘Great Recession’. Apart from contributing to confirming the existence of a global housing crisis, it could be argued that opinions such as those expressed in Fields & Hodkinson have been subject to counter viewpoints, as for instance expressed by MacDonald (2021) in section 2.2.2.8 above, who explains that by supplying rental accommodation in the middle to upper ends of housing markets, PRS providers aid overall housing supply in an undersupplied market by freeing up accommodation in the lower end of housing markets. In a more recent discussion, which considers whether Wall Street real estate investors are responsible for the US housing crisis, Bokat-Lindell (2022) argues that institutional investors simply don’t have the market power to be driving an unaffordable housing market. To support this argument Bokat-Lindell explains that according to industry analysts, institutional investors owned only 3% of US single family rentals as of 2021. This represents less than half of 1% of the total number of 84 million single family homes in the US.

Casselman & Daugherty (2019) write of a confluence of factors influencing the shortage of housing in US metropolitan areas, citing restrictive zoning, rising construction costs, shifting consumer preferences and an exploding investor interest amongst others, that have led to a scarcity in supply. Estimates from Freddie Mac for 2022 show a deficit of 3.8 million housing units up from 2.5 million in 2018, which according to Bokat-Lindell (2022) is down to the sluggish pace of housing delivery arising from a lack of public investment, restrictive zoning and land use laws and opposition to reforming those laws by Nimbyist enthusiasts. In the midst of global concerns of growing inflation in 2022 and international central banks efforts to rein it back by raising interest rates, housing construction will be further impacted upon, which will increase the gap between supply and long term demand, making housing even more unaffordable.

Following the Covid 19 crisis and current worldwide geopolitical tensions and energy constraints brought about by the war in Europe, global inflation rates have reached levels not seen in the last 40 years (Santander, 2022). In September 2022, the UK annual inflation rate stood at 10.1% (Trading Economics, 2022). Rates across the EU averaged 9.9% for the same period (Eurostat, 2022a) and stood at 8.2% in the US (Statista, 2022a). Central banks around the world are responding to the inflation phenomenon by tightening monetary policies and increasing interest rates. Marked interest rate increases are likely to affect international house prices, which some economists are predicting will fall if not stabilise across OECD countries in the short to medium term, resulting in a cooling off of housing market activity (Romei 2022). The combined effects of inflation and rising interest rates will also contribute to a further erosion of real incomes, which in turn will put pressure on house delivery viability and thereby impacting on builder sentiment. Overall, the combined effects of the energy crisis, inflation and higher interest rates is expected to give rise to contractions in worldwide economic growth, rises in unemployment rates and recession. Elliot (2022) suggests that a toxic mix for house prices and supply is rising interest rates, collapsing economic growth and rising levels of unemployment. On that note, global housing shortages look set to continue into the future.

In a study on the prevalence of housing crises globally, Coupe (2020) suggests that if housing affordability is central to the problem, then global solutions and the transfer of successful housing polices from one country or region to another should be seriously considered. Wetzstein (2017) calls for the identification and replication of best practice patterns associated with countries who are most successful at managing their housing markets. To achieve this, he suggests, for instance, the spreading of models such as the Vienna housing model and German tenancy laws. In Ireland, academic researchers such as Stephens (2017) and Breen & Reidy (2021) have also suggested future direction paths to policy makers on rental model systems based on observations made in other jurisdictions, such as Viennia.

Those particular suggestions are discussed in section 2.2.2.12 above, where it is noted that policies in other EU states clearly identify the benefits of the cost rental based 'Unitary' rental system as a future policy approach to overcome pro-cyclicality and affordability issues in social housing. It seems that Ireland is not an international outlier when it comes to having to deal with a housing supply crisis and it is possible therefore that observations on experiences, solutions and policies implemented in other countries may prove transferable or useful in parts.

2.4.8 Comparing international construction costs

International construction cost comparisons are published by a number of multinational based construction services consultancies, including Turner & Townsend (2022), Arcadis (2021) and CBRE (2020). Recent research by the CBI and Davys Stockbrokers to compare Irish residential construction costs with those in international markets, have used the Turner & Townsend (TT) database. This data covering 88 property markets worldwide, is compiled by TT regional cost consultant teams around the globe. The listing of locations covered include markets in Ireland, the UK, Europe, North America and Asia, as well as Australia and New Zealand. To establish listings on the most expensive places to build, the report adopts a straight line USD conversion as a primary means of comparison based on four different building types. The building types are commercial offices, large shopping centres, large warehouses and medium sized townhouses. According to the TT 2022 report, it is believed that most markets have recovered from the initial impact of Covid19, but that global economies and construction markets are now feeling the effects of the war in Europe, which has increased energy costs, fuelled inflation and led to higher interest rates. Table 2.15 below lists the 15 most expensive construction markets worldwide in 2021, according to TT.

Table 2.15 Top 15 most expensive World markets to build in 2021 Source: Turner & Townsend

	Market	USD $/Square metre	Index
1	San Francisco	$4,728	100.0
2	Tokyo	$4,665	98.7
3	Osaka	$4,558	96.4
4	New York City	$4,517	95.5
5	Geneva	$4,332	91.6
6	Zurich	$4,286	90.7
7	Hong Kong	$4,237	89.6
8	Boston	$3,998	84.6
9	Los Angeles	$3,982	84.2
10	London	$3,910	82.7
11	Nashville	$3,728	78.8
12	Seattle	$3,691	78.1
13	Atlanta	$3,602	76.2
14	Chicago	$3,586	75.8
15	Dublin	$3,488	73.8

Table 2.15 shows that San Francisco was the most expensive place in the world to build in, where construction costs per square metre averaged USD $4,728. Tokyo was the next most expensive place, followed by Osaka and New York, where construction costs per square metre averaged $4,665, $4,558 and $4,517 respectively. Ranking as the 5th and 6th most expensive markets, Geneva and Zurich were the most expensive European cities to build in. The next most expensive European locations were London and Dublin ranked 10th and 15th overall, where average construction costs were $3,910 and $3,488 respectively. Of the top 15 most expensive markets, 8 were based in the USA, 4 in Europe and 3 in Asia. There was almost a 30% difference in construction costs between Dublin and San Francisco. The most expensive place to build, not located within the USA, Europe or Asia, was Vancouver in Canada which was ranked as the 18th most expensive market, with construction costs averaging $3,236 per square metre. Auckland is the most expensive location in Oceania and is ranked as the 27th most expensive location. Average construction costs in Auckland are estimated to be $2,959 per square metre. Dublin is ranked the 15th most expensive of 88 markets across the globe and 4th in Europe. This would suggest that by international comparisons, Ireland’s capital city is an expensive place to build. Table 2.16 below lists and compares the most expensive European cities in which to build. Apart from London, which is ranked as the third most expensive European city in which to build, the only other UK cities included on the list are Edinburgh and Manchester. Cities such as Berlin and Paris are conspicuous by their absence from the list.

Table 2.16 Top 12 most expensive European markets to build in 2021 Source: Turner & Townsend

	Market	USD $/Square metre	Index
1	Geneva	$4,332	100.0
2	Zurich	$4,286	98.9
3	London	$3,910	90.3
4	Dublin	$3,488	80.5
5	Munich	$3,220	74.3
6	Vienna	$3,175	73.3
7	Stockholm	$3,152	72.8
8	Amsterdam	$3,096	71.5
9	Edinburgh	$3,016	69.6
10	Frankfurt	$2,988	69.0
11	Manchester	$2,956	68.2
12	Brussels	$2,940	67.9

Excluded from the 2022 TT report, but contained in their 2021 report, are cost per square metre comparisons for the construction of medium standard Townhouses in major international cities. Table 2.17 below outlines cost comparisons in descending order, for this residential building type, as gathered from various parts of the 2021 report. Major EU cities such as Paris, Amsterdam and Munich are included in this comparison.

Table 2.17 International Construction Cost Comparisons - Medium Standard Townhouse in 2021 Source: Turner & Townsend

	Market	USD $/Square metre	Index
1	London	$4,200	100.0
2	San Francisco	€2,870	68.3
3	Dublin	$2,416	57.5
4	Glasgow	$2,341	55.7
5	Birmingham	$2,273	54.1
6	Manchester	$2,251	53.6
7	New York City	$2,248	53.5
8	Leeds	$2,203	52.5
9	Vancouver	$1,995	47.5
10	Auckland	$1,884	44.9
11	Munich	$1,853	44.1
12	Amsterdam	$1,786	42.5
13	Chicago	$1,760	41.9
14	Sydney	$1,715	40.8
15	Paris	$1,633	38.8

According to the data in Table 2.17 the construction costs to build a medium standard Townhouse in London is over twice as high as the mean average of all the other markets reviewed. In San Francisco, which according to TT is the most expensive construction market on the planet, the cost to construct a Townhouse is more than 30% less than it is in London. While Table 2.17 suggests that it is almost 40% cheaper to build a townhouse in Dublin than it is in London, the average costs in Dublin are more expensive than any other European or UK city and are even higher than in New York city. The TT reports also compare labour and material costs across countries. According to an analysis of Turner & Townsend (2021) by MacCoille (2021), Ireland's labour and material costs are close to European averages and marginally higher than international norms. This raises the question of why is it that Ireland's residential construction costs are much higher than European and International averages.

Research carried out by IHA (2018) also compared average construction costs on residential developments across five central European countries. Ireland, the UK, France, Germany and the Netherlands were chosen for the comparison and the reasons for this selection were threefold. The first was because all five countries have broadly the same climatic conditions, hence, they generally employ similar building methodologies. The second and third reasons were because of their comparable GNP per capita and labour costs. Similar to the Turner & Townsend data, the IHA comparisons do not include soft development costs such as site costs, LA and professional fees, finance costs and taxes etc. The findings are illustrated in Table 2.18 below.

Table 2.18 Comparison Index for International Residential Construction Costs Source: IHA

Country	Residential Cost Index
UK	101.0
Ireland	**100.0**
France	98.7
Germany	97.1
Netherlands	82.0

IHA found that construction costs in the UK, Ireland, France and Germany were generally comparable, with a less than 4% spread across all 4 countries. They also noted a significant difference, over 15% between the average construction costs and the costs established for the Netherlands. The study cautioned that it was difficult to gather similar and true comparisons between countries and that this was due to the mixed variety of approaches to residential development taken in each country. For instance, in the Netherlands and in Germany, interventions for the purposes of controlling development by local government can result in the provision of site infrastructure such as roads and utilities on sites before they are taken over by a developer. This is common on not-for-profit projects, and it is also not unusual for site development costs to be built into site acquisition costs. The report also opined that Ireland's cost index was closer to the UKs than the other three countries because Ireland has a smaller construction sector than its closest neighbour and trading partner to whom it cannot avoid the influence of.

The methodology adopted by the IHA to gather and compare data relied on 3 sources. These consisted of, published indices, CEEC sourced market based data and CEEC office cost data. The CEEC (Conseil European des Economistes de la Construction) is a body representing construction economists from various European countries. Insights provided by the IHA study may assist to inform observations gathered from the Turner & Townsend data. For instance, does the mixed approaches to development in countries such as the Netherlands and Germany help to explain why the cost to build Townhouses in Munich, Amsterdam and Paris are reported to be so much lower than they are in Dublin or the UK cities noted in Table 2.17 above. At the same time, it is notable that the IHA study professes to relying on labour and material cost indices as a source for determining market costs. It was established in section 2.5.5.2.4 above that in isolation, indices may not be a reliable gauge for determining construction costs.

2.4.9 Comparing housing provision structures

According to ECB (2003), national housing provision structures have a major influence on government monetary policies, economic activity, consumer prices and in particular house prices and rents. Key to the systemic influence that housing market structures bring to bear on an economy is the degree to which housing related expenditure can impact on domestic spending levels in the wider economy. Also important is the role that housing assets play in determining the wealth of individual citizens and the private sector. In a cross country comparison of EU housing sector data, ECB determined that differences in the nature of housing market structures can be established by analysing housing tenure distributions and ratios of residential investment to GDP and mortgage debt to GDP. The housing system within which a housing structure operates also plays a key role into how well the structure operates and may also give an indication of why and how that housing structure may or may not change over time. Modern housing systems are predominately organised around housing markets, with varying levels of state provision and subsidisation (Kenna, 2010). Key features of housing systems include the degree to which property rights are protected or restricted, credit supply, financialisation, infrastructure investment and housing regulations.

In the aftermath of the global financial crisis, Van Der Heijden et al (2010) wrote that the varying impacts that the crisis had on different countries was explainable by the differences in each country's housing provision structure. In Van Der Heijden's analysis of relationships between housing crisis outcomes and housing structures, a distinction is made between what they refer to as Dynamic and Static housing structures. This distinction is influenced by previous categorisations in Ball et al (1988) and Martens (1990), who distinguished housing provision structures as having either Unified or Fragmented characteristics. A Unified system bases itself on a housing supply model where the market for new housing construction is primarily dictated on the number of conveyancing transactions for existing dwellings and a Fragmented system is one based on markets dominated by first time buyers and consisting of various submarkets and regions. In a Dynamic housing structure, new stock largely comes from speculative house building, in a market exhibiting high rates of household mobility and turnover in the existing stock. This results in a large volume of owner-occupier transactions relative to the number of homeowners. The high level of household mobility that characterises this system is essential to the functioning of the market and the demand for new dwellings. In Static structures there is more self-build housing, less speculative development and lower levels of household mobility. According to Van Der Heijden, increases in demand in Static housing structures are frequently deflected in adaptations of existing dwellings instead of by moves to new dwellings. In a Static structure, house prices are more likely to be linked to factors such as land and building costs, as opposed to in Dynamic structures, where house price increases can be a function of several other market demand factors, such as credit cycles, demographics, disposable income levels and location (Murphy, 2018).

In Van Der Heijden (2013), comparisons between housing structures in 5 Western European countries identified Germany and Belgium as demonstrating Static housing structures, while the Netherlands, the UK and Ireland were categorised as Dynamic. The study shows that the housing markets in all 5 countries were affected by the global financial crisis, but that the effects were greatest in Ireland, followed by the UK and then the Netherlands. The country whose housing market was least affected by the crisis was Belgium, where house prices and the owner occupier segment of the housing market remained relatively stable. The German owner occupier market also stood up to the headwinds of the crisis, despite existent pressures in the market due to demographic changes. Germany's was also the least active of the 5 governments insofar as implementing measures aimed at protecting the housing market. By contrast, Ireland followed by the UK had the highest level of government interventions.

Van Der Heijden (2013) argues that the high level of measures implemented by Ireland post the 2008 crisis, reflects the Dynamic structure of the Irish housing market, where at the time, proportionately Ireland's rental sector was smaller and its owner occupation segment was bigger than the other countries under review. The study also showed that the number of conveyancing transactions per 1000 owner occupiers in the period between 2000 and 2007 were highest in the UK, followed by Ireland, the Netherlands, Belgium and then Germany. Interestingly, the number of transactions in Germany were less than 40% of the number carried out in the UK. Wetzstein (2021) tells us that home ownership rates in the capital city of Berlin are estimated to be around 15%, which would help explain why transactions there are so low. Van Der Heijden (2013) also suggests that the proportion of self-build homes in a market is another important distinguishing feature of Dynamic and Static housing structures. In this area, his analysis shows that in both Belgium and Germany the percentages for self-build housing as a proportion of total production is comfortably above 50%, whereas in Ireland the proportion is around 25%, and even less in the Netherlands and the UK. In a qualitative based study on post financial crisis interventions on housing markets in 5 international cities, Wetzstein (2021) suggests that the housing market systems in Berlin and Vienna operate within Static structures and that the markets in Sydney and Auckland function in Dynamic structures. Wetzstein also reviews the housing market in the city state of Singapore, which he describes as globally unique. A public-private housing model in Singapore sees the state prominently involved in housing development, where citizens are encouraged to purchase and resell subsidised homes.

Norris & Byrne (2017) and Breen & Reidy (2021) also approach housing market system comparisons by considering how some countries successfully manage to overcome pro-cyclicality in order to sustain a relatively constant supply of new housing, but particularly social housing. They found that countries exhibiting resilience to fluctuations in economic growth, whereby a steady stream of public housing supply was seen to continue irrespective of the economic cycle, followed financing approaches that were dissimilar to Ireland. Norris & Byrne identify Austria in particular, as a country where the housing market is least reactive to economic cycles, which they credit to an embedded cost rental system and Unitary structures. In Vienna homeownership rates are estimated to be less than 20% and the city is unofficially dubbed as the capital of social housing (Wetzstein, 2021). The Unitary system is discussed in section 2.2.2.13, wherein social housing market systems are defined by Kemeny (1995) as either Dualistic or Unitary supply structures.

The key distinction between the two systems is that the Dualist structure is based on the public and private housing supply models working completely independent of each other with no market competition between the two, while the Unitary structure is based on a system where the two supply models are closer integrated and to some extent ,competing against each other. Norris & Byrnes descriptions of the Dualistic system largely reflect elements of Ireland's rental market, while the Unitary system is characteristic of the market in Austria and other EU countries whose housing markets were least affected by the global financial crisis. Norris & Byrne claim that Dualist structures operate in English speaking countries such as the USA, the UK, Canada, Australia, New Zealand and Ireland. In contract, the Unitary system operates in mainly EU countries such as Germany, France, the Netherlands, Austria, Sweden, Denmark and Switzerland.

According to Golland (1998), much of the research in housing structures and systems in the EU and broader afield have focussed on the extent to which systems are converging and hence bringing about similar results or outcomes. More recently however, the literature appears to suggest that housing systems are so embedded by cultural norms or historically institutional structures that convergence or harmonisation is not that easily foreseeable. This reality will continue to present challenges for housing market researchers and particularly those concerned with comparing findings across international jurisdictions.

2.4.10 The rights of individuals to adequate housing

According to the United Nations Commissioner for Human Rights, every individual has the right to an adequate standard of living, including adequate housing. This right was recognised in the 1948 Universal Declaration on Human Rights and in the 1966 International Covenant on Economic, Social and Cultural Rights (UNHABITAT, 2014). Subsequent human rights treaties have further recognised or referred to other elements of this right to housing, including the right to security and privacy of one's home. UNHABIT asserts that this right to adequate housing is relevant to citizens of every country, because each one has ratified at least one international treaty declaring and committing themselves to some element of the right. Despite the centrality of this right in our global legal system, there is estimated to be well over one billion people living in inadequate conditions.

Randell & Kelleher (2017) tells us that the right to housing is enshrined in state laws and constitutions in over 80 states worldwide. In Europe this includes countries such as France, Germany, Holland, Belgium, Sweden and Spain. Elsewhere, countries such as Brazil, India and South Africa all recognise a socio economic right to housing, but due to limited resources can be seen as failing to realise their written aspirations (Maxwell, 2019). According to Kenna (2010), countries such as Scotland have legislated to enforce housing rights. This is contained in the Housing (Scotland) Act 1987, which provides a right to temporary and permanent accommodation to homeless persons. This right is enforceable in appropriate circumstances by the civil courts. Similar enforceable rights are contained in France under the Enforceable Right to Housing Act 2007. Elsewhere in the UK, debates on the rights to adequate housing are not new and a renewed emphasis has emerged following the 2017 Grenfell Tower fire disaster (Maxwell, op cit).

There is no express legislation or article in the Irish Constitution enshrining the right to housing for Irish citizens, despite loud calls for its incorporation. The only basis to protecting a person's rights in relation to housing, arises out of infringements with other constitutional rights and it has been long argued in many parts of Irish society that a right to housing should be put in place, which would provide a level of basic protection to citizens that recognises a home as a place of security, shelter and central to the dignity of every person (MLRC, 2022). There is no doubting that a tension exists between the principles of a right to housing and a state's ability to deliver.

2.5 Building regulations in history

2.5.1 Classical Era: 600BC - 475AD

The ancient Code of Hammurabi is considered to be the oldest known legal code in human history (Urch, 1929. pp.437). It is a collection of 282 principles and rules setting out standards, fines and punishments to be exercised in commercial and social transactions, as proclaimed by Hammurabi, who reigned as the king of Babylon from 1792 to 1750 B.C. The code was inscribed onto a finger shaped diorite stone pillar. It was lost for centuries but rediscovered during an archaeological excavation in Persia in 1901 (Britannica, 2018). Rule 233 refers to structural stability in a wall and provides that a builder shall insure that it is so. Rules 229 to 233 establish the concept of civil damages for defective building work (Smyth, Currie & Hancock, 2012).

In ancient Rome, apart from the Twelve Tablets, produced by the Decemvirs, a 10 man committee established in 451 A.D to document centuries old customary laws, there were practically no written laws in the empire up to the coming into power of the Byzantine Emperor Justinian in 527 A.D (Genest, 1924). Faced with the challenge of maintaining control and unity within the empire, Justinian sought to create a system of codified laws and reorganised administrative systems so that citizens could gain access to justice (Hussey, 2022). Appointing a commission to execute this work, Justinian developed a corpus of laws known collectively as the Corpus Juris Civilis, consisting of four parts, the second of which was Codex Justinianus, also known as Book 2 of the Institutes of Justinian. According to Genest, it is in Book 2, where the first references to rules on building works can be found.

Notwithstanding the first records of codified building rules, it is recorded that in the aftermath of the great fire of Rome in AD 64, that rebuilding works were carried out within the confines of a number of authoritative precautionary orders. These orders included requirements for wider streets, open spaces between buildings, eliminating party walls, stone porticoes, height restrictions and controls on where timber may be used (Klitzke, 1959, pp.175). The resulting high reconstruction costs are cited as one of the collective of issues that led to the subsequent decline and fall of the Emperor Nero in AD 68 (History.com, 2019).

According to Klitzke (1959), Constantinople experienced a number of devastating earthquakes and fires between 396 and 487AD. After these events, the city's citizens went about rebuilding their properties and public buildings, but with more attention to the consequences of fire. This attention would eventually relax and another fire would start. It was significant then that following a very major fire event in the city in 469, Emperor Leo 1, followed by Emperor Zeno promulgated a number of decrees requiring buildings to be built with closer emphasis on controlling the spread of fire. Klitzke states that the Justinianus codifiers were strongly influenced by the purpose and substance of Zeno's decrees, leaving many of them intact and only adding interpretations.

2.5.2 Middle Ages: 476 – 1450

Myers (2019) tells us that Henry FitzElwyne's Assize of Buildings in 1189 is the earliest extant regulation in Britain to concern buildings. FitzElwyne was the first mayor of London and he served for 24 years. The Assize of 1189 was mainly concerned with the construction of party walls, rainwater nuisance and rights of light. It also contained a process for resolving neighbour disputes during construction works. Following the great fire of Southwark in 1212, which reportedly killed upwards of 3,000 people while also destroying most of the borough and London Bridge (Jones, 2013) and (Tinniswood, 2016), the mayor issued ordinances banning thatched roofs and obliging citizens to re-roof their properties using solid tiles or lead. According to Myers, other towns eventually followed suit by adopting comparable building controls. He notes that Salisbury prohibited thatched roofs in 1431 and Worcester published ordinances in 1467 banning thatch and timber chimneys within the town walls.

Tragbar (2006) tells us that in Italy, similar concerns surrounding the spread of fire from timber roofs and chimneys saw statutes, in towns like Lucca in Tuscany, where in 1342 it was ordered that chimneys should be built with bricks, extending at least 1.20 metres above roof level or 3.6 metres, if the rest of the house was built in timber. Tragbar also notes that around this time, Statute II 35 ordinanced that properties in Genoa and Liguria with thatched roofs were to have them replaced with tiled roofs. Following the great fire of Venice in 1105, which destroyed or badly damaged vast areas of the city, including up to 23 church buildings, the city authorities banned straw roofs. Due to weak enforcement and a continued reliance on timber structures bearing on wooden piles rising from the canal waters, future disasters such as the Rialto Fire of 1514 and the Arsenale Fire of 1569 would eventually see administrative directions applied on the use of brick and stone in chimney structures and restrictions on the permitted location of certain industries such as glass making and olive stores (Howard, 1991). Today, there are approximately 100 glass foundries based on the island of Murano in the Venetian Lagoon (Pitrelli, 2022). This concentration of glass furnaces on an island close to but separate to the more heavily populated island containing the areas of Rivo Alto and Dorsoduro can be considered to be a direct thread to those centuries old directions.

2.5.3 Early Modern: 1450 - 1750

According to Garrioch (2019), the great fire of London in 1666 followed a period of unusually hot weather which limited the supply of water and had the effect of drying out the many wooden buildings destroyed. Porter (1998) tells us that this enormous devastation was also due to the congested nature of buildings in the city and their extensive use of combustible materials. The fire destroyed over 70% of the city and led to Charles II issuing a proclamation that rebuilding works would be carried out in stone or brick and that streets would be laid out wide enough to prevent the spread of flames from one side to the other. This was followed by commissions to Christopher Wren and others to draft building regulations that would become known as the London Building Act 1667 (Bromley, 2022). This Act extended the scope of controls beyond fire precautions by covering areas such as foundations, load-bearing walls, beam bearings, joists centres, party walls, roof coverings and rainwater systems. It was also said to be the first act to provide for building inspectors to enforce the regulations (Thomas, 1940) .

Following the 1667 Act, new requirements were introduced over time and this also led to similar local building codes developing in different towns throughout Britain, based on the London Act (Bromley, 2022). Unfortunately, however, these local measures did not have the desired levels of success or endurance, mainly due to a lack of enforcement (Ley, 2006). In 1694 after a major fire destroyed the town of Warwick, a new act of parliament established further rules and regulations on architecture and street planning. Referred to as the Fire Act 1694, it required that streets should have minimum widths and did away with jetted facades and the concept of overhanging floors. It also stipulated on matters such as storey heights (Farr, 1992).

2.5.4 Modern: 1750 – 2000s

Building Acts that closely followed the provisions contained in the London Act were also introduced in the busy port town of Bristol in 1778 and 1840 (Ley, 2006). Driven largely by public health concerns, Building Acts were passed in 1825 and 1842 for the port city of Liverpool, which experienced population growth in excess of 100% between 1800 and 1850, mainly due to immigration from Ireland. In the 1851 census, it was recorded that almost 25% of the city’s population of 375,955 were born in Ireland (Belchem, 2007). Up to this time, the main areas of concern for building regulations were protection against fire and structural stability, but with growing populations and quickly expanding towns, it was beginning to be realised that government had to devise ways to restrict the spread of disease caused by congested residential areas and tenements with very poor sanitation, conditions and infrastructure (Errazurez, 1946).

In 1832 a cholera epidemic spread rapidly throughout Britain and Ireland (Keane, 2003). While mainly affecting the lower classes, the disease was altogether indiscriminate, spreading mainly through towns to people of all classes and professions. It was initially thought that Cholera was spread through air borne contact, but it eventually came to be understood that it was a disease mostly transmitted through poor sanitation conditions, infected water and food (Rosenberg, 1959). Based on a report by a Doctor Southwood-Smith, which considered that the spread of the disease could be greatly decreased by the implementation of sanitary measures framed by building regulations, a select committee of parliament proposed that a bill based on the London and Bristol Building Acts be placed before parliament in 1841 (Ley, 2006). Resisted by local authorities who saw it as unwelcomed political interference and a way to limit their right to function as a controller of local building and related expenditure, the bill failed to make law.

Local control of building works was further strengthened with the Local Government Act 1858, which gave local authorities the power to adopt their own byelaws without central interference, apart from the issuing of model byelaws for the first time ever, under this Act. Ley (2007) suggests that the 1858 Act effectively left building standards under the control of local byelaws for the next 125 years. Notwithstanding, the Public Health Act 1875, which apart from being a milestone in the development of Victorian public health legislation (Hamlin & Sidley, 1998), introduced major nationwide legislation to deal with bye-laws and wide aspects of building (Ashby, 1903). This Act was followed two years later by the issuing of new model byelaws, which according to Booth (2010) were adopted by some rural authorities and most urban ones. The 1877 model byelaws were the first to require the submission of plans and other drawings to local authorities. They also required builders to give notice of when the works were due to commence. An amendment of the Act in 1890, brought about further building measures aimed at improving public health provisions. These included requirements concerned with refuse removal, paving yards, heights of habitable rooms and flushing toilets. In Britain, further Public Health Acts in 1936 and 1961 contained additional provisions in relation to buildings, sanitation and drainage (RICS, 2022).

Troy (2004) tells us that in the formative years of the British colony of New South Wales in Australia, the earliest governors, commencing in 1788, imported regulations from England, which despite obvious climatic and cultural differences etc. were transposed largely unamended. By this action, Troy draws a conclusion that those regulations were introduced largely as symbolic acts, aimed to deliver a message to new inhabitants that government was looking out for their interest. He also tells us that, it was not until the introduction of the Building Act of 1837, that targeted rules were introduced in the regulation of new buildings concerning the prevention of fire. This act also made provision for structural considerations in building works and along with concerns to do with the flammability characteristics of materials, it focussed on matters to do with spread of flame and spacing between buildings.

Continuing a common theme in the history of building regulations, Troy (2004) further notes that from the earliest days of government in New South Wales, urban development regulations have been largely introduced in episodic progressions, reacting to catastrophic events that had resulted in the loss of life, followed by public anger and calls by civic leaders for action.

Even though, building control standards in Ireland were based on the same legislative provisions pertaining in the UK, for most of the modern period, between 1750 - 2000, it appears that living conditions and housing standards in Ireland's cities were quite a distance behind Britain in that time. This was most likely due to the differential in wealth per capita between the two islands and because of the way in which legislation, such as the 1858 Local Government Act, left building standards under the control of under-funded local administrators (Ley, 2007). Following the Act of Union in 1801 and the abolition of the Irish parliament, Ireland became part of the United Kingdom of Great Britain. According to Prunty (2001), it can be fairly stated that this event was a critical juncture in the progression of the social and environment fabric of Ireland, but especially for Dublin city. Prunty's argument is that prior to this event, Dublin was a capital city which enjoyed all the economic and dynamic trappings of that status. It was also home to the Irish parliament and a contented resident aristocracy. Under these favourable conditions, the city had developed in accordance with the best principles of European design. Boosting a grandeur of fine squares, malls, wide streets and classical public buildings, Dublin was placed among the finest European cities, but with the stroke of a pen by King George III in 1801, it was reduced to the position of a regional capital (Bloy,1997). Under this new status, many of Dublin's leading citizens, along with their political influence and money, was transferred to London and with their movement, the former progressiveness and positive urban development of the city discontinued.

Prunty (2001) also notes that many of the better well off citizens that chose to stay in Dublin, were attracted to the new semi-rural suburban areas, away from municipal rates and those city areas previously inhabited by the aristocratic classes, but now evolving into tenement districts. This phenomena further disadvantaged the city. The depletion of better off inhabitants from the capital also had an impact on the ability of administrators to raise municipal rates sufficient for the provision of drainage and other public works necessary to sustain the health and wellbeing of an increasing number of less well-off inhabitants. As a result, nineteen century Dublin very quickly became synonymous with poverty and slum conditions, where inadequate housing and public health dominated people's lives (Cullen, 2011). Underfunded and poorly administrated, civic authorities in Dublin and other parts of the country were overwhelmed with the enormity of the task of ensuring that fever dens associated with poor sanitation and overcrowded conditions could be controlled and reversed. Prunty (op cit) also notes that during the period 1800 – 1850, the prevailing administrative structure in Dublin was a complex mix of bodies with overlapping functions operating with varying degrees of commitment, competence, and cooperation. The control exerted by landlord members on these bodies was also an impediment to the improvement of standards. This problem was most clearly demonstratable where sentence for sanitation nuisance was most likely handed down on the occupier rather than the landlord.

2.5.5 Contemporary

According to Ley, (2004), the current system of building regulations in the UK has directly evolved from the aftermath of the great fire of London and the Rebuilding of London Act 1666. From there the UK system has evolved to encapsulate a now well understood objective to prevent fires, ensure structural soundness and to promote public health, safety and wellbeing (IHBC, 2022). In the UK, building regulations in their modern form were first introduced in 1965. These took the place of individual local authority building byelaws and were applied largely throughout England and Wales, apart from the inner London Boroughs, where the extant London Building Acts continued to apply (Bromley, 2022). Following numerous amendments and increases in the scope of areas covered by the 1965 regulations, the Building Regulations 1985 were introduced to consolidate these into a single text. Departing from the format of all previous building regulations, these consolidated regulations provided clear statements as to their requirements and were also accompanied by sets of supportive technical guidance documents. Once it could be shown that the guidance in the document had been followed, then this would be considered as evidence that that the regulations have been complied with. Nationwide uniformity of the building regulations was completed in 1987 when the consolidated Act was also applied to the inner London Boroughs. If the underlining story of building regulations in the UK and beyond is one of delayed but formative action in response to tragedies and crisis as well as tensions between the protection of the public and the private sector, then the unfolding is about the critical response to the Grenfell Fire tragedy and its aftermath (IHBC, 2022).

2.6 Evolution of modern building regulations in Ireland

As buildings in Ireland became more complicated, abundant and required, policy makers came to understand that current building control legislation and implementation structures were insufficient and fell far short of those already in place in neighbouring countries. Another engine destined to drive Irish building standards came under in the wave of EU building policies, mainly focussing on the decarbonisation of European building stocks (Fabbri et al, 2020). But, building control in Ireland might have remained very much as it was, if it were not for a major tragedy that took place in 1981, which eventually provided the catalyst for action to be taken (Keane, 2003, pp. 179).

2.6.1 The Stardust Tragedy

Over 40 years ago, on 14th February 1981, a major fire broke out in a Dublin nightclub, claiming the lives of 48 young people. A further 214 people were injured and a local community left devastated. This devastating event is known to this day as the Stardust Tragedy. The lives of so many injured and bereaved were and continue to be affected in countless ways. In its aftermath, an emotionally charged tribunal of enquiry was held. Many of the findings of that enquiry are actively disputed to this day, however, there was a unanimous acceptance of the tribunal’s damning criticism of fire safety standards on the premises and also its criticism of the Irish government’s failure to introduce building regulations as provided for under the Local Government (planning and development) Act 1963 (Keane. 2003 p.26). In Ireland at that time, it was left to individual local authorities to decide whether or not to implement building bye laws, which in any event, only covered general construction standards. History shows that the Stardust tragedy and subsequent tribunal of enquiry was a critical juncture of societal events, which ultimately kick-started the necessary political will and cultural change required to put in place a rigorous and continuously evolving path dependant process of Irish building control systems, primarily dedicated to protecting people in and around buildings (O’Cofaigh 1993).

2.6.2 From building byelaws to building regulations

After the Stardust enquiry and for one reason or another, almost 10 years were to pass before the first Irish building regulations were introduced, under statutory instrument S.I 306 in December 1991, but the mould was cast. Keane (op cit) asserts that it was the fire safety aspect of building control that worked as the ‘tail which wagged the building regulations dog'. It is hard to disagree with Keane's view, because it seems that when Irish legislators finally went about working on improving fire safety codes, they did not overlook other elements of construction which also required a formalised setting of standards. These included, structures, materials and workmanship, ventilation, and energy conservation. O'Cofaigh (op cit) and other commentors at the time readily acknowledge that original versions of Irish technical guidance documents and their earliest amendments were largely based on existing TGDs published in the UK.

The framework for the establishment of building regulations in Ireland was created by the passing of the Building Control Act on the 21st of March 1990. This Act provided for the establishment of building control authorities and the making of building regulations. Under S.I 306/1991, section 5(1) provided for the minister to arrange for the publishing of 'technical guidance documents' for the purpose of providing guidance as to compliance with the requirements of the provisions of the regulations. The original versions of the technical guidance documents (TGDs) were arranged and issued in 12 parts according to function, (O'Cofaigh, 1993). The documents could be purchased from the Government Publications office in Dublin, individually or as a suite in a briefcase style holder. S.I 306 1991 also stated in section 5(2) that where building works are carried out in accordance with the TGDs, then this will indicate prima facie evidence of compliance with the relevant requirements of the building regulations. Since the TGDs were first published, there have been numerous revisions published. The current versions of the TGDs are much more expansive and illustrative than the original versions. Many of the TGD Parts have been revised up to 3 times. Both, Part B, Fire and Part L, Conservation of Fuel and Energy, have each been updated over 5 times.

In a National Consumer Agency study on building regulations, published by Grant Thornton in 2008, it was concluded that ongoing progress in the area of building regulations development had been very good, since their initial introduction in 1991. They also noted that this view appeared to be mirrored by professionals operating in the industry (NCA, 2008). Evidence that progress continues to be made in the ongoing building regulations updating process, is available on the gov.ie website, which demonstrates that since the NCA 2008 study, a further 20 plus revisions to the TGDs and additional ancillary documentation have been published. Those revisions are identified in Appendix 2.1 of this thesis.

2.6.3 EU building standards policy initiatives

Since the early days of establishment of the EU project, energy efficiency, environmental protection, sustainable development and citizen welfare objectives have underpinned many of the key values and aims. A formal list of EU values and aims are laid out in articles 2 and 3 of the Lisbon Treaty. Key among those aims and values are the promotion and protection of the single trade market and peace security (Lombardi & Gruenig, 2016). According to findings of the pilot study to this research, Brunton (2016) argues that EU policy objectives affecting construction, originate from wider policy aims, such as those outlined in Lisbon, especially ones concerning the single trade market, energy efficiency and social rights. According to (Fabbri et al, 2020) EU policies in relation to buildings have undergone considerable development since the early 1990s. Those building policy objectives are passed on to member states through directives or regulations. According to the pilot study, EU policy directives with particular effects on housing and construction generally came in the form of:

1. Product procurement directives
2. Construction product directives
3. Occupational safety & health and construction sites health and safety directives
4. Energy performance of buildings and energy efficiency directives
5. Environment directives

The product procurement and construction product directives were mainly driven by aims to strengthen the single trade market. Energy performance of buildings and energy efficiencies directives are driven by commitments by the EU to international climate security and policies aimed at reducing the blocks dependence on imported fossil fuels. Occupational and construction site health and safety directives are rooted in the EU objectives of improving social rights and strengthening single market harmonisation provisions. (Brunton, op cit). EU environmental policies cover the widest range of areas, including air and water quality, waste management, flood risk, urban sustainability, biodiversity and rural conservation, birds and habitat etc. According to Beunen et al (2009), over 200 EU regulations, directives and other forms of legislation were enacted in the first decade of this century. Environmental policies at national level are generally implemented through environment and planning law systems. Many have direct and indirect impact on building regulations.

2.6.3.1 Background to European law making functions

Developed out of the 1950 Schuman Plan in response to Europe's post war economic decent and vulnerability to global energy supply chains, the European Economic Community (EEC) was created by the Treaty of Rome in January 1958 (CVCE, 2016). The prescribed founding policies of the treaty were to eliminate trade barriers and to set in train the creation of common external trade and agricultural policies (Eur-Lex, 2016a). It was signed into being by the originating member countries, Belgium, France, Holland, Italy, Luxembourg and West Germany. The UK, Denmark and Ireland joined in 1973 (Gabel, 2016). The EEC has since been reshaped and revamped into what we now know as the European Union (EU). This reshaping included the gradual accession of a further 18 countries between 1981 and 2007, and the departure of the UK in January 2020.

In the ongoing development of the European project, there have been a number of new treaties and major treaty amendments agreed between member states, setting out how the EU is structured and administered. These are referred to as primary European legislation (EC, 2016a). The primary laws give effect that EU law is superior to all national laws of member states and also gives power to institutions such as the European Commission (EC), to propose secondary laws which must be passed through the European Parliament and the Council of the EU (Eur-Lex, 2016b). The creation of secondary legislation by the institutions is only made possible by the powers conferred on them by the Treaties. It is this secondary level of legislation, which gives tangible expression to EU building policies.

There are two forms of secondary legislation that affect built environment practice. These are Directives and Regulations. An EU Directive comes in the form of instructions to member states to implement national legislation in order to achieve a particular EU policy objective. Directives normally have timeframes or deadlines for member states to transpose their objectives into national laws (Citizens Information. 2020). Although binding on member states, it is left up to each state to decide on the most appropriate measures to be put in place in order to meet the objectives of a Directive. An EU Regulation is an entirely binding piece of legislation which immediately becomes part of the national law of all member states. Unlike Directives, these do not require to be transposed into national law (EC, 2016b). From the evidence available on the EU's directives website, there are substantial volumes of EU regulations and directives issued every year that have an impact on the construction industry and house building sectors in EU member states including Ireland. EU building directives have particularly impacted on building quality and processes in the areas of energy standards, sustainability, environment, ecology, health & safety and construction product specification.

2.6.3.2 Product procurement directives

EU Directives having an impact on construction, but which were mainly concerned with protecting and improving access to the single market, came about in the form of product procurement directives. Product procurement directives were originally introduced to encourage open, non-discriminatory and transparent competition for the delivery of goods and services to public bodies (Linehan, B. 2011). They achieved their objectives by outlining procedures, thresholds and such which had to be followed by member states before, during and after the award of a public works contract (Crown Commercial Services, 2015). Their stated aim was to harmonise the rules across Europe (EC, 2016a). Information sourced on Eur-Lex (2016c) tells us that Directive 66/673/EEC 1966 was the first European public procurement directive to be issued, quickly followed by Directive 66/683/EEC 1966, which sought to prohibit rules requiring the use of national products only or prohibiting foreign products in procurement. Both Directives came 6 years before the accession of Ireland and the UK to the then EEC.

The stated purpose of these earliest directives was to eliminate differences in the treatment of national products across the EEC. It seems over the years that member states have continued to promote domestic enterprise whenever possible and that EU Public Procurement Directives have been continually introduced to incrementally close out on the use of practices that give national products or services an unfair advantage. Bovis (2012, pp.2) claims that in excess of €2.0 trillion is spent on public procurement by over 250,000 public authorities in the EU annually. This accounts for around 14% of EU GDP annually (EC, 2020b). Bovis also states that approximately 75% of the value of public procurement is expended on construction related services. In this context, it is clear that any directive emanating from the European Commission in relation to procurement rules is likely to have an impact on public bodies and construction firms engaged in the provision of public housing.

The key product procurement directives and transposing Irish regulations are outlined in Table 2.19 below. Article 23 of 2004/18/EC deals with the drafting of technical specifications by public procurement bodies and their agents. There are 8 provisions set out under this article, which together combine to impose restrictions on the use of manufacturers or brand names in the drafting of specifications (Eur-Lex 2016d).

Table 2.19 Key EU Product Procurement Directives

	EU Instrument	Transposed into Irish Law
1	Procurement Directive 2004/18/EC – Consolidating Directive	S.I 329 of 2006
2	Procurement Directive 2010/24/EU – Replacing Directive	S.I 643 of 2011

It may be that each member state has their own view on how to interpret Article 23 of 2004/18/EC. In Ireland the introduction and transposing into law of the directive roughly coincided with the introduction of the new public works contracts (PWCs) in 2006. Within the framework of the PWCs, the matter of technical specifications and how they formed part of the works requirements was stitched into a contractual process, whereby contractors are obliged to submit 'works proposals' under clauses 1.4 and 4.6, as contractor submissions under clause 4.7. These are required to demonstrate compliance with the 'works requirements' as described in Schedule 1.B. Under the stewardship of this process, technical specifications are provided to tendering contractors wherein products and systems to be provided under the contract must be described by reference to the requirements of Article 23 section 3(a) of 2004/18/EC. This requires specifiers to give preference to European standards, European technical approvals, common technical specifications, international standards or other technical reference systems established by EU standardisation bodies. Only when EU standards do not exist, is a specifier permitted to quote national technical standards, which must be accompanied by the words 'or equivalent'. This approach to specification writing means that when contractors are tendering for work, they are obliged to decide which products best meet with the technical specifications and to offer these products as part of their product submissions for employer approval during the course of the project.

Delany and King (2007) describe how as a set of instructions to the contractor, a specification should be clearly written, well defined, concise and unambiguous. Gelder (2011) suggests that the theory behind product selection is supposed to be based on characteristic constraints and that as the constraints increase, the brand options invariably diminish; ultimately leaving just one. Gelder also notes a number of other reasons why specifiers like to name products. These include familiarity, habit, the devil you know approach and so forth. He further points out that sometimes the only reason for specifying a brand name will be to indicate the type of product that will be acceptable. In relation to the Irish PWCs and Article 23 combination, Du Siun (2022) asks; what could be more uncertain than for a specifier to specify products in a way that invites alternatives. Siun also questions how government departments can describe

PWCs as encompassing works requirements that have been 'fully designed' by the employer, especially if the products putting the building together have not been actually selected. What is the act of picking one product over another, if not an act of design?

2.6.3.3 Construction products directives

The first Construction Products Directive 89/106/EEC for the harmonisation of construction product standards was introduced with the intention that it built upon the previously discussed procurement directives, by addressing the problem of technical barriers between member state trade, caused by varying national standards (BRAB, 2016). This directive was to form part of an incremental process to lay down EU wide harmonised conditions for the marketing of products based on uniform product assessment methods and common technical specifications (Neary, 2013). Due to the complexity of the task of gaining consensus among member states regarding the production of harmonised approval standards for construction products, the project took much longer than originally planned (BRAB, op cit). But by July 2013 consensus was reached and Construction Products Regulation No. 305/2011 replaced 89/106/EEC. Table 2.20 outlines a list of the key construction products directives and their transposing Irish regulations.

Table 2.20 Key EU Construction Products Directives

	EU Instrument	**Transposed into Irish Law**
1	Harmonisation of construction products standards Directive89/106/EEC	S.I 198 of 1992
2	CE Marking Directive 93/68	S.I 210 of 1994
3	Mutual Recognition Directive2005/36/EC	S.I 139 of 2008
4	Construction Products Regulation 305/2011	N/A

Construction Products Regulation No. 305/2011 was a much more defining instrument insofar as the industry was concerned. According to EC (2016b), regulation 305/2011 brought in rules for a common technical language and a single conformity verification system to be followed by manufacturers and assessment authorities. It also ruled that CE marking was now mandatory for all products covered by harmonised European Standards (hENs) (Economidou et al 2020). The regulation also simplified assessment procedures for manufacturers wishing to achieve CE marking, by making them more uniform. In conjunction with regulation 305/2011, Irish legislators added a number of further provisions relating to penalties and fines for non-compliance (Neary, 2014). In order for construction products to be placed on EU markets for permanent incorporation into a building project, they have to satisfy 7 basic requirements as set out in Annex 1 of the regulation. These relate to mechanical resistance, fire safety, hygiene, health and environment, safety and accessibility in use, protection against noise, energy, heat retention and sustainability. The first product to be covered by hENs was ‘Common Cement’ – IS EN 197 in 2002 (Irish Cement, 2016). There are currently in excess of 440 products listed on the hENs register. This is a generic list of components, systems and products ranging from lighting columns and fire protection systems to vitrified clay pipes (EC, 2016b).

Housing and construction professionals are familiar with national building standards and will understand their importance in helping to achieve quality in construction works. The British Standards Institute describes standards as forming a consistent basis and agreed ways of doing something, whether it is making a product, delivering a service or managing a process (BSI, 2016). In Ireland, building practitioners have traditionally relied upon Irish standards (I.S) and British standards (B.S) to comply with building regulations and specifications for public works contracts (BRAB, 2016). A number of commonly used I.Ss and B.Ss have become embedded into the knowledge base of many practitioners and because of this, many busy professionals are reluctant to look beyond them for guidance. National standards can vary widely from one EU member state to the next and our reluctance to work with international standards that we are not familiar with can be an effective technical barrier to opening our collective minds to the use of products or systems currently employed in other jurisdictions (BRAB, op cit).

2.6.3.4 Health and safety directives

Article 153 of the Treaty of the Functioning of the European Union gives the EU authority to pass legislation in the area of health and safety in the workplaces of its member states. According to EU-OSHA (2022), the earliest directives on health and safety matters were introduced on the basis of general market harmonisation policies and it was not until after the Treaty of Amsterdam in 1997 that health and safety provisions were brought in through the promotion of EU social policies. Notwithstanding, Directive 89/391/EEC was the first substantive directive to be introduced whose primary purpose was to encourage improvements in health and safety at work. It is referred to as the Framework Directive because a core principle of the directive was to provide the root basis from which future safety and health directives were to stem. Since 89/391/EEC further individual health and safety related directives have been introduced, including Directive 92/57/EEC – temporary or mobile construction sites.

In Ireland legislation dealing with health and safety (H&S) on construction works had been in existence prior to the Directive 92/57/EEC. In 1975 the Construction (Safety Health and Welfare) Regulations and in 1989 the Safety, Health and Welfare at Work Act had been passed to deal with general safety matters in workplaces, including on building sites. (Keane, 2002, pp. 206-210). The 1975 and 1989 legislation mainly contained provisions relating to operational functions, such as excavation works, the use of plant and so forth. They contained very few provisions requiring management to follow specified procedures or to produce specific documentation. Although interestingly and perhaps indicative of what was coming down the tracks, section 12 of the 1989 act did contain requirements for employers to prepare safety statements. In 1992 when EU Directive 92/57/EEC was published, it was considered to be a monumental event, ultimately changing the ways in which construction workplace health and safety was to be managed.

The main objective of Directive 92/57/EEC was to reduce the risk of accidents occurring on sites by establishing a chain of responsibility between all of the parties involved on a construction project (EU-OSHA, 2022). It did this by requiring the client to nominate persons to take responsibility for coordinating health and safety during the design and construction stages of a project. It also required the setting up of statutory procedures whereby the client and project supervisors design stage (PSDS) and construction stage (PSCS) were tasked to draw up a pre-start health and safety plan and to prepare a post project safety file. The PSCS was also required to notify the national safety authority within minimum/maximum time notice periods before construction works commenced (EU-OSHA, op cit). The directive was transposed into Irish law through S.I. 44 of 1993 and S.I 138 of 1995. A number of subsequent safety directives and transposing regulations have followed on from Directive 92/57. However, these could be categorised as being more site operations focused, dealing with areas such as work equipment, electrical equipment, pressure equipment, lifts, signage and such. Table 2.20 below, outlines what may be referred to as the key legislative apparatus responsible for setting up the current safety management frameworks in EU member states.

Table.2.21 Key EU Health and Safety Directions and Transposed Legislations

A	**EU Instrument**	Date
1	EU Directive 89/391/EEC – Framework Directive	June 1989
2	EU Directive 92/57/EEC – temporary or mobile construction sites	June 1992
B	**Transposing Irish Legislation**	
1	S.I. 44 of 1993 – Safety, Health and Welfare at Work (General Application) Regulations	February 1993
2	S.I. 138 of 1995 - Safety, Health and Welfare at Work (Construction) Regulations	June 1995
3	S.I. 481 of 2001 - Safety, Health and Welfare at Work (Construction) Regulations	January 2002
4	Safety, Health and Welfare at Work Act 2005 (No.10 of 2005)	September 2005
5	S.I. 504 of 2006 - Safety, Health and Welfare at Work (Construction) Regulations	November 2006
6	S.I. 291 of 2013 - Safety, Health and Welfare at Work (Construction) Regulations	August 2013

As demonstrated in Table 2.21, Irish legislators continued to build upon the provisions contained in S.I 44 and S.I 138 with further regulations. For instance, in 2001 and 2005, S.I. 188 and S.I. 481 brought in a number of provisions relating to work operations, while also introducing some notable procedural requirements in relation to notifying the Health and Safety Authority (HSA) of when an accident had occurred on site and procedures for selecting site safety representatives. S.I 481 also contained provisions for the setting up of Safe Pass procedures and Construction Skills Card schemes for site operatives. These schemes involved the issuing of mandatory permit cards to workers who had attended compulsory safety awareness and secondary skills training. The secondary skills courses related to site activities ranging from basic scaffolding to plant operation, ensuring that only appropriately trained persons are permitted to carry out those activities. According to Keane (pp. 213) the scope of the 2001 regulations extended beyond much of what had been originally envisaged by the 1992 directive.

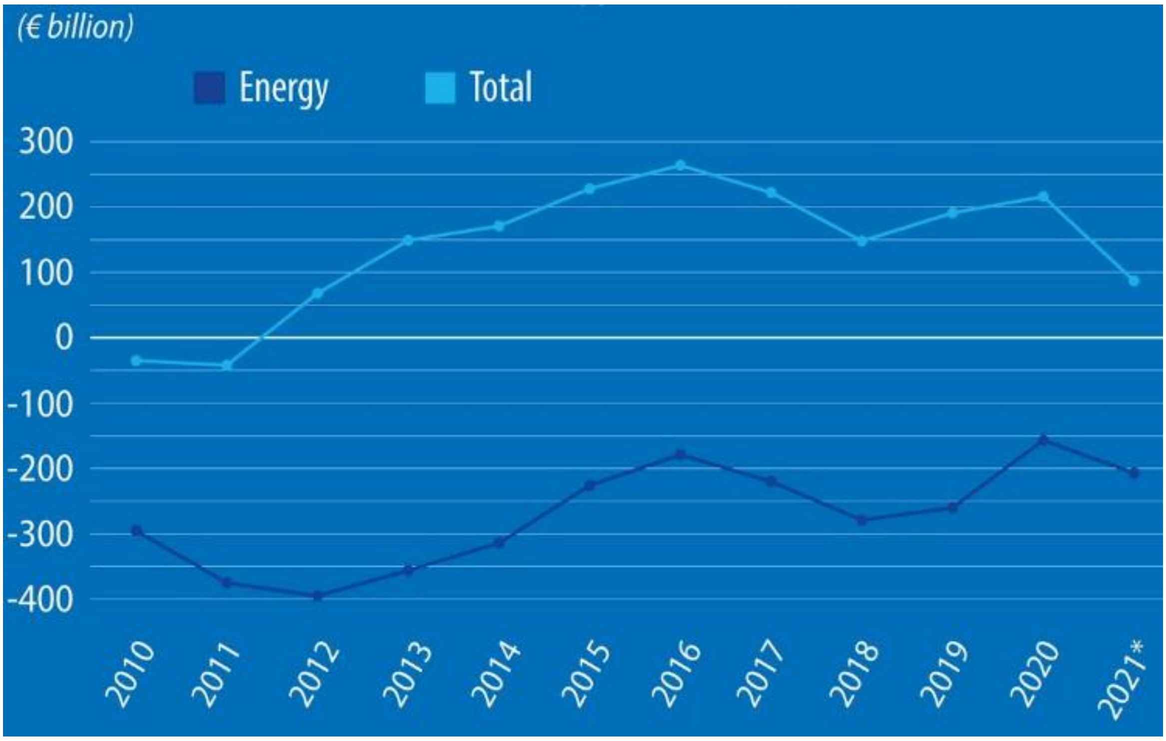
In 2005, a new Safety, Health and Welfare at Work Act, was brought in to repeal and replace the 1989 Act. This replacement act reinforced existing provisions and introduced new ones. Amongst several additions, the act provided for an expanded range of functions and powers for the Health and Safety Authority (HAS), particularly in relation to inspections and enforcement and it also set out a range of penalties that may be applied for breaches of the regulations. It made changes to the rules and procedures to be followed in the nomination of employees safety representatives and in the production of site safety files. It also introduced much clearer descriptions of the roles to be carried out by the PSCS and PSDP and a formalisation of the activities of temporary works designers (HSA, 2016). Other health and safety regulations were introduced in 2006. These related to operations issues such as working at heights and exposure to asbestos etc. Giving further effect to Directive 92/57, a number of codes of practice were issued by the HSA in 2008, 2010 and 2011. These codes related to avoiding overhead electrical lines and underground utility services, scaffolding operations, working on roads, working in confined spaces, working on roofs and the installation of anchors. In 2013, S.I. 291 provided a comprehensive updating of the existing regulations and introduced some new provisions, including an extension of the scope of the legislation to single residential projects and requirements for contractors to notify clients of their responsibility to appoint a PSCS (Toomey, 2013).

By reviewing some of the main additional provisions to be found in the updated 2005 Act, as above, it is demonstrable how the 1992 Directive - EU Directive 92/57/EEC continues to effect and change approaches to construction safety in Ireland. An overview of directives listed on EU-OSHA (2022) shows us that there have been over 25 separate health and safety at work directives enacted since the framework directive 89/391/EEC was first adopted in 1989.

2.6.3.5 Energy efficiency directives

The EU is the largest economic trading block in the world, enjoying stable trade surpluses over the last decade. (Politico, 2022). In spite of its overall trade surplus however, it is estimated that over the same period, the average combined EU energy trade deficit was approximately €300 billion per annum. Figure 2.1 below illustrates the variations between overall trade surpluses and energy trade deficits in the EU block during the period 2010 to 2020. Data collected in 2015 showed that EU countries combined bought approximately 60% of their gas and 80% of their oil from outside of the union (Eurostat, 2015). Since 2020 and mainly due to the energy supply crisis caused by the war in Europe, the EU energy trade deficit has almost doubled and the manufacturing trade surplus has almost halved (Politico, op cit). According to the EC (2013a), the EU block is the world's largest importer of oil and gas energy and that the resulting energy trade deficits directly depletes member state coffers every year. Bloomberg (2022) confirms that Europe remains the world's biggest importer of oil and gas, with China a close second.

Figure 2.12 EU Trade Balance of Total Trade and Energy Trade 2010 to 2021 Source: Eurostat



In light of the previously noted EU energy trade deficit statistics and dependency on imported fuels, it is not surprising that Bosello & Buchner (2004) consider the EU as perhaps the most committed participant in the long series of United Nations Climate Change Conventions. Cifuentes (2022) describes the EU as a leading player in international negotiations on international climate measures and the most active super economy participant in collective global endeavours to drive down dependence on fossil fuel sources. The EU targets its energy efficiency goals at a number of industrial sectors, including building, transport, energy supply, appliances, farming and others (CES, 2013). According to (Fabbri et al, 2020) and (EC, 2022) it is estimated that buildings are responsible for nearly 40% of annual energy use and up to 36% of annual CO^2 emissions in the EU. A substantial proportion of that 40% figure is considered by the EC to be of untapped energy saving potential. Their investigations indicate that much of the energy used is wasted, due to the use of inefficient building services systems or heating appliances, deficient technical control systems and outdated construction practices (Economidou et al (2020). In light of these findings, EU policy measures target the building sector, as a crucial medium to achieving its wider environmental and energy goals. The Commission also considers that more energy efficient homes improve the quality of citizens lives by reducing household energy expenditure, alleviating energy poverty and improving indoor environment quality (Economidou op cit).

Up until the early 1990s, it was the opinion of EU policy makers that building efficiency standards, mainly achieved through insulation measures were best left to individual member states, according to principles of subsidiarity (Asdrubali & Desideri, 2019). By 1992 several EU member states, particularly Northern European countries like Ireland, the UK and Germany had already unilaterally adopted mandatory building standards, containing minimum insulation requirements, but at the same time most Southern based EU states did not follow mandatory building standards. In 1993, the EU introduced its first energy directive for the building sector. This was referred to as the 'SAVE' Directive 1993/76/EEC). Before the SAVE directive, EU policies promoting energy efficiencies were passed down to member states through communications on adopted resolutions by the European Council. Those resolutions including OJ C 153/2 in 1974, were adopted following the Middle East oil crisis in 1972/73. The modest goal of OJ C 153/2 was to reduce the rate of energy consumption growth to 15% below 1973 levels by 1985. However, EC energy efficiency resolutions were not considered robust enough to oblige member states to act on them. According to Asdrubali & Desideri (2019), the measures called for in the SAVE directive were not implemented by most member states either. This inaction is believed to have occurred mainly because the wording contained in the directive was not strong enough to oblige compliance (Economidou et al, 2020). Since the SAVE Directive, the EU have delivered a number of energy directives, containing more robust directions on various measures aimed at improving energy efficiency and the energy performance of buildings. Table 2.22 below outlines the key energy efficiency directives passed down to member states since the SAVE directive in 1993 and their transposing Irish legislation.

Table.2.22 Key EU Energy Directives and Transposing Legislation

A	**EU Instrument**	**Date**
1	Directive 1993/76/EEC “SAVE” to limit Carbon Dioxide Emissions by improving Energy Efficiency,	July 1993
2	Directive 2002/91/EC on the Energy Performance of Buildings (EPBD)	December 2002
3	Directive 2006/32/EC on Energy End-use, Energy Services and repealing Directive 1993/76/EEC	April 2006
4	Directive 2010/31/EU on the Energy Performance of Buildings (EPBD Recast)	May 2010
5	Directive 2012/27/EU on Energy Efficiency, amending three previous Directives and repealing 2006/32/EC	October 2012
6	Directive 2018/844/EU on the Energy Performance of Buildings, amending 2010/31/EU and 2012/27/EU	May 2018
7	Directive 2018/2002/Eu on Energy Efficiency, amending 2012/27/EU	December 2018
B	**Transposing Irish Legislation**	
1	S.I 497 of 1997 – Building Regulations 1997	December 1997
2	S.I 666 of 2006 – European Communities (Energy Performance of Buildings) Regulations	December 2006
3	S.I 259 of 2011 – Building Regulations (Part L Amendments) Regulations 2011	May 2011
4	S.I 243 of 2012 – European Union (Energy Performance of Buildings) Regulations 2012	July 2012
5	S.I 426 of 2014 – European Union (Energy Efficiency) Regulations 2014	October 2014
6	S.I 183 of 2019 – European Union (Energy Performance of Buildings) Regulations 2019	May 2019

The main requirements under the SAVE directive, as relating to domestic type dwellings, involved implementing a programme for certifying buildings types under energy rating characteristics and ensuring the regular inspection of heating installations (Asdrubali & Desideri, 2019). Following commitments made by the EU in the Kyoto Agreement, and the experience of mixed adherences to the SAVE directive, in 2000, the Commission published the first of several Energy Efficiency Action Plans (EEAP), laying down its strategic vision and proposed actions to strengthening existing adopted measures. An important part of the implementation strategy to meet the Kyoto targets of reducing energy consumption and CO_2 emissions involved the development of 2 main types of directives. The first directive type was in Energy Performance of Buildings Directives (EPBD) and the second type was in Energy Efficiency Directives (EED). One outcome of the 2000 Energy Efficiency Action Plan was the part replacement of SAVE by Directive 2002/91/EC on EPBD. The remaining parts of SAVE were completely replaced by Directive 2006/32/EC on Energy End-use and Energy Services (Economidou et al (2020).

Directive 2002/91/EC brought improved energy efficiency standards, based on a 'whole building' performance evaluation approach. This approach referred to as Building Energy Ratings (BER), assesses the energy performance and associated CO2 emissions of dwellings, using a general methodological assessment framework which in Ireland was transposed into a Dwelling Energy Assessment Procedure (DEAP). BER results are calculated and stored on a nationally administered computer software system (SEAI, 2016). Directive 2002/91 also added further measures in relation to the inspection of boilers and air conditioning systems. Under Directive 2006/32/EU member states were required to develop and regularly update National Energy Efficiency Target Plans (NEEAP) to track and achieve energy saving targets of 1% per annum between 2008 and 2017. Reflections on the 2002 and 2006 directions made by (Asdrubali & Desideri, 2019) and (Economidou et al, 2020), suggest that both directives lacked ambition and were essentially unbinding on member states. But these suggestions are somewhat countered by European Commission NEEAP progress reports which show that since directive 2006/32, a number of member states including Ireland have delivered no less than 4 NEEAPs (EC, 2022c).

Following the publishing of the Commissions 2006 Energy Efficiency Action Plan and policy debates that followed, Directive 2010/31/EU (EPBD Recast) was introduced in May 2010. This directive aimed at strengthening provisions already covered in the earlier 2006/32 EPBD directive and at capturing further energy savings committed to under the 2006 EEAP. Perhaps the most significant provision in 2010/31 insofar as this research study is concerned, would be Article 9, which introduced the concept of near zero energy building standards (NZEB). Under Article 9 it was established that all new buildings occupied after 31st of December 2020 were to comply with NZEB standards. Guidance published by the EC in 2016 for the Oceanic zone which includes Northwest European countries such as Ireland, the UK, Germany, Belgium and the Netherlands, recommended that in order for new family homes to comply with NZEB, net primary energy use should be within 15-30kWh/(m2.y) with typically 50-65 kWh/(m2.y) of primary energy source covered by 35kWh/(m2.y) of on-site renewable sources (EC, 2016). According to IGBC (2022), NZEB standards are very closely related to Passive House standards. Directive 2012/27/EU EED, introduced requirements for member states to publish new NEEAPs by 2014, containing improvements on energy efficiency targets contained in EED 2006/32/EU. It also established a new energy saving target of 20% by 2020 and prepared the way for further energy improvements in the future.

Directive 2018/844/EU EPBD was published in June 2018 and amended directives 2010/31/EU and 2012/27/EU. Along with targeted amendments to strengthen provisions in the previous directives, 2018/844/EU introduced a number of new provisions. In relation to residential works, this directive set out EC policy requiring member states to build upon recent technological improvements in building automation and control systems, through requirements to promote smart technologies in their operations. It also sought that the health and wellbeing of occupants are considered in the provision of ventilation and air quality systems (ECEEE, 2022). EPBD 2018/884/EU was shortly followed by EED Directive 2018/2002/Eu, which was implemented to put a legal framework around the 2030 energy efficiency targets. The 2030 targets are aimed at cutting GHG emissions by at least 40% from 1990 levels, improving energy efficiency by 32.5% and to provide that renewable energy sources deliver at least 32.5% of efficiencies.

In 2019 the EC adopted further policies targeting climate security commitments made at the 2015 Paris: United Nations Conventions on Climate Change (UNFCC). These policies also brought about the announcement of the European Green Deal; a new economic growth strategy, aimed at transforming the EU into the first climate neutral continent by 2050, while also decoupling economic growth from resource use (EC, 2022a). In line with the 2015 Paris Accord goals of keeping global temperature increases below 2 degrees and preferably below 1.5 degrees, greenhouse gas emission reductions of 55% on 1990 levels by 2030 are targeted on the way to achieving climate neutrality (Cifuentes, 2022). Approximately 1/3rd share of the EU's 55% reduction target is aimed at improvements in energy efficiencies. Making buildings more energy efficient is the primary means of achieving this share of the target (EC, 2022a). In January 2022 the EC published proposals for a recast of the EPBD, which aims at road mapping increases in standards to completely decarbonise the building sector. This aim forming part of an overall plan to put the EU on track to reduce CO_2 emissions by 55% by 2030. This would include provisions to the eventual banning of boilers and requirements for pre-installation of infrastructure and cabling for e-car charging (Interreg Europe, 2022).

2.7 Building regulations in other national jurisdictions

A review of international government websites shows that when it comes to residential construction, most if not all developed countries publish data on building standards to be followed in their jurisdictions. On closer inspection, it seems that those standards are very much influenced by a country's prevalent climatic conditions and geographic location. In the EU for instance, different benchmark levels for achieving energy performance standards such as NZEB are published for different climatic zones (Economidou et al, 2020). This is because, flexibility is needed to account for the effect of different climatic conditions on the heating and cooling needs of the countries located in each zone. Flexibility in the transposition of energy performance standards was previously referred to in section 2.6.3.5, as the EU applying principles of subsidiarity to achieve the desired effect (Asdrubali & Desideri, 2019). There are 4 EU zones, named, the Mediterranean, Oceanic, Continental and Nordic zones (Commission Recommendation, 2016). Building regulation approaches in the Oceanic, Continental and Nordic zone countries appear to endorse the use of concrete, glass and insulation products over more lighter forms of construction, associated with countries located within the Mediterranean zone. While most Southern and Mediterranean zoned countries place greater emphasis on building materials and techniques that facilitate a resistance to earthquake damage (Schmidt-Thome et al, 2012).

2.7.1 Building regulations in the UK and the EU

According to Van der Heijden (2009), building regulations systems vary widely in developed economies, but the broad objectives to regulate for minimum quality levels in building construction are similar. In the UK, Ireland and other EU member states, the influence of EU governance is clearly evident regarding the content, scope and formation of regulations and their technical objectives (Meijer & Visscher (2008). More locally, building control and regulations systems in Ireland and the UK, are very similar in formation and content (Keane, 2003), where TGDs describe solutions, which if followed are deemed to comply with the regulations requirements. Meijer & Visscher (2010) maintain that most EU countries have a single document or sets of documents similar to Ireland's TGDs, describing solutions as a guide to regulations compliance. TGDs in all EU countries are required to be upholding of standards referred to by EN Codes and Products Performance directives. In the UK, most pre-Brexit EU building standards have been adopted as national standards and will apply until such time as newer and updated national standards are developed (BSI, 2022). This would suggest that a study on the cost implications of building regulations in Ireland would be generally transferable to the UK and other European countries.

2.7.2 Building regulations in New Zealand and Australia

On a wider review of international building regulations, the available literature appears to suggest that building regulations or building codes as they are commonly referred to internationally, may not be as structured or as comprehensive as they are in Europe. For instance, according to information published on government websites in Australia and New Zealand, their building codes are more performance based and are so because policy makers there wish to promote flexibility for designers and developers that will facilitate innovation, modern methods of construction (MMC) and prefabrication. A review of New Zealand’s versions of the TGDs, namely the Acceptable Solutions and Verification Methods (ASVM) documents, illustrates a comprehensive if less detailed adherence to building control processes, with continuous updating of building codes. Published in 9 parts, the ASVMs include parts offering guidance on fire protection, structural stability, access, moisture and energy efficiency. Each of the 9 part contains somewhat comparable sections to those contained in the 12 parts Irish TGDs and the 18 parts UK TGDs. In Australia their building codes are arranged in parts with titles similar to those published in New Zealand. Some of the parts are presented in several sub-parts and codes also provide for variations specific to climatic conditions in the 7 states of the country.

2.7.3 Building regulations in the USA and Canada

In the USA, building codes are based on a model code system which is then adapted to local conditions in the various states and cities by local municipal authorities (Vaughan & Turner, 2013). According to NIST (2022) model codes in the USA are primarily produced by the International Code Council (ICC), a non-profit organisation. The codes are largely based on consensus building standards developed by professional bodies with field expertise, such as the National Fire Protection Association and the American Society of Civil Engineers. The standards and codes are reviewed and updated every 3 to 6 years by committees containing a balance of representatives from interested parties including researchers, building officials, manufacturers, builders and others. The process for amending codes involves public comment periods, hearings and voting by ICC governmental members (ICC, 2022a). There are separate model codes for residential and commercial buildings and codes will vary from state to state, as legislators limit or omit certain requirements based on cost or inappropriateness for their constituents or location. For instance, measures in Florida will be more likely to focus on addressing hurricanes than earthquakes. The opposite would be the case in California. A review of the residential building codes for New York State (NYS) showed an extensive collection of technical guidance information arranged in 9 parts, which contained 44 chapters in all. Unlike the TGDs in Ireland and the UK, the NYS chapters contained extensive prescriptive details on topics such as electrical services, specialised plumbing services and other specialised areas.

In Canada, building regulations are also based on a building codes system, but unlike in the USA, where codes are primarily produced by an independent international organisation, Canadian codes are nationally produced by the Canadian Codes Centre, comprising of the Commission on Building & Fire Codes and the Canadian Standards Agency. The model codes are widely adopted by the territorial governments, even though they are not required to enforce them (APEC, 2021). Like in the US, the building code review process in Canada is very intensive, involving a number of government bodies who analyse new standards through initial feasibility, draft documentation stage, committee review and revision, public enquiry, secondary review, and systematic reviews. The codes are published in 12 sections, including Electrical, Energy, Water & Sanitation, Water Quality, Mechanical Systems, Indoor Air Quality, Lighting, Structure, Location/Siting/Zoning and Environment. According to APEC (op cit) there is no safety code in Canada. There are a number of Green Building codes running through the various sections, relating to areas such as indoor air quality and energy and water conservation, noise reduction, daylighting and outdoor views. The Canadian building regulations are published online in 2 volumes. Each volume contains an acceptable solutions section, similar to the UK and Irish TGDs. The current 2020 version of the documents is noted as the fifteenth edition. The first edition was published in 1941. There is also access to variation productions relative to the various Canadian territories.

2.7.4 Building regulations in Latin America and the Caribbean Countries

In Latin American and Caribbean countries, it is estimated that earthquake zones represent a significant proportion of the land mass. The so called ring of fire region, stretches almost 40,000 Kilometres along the Pacific west coast. At the same time, it is estimated that earthquakes represent only 13% of natural disasters in the south and central America region, as floods, landslides and earthquakes are mainly responsible for the destruction of buildings and homes, particularly the vast numbers of unreinforced adobe structures, dispersed across the continent. Adobe is generally described as an organic building materials, made of combinations of earth, clay and straw. In Spanish the word means mudbrick (Cocco eta al

(2022). Following the Huaraz Earthquake in 1970, when approximately 70,000 people died, many as a result of adobe structure buildings collapses (Britannia, 2022), the first building codes relating to this type of construction was published by the Peruvian Government. Over time, the Peruvian codes have been further developed and are also regarded as best reference practice in other Latin American Countries. However, even where guidelines for Adobe structures are present, the risk to their inhabitants remains high (Cocco, op cit). Deficiencies in the Adobe build system include the choice of wood as the preferred structural partner, because the thermal expansion coefficient is similar to that of the earth or clay material used in Adobe blocks. Experience and building science shows that the use of metal in Adobe structures can result in differential expansion and corrosion problems due to the moisture in the blocks (Hoeben, 1994).

According to (GABC, 2020a) there is a lack of ambition in many Latin American countries for the advancement of energy efficiency measures and building codes adoption. Their research also indicates that building codes are not mandatory in most countries. In Mexico, Chile, Brazil and Argentina codes are only mandatory in more urbanised parts of the country, with voluntary codes or none at all in more rural parts. Insofar as Paris climate security commitments, energy consumption and efficiency aspirations are concerned, Latin America faces different challenges to those faced in Europe and elsewhere. Measures to achieve net-zero carbon emission buildings by 2050 have been targeted by regional and national roadmaps facilitated by a Global Alliance for Buildings and Construction (GABC), where accelerated action on building retrofits and a strengthening of new energy efficiency buildings codes are amongst the recommended measures (BEA, 2022). The big question is whether local action will follow national and regional targets. The GABC also facilitates regional roadmaps targeting net-zero carbon emission buildings in Africa and Asia.

2.7.5 Building regulations in African Countries and in India

According to the ICC, a majority of countries on the continent of Africa do not publish building codes online, which makes it difficult to run a rule over building control systems and energy efficiency targets in those jurisdictions. Also, in most African countries it is unclear whether there is any centralised regulatory authority. Apart from this, it was also found that some in African countries standards or codes from former colonial nations or neighbours have been adopted. For instance, according to ICC, Angola base their codes on Portuguese standards, while Namibia uses South African regulations. In Egypt many building codes are based on Canadian codes and Eurocodes (ICC, 2022b).

In India, national building codes are published by the Bureau of Indian Standards in the form of a recommendatory document, which is issued to the 28 States and 8 union territories, for incorporation into local building bye laws, which are based on each states geographical location and climatic conditions. According to the Indian Ministry of Home Affairs, the incorporation of the recommendations into local bye laws is mandatory. Interesting, Patel et al (2018) suggests that building regulations in Indian cities are very restrictive. They argue that by rationalising certain regulations, housing costs could be reduced by as much as 34%, which would also increase supply by over 70%. While the suggested findings of Patel's research have a particular interest to this study, their transferability may be quite limited, as Indian building codes do not directly address energy efficiency standards on the same terms as those in Ireland, the UK and the rest of Europe (Young, 2014) .

2.7.6 Building regulations in Asia Pacific Countries

In a study developed for the purpose of understanding the utilization of building codes, regulations and standards in Asia-Pacific Economic Cooperation (APEC) member economies, USAID (2013) details how each member approaches the development, adaptation and administration of building codes. APEC is an inter government forum of 21 countries promoting free trade throughout the Asia Pacific region (APEC, 2021). A review of this extensive 230 page study shows that in Taiwan, Japan, Korea and Vietnam building regulations are developed by central government with regional variations permitted at adoption stage by local government. In China, Indonesia and Thailand, building regulations are also developed by central government, but they may be adopted, modified or rejected at local level depending on regional needs. The Chinese system also permits the use of alternative equivalents, so long as they meet with the underlying aim of the national standard and best practice. In Hong Kong, Singapore and Malaysia building regulations are also set by central government with provision for local jurisdictions to allow standards and best practice equivalents.

In Japan, building codes are established by central government for administration and enforcement, by municipal authorities but without modification. Japanese codes are developed or imported for recommendation to the Ministry of Land, Infrastructure and Transport by the Architectural Institute of Japan. Codes are updated every 5 years. From what can be interpreted on government websites and as described by Apec (2021), mandatory detailed building provisions in Japan and in several Asian Pacific countries are generally consistent across elements such as fire safety, structure, energy efficiency, water and sanitation, mechanical and electrical systems, amongst others (Apec, op cit). The elements covered in Asian Pacific building regulations also appear to be reasonably similar to those covered in the UK and Irish TGDs documents.

2.8 Chapter Summary

In the introduction to this chapter, it is stated that a key focus will be to relate its contents through logical steps to the research aim and particularly to the first two research objectives, which seek to identify and understand the range of issues contributing to the Irish housing crisis and also to ascertain if building regulations costs are considered as a significant contributing factor to the Irish housing crisis. With this focus front and centre, following is a chapter summary of the key points.

The review began by considering house price theory, where the outcome suggests, that due to the complexity of housing markets, the fundamental tenets of equilibrium market price and basic laws of supply and demand do not naturally apply. This suggestion is weighted in acknowledgements that in many housing market transactions, offer and acceptance processes can be anything but straightforward, and claims that housing markets do not run in ways that naturally work to meet demand or society's needs. The review then explored how collective failures to understand modern housing market complexities, including linkages between the economic significance and multi characteristics of the market product, as well as product financialisation, have led to poor policy making, culminating in further market issues. Challenges faced by the construction industry in the immediate aftermath of the financial crisis, skills shortages, supply chain issues and inflationary pressures, due to the recent Covid crisis and the current war in Europe, were also established as factors impacting on the housing sectors ability to deliver new homes.

The literature review then examined what it described as the wider systemic issues in the housing market. These systemic issues generally centre around the under supply of fully serviced zoned land, planning decision backlogs and the availability of mortgage credit. A key inference in this part of the review, related to the second research objective, as it is argued that the elevated level of concern focussed on these systemic issues have served to overshadow any sense of the serious structural imbalances that have simultaneously developed due to continuous increases in the construction cost base. The review identified the Irish planning system as creating multiple bottlenecks in the roll out of development land, plus failed or non-existent land management policies, especially successive failures to invest in public infrastructure and utilities. In an assessment on the impact that credit regulations and conditions have played in the crisis, the review highlights how Ireland's banking system has been allowed to swiftly re-capitalise and recover from the 2008 crash, perhaps at the expense of wider society, the housing market, but especially the FTB cohort. In this regard, the review emphasizes that Irish banks have for some time, benefitted from the second highest interest rates in Europe. It also highlights how, in order to keep house price increases under control, the CBI has stood over the most challenging LTI mortgage lending ratios in the EU.

In a review of the supply versus demand mismatch in the Irish housing market, the literature review considered that when a mismatch extends over time and unmet demand accumulates, that the demand imperative eventually changes to one of need. This process starts by a transfer of demand for owner occupation to the private and public rental markets and then disproportionately onto the social housing market. Through this lens, the review considered Ireland's Dualist social housing supply system and compared this to policies in other EU states, such as in Austria, where 'Unitary' housing supply systems are operated. The review concluded that by eventually converting to some form of Unitary system, Ireland could go some of the way to overcoming pro-cyclical and affordability issues in social housing provision. The literature review then examined housing supply, the main drivers of demand and prevailing economic conditions over various time periods in Ireland since the formation of the Irish Free State in 1922. This part of the review also discussed the nature and effect of government interventions during those periods, including the impact of tenant purchase schemes and how these were instrumental in transitioning Ireland's housing supply system from a more stable unitary or socialised system to a marketized housing system.

In an assessment of the current drivers of housing demand in Ireland, the literature review identified demographics, economic growth and immigration as the main key drivers. The review also pinpointed how government's failure to accurately project population growth targets and acknowledge housing obsolescence, together with policy decisions, such as those responsible for the 3.5 LTI mortgage ratio rules, as reasons contributing to the considerable backlog of unmet demand, which is currently considered to be in excess of 170,000 units. Commenting on the wide differences in estimates of the number of dwellings required to be built in Ireland between 2022 and 2030, the review notes the divergence of opinions held by respected commentators, such as, the ERSI, CBI, KPMG and Lyons. Their demand estimates range from 26,000 to 50.000 units per annum. Through a meta-analysis of data gathered from various research studies and published data, the literature review considers that the number of dwellings required is closer to 46,000 per annum.

In an overview of Irish house prices, development costs and building regulations costs, the review noted a claim by Lyons & Monert (2021) that house prices in 2020 were lower than they were in 2007, yet housing construction costs are around 80% higher than they were in 2007. Interested by this claim and an understanding that construction inflation during the same 13 year period was historically low, the review undertook further investigations, by comparing published CSO construction inflation data with SCSI housing cost data, over a recent 4 year period. From this exercise, the review found a significant cost increase difference between the two sets of data. The outcome which is illustrated in Table 2.11 showed that according to the SCSI, the construction costs to build a 3 bedroom semi-detached house had risen by €28,650 or 19.1% over 4 years, while the CSO had reported housing construction inflation of €13,222 or 8.8% for the same period. This substantial difference between the reported inflation increases and actual cost increases is interpreted by the review to be mainly a result of improved housing design standards and building regulations. This finding, identified through a meta-analysis of 2 separate independent data sets, provides significant evidence that cost drivers other than inflation are responsible for increasing construction costs. These findings will be noted in the Thesis conclusions chapter as a basis for triangulating the primary findings from the data analysis discussion chapter.

In a discussion on the housing crisis in Ireland, the literature review notes that the Irish housing crisis emerged initially as a housing supply shortage issue, during the housing bubble crash and arrears crisis that immediately followed the 2008 global financial crisis. It notes that a demand/supply mismatch between 2013 and 2022 has accumulated to a housing supply deficit of approximately 170,000 units, bringing with it numerous issues for Irish society. Those issues include high homelessness levels, household overcrowding and pressures on Ireland's economic growth potential. In the face of those stark details, the review investigated the housing situation in other national jurisdictions around the globe. The overall finding was that Ireland is not alone and that rapid increases in housing costs relative to incomes has made home purchase and rents unaffordable for vast numbers of international urban dwellers across the developed and developing world. The review found that housing supply deficits in developed economics such as the UK and the USA are estimated to be accumulating by approximately 100,000 and 300,000 units per annum respectively. Looking into the background behind the UK annual supply shortfall, in order to identify comparisons with Ireland, the review noted that affordability is especially problematic in the metropolitan area of London, where the UK NSO estimates that the ratio of average property prices to average national earnings is over 40.0. This incredibly high ratio is possibly 2 to 3 times greater than one might expect, in the most exclusive suburbs of South Dublin.

The review also compared international construction costs, identifying a clear link between high residential construction costs and what international bodies such as the UN, OECD and IMF refer to as ‘affordability crises’ in many major cities across the developed world. In global residential construction cost comparisons carried out by international cost consultants Turner Townsend, it was found that Dublin and especially London, featured prominently in the range of most expensive cities in which to build. Other cities well known for their housing supply shortages, such as San Francisco, New York, Vancouver and Auckland also featured on the list of cities with the highest construction costs.

The literature review then focussed on building regulations, tracing their development through history, up to the recent punctuated equilibria period, whereupon, during the past 30 to 40 years, this researcher’s generation have evidenced what could arguably be defined as the most dramatic development in building standards since the first rules on building works were codified in the Corpus Juris Civilis, on the instructions of the Byzantine Emperor Justinian, in 527 AD. This section of the review also identifies critical events in history such as the great fires of Rome in AD 65 and London in 1666, as well as the worldwide Cholera epidemic in 1847, the Dublin Stardust Tragedy in 1981 and the Grenfell Tower Fire in 2017, each of which have focussed minds on elevating fire standards for the greater good. The review also considers events such as the signing of the Treaty of Rome in 1957 and world energy crises in 1956 and 1973 as critical junctures that would have led to an eventual ushering in of EU directives and regulations on energy efficiency standards in buildings. The review then considers how, once the initial decisions to improve energy or fire standards were made, it set policy makers on a path dependant process, resulting in continuously evolving building control systems and building regulations improvements in Ireland, the UK, the EU and in developed countries around the world, where for instance, by 2021, nearly all new homes are required to be built to NZEB standards.

In an overview of international building standards, the review established that building standards are published in most developed countries around the world. It also found that those standards are very much influenced by each countries prevalent climatic and geographical location, especially so if they are situated in a region that is subject to earthquake or hurricane activity. Similar to Ireland and the UK, most OCED countries appear to publish their building standards in the form of TGDs, but it seems that their approach to drafting those standards are not always similar. For instance, it was identified that in the USA and Canada, independent or government bodies produce model code systems, which are issued to the constitutive states or territories, who can then make modifications as deemed necessary. It was also noted in New Zealand and Australia that their TGDs are more performance based than in Ireland and the UK. However, even apart from climatic, geographical and drafting variations in international building regulations, the review suggests that there are more similarities than differences in building regulations systems across the globe. On this basis, an important take-away from the literature review is that the findings of the data analysis chapter will be generally transferable to other national jurisdictions around the world, but especially in the UK and Oceanic, Nordic and Continental climatic zones of the EU.

2.8.1 Chapter Conclusions

In keeping with the aim of this research, the literature review has highlighted the complexity of the housing sector and identified systemic and structural issues in the Irish housing market that individually and collectively have the effect of constraining housing supply. The systemic issues identified include fundamental complications in many aspects of the planning system, plus infrastructure deficits, serviced land shortages and an unsupportive credit environment. Structural issues in the market are suggested to be routed in Ireland's Dualist social housing and Dynamic housing market models, plus a regulatory system that embeds high hard and soft costs into the production cost base, a substantial part of which is driven by ongoing improvements in building regulations.

A conclusion of this review is that policy changes intended to transform the Irish housing market from Dualist and Dynamic models to more stable Unitary and Static models would be a very long term project, perhaps only possible under different demographic and economic circumstances. Apart from this long term project, the findings of the review also suggest that if the more heralded systemic issues contributing to the housing crisis, such as Ireland's planning and land management problems can be brought under control, then this will release the raw material that is zoned and serviced development land into the housing market. While it is acknowledged that such an occurrence would make a monumental difference to the housing supply chain, the review suggests that even if this can be done, it will still be necessary for viability and affordability to be brought into a state of harmonisation, before the housing market can truly operate as a fit for purpose productive system. The review considers that viability and affordability will not harmonise until housing delivery costs are sustainably lower than house prices, under circumstances where credit conditions allow this to continue into a reasonable future time. If housing delivery costs are too high, then according to this literature review, a significant part of that reason is high construction costs, fuelled by building regulations costs.

This literature review has met the first and second objectives of the research aim by highlighting the key known factors contributing to the Irish housing crisis and establishing that there is very little research or discourse identifying building regulations as a key contributor. It has also established through a meta-analysis of reports and published government statistics that construction costs have increased at a greater rate than construction inflation thereby further justifying a case to drill further into this question of the impact of building regulations costs. The review has also clearly identified that Ireland is not an international outlier when it comes to having to deal with a major housing supply crisis. It is likely therefore, that an investigation and findings made in this research study will be transferable to other international jurisdictions, in one way or another.

This review has demonstrated that building regulations are sets of rules which can often be traced back through time and chains of actions, following on from a previous event or series of events. By our understanding of this pathology, it can reasonably be established that an underlying theoretical framework for this research has clearly emerged, based on the nature of historical institutionalism. Approaches to theory development in historical institutionalism consider critical junctures as constituting key starting points which prelude path dependencies as the essential mechanism, rolling out the continuing impact of decisions made at those critical points (Thelen (1999). The next chapters of this research will seek to ascertain if accumulating building regulation costs are of such a proportion of overall construction and development costs, that they have been hiding in plain sight of policy makers and others, and whether they should be justifiably considered as a significant contributing factor to the Irish housing crisis.

CHAPTER 3

METHODOLOGY AND METHODS

3.1 Introduction

QAHE (2020, pp.9), states that professional and practice based doctorates are required to demonstrate engagement with research methods and to connect them to how they inform professional practice. It also advances that professional doctorate candidates can use practice as a legitimate research method. According to Barlow (2012), any form of disciplined inquiry aiming to contribute to a body of knowledge should have certain prescribed characteristics. Two of those characteristics are that the inquiry must adopt a justified methodological approach and secondly that it must be undertaken within an explicit philosophical framework.

This chapter considers and justifies a methodological approach for addressing the research, aim and objectives and links the research strategy to an underpinning philosophic framework. The process for establishing the methodology and methods, closely follows the linked approach as devised in the Research Onion (Saunders et al, 2007). Guided by Saunders linked approach, the study firstly considers the researcher's assumptive views and philosophical position to the research. It then examines approaches to theory development, before introducing the methodological choice and research methods to be followed. Following this the chapter reflects on the credibility and quality of the research design and the research delimits. The final sections deal with the researcher's positionality, research ethics and a concluding summary. Historical Institutionalism (HI) is identified in the conclusions of the literature review chapter as an appropriate philosophical framework on which to carry out this research. The case for HI, is considered in section 3.5, as part of an overview of theory development and how it applies to this research.

3.2. Research Aim and Objectives

Saunders et al (pp.122) suggests that the choice of data to be collected and the choice of techniques to be employed in collecting, using, and interpreting that data are essential considerations in any research strategy designed to resolve a research problem or to answer a research question. A strategy to accomplish the research objectives and to achieve the research aim is at the centre of this research methodology design. The research aim and objectives of this research study are as follows.

3.2.1 Research Aim

The aim of this research is to explore how gradually accumulating building regulation costs have increased housing delivery costs, in order to understand the extent that this phenomenon has on development viability and purchaser affordability issues at the heart of the Irish Housing Crisis.

3.2.2 Research Objectives

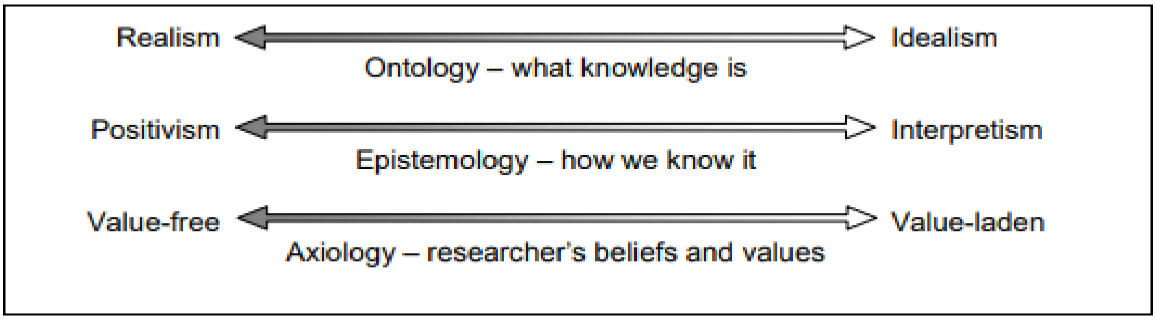
1. To identify and understand the range of issues contributing to the Irish Housing crisis.
2. To ascertain from a review of literature if building regulations costs are considered as a significant contributing factor to the Irish housing crisis.
3. To assess the impact of Irish building regulations costs on residential development viability and purchaser affordability.
4. To position the findings of the research with existing knowledge on building regulations and the Irish housing crises.

3.3 Research assumptions and approaches

Research philosophy is a term that refers to a researcher’s systems of beliefs and assumptions about how knowledge is developed. Our system of beliefs eventually lead us to how we decide what are the best methods to be employed in the collection and analysis of data and how it will be used to study a phenomenon (Remenyi et al, 1998). According to Saunders et al (2016), researchers make a number of assumptions about the nature of knowledge (epistemological), the realities encountered in our research (ontological) and on the ways in which our own views or values should influence the research (axiological). Saunders also suggests that each of the three assumptions guide researchers in their choice of positions, between the extremes of objectivism and subjectivism. In the case of epistemology, the continua might span between assumptions as to what is fact or opinion. Ontological positions might span between what may be considered concrete or abstract, and Axiology extremes, between detachment and absorption.

Because researchers may choose to take positions between extremes of objectivism and subjectivism, Barlow (2012) suggests that this helps to safeguard against tendencies to polarise methodologic choices, by instead emphasising the links rather than the divisions between them. Figure 3.1 below is a graphic illustration of Barlow's interpretation of the continua between extremes of the three research assumptions. The assumptions that we make between the extremes of these three key concepts shape how we construct our research questions, the methods we chose and how we interpret our findings (Biddle & Schafft, 2015). Crotty (1998), argues that researchers with multiple worldview assumptions might lean towards mixed research methods as a functional approach to explore research problems.

Figure 3.1 The continua of the three key philosophical assumptions Source: Barlow (2012)



3.3.1 Epistemology

According to Knight & Turnbull (2008, pp.65) and Grix (2010, pp.166) epistemology comes from the ancient Greek words episteme and logos, meaning knowledge and reason. Grix tells us that epistemology is primarily concerned with the theories and nature of knowledge, and issues such as forms of knowledge, how we acquire it and so forth. Gill and Johnson (2010) emphasis the connection between knowledge theory and a researcher's own theories about what is a true and warranted addition to knowledge. Knight & Turnbull refer to this as 'justified true belief' and suggest that it may not be good enough to only believe, as ones beliefs must have justification. In this sense, a researcher has to show how this justification has been reached. Saunders et al (2016), citing (Burrell and Morgan, 1979) explains how for researchers, epistemology is concerned with our assumptions about knowledge insofar as what constitutes acceptable, valid, and legitimate knowledge, and how we communicate our knowledge to others.

3.3.2 Ontology

According to Collins (2000), the first part of the word ontology comes from the ancient Greek verb ‘to be’. Saunders et al (pp.127) says that ontology refers to our assumptions about the nature of what is real. Knight and Turnbull tell us that ontology is concerned with what we assume to exist and that this clearly has implications on what we can claim to know. Grix further explains this by saying that our ontological claims and assumptions are based on our interpretations about the nature of social reality, what exists, what it looks like and what units make it up and interact together. We are all of different nature and nurtured experience and this leads us to question, whether reality can be viewed objectively or is it simply ones subjective interpretation. Barlow (2012) offers a response to this question by suggesting that everybody encounters their own distinct experience of objects and events, which in turn tailors their very own interpretations of reality.

3.3.3 Axiology

According to Britannica (2022), Axiology comes from the ancient Greek word ‘axios’ meaning ‘worthy’ and is concerned with the philosophical study of value. This may include issues about the nature of values and what kinds of things contain value, but in the research process, axiology is mainly concerned with the role played by the researcher’s own values and ethical nature (Saunders et al, pp.128). According to Kuhn (1962) as discussed in Loewenberg (1976, pp.448), facts are invariably circumscribed by the objectives of a researcher and it is for reasons such as this that Biddle & Schafft (2015) recommend that researchers should identify areas in a study where their own values or potential bias may undermine the validity of their research. Saunders suggests that a research study can be considered to be either ‘value free’ or ‘value laded’ and associates these two categorisations with objectivism and subjectivism approaches.

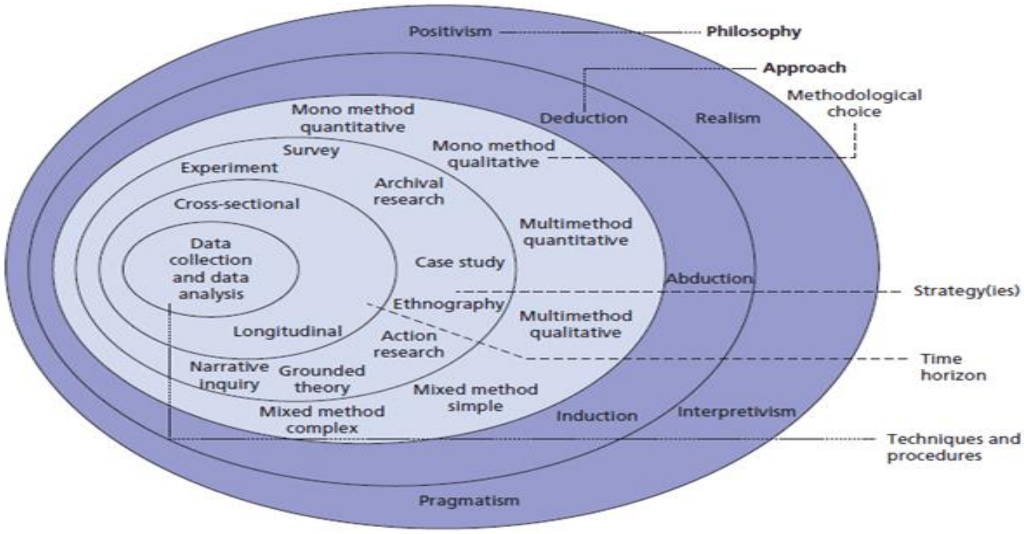
In view of the mixed methods approach taken in this particular research study, it is suggested that a mainly value free research has been pursued. This is put forward because the data extracted from the documents contents analysis is clearly factual based and because the target data sourced from the instrumental case study is primarily quantitative and factual. It is accepted that the findings on the factual data will be subjected to interpretations by the researcher, which it could be argued stray even if unintentionally into subjective territory. But in any event, a reader will in most cases bring their own judgement when drawing on the findings.

3.3.4 Research methodology

Research studies suggest that there are two main approaches to inquiry in the social sciences. One is imbedded in highly structured, systematic and numbers based quantitative research techniques associated with the natural sciences and positivism, the other is based on broader qualitative interpretation of events (Saunders et al, 2016). Creswell (2003) recommends that researchers may choose between qualitative or quantitative data or a combination of both (mixed methods) from which to base their research. Similarly, Grix (2010) advocates that in social science many research studies involve an essential interplay or mixing of methods. He also suggests that theoretical concepts can be proven or will emerge by employing the use of either inductive or deductive research approaches. Perry (1998) and Saunders (op cit) suggest that inductive research techniques are used to build theories, while deductive research involves a strategy where existing theories inform the research, which can then be used to deduce and test hypothesis against collected data.

Saunders et al (2016, pp.122–124) also suggests that it is through the medium of our assumptions and approaches to knowledge, reality and values, as described above, combined with our approach to theory development, that we ultimately arrive at our choice of data collection methods. The way this process unfolds is described by Saunders and illustrated in the ‘research onion’ diagram as contained in Figure 3.2. When the various research approaches proposed to be taken in this study are threaded through the onion layers, a pluralist philosophical position is suggested, combining and linking characteristics of research paradigms such as pragmatism, critical realism, interpretivism and positivism. Creswell (2003) tells us that plural or mixed philosophical positions in research are not uncommon. Goldkuhl (2012) suggests that it is practical to combine research paradigms from which one of them can be determined as dominant and the others as secondary instrumental.

Figure 3.2. The Research Onion. Source: Saunders et al (2016)



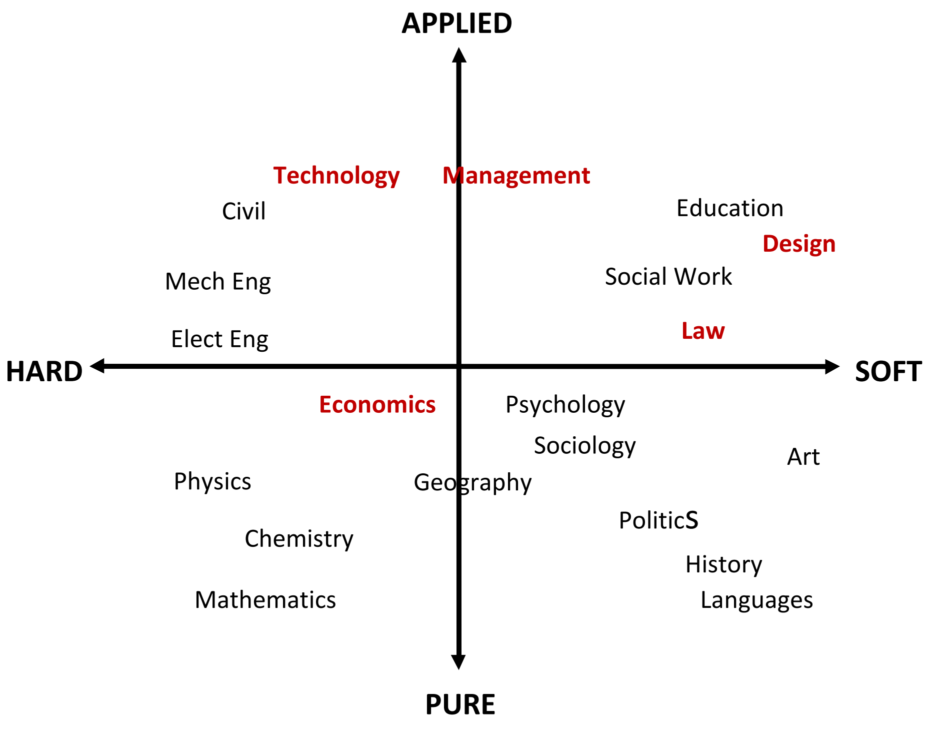
3.4 Philosophical positions

3.4.1 Pluralism

According to Falconer & Mackay (1999 pp.624), citing (Webb et al, 1966; Denzin, 1970), methodological pluralism has long been endorsed by researchers of social science. Mingers (1997) charts the history of methodological pluralism, wherein he states that, chinks in the armour of positivism research first became apparent within quantum physics, and the emergence of the Werner Heisenberg's 'uncertainty principle' in 1927. Hilgevoord & Uffink (2016) explains the basic proposition of this principle as; that you can never simultaneously know the precise position and the precise speed of an object, because everything in our universe behaves like a particle and a wave. Ergo, a measurement cannot be 100% accurate because of the inevitable instability of combining particle and wave nature. Minger (1997, p.3) says that while the uncertainty principle did not affect the propensity of positivist approaches to natural science research, it did help legitimise the rise of social science research methodologies. He also suggests how over time, an artificial situation in social science, where each discipline came to be associated with a single or small set of paradigms, was increasing being called into question. But, also according to Mingers, by the mid-1980s, when Roth's book on 'Meaning and Method in Social Science – A case for Methodological Pluralism' was published, it was acknowledged that methodological pluralism was an accepted practice in research. This endorsement was, he says, because of the ability of mixed methods to better capture the richness of real life situations and to provide triangulation.

This thesis is undertaken by a practitioner researcher in the fields of construction and development management and economics. According to Chynoweth (2014), referencing Biglan's disciplinary model (1973) as outlined in Figure 3.3, construction management is a relatively new research sphere, drawing mainly from the social science branch. Chynoweth goes on to argue that construction management research positions itself into Biglan's model as an applied management field that would normally take interpretivist philosophic approaches to research. At the same time and according to Biglan's model, investigations involving the study of economics are inclined to position themselves into areas associated with hard and pure research approaches. This research study comes from a construction and development management background and combines significant construction and development economics aspects. It is considered therefore, that a pluralist methodological approach would not be out of step with the variety of conventional approaches taken in the practitioner's fields. As suggested by Minger (pp. 243) it is also advocated that by combining together the results from different research methods, that more reliable investigative results and deeper insights can be drawn from this most complex research issue. Furthermore, it is considered unlikely that the research objectives as set out to achieve the aim, would not be resolvable especially at Doctorate research level, without taking multi-dimensional (Mingers, pp. 244) pragmatic, pluralist approaches.

Figure 3.3. The Biglan Academic Disciplinary Model   Source: Chynoweth 2014

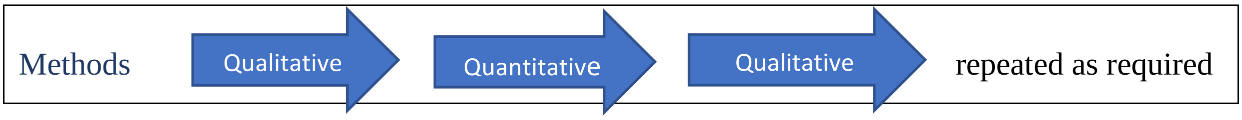


Knight & Ruddock (2008 pp.10), citing Dainty (2008) also postulate that construction management research can draw from either social or natural science approaches and that researchers can also draw simultaneously from both traditions when designing their research. Dainty noted an apparent constriction in the methodological outlook of the construction management research community with regard to pursuing pluralistic research approaches. In this regard, he contends that researchers have a tendency to exhibit entrenched adherence to either positivist methods or a total reliance on open ended interviews in qualitative methods. Dainty's conclusion is that by mixing methodologies and methods, researchers can yield deeper insights and expand the outlook over which a problem can be explored. This is possibly best explained by Minger's (p.256), analogy that instruments such as telescopes, microscopes and x ray machines can offer us views of the world through aspects which are completely blind to each other. And, by singularly adopting only one of these instruments, we may risk limiting our view of the sometimes many different dimensions of a real situation or problem.

Dainty's logic brings a compelling rationale to justify pluralist and pragmatic philosophical positions and mixed methodological approaches to this research study. Dainty's views also appear to be fully supported by the suggestions of Chynoweth and this researcher's parallel interpretations of Biglan's model. As a result, the approaches to research in this thesis will follow expansive pluralistic methodologies. This will involve the employment of positivist methods, yielding numerical data from an instrumental case study and interpretative data selected in a documents contents analysis of 'informant' building regulations documentation, which when combined together will facilitate critical realist observations from which to establish the full extents of the research problem.

In the following data collection, analysis and findings chapters, it is intended that the primary findings of this research will emerge through the answering of research questions in response to the research objectives outlined to meet the overall research aim. The research objectives and research questions are formulated to provide a sequential process to guide the inquiry to achieving the research aim (Grix, 2010, pp.172), employing a sequential multi-phase approach to theory development as described by Saunders et al (2016, pp.171) and illustrated in Figure 3.4.

Figure 3.4 Sequential Multi-phase, Mixed Methods Research Design Source: Saunders et al (2016)



Based on the researcher's proposition that there are a number of research paradigm orientations in the philosophic approach taken in this thesis, it may be justifiably considered that pragmatism can be regarded as the overarching or dominating philosophy employed.

3.4.2 Pragmatism

According to (Saunders et al, 2016, pp.144) pragmatism is a research philosophy which recognises that there are many ways of interpreting our world and to carrying out research. Morgan (2007) says that the main focus for pragmatists is to resolve real world issues through research questions and objectives. While Feilzer (2007, pp.3) and Saunders et al (op cit) consider that pragmatism avoids the bony issues of cornering a researchers world views and assumptions on reality, knowledge, and truth, accepting that all of these can be singular, multiple, or mixed. By taking a pragmatist's position, researchers do not tie themselves to rigid or proscriptive approaches in their research, as may be the case with other research philosophies, associated with singular or specific research methods to the exclusion of others (Denscombe, 2008). Feilzer relates Denscombe's analysis to putting aside metaphysical issues in order to pursue the practical decisions that will ultimately resolve the research question. Morgan (op cit) citing Dewey (1920) exclaims that pragmatism as a philosophy is very often associated with practical approaches to problem solving and asking 'what works'. Pragmatism, therefore, aims to interrogate issues, questions, theories, or phenomenon with the most applicable research methods.

The word pragmatism is derived from the ancient Greek word "pragma" meaning action, and from which the words practical and practice also originate. (Pansiri, 2005). As a research paradigm, pragmatism is founded on the historical contributions of the philosophical movement that originated in the United States in the late nineteenth century (Maxcy, 2003). The movement traces back to a discussion group meeting in Cambridge, Massachusetts in the 1870s, which included Harvard philosopher Charles Saunders Peirce, psychologist William James and philosopher, mathematician Chauncey Wright. Considered the establishing fathers of this philosophical doctrine, they were together in fundamental disagreement with a number of conventional assumptions on the nature of truth and knowledge creation (Creswell, 1999).

Kaushik & Walsh (2019) summarise that a major tenet of the group would have been that inquiry should focus on the question instead of on the methods used to answer it.

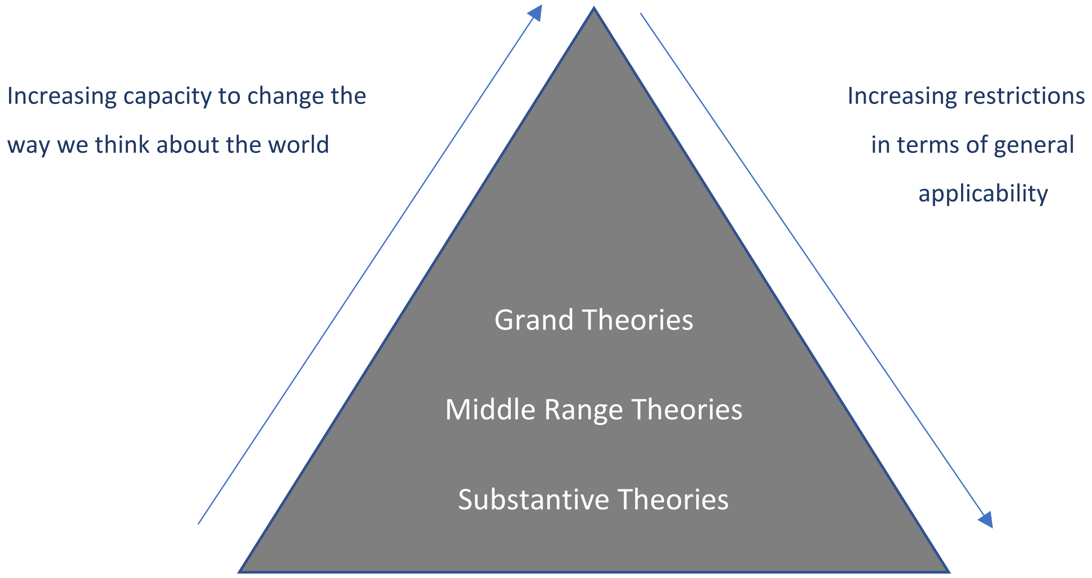
The doctrine was further developed by philosophers and academics such as George Herbert Mead and especially John Dewey (1859 – 1952) who had a very long career, writing and contributing extensively to debates on inquiry and education reform (Maxey, op cit). Dewey's own version of pragmatism, which he referred to as Instrumentalism, was based on his view that knowledge comes from our ability to comprehend correlations between processes of change or events (Gouinlock, 2021). In relation to this research study, the appeal of pragmatism has much to do with practicality and combining the strengths of qualitative and quantitative research methods than its broad philosophical basis.

3.5 Approach to theory development

3.5.1 Introduction

Grix (2010, pp. 101) tells us that in human science today, there is much confusion surrounding the use of the word theory, where he mentions homonymies and synonymies as contributing to the issue. He also suggests that this confusion is particularly so, because of the different uses that theory plays in social science research, depending on the context, purpose or academic perspective of the research. According to Saunders et al (2016, pp. 49-53), theories are formulations regarding cause and effect relationships between two or more variables, which may not have been already tested. Creswell (2002) is less defining. He suggests that not all theoretical contributions are the same. On this point, Grix (op cit pp.119) explains that contribution differences in the role that theory plays in research are based on their level of abstraction, range and the degree of social reality they encompass. Creswell explains these differences in a threefold typology of theories as outlined in Figure 3.5. In this typology, a grand theory can be explained as one that covers the general framework of high order and important society based principles, while a middle range theory, is one which is concerned with more specific aspects of social concern. A substantive theory can be described as a theoretical interpretation of a studied phenomenon that may involve groups.

Figure 3.5 Threefold Typology of Theories. Source Creswell (2002)



Theoretical frameworks underpinning a research study will most likely integrate with the more abstract grand theories level of Creswell's typology, while approaches to theory development at research design stage will centre on middle range or substantive theorising. At which stage, an important theoretical concept to be considered is the reasoning approach to be adopted. This is most often portrayed by following one of two contrasting approaches; deductive or inductive as illustrated in the research onion approach. According to Saunders et al (2016), deductive research involves a strategy whereby existing theories inform the research, which can then be used to deduce and test hypothesis against collected data. While inductive research techniques are used to build theories.

According to Harriman (2010, pp.235-236), it was Aristotle who first developed a formal system for reasoning, and that he saw deductive and inductive thinking as being complimentary to each other. It was Aristotle's view that induction was necessary to develop theories and that this logically led to deduction, which was necessary to develop and refine those theories. Later, the philosopher Francis Bacon (1561-1626) and mathematician Isaac Newton (1643-1727) championed inductive study of the natural world, but it was deductive reasoning that came to dominate scientific research, thanks to the influence of philosophers like Rene Descartes (1596-1650) and David Hume (1711-1775), (Locke, 2007, p. 870). Descartes and Hume held a view that inductive reasoning was inferior to deductive, because our senses are not valid means of attaining knowledge and because of this, we have to rely on innate ideas and existing theories from which to deduce hypothesis (Woiceshyn &

Daellenbach, 2017). More recently, the writings of Karl Popper (1959), including his falsification theory and elevation of deduction have generated much debate as to the functionality of inductive research, by challenging the concept of generalising from empirical observations. But for many, Popper's arguments only served to beg the question of 'where will the theories come from in the first place'? (Ormerod, 2009). Indeed, Locke (2007, pp.888), quoting Galileo, argues that whatever 'sensible experience shows' ought to be accepted over any deductive argument, however well founded.

3.5.2 Deductive research

Deductive research approaches are said to begin with clear assumptions and previous knowledge and understanding of a specific problem or issue. Grix (2010) says that above all, deductive research is a label given to research that lends itself to testing or confirming a theory. Creswell & Plano Clark (2007, pp 23) describe deductive research as working from the top downwards, from a theory to a hypotheses, then to data, from which to add to, or to contradict a theory. As a consequence of this approach, it is, according to Trafford & Leshem (2008, pp. 144), highly likely, any conclusions drawn in research of this nature will be highly reliable. Deductive research can also be explained as an approach that moves from the general to the particular, starting with a theory, then formulating hypothesis from that theory, to test those hypothesis, against collected data, in order to confirm, support, reject or propose modifications to the theory.

3.5.3 Inductive research

Inductive research uses empirical observations about a phenomenon to identify patterns in order to develop explanations or generalisations to build a theory (Grix, 2010 pp.115). As such, this approach is concerned with theory development, as opposed to theory testing and involves moving from the specific to the general (Locke, 2007). Creswell & Plano Clark (op cit) describe inductive research as working from the bottom upwards, using participants or possibly instruments, to generate theories. Saunders et al (2016, pp.147) notes that unlike deduction, which has a tendency to advance rigid outcomes, induction can permit alternative explanations or interpretations of 'what's going on' and is likely to be particularly interested in the context where the events are happening. He also notes that inductive research is commonly carried out in situations where there is very little literature on a topic.

3.5.4 Abductive research

According to Saunders et al (op cit, pp. 148-149), abduction is an approach to research where, instead of moving from a theory to data, as in deduction and from data to a theory, as in induction, the research moves back and forth, in effect, combining the two approaches. Grix (op cit, pp.115), citing Raglin (1994, pp.47) suggests that most social research approaches use inductive and deductive theory together, as there is often a necessary interplay between concepts and evidence in the research process. Similarly, Saunders et al (op cit), suggests that in social science many studies involve a necessary interplay or mixing of both approaches. They also contend that abduction can begin in the middle of the research process, with the observation of a surprising fact or issue, which through deductive and inductive interplay, a plausible theory or reason is worked out for how this could have occurred. Abduction can also involve either one approach or the other being more dominant. Interestly, Grix (op cit, pp.164) doubts whether the so called deductive-inductive dichotomy is anyway near as clear cut as some academics might suggest.

3.5.5 Abductive and multi method approach to this research

Due to the complex step by step nature of this research study, there is a significant back and forth interplay between the various approaches taken to understand the research problem. Overall, it appears that for practical reasons, the data collection and analysis process and the format for interpreting the analysis and achieving the research objectives will clearly be abductive in approach. It is also reasonable to state that the abductive process shows no major signs of dominance from either of the two approaches of inductive or deductive.

3.5.6 Underpinning theoretical framework

3.5.6.1 Introduction to Historical Institutionalism

In the closing section of the literature review, the concluding analysis introduced Historical Institutionalism (HI) as an appropriate theoretical framework on which to underpin this research study. In HI, institutions are sets of formal or informal rules and conventions that govern human behaviour, and society is studied in terms of the development of those rules in a temporal sequential context (Hall & Taylor, 1996). For clarity, it is worth noting that in this instance the word institution should not be mistaken for the homonym word that refers to bodies or societies, such as universities or professional organisations. According to Capoccia

& Kelemen (2007), HI is a research approach emphasising rules, change, timing, and path dependent processes as key components that shape political and economic behaviour. In HI, strong emphasis is placed on context and emphasis on empiricism rather than pure theory (Thelen, 1999). Steinmo (2008) neatly connects the approach of HI with a research study of this nature, by describing how it seeks to understand why certain choices were made and then why a certain outcome has occurred.

Two key concepts contained in the framework of HI are Critical Junctures and Path Dependencies (Thelen, 1999). Acting together, these two concepts underline the idea that once a critical choice has been taken and patterns set in an institutional framework, that the range of opportunities to alter them are considerably narrowed (North, 1990). Path Dependencies are subsequent decisions or actions taken on prior decisions and such (Nowlan, 2018). Critical Junctures are the antecedent or key interruptions in the path dependencies when critical decisions or events take place that are difficult to reverse (Bell & Feng, 2019).

3.5.6.2 Institutionalism

In political and social science research, Institutionalism is a theoretical approach to the analysis and study of governance and rules. In this respect, Shepsie (1983) defines Institutions as a framework of rules, arrangements and procedures. According to Thelen (1999), there are three variants to institutional research approaches, each representing an expansive literature base. In political science, the three variants are collectively referred to as ‘New Institutionalism’. Hall & Taylor (1996) refer to the three different approaches in terms of schools of thought within Institutionalism, and label them as Rational Choice Institutionalism, Socio-logical Institutionalism and Historical Institutionalism. Thelen suggests that although each school of institutionalism is characterised by a different analytical approach and a unique internal diversity, it is often difficult to draw hard boundaries between them.

Steinmo (2008) provides a useful summary of the main differences between the three institutionalist thoughts. While noting that all three agree that institutions are rules that structure our behaviour, they have somewhat different interpretations of the nature of the individuals whose behaviour or actions are being structured. Here Steinmo offers that the Rational Choice school believes that humans are rational individuals in the choices that they make, by for instance predetermining cost and benefits in decisions that they take. In this context, institutions simply provide the structures from which individuals can frame strategic behaviour. Therefore, in Rational Choice Institutionalism, people cooperate and follow rules because they are strategic actors who understand that by doing so, they are most likely to improve their individual circumstances. By contrast, Sociological Institutionalists identify human beings as social actors. Through this lens, people are seen to act less from pure self-interest perspectives but from more habitually motivated choices, based on what may be the most appropriate way to act under the circumstances found. In this school of thought, the important institutions are the social norms that govern social interaction and our everyday lives.

Perhaps influenced by the analysis of Hall & Taylor's (op cit), Steinmo's summary of the main differences between the three institutionalist schools concludes that Historical Institutionalist scholars stand between the two alternative views, determining that human beings predicate their actions based on what is appropriate or what is in their best interests, within the context of the rules and the situation in which they find themselves in at any particular time. In a broader critique of the variations within Institutionalism, Thelen (1999) argues that Historical Institutionalists place a stronger emphasis on context and empiricism rather than pure theory. She also asserts that HI is less inclined towards assumptions of equilibrium order, whereby change is perceived as a step from one state of equilibrium to another. This assertion is important in the study of building regulations within a historical and futuristic based process of evolving and changing rules.

3.5.6.3 Foundations of Historical Institutionalism

The term HI spawned from an academic workshop held in Boulder, Colorado in 1989 and was first coined in 1992 in a subsequent academic paper by two of the participants, Kathleen Thelen and Sven Steinmo. Interested in real world outcomes and challenged by questions of why some turn out differently than others, this group of academics accentuated the influence of institutions, because of the propensity with which they appeared in their analysis (Steinmo, 2008). Inspired by evidence of institutionalist theories found in earlier works of academic writers, most notably in Karl Polanyi's *The Great Transformation* (1944) and more recently in Theda Skocpol's *States and Social Revolutions* (1979), they found that pre-existing state institutions had a profound influence over revolutionary and real world outcomes. Steinmo (2008) also suggested that institutional theories were to be found in writings on political studies dating back to Plato's *Republic* and Aristotle's *Politics.* He further argued that many past political scientists, such as Max Weber, David Truman and Karl Polanyi, would, if they were writing today, be considered as Historical Institutionalist scholars. This he asserts, is because their work was invested in real world outcomes, where the analytical tool of choice was history and also because they were interested in the way in which institutions or rules shaped outcomes.

Previous recent studies using a HI approach include research by Norris (2014), where critical junctures and path dependencies are used in a study of the Irish rental market, which explores triggering policies and a roll out of measures over time, which the author suggests are indicative of an unravelling of Ireland's Dualist rental model and replacement by an embryonic Unitary model. In a study by Jacobs and Manzi (2017), critical junctures are used to explain the limited capacity of consecutive UK housing policy makers to change a course established by Labour government housing reform policies created between 1974 and 1979. More recently, Nowlan (2018) uses the prism of HI theory to develop a rationale for funding social and affordable housing by private sector actors in Ireland.

3.5.6.4 Critical junctures

Pierson (2011) describes critical junctures as a starting point for many path dependent processes. He notes that in HI junctures are 'critical' because they will place institutional activities on trajectories or paths that are subsequently very difficult to dismantle. In an earlier definition, Pierson (2000) describes critical junctures as triggering events, setting development along a specific path. Thelen (1999) refers to critical junctures as 'critical founding moments of institutional formation', from which countries are sent along unique developmental paths. Critical junctures can stem from events and may also be heavily influenced by the timing of exogenous factors such as international agreements. Capoccia & Kelemen (2007, pp.243) argue that choices made by powerful political actors during Critical Junctures can have the effect of closing off alternative options and that this ultimately leads to the formation of institutions or rules that produce self-perpetuating path dependent processes. They also claim that despite Critical Junctures practical and theoretical importance as the originating genetic base in historical institution's equilibria moments, that the majority of scholarly analysis concentrates on the subsequent 'reproductive' path dependent process phases. In Caldari, (2010), the condition of 'moving equilibria' in Institutionalism is described in terms of the Darwinian idea of crucial connections between equilibrium and change.

Critical Juncture principals can be invoked as means of interpreting subsequence and sequels in various types of study on developmental processes (Capoccia & Kelemen op cite). For instance, in Eldredge & Gould (1972) study on punctuated equilibria, they suggest, in a challenge to more gradualist models in the study of evolution, that models in which short bursts of change are followed by very long periods of equilibrium, are credible hypothesis in speciation studies. Speciation was a term coined by Orator Cook in 1906, to describe the process where populations or groups evolve separate from their original members to become distinct species with their own characteristics (Cook, 1906). In David (1985), the story of the QWERTY keyboard, which is the most commonly used keyboard today, relates to us how in 1867 a Milwaukee printer, named Christopher L Sholes, developed a writing devise based on a desire to lessen the number of typebar clashes and jams. Since QWERTY, there have been many other faster and easier to use keyboard layout designs produced, including the ABC and the DVORAK versions, which lines up the most commonly used characters. However, none of the above have managed to replace the over 150 year old QWERTY layout. This story is a primary example of the concept in critical juncture studies emphasising that once a subsequent trajectory path is set in motion it can be very difficult to disassemble. Another example is the case of the standard gauge of railway track, which since the 1820s has been set at 4’ 8½” in North America, Europe and many parts of the world, despite numerous engineering studies to assess the technical, regulatory and economic gains of wider tracks (Puffert, 2008).

Mahoney (2000) emphasises the importance of meaningful choice and the role of agency in the concept of critical junctures. Here the connection of critical juncture and path dependent processes is considered with a recognition that a juncture is critical because it is a ‘choice point’ from which once a particular option has been taken, it may no longer be possible to go back to change to another option. Mahoney uses the, passing the point of no return, scenario, to underline the significance of agency in the exercise of choice, as this shows how the decisions of distant actors in the past can affect long term path dependant developments. Possibly the most famous example of this scenario, is married to the phrase “crossing the Rubicon”. This idiom refers to the monumental event in 49 BC, when Julius Caesar and his army crossed the river Rubicon, which separated roman territory from its provinces. The act of crossing the Rubicon with a provincial army, at that time, was a de facto declaration of civil war. This critical decision, precipitated Caesar’s coming to power, the eventual dissolution of the Roman Republic and the emergence of the Roman Empire dictatorships

(Beard, 2015). It is famously claimed by historians, that once across the river, Caesar declared, “the dye has been cast”.

3.5.6.5 Path dependencies

Where critical junctures are deemed to constitute starting points in HI approaches to theory development; path dependence are then considered as the crucial mechanisms in rolling out the lasting impact of choices or decisions made at those points. When Thelen (1999) purports that Critical Junctures are crucial founding moments of institutional formation, she then also suggests that those institutions continue to develop in response to ongoing political manoeuvring and environmental conditions, but in trajectories that are constrained by past actions. Levi (1997) describes this constraint by explaining that once a country or union of countries decide to go down a particular track, an entrenchment of specific institutions can occur obstructing a reversal of the original choice. And, the further you go, there is less opportunity to change direction and the likelihood of further steps in the same direction. It then follows, that an accumulation of gradual incremental changes, combines to create a substantial transformative change (Streeck & Thelen, 2005)

In a critique on the use of path dependencies in political studies, Kay (2005) examines their application to policy studies and the advantages of the concept in understanding policy development. Unlike Malpass (2011), Kay does not question whether path dependencies are best used to look into either policy institutions or policy, but he does consider that path dependency is better at describing stability and continuity, rather than observable change. On the other hand, Malpass (op cit) and Pierson (2004) specifically define how processes of continuity and observable change over time are distinguished in path dependencies and that it is the interplay between timing and sequence which makes the concept an attractive means to studying Institutions.

In economic studies, Puffert (2008) regards path dependent processes, as courses of actions primarily based on previous economic outcomes. In this approach, the history of previous economic results have an enduring influence, particularly if it can be assumed that by following previous approaches to meet end goals that the chosen course will save time and present less financial risk arising from ill-informed judgements. While this approach to path dependency is different to how the theory is applied in administrative politics, there are similarities. The main similarity being, how the application of path dependent processes can weaken the efficacy of final outcomes, by an observed inability of the process to change direction or be swayed by current conditions, such as the emergence of modern technologies or a building up of unintended issues.

Streeck & Thelen (2005) explains why path dependency processes can be applied in different ways, depending on the nature of study, such as in political administration or economics research. On page 31 of their study on institutional change in advanced political economies, they list 5 ways in which path dependent processes can apply in non-dramatic changes to institutions or practices. These are referred to as Conversion, Displacement, Drift, Exhaustion and Layering. Conversion implies redeployment of old institutions to new purposes. Displacement implies a slow replacement of subordinate institutions for more dominant ones. Drift implies a slippage of use in practice. Exhaustion is explained by a gradual withering away of institutions over time. Finally, Layering is explained as an ongoing implementation of new institutions, which have the effect of gradually changing the status and structure of previous institutions. The parallels between the concept of Layering Path Dependencies and the phenomenon of ongoing developments in the institutions that are building regulations are clearly recognisable.

3.5.6.6 Historical Institutionalism in the context of this research

Within the framework of this research, which is essentially centred on rules, change and time, HI offers a theoretical basis into how and why building regulations have steadily developed in this modern time. By understanding how and why building costs have risen due to developments in building regulations, HI then also aids us to articulate casual arguments that; in spite of policy and law makers best efforts, unintended consequences have arisen, where in order to achieve desired improvements in building standards, building costs appear to have outpaced housing consumer earnings to such an extent that home buyer affordability levels in the Irish housing market may have been structurally undermined.

In the context of this research institutions are the building regulations, path dependencies are the continuous and incremental changes in the regulations and critical junctures are the dramatic or episodic events which have for instance, brought about policy maker decisions to introduce near zero energy building standards NZEB in new residential dwellings. Pierson (2011) neatly summarises this connecting theoretical and empirical context, where he suggests that through the prism of HI, interpretations of longitudinal rules based data can provide us with a clear lens from which to understand the how and why of a contemporary phenomenon.

3.6 Methodological choices

A traditional view of what differentiates research methodologies is that quantitative inquiry collects and analyses numbers, while qualitative inquiry collects and analyses narrative. Related to this dichotomy is the parallel view that quantitative research is more generally associated with deductive approaches and that qualitative research is generally adopted in inductive research approaches (Hyde, 2000). Further characterisations recognised by Hyde is that quantitative research is most closely related to positivist philosophies of science, while qualitative research is more closely linked to interpretivist and relativist type paradigms. Apart from this, Guba & Lincoln (1994, pp. 105) and Saunders et al (2016, pp. 170) suggest that quantitative and qualitative methods or combinations of methods can be utilised in any research approach or philosophy. Saunders et al (op cit, pp. 165) defines numeric data as obtainable from techniques such as questionnaires, graphs or statistics. Whereas qualitative data can be generated from interviews, focus groups or documents. Saunders et al (op cit, pp.185) and Yin (2018, pp. 18) suggest that qualitative methods are the predominant approach to data collection in case study research. However, Yin (pp.64) also acknowledges that mixed method approaches which funnel qualitative and quantitative data into an integrated mode are common research techniques to elucidate data embedded in the case.

Onwuegbuzie & Leech (2005, pp. 270) as cited in Soiferman, maintain that researchers choose either quantitative or qualitative research approaches based on their views on the nature of reality. They suggest that quantitative theorists are invariably positivist in philosophical approach and that they view the world as a single reality that can be reliably measured using scientific principles. Whereas qualitative theorists are understood to view the world as being constructed of multiple realities, that generate different meanings and contexts for different individuals. Others such as Grix (2010, pp.122) do not see the quantitative-qualitative dichotomy as logically, and argue that there is no reason why a researcher should not employ quantitative based research methods, in for example, an in depth case study of a particular perceived observation. Equally he argues that qualitative research methods can be employed, to for instance, compare the results of quantitative studies across jurisdictions. Building on his arguments as to the blurriness of the deductive-inductive dichotomy, Grix is also of the opinion that broad divisions between when and how quantitative and qualitative research methods should be employed are not always clear cut and he therefore advocates that mixed and multi-methods ought to be used when appropriate (pp.124). Soiferman (2010) also contends that the two data collection and analysis methodologies are not mutually exclusive, because sometimes they can be shown to address the same question using different methods.

The methodological choices adopted in this research incorporate mixed and multi method data collection, analysis and interpretative processes, employing the use of qualitative and quantitative approaches, through documents contents analysis and an instrumental case study. The choice and sequences of methods use are contextual and circumstantially driven, which align with the views of Grix and other research method theorists who advocate pragmatic pluralist approaches to research.

3.7 Research strategy and methods

3.7.1 Introduction

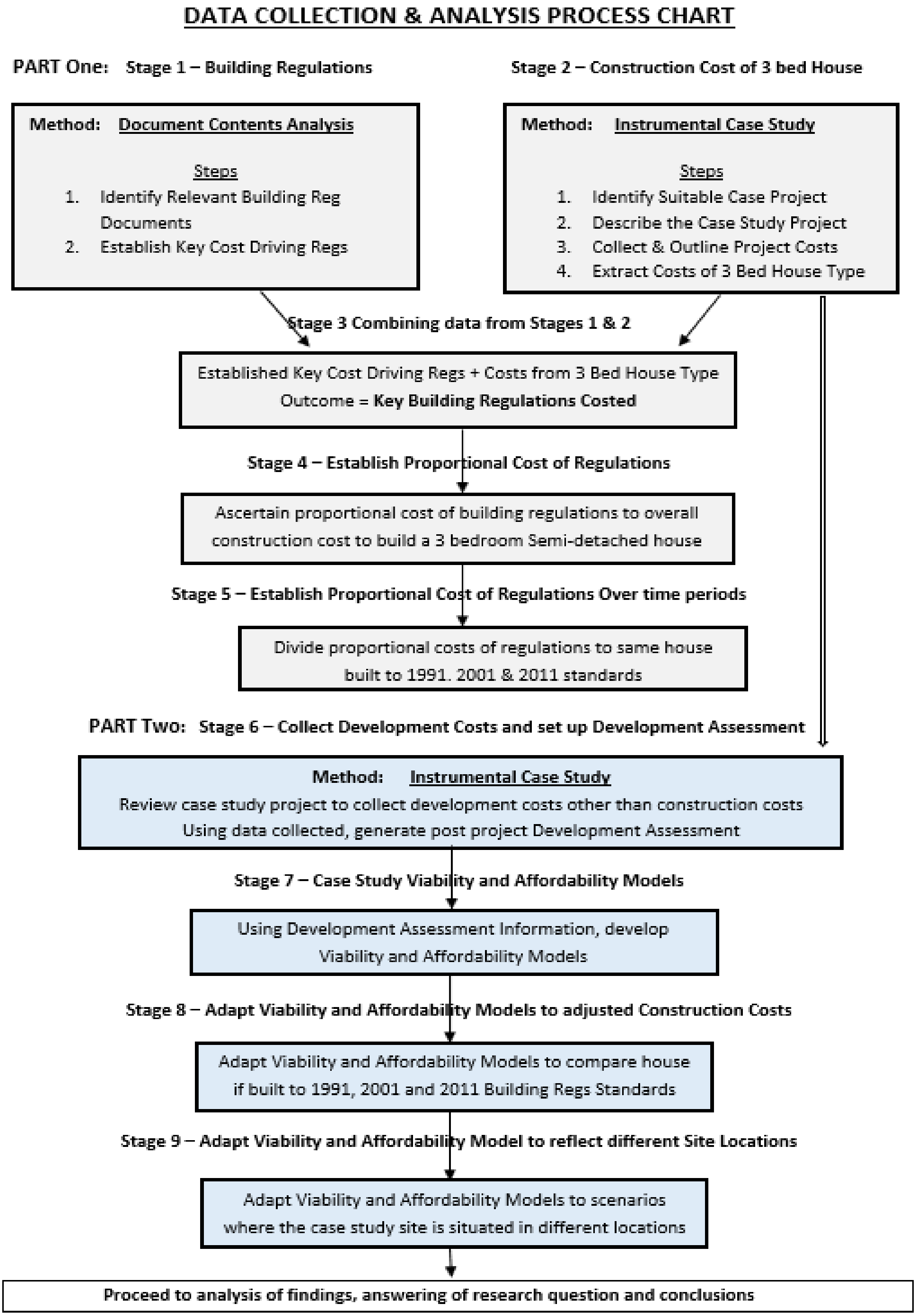
The research aim and objectives for this research are outlined in section 3.2 of this chapter. As noted in section 1.4 of the Introduction chapter, the research objectives are refined into a series of connected research questions, devised as explicit means to resolving those objectives and thereby achieving the research aim. The research objectives and questions are addressed in the discussion on findings chapter 5. Table 3.1, below, sets out the link between the research objectives and the research questions. It also locates the chapter from where the information or analysed data used to resolve the question, may be found.

The following data collection and analysis chapter, contains a process chart which has been developed to serialise and guide the various multi method stages to be followed in order to answer the research questions. This process chart is contained in Figure 3.6 and illustrates the use of a two part, nine stage data collection and merging process, involving a mix of quantitative and qualitative research methods and an abductive research strategy approach. The first part is concerned with the effects of building regulations costs on overall ‘construction costs’ and the second part is concerned with the effect of building regulations costs on overall ‘development costs’.

Table 3.1 Linking Research Objectives to Research Questions

	Research Objective	Responding Research Question	Chapter
1	To identify and understand the range of issues contributing to the Irish Housing crisis.	1. What issues can be identified in the review of existing literature as contributing factors to the Irish Housing Crisis?	Chapter 2
2	To ascertain from a review of literature if building regulations costs are considered a significant contributing factor to the Irish housing crisis.	2. Have building regulations costs been directly identified as a contributing factor in the literature?	Chapter 2
		3. Can building regulations costs be indirectly identified in the literature as a contributing factor to increased construction costs?	Chapter 2
3	To assess the impact of Irish building regulations costs on residential development viability and purchaser affordability.	4. Can building regulations specific to housing be identified and then assessed for their proportional impact on the construction costs of a typical estate built house, using live cost data?	Chapter 3 and Chapter 4
		5. Are building regulations costs a significant proportion of the overall cost to construct a typical estate built 3-bedroom semi-detached house?	Chapter 4
		6. Since Irish building regulations were first introduced in 1991 have their impact on overall construction costs gradually accumulated?	Chapter 4
		7. What is the current position of residential development viability and how does the current position compare to scenarios where accumulated building regulations costs are factored out of the cost base?	Chapter 4
		8. What is the current position of new homes purchaser affordability and how does the current position compare to scenarios where accumulated building regulations costs are factored out of the cost base?	Chapter 4
		9. What would be the effect on development viability and purchaser affordability if the case study development site was situated in alternative locations?	Chapter 4
4	To position the findings of the research with existing knowledge and literature on building regulation costs and the Irish housing crises	10. How does the findings of this research add to the existing knowledge and literature on buildings regulations and the Irish housing crisis?	Chapter 5

Figure 3.6 Data Collection & Analysis Process Chart



The process chart establishes for readers that in part one, stage 1, a documents contents analysis investigation has been chosen to identify building regulations that have had the effect of increasing the cost of residential construction. In part one, stage 2, an instrumental case study investigation of a recently completed housing development is chosen, where the purpose is to identify live construction costs to construct a typical estate built, three bedroom semi-detached house. The 3rd stage involves bringing the data from stages 1 and 2 together, so that the cost driving building regulations identified in the documents contents analysis investigation can be valued using the cost information provided by the case study. Stage 4 then ascertains the proportional value of building regulations costs insofar as the overall construction costs are concerned. Stage 5 then subdivides the cost of building regulations into the 10 year time periods within which they came into effect, so that the research can establish what it would cost to build the same house today using building regulations standards that applied in 1991, 2001, 2011 and 2021.

In part two, stage 6, the instrument case study switches from establishing live construction costs to establishing live development costs. The development costs are taken from the same residential development project that provided the construction cost data. Those development costs are then analysed to enable the research to extract the develop cost value attributable to the single case study house. In stage 7, the development costs for the case study house are then incorporated into development viability and purchaser affordability assessment models. In stage 8, the assessment models are adapted to establish what the effect would be on development viability and purchaser affordability, if the case study house costs are swapped with the costs to build the same house today using building regulations standards that applied in 1991, 2001, 2011 and 2021. Finally, in stage 9, the stage 8 exercise is repeated, but this time to reflect scenarios where the case study house is re-located to an adjacent region, closer to, or further from Dublin City.

3.7.2 Documents contents analysis investigation

The systematic analysis of documents has been a staple source for data collectors in qualitative research for many years (Bowen, 2009). According to Yin (1994; 2018) documentation and archival records can provide rich sources of numerical and narrative data. Yin also notes that time series analysis of documents is a useful document categorising technique. Documents used for systematic analysis as part of a research study can take many forms, including government publications, manuals, statistical data and so forth (Rapley, 2007; Prior, 2008). The purpose of documents in social studies research can also be interpreted in different ways. Grix (2010) claims that document analysis can range from examining specific texts, with the simple aim of gaining insights into an organisation's policy or viewpoints, to for instance, a full-blown technical discourse of official documents or archives to garner specific information.

Prior (op cit) argues that in document contents investigations, the position of the documents may be elevated to the role of active agents or informants in the network of actions, rather than just filling a single or passive role of receptacles of data. In this way public documents, in this case, the building regulations will be regarded as informants, much like interviewees and using this approach the documents being analysed are not interpreted as secondary data (Glaser & Strauss, 1967). Saunders et al (2016, pp.184), citing (Hakim, 2000) stresses that in documents contents analysis, it is important to spell out the distinctions between the subject documents original purpose and the purpose of research analysis.

Insofar as this research study is concerned, the views of Grix and Prior fully align with the context and justifications for utilising documents contents analysis as one part of a two stage data collection, analysis and interpretation approach. This conclusion is supported by the fact that building regulations are to be found in a voluminous collection of technical rules and legislative documents on construction and design science, methods, materials, and procedures. These rules have been developed over time by government departments and legislators and are not simply a collection of documents containing information or data that has been previously collected, synthesised and analysed by previous researchers. Furthermore, the data information to be interpreted, extracted and synthesised from the building regulations documents is distinctively instrumental in nature, because the documents are to be analysed only for the purpose of identifying regulations that are deemed to exhibit tangible cost implications. In summary, this research will use current and previous versions of building regulations as a source base from which to shed light on the specifics of their cost implications and from which to launch the inquiry.

3.7.3 Case study investigation

There are numerous definitions available to researchers that describe case study research. According to Yin (2016, p.211) a case study is an in depth empirical investigation into a topic or phenomenon within its real life setting. Harrison et al (2017) suggest that the most commonly considered case study definitions come from the influential works of Robert Stake

(1995), Sharon Merriam (2009) and Robert Yin (2014). Stake defines case study as research revolved around understanding "the particularity and complexity of a single case" within certain circumstances, while Merriam describes case study as an in depth description and analysis of a bounded system. According to Simmons (2009, pp.4) a case study can involve inquiry into any number of subject matters, including a person, an institution, a policy or an event. Saunders et al (op cit) expands the list to include organisations, associations and so forth. Both agree, as does Creswell (2017, p.73) that determining the bounded context of the case is a key factor in defining the inquiry. According to Yin (2018, P.20), a case study should be selected where it is clear to the researcher that it is the most efficient and accurate means to link collected empirical data to the process of answering research questions.

There is much ambiguity in academic theory surrounding whether case study research is a methodology, a method or both (Harrison, op cit), and much has been written about the many approaches to case studies that researchers can follow depending on one's epistemological position. This aspect of case study research can be viewed as a positive characteristic or otherwise, but it has its critics. According to Yazan (2015), the current literature on case study research, tells us that among the prominent research methodologists, including Stake, Merriam and Yin, there is not a collective consensus on a specific type, design or use of case study research work. In a review of their published work, Yazan finds that each of the three methodologists has his or her own unique epistemological position, methodological definition, and approach to research design. He points to this aspect as a significant reason why consensus does not exist and why there are so many established case study approaches. Harrison (op cit) purport that case studies have a 'practical versatility' and are not assigned to any fixed philosophical position. This they suggest makes case study research suitable to inquiries where a researcher holds positivist, realist or pluralist perspectives. Costley et al (2010, pp.89) recommends that case study researchers may draw from a variety of methodological positions and take qualitative or quantitative approaches to data collection and analysis. In agreement with this perspective, Simons (2009, p.127) further recommends that case study researchers should draw from any number of data collection techniques and strategies, in a way that best suits the purpose, dependability, and defence of one's research study. The pluralist methodological positions and duly considered pragmatist approach to data collection and analysis strategies adopted in this research, are endorsed by the recommendations of Costley and Simons, insofar as they best fit the purpose, reliability and ultimate defence of this thesis.

Case studies can also be based on a single or multiple cases. Yin (2014, p.57) argues that while multiple case studies may provide the research with a perceived additional element of rigour over and above a single case study, the disadvantages with respect to time and resources can inhibit their use, especially for low budget or self-funded persons such as doctorate researchers. This argument is supported by Stake (2006, chapter 2), where he advises that in time managed multiple case studies there may be a requirement for each case to taken by one person, otherwise the review could lack thoroughness and depth. Stake also suggests that when a single case study is chosen, it will usually be because there will be meaning to the researcher, to some extent, in terms of other unstudied cases that he or she will already be aware of. The advice of both Yin and Stake of the practicality of single case study use over multiple case study in certain circumstances supports the suitability argument of single case study research as chosen in this research. A single case study approach also aligns with the research objectives to collect real cost data from a live construction project, undertaken under market conditions, within the confines of a self-funded doctorate student.

Stake (1995) distinguished three main types of Case Study: ‘Collective’, where several similar cases are studied to form a wider understanding of a phenomenon, ‘Intrinsic’, where the researcher wants to understand the case and therefore the case itself is dominant, and ‘Instrumental’, where the inquiry is more interested in an object or particular part of the unit of analysis and therefore the case itself is secondary to understanding a separate but particular issue. Stake previously explained the function of an instrumental case study, as offering a supportive role to facilitate the understanding of something else, or to cast a wider lens on the studied phenomenon (Stake, 1994, pp. 237). In this research study, the case study type will be instrumental in nature. This is because the purpose of the case study will be to identify and collect specific data (Idowu, 2016) and to apply that data to another set of collected data, as part of a wider research strategy. In context, this research study will identify and collect cost data from the instrumental case study and apply that data to building regulations data, collected in the documents contents analysis, in order to build an understanding of the proportional impact that building regulations costs have on the overall cost of housing.

3.7.4 Dealing with criticisms of case study research

Like many social science research methods, case study research has its critics and advocates (Idowu, 2016). Issues with subjectivity, rigour and generalisability are commonly expressed and for this reason, researchers are encouraged to consider and discuss those concerns and also to explain the process for choosing this method (Merriam, 2009). According to Flyvbjerg (2006) many of the criticisms of Case Study research come from social science researchers who have a preference for quantitative methodologies or those who believe that in order for research to have validity it must be generalisable (Abercrombie et al, 1984). Flyvbjerg also suggests that the main criticisms associated with case study research relate to; an inability to generalise the results. He also outlines a further 3 criticisms, including an inability to add to theoretical knowledge, an inability to avoid bias toward verification, and a difficulty with summarising the research.

In this research study, all four criticisms raised by Flyvberg may be individually argued against or together as one. In terms of generalisability criticisms, this instrumental case study cannot be judged, because the purpose, nature and detail of the data that is sought is most appropriately obtained from a single typical live project source. In relation to an inability to add to theoretical knowledge; it can be reasonably argued that the purpose of this case study is instrumental in nature, as it aims to gather practice based numeric information from the case project that will be subsequently combined with other data taken from another source, in order to create theoretical knowledge. Concerns over bias toward verification are considerably low, given that the data that is taken from the case study is mainly quantitative and factual. Finally, the very purpose of the chosen case study ensures that it will be instrumental and therefore bounded in nature. So, there can be no concerns that the goal of the case study will be difficult to summarise. A single argument against the list of potential criticisms raised by Flyvbjerg, would be that there may not be a single research methodology or method that can be regarded as unquestionably suited to fully meeting the needs of social science research questions (Stake, 1995). On this basis and as with any other research methods, a case study will only be selectable on the basis of its fitness for purpose over and above any other research methods available for use.

Another common criticism of case study research, according to Yazan (2015), comes from its association with thick descriptive analysis and reporting, which can be very time consuming and overwhelming for individual researchers and first timers with limited experience. Yazan also suggests that this criticism comes from the direction of proponents of quantitative research methods. In terms of this case study research, there can be few concerns from this direction, as the data collection focus is specific and numerically based. Arguments in support of case study research are well documented in the writings of the several prominent multiply cited academic researchers such as those cited above. And, for many emerging researchers their writings contain added credibility through examples of real world case study situations and directions on when and how this particular research method can be best applied.

3.7.5 Alternative research methods considered

Earlier discussions in section 3.2.3.1 on methodological pluralism, considered the position of this practitioner based research study within the fields of construction, development management and economics. That discussion also looked into where a study of this nature would locate itself within the Biglan Disciplinary Academic Model. Based on the model and Chynoweth's interpretative analysis on the position of the construction related areas, it was considered that a pluralist methodological approach would not be out of step with the variety of approaches suggested as appropriate to the range of academic fields influencing the research. And, whereas on that basis, this research has already considered that documents contents analysis and an instrumental case study are approaches best fit for the purposes, reliability and ultimate defence of this research, it is also necessary to note that there are a selection of other alternative research approaches that the researcher has duly considered and set aside.

According to an analysis of qualitative research approaches and software tools by Tesch (1990), there are around 50 approaches that can be adopted in a qualitative research study. Creswell (2007) narrows this list down to 5 main approaches, a suggestion which Chynoweth (2015) believes is possibly an oversimplification. Saunders et al (2016) lists 8 approaches, which they refer to as strategies and which also have links to quantitative and mixed method designs. Similar to earlier observations in this research to the sometimes blurriness in the dichotomies faced in approaches to theory development and methodological choices, research methods and strategies can also appear to overlap somewhat in their approach. For the purposes of this research, the following approaches identified by Saunders were considered for selection

1. Experiment
2. Survey
3. Action Research
4. Ethnography
5. Narrative enquiry
6. Grounded Theory

3.7.5.1 Experiment

According to Saunders et al (op cit) experiment based strategies are rooted in natural science, laboratory based research. This research approach is often seen as the gold standard of research, on which the rigours of other methods are measured. In construction research, experiment has its uses, in for instance, testing various physical and chemical based characteristics of building materials, but would not be regarded as a practical approach to develop our understanding of complex systemic problems in the housing market.

3.7.5.2 Survey

Surveys are a quantitative data collection method, used to generate information from a predefined sample group, usually by questionnaire or interview. The information is then generalised to a wider population with the objective of providing statistical insights on business products, services, consumer issues or even political sentiments (Fellows & Liu, 2008). This approach would not be capable of delivering the information required to address the research objectives.

3.7.5.3 Action research

Action research has been defined as an iterative process derived from the process of solving problems in real-life - work based situations through participation and collaboration (Boylan, 2020). This is an approach where the researcher actively participates and intervenes to process and effect intentional change to improve practice. Action research has also been described by McNiff (2013), as a process in which, people interact together, learning with and from one another, for the purpose of providing a better understanding of their practice and work situations, so that action can be taken to improve them. This approach is more suitable to resolving micro based workplace issues immediately, through participant observation, and action, by for instance, effecting the useful transfer of tacit knowledge from one practitioner to another. This research is not about resolving day to day work related issues and therefore, action research would not be an appropriate strategy to employ in this research study.

3.7.5.4 Ethnographic research

Ethnographic research is a strategy generally used to study groups of people in their cultural settings. According to Grix (2010), it is characterised by submersion in the field, over long periods, by the researcher in order to live, observe and communicate with those whom you are studying, in order to provide detailed accounts of their behaviours, rituals, shared beliefs, interactions and so forth (Saunders et al 2016, pp. 188, citing Cunliffe 2010). This research study is not concerned with the study of groups or the everyday minutiae of people connected to the housing sector.

3.7.5.5 Narrative inquiry

Narrative inquiry is concerned with collecting and interpreting personal accounts of experiences and events, usually in a workplace setting, such as hospitals or schools. It is an approach to inquiry used by practitioner researchers, such as healthcare professionals, working in environments where human interaction is ongoing. According to Wang & Geale (2015), this research method has grown in popularity in the area of nursing research, as it enables practitioners to uncover thick descriptions, detail and nuance from the previous experience of other colleagues and patients. Collecting personal accounts of experiences or events would not provide constructive research information to this study.

3.7.5.6 Grounded theory

According to Hunter & Kelly (2008), grounded theory is a methodology involving the systematic gathering and analysis of empirical data to inductively generate theory that is embedded in that data. The theory may then be used to explain a phenomena and is likely to have begun with a question. Grix (2010) tells us that the concept of grounded theory depends on the researcher approaching the data without preconceived ideas, categories or codes. He also explains that this research strategy largely interprets qualitative data, which may, according to Hunter & Kelly (op cit), be sourced in interviews, field data or literature. Developed by sociologists Glaser and Strass in 1967, this research methodology is mainly used in studies with social or cultural backgrounds. Apart from the fact that there appears to be an element of grounded theory in most social science research studies, it is clear that a grounded theory methodology would not perform the multi method tasks necessary to address the research questions, and objectives aimed at addressing the research aim of this study.

3.8 Meeting research standards - Validity and Reliability

Judgements in relation to the measurement of validity and reliability are key when testing the quality of a research study, especially where quantitative methods have been employed (Heale & Twycross, 2015). Saunders et al (2016) explains how these judgements are concerned with the rigour of the research as opposed to the results. Yin (2008) says that there are four tests commonly used to examine the credibility and quality of a research design. These are construct validity, internal validity, external validity and reliability.

3.8.1 Construct validity

Construct validity is a judgement on the extent to which a research study accurately assesses the unit of measurement that it originally sets out to measure (Yin, 2018). In relation to this research study, the documents to be analysed for their contents are clearly identified, and the data to be collected from those documents are clearly defined as building regulations with tangible cost implications. In relation to the instrumental case study, it is clearly set out that the cost data to be extracted is to derive from a specific house type on a particular project. Also, the data to be extracted from each of the two research methods will be factual. The risk that important sections could be missed or misinterpreted is very low, due to the researcher's familiarity with the subject matter and data to be collected. Unintentional researcher bias in the interpretation of case study data, as cautioned by Hunter & Kelly, (2008 p.94) will be limited by the quantitative nature of the key data.

3.8.2 Internal validity

Internal validity can be defined as the extent to which the findings of a research represent the truth. Saunders et al (2016) tells us that internal validity is established when a research can show that it accurately demonstrates the relationship between two variables. Merriam (1995), suggests that triangulation is one way to demonstrate this. In the previous literature review chapter, the research found in a meta-analysis of data from two separate sources, that evidence exists to illustrate how building regulations costs impact housing delivery costs, over and above what is currently reported. In the discussion on findings chapter, those findings from the literature review will be compared with the findings from the data analysis chapter to provide a credible level of triangulation to backup or dispel the anticipated primary findings

3.8.3 External validity

Merriam (1995), defines external validity as the extent to which the findings of a research study are generalisable or can be applied to other situations. The criticism that case study research provides results that are a weak basis for generalisation was previously refuted in section 3.2.6.5 on the basis that in this research, the chosen case study is instrumental and also that the data to be extracted from it will for the most part be verifiable real live construction costs. Also, the data to be sourced in the documents contents analysis is factual, leaving very little scope for subjective interpretation. On those platforms, it is argued that the findings of this research will be generalisable for national researchers undertaking similar or related research. Similarly, the research will, within certain levels of confidence, be of interest and transferable to international researchers depending on factors such as climate and political science.

3.8.4 Reliability

Yin (2018) explains that the object of reliability in research is to ensure that if a subsequent researcher follows the same processes and procedures as described in the current research in order to conduct a similar study, then that later researcher should be able to arrive at the same outcomes. Merriam (1995) defines reliability more succinctly and says that it is concerned with the extent to which a researchers findings can be found again by a later researcher. Yin (2018) recommends that this can be achieved by setting out a research protocol. As illustrated in the data collection and analysis process chart, in Figure 4.1, this research study will endeavour to make explicit the various approaches adopted and thereby provide a roadmap and audit trail to establish reliability. The Appendices section to this research will also provide an extensive background information source to the case study project, building regulations costings and data merging processes.

3.9 Research delimitations and limitations

Limitations in a research may not be within the researcher’s control, but delimitations which are based on matters which are excluded from the research generally are (Perry, 1998).

3.9.1 Limitations

According to Theofanidis & Fountouki (2019) limitations occur in every research and reflect the confines of methodological approaches and the practical constraints inherent in research processes. As previously noted, Merriam (1995) draws attention to a perceived weaknesses in case study research, where a number of social science theorists consider that an inability to correlate the study to wider populations affects internal and external validity. Responses to those perceived issues in relation to this study are addressed in sections 3.8.2 and 3.8.3 above. In relation to the documents contents analysis process, it is again worthy of acknowledgment, that some social science theorists point to perceived weaknesses associated with this method. These include a potential to biased selectivity of data or opinions that the data is of a secondary source nature (Yin, 1994, pp.80). Responses to these perceived threats to the credibility of this element of the research process are addressed in section 3.7.2 above. McCann (2017) has suggested that professional doctorate research has inherent limitations due to its small scale and general self-funding nature. These limitations can be further stretched due to the part-time nature of the process.

In the introduction chapter, it states that it is not the intention of this research to try to find a resolution to the viability and affordability problems in the housing market or to advocate for the redaction of building regulations, but rather to shine a light for policy makers and others, on the embeddedness and impact of high building regulation costs in the housing market system. Concluding the research at the point of shining an observation light on the perceived problem, without extending the inquiry into other areas, such as the exploration of future strategies to counterbalance the problem, may be viewed by readers as a significant limitation. To decrease this limitation, a section is provided in the conclusions chapter, outlining areas recommended for future research. The role of innovation and MMCs is seen by the researcher as key to reducing the impact of building regulation costs. Future research is proposed in areas of this evolving field, especially where implementation barriers to MMCs appear to exist.

3.9.2 Delimitations

Delimits have been described by Theofanidis & Fountouki (2019) as the limitations on the research that authors themselves have consciously set. They are essentially a set of boundaries outlined to limit the work, so that the aims and objectives do not become impossible to achieve. They also address the research parameters for those reading the study. Table 1.1 in chapter 1 outlines a range of parameters for those reading this research study. They clarify for researcher and reader, the boundaries of the research in relation to subject matter, units of analysis (UOA), location of UOA, time period applicable to data findings, time horizons and other exclusions.

3.10 Research ethics

Following the infamous ‘Doctors Trial’ in Nuremberg in 1946, international attention and awareness for the need to develop ethical principles for conducting medical research resulted in the emergence of the Nuremberg Code in 1947 (Shuster, 1997). This document served as a blueprint for subsequent developments in the concepts of research ethics and how they apply to natural science and subsequently to social science research approaches. Research ethics present different issues for different research areas. In medical research, ethical principles will normally seek to protect an individual from physical or mental harm, whereas in social science, researchers should seek to identify, assess, and overcome the risk of harm to participants, organisations, and businesses by the application of social moral codes (Simons, (2009). These will include but are not limited to, respect for consent, privacy, sensitivity and integrity. The respect for persons codes stem from the conceptualisations and the main ethical principles outlined in the Belmont Report (1978).

The primary ethical concerns that arise in the conduct of this research study, centres on the use of commercially confidential information provided by the instrumental case study. Stake (2003, p.154) tells us that although case studies can often deal with subjects of public interest, there is no public or scholarly right to the information. Stake also suggests that regardless of the outcome value or sincere scholarly intent of a study, that this does not give licence for researchers to encroach on the privacy of other persons or to expose injury upon those that have made the commitment to assist the research. Schwandt, (1993) recommends that an informal moral undertaking or protective covenant between researcher and the researched would also help to increase participation. It is also important that boundaries should be discussed in advance and work in progress feedback given, so that any expressions of concern are listened to and acted on. Another aspect of the researcher's integrity code involves conducting research in ways that avoid accidental or wrongful acts such as plagiarism, defined by Grix (2010, p.139) as 'the stealing or presenting as one's own, the ideas and works of others'. This research has taken great care to ensure not to misinterpret the arguments made by other authors in order to back up some point being put forward in this research.

Insofar as the case study undertaken in this research is concerned, valid informed consent as described in Flory & Emanuel, (2004) has been sought and the boundaries discussed and agreed in advance with the participant organisation. The participant organisation also happens to be the researcher's employer and as a result there will be an element of insider research. However, as the objective of the case study is instrumental and mainly focusses on the extraction of construction cost information relating to a particular project, there will not be a requirement to engage in a form of ethnographic immersion in order to extract deep descriptions and such. This boundary has been made very clear. A template copy of the letter submitted to the researcher’s employer, requesting permission to carry out an instrumental case study on a selected project, is contained in Appendix A.2

No company or project name and no individual personal details have been revealed in any section or part of this research thesis, including the Appendix cost analysis and drawings documents. Where it has been necessary to collect and format paper documents and notes, these have been stored in key locked metal cabinets located in the researcher’s home office. All electronic data records are stored in password protected dongles, which are also stored under lock and key in the same cabinet. All backup data will be destroyed in due course.

As part of the doctoral research programme at Salford University, research candidates must obtain ethical clearance from the schools ethical clearance panel before data collection involving participants or fieldwork can begin. Applicants for ethical approval are required to demonstrate that they understand the University’s ethics policies and how ethical aspects of their research will be managed. The Ethics Panel considers research projects as falling into one of three types, depending on the level of human interaction involved. The first type involves research containing very routine research with no ethical issues. The second involves human, non-human or corporate subjects, where ethical issues have been considered and will be appropriately addressed. The third type may involve significant ethical dimensions. For this research, Type 2 ethical approval was sought and approved. A copy of the approval confirmation dated 24-06-21 is contained in Appendix A.1.

3.11 Chapter Summary

This chapter introduced the reader to the researcher’s interpretations and assumptions as to the nature of knowledge. Using the Saunder’s Onion linked approach process to establish the methodological choices, the chapter then identifies pluralism and pragmatism as the overarching philosophical positions adopted by the researcher to locate the research methodology and mixed methods approaches to addressing the research objectives. This is followed by an overview of approaches to theory development, which concludes by outlining a rationale for the use of abductive approaches to data collection methods used in the design of the research. It then also explains how Historical Institutionalism emerges as an effective theory to underpin the research. This explanation is justified in the context of how building regulations can be regarded as rules or institutions, undergoing continuous and incremental changes in path dependant processes, triggered by critical junctures, arising in the shape of dramatic or episodic events in history. The chapter also sets out a logical justification for the choice of documents contents analysis and instrumental case study analysis as the most practical and effective research methods for use in the investigation. The limits and delimits of the study and researcher's positionality are also considered. The chapter concludes with a review of ethical matters that have been considered in the execution of the research.

CHAPTER 4

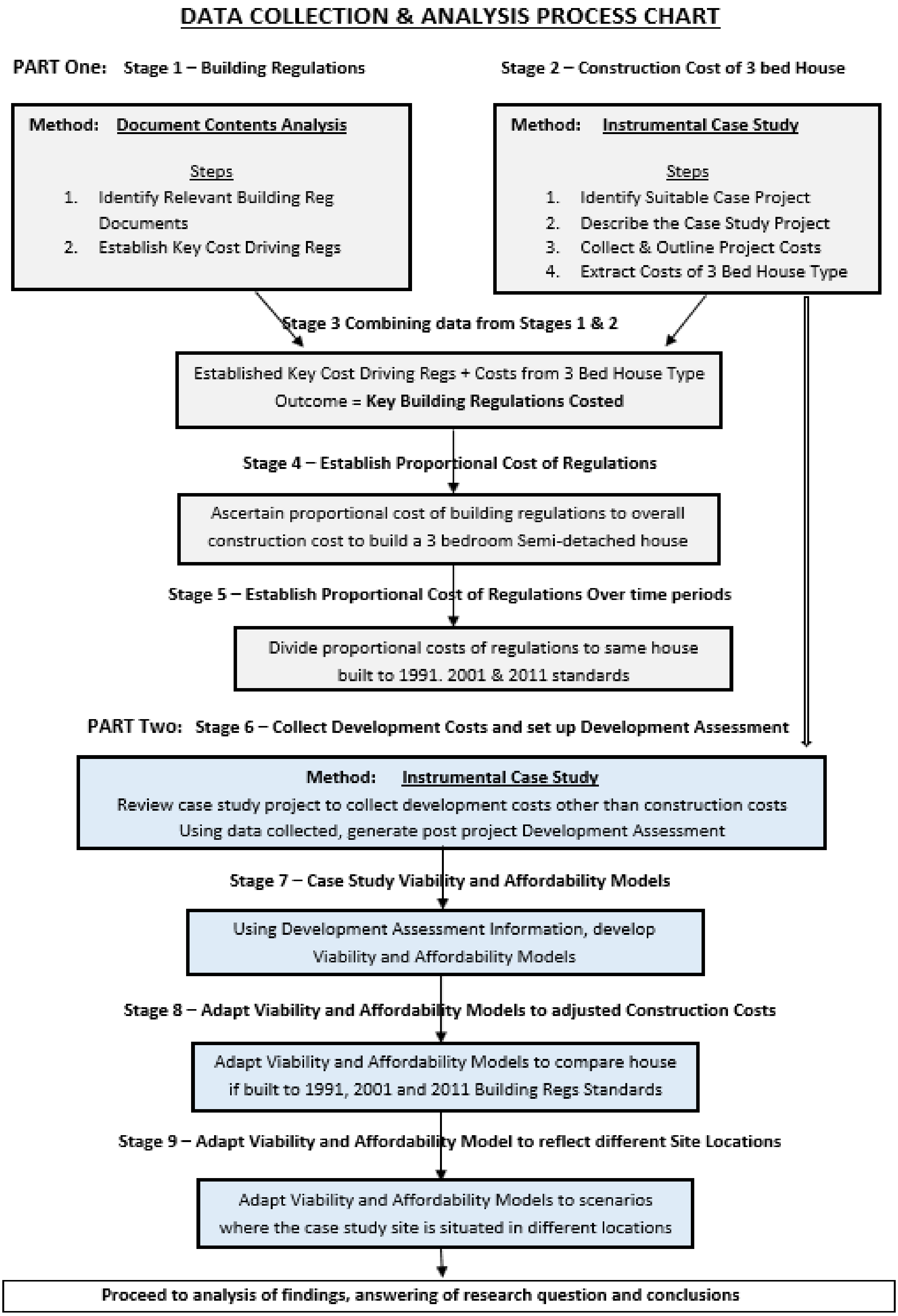
4. DATA COLLECTION, AND ANALYSIS

4.1 Introduction

According to Perry (1998) strategies for data collection and analysis are structured around the researched problem, question or hypothesis. As outlined by Perry, the data collection and analysis process in this research will focus on the research question, systematically proceeding in stages and steps to meet the desired outcoming of achieving the research aim. In this research, the data is gathered, presented and analysed through words, numbers and percentages, and is mainly located in the Appendices sections A to F. The data is collected from two main sources. The first data source comes from statutory documents, and the second source is obtained from an instrumental case study. The data collection and analysis process is structured into 2 parts, combining 9 stages. The process is outlined in Figure 4.1.

Part 1 of the process collects data from building regulations documents and separately from an instrumental case study of a live residential development project. Once the data has been collected and formulated into the required order, it is then combined, to establish the proportional cost of building regulations, within the overall net construction costs of the case study project, built in 2021. This exercise is repeated, to establish the proportional cost of building regulations, if the same house, was constructed to 2011, 2001 or 1991 building regulations standards. In Part 2 the proportional cost of building regulations is re-assessed as a proportion of the overall gross development costs, which is then used to assess the impact of the proportional cost of building regulations on development viability and purchaser affordability. This exercise is repeated, to establish the proportional cost of building regulations, on gross developments costs, if the same house, was built to 2011, 2001 or 1991 building regulations standards and located in different regions.

Figure 4.1 Data Collection & Analysis Process Chart



4.1.1 Statutory Documents – the root 'unit of analysis'

Data extracted from the statutory documents is taken using the research method of documents contents analysis (Yin, 2018). This occurs in Stage 1 of the data collection process. The statutory documents were chosen based on their significance to the Irish building regulations and on their usefulness in providing information on those building regulations that have contributed to increasing house construction costs. In this research study, the documents contents analysis element can be viewed as being the root 'unit of analysis'. Miles et al. (2014), explains how the 'unit of analysis' can be studied to explain a phenomenon occurring within a bounded context. Using Miles rationale, the corpus of building regulations documents represents the bounded context from which the phenomenon of increased costs associated with regulations upgrades can be explained.

4.1.2 Real residential development – 'instrument' to understand unit of analysis

Stage 2 of the data collection process was carried out through the medium of an instrumental case study. In keeping with the conceptual theory set out by Miles et al as above, Yin (2018, P.20) explains that an instrumental case study is most suited where the inquirer is more interested in an object or particular part of the 'unit of analysis' and therefore the case study itself is secondary to understanding a separate but particular issue. In that context, the purpose of the case study is to collect live construction costs and development cost data from an actual residential development project, from which to establish the real cost to build a typical estate built 3 bedroom semi-detached house and to use these costs to put a cost value on the key building regulations identified. The construction costs of the 3 bedroom semi-detached house include proportionally allocated costs relating to siteworks and builders preliminaries. The gross development costs comprise of all of the costs incurred by the developer on the project, and include costs such as professional fees, local authority levies, land and acquisition costs, sales and marketing, and so forth. Net construction costs were referred to in the literature review as hard costs. When the so called 'soft costs' are added to the hard costs, this gives us the gross development costs.

The case study is instrumental in nature, as its purpose is to focus on the collection of two sets of project data. The first is construction costs, from which the research intends to evaluate the proportional cost of building regulations identified in the documents contents analysis. The second is soft development costs, which the research will use to set up a development cost assessment and viability models from which to measure house delivery viability and purchaser affordability. The case study will therefore, take a supporting role in the process of seeking to understand a larger issue (Stake, 2003). The case study also gives the research a valuable opportunity to apply the findings from the documents research analysis to an actual in context setting. And therefore, the phenomena is being studied where it is actually occurring (Stake, 1995).

4.1.3 Merging the 'unit of analysis' with the 'instrument'

Once stages 1 and 2 have been completed, the data is brought together in Stage 3 of the process, wherein the building regulations data from the documents contents analysis are combined with the real live costings taken from the case study project analysis. This bringing together of the data enables the research to put a live cost against each building regulation identified as having cost increase characteristics. After the combining process is completed, it is then possible to move into Stage 4 of the process, which identifies the proportion of the cost of the typical estate built 3-bedroom house, that can be attributable to building regulations upgrades since 1991. In the following stage 5, the process of identifying the proportion of the costs attributable to building regulations is then further analysed to establish the proportional cost of building regulations, if the same house, was built to 2011, 2001 or 1991 building regulations standards. Stages 1 to 5 are primarily concerned with providing evidence that the introduction and incremental improvements in building regulations standards have significantly increased the cost to construct a typical estate built house. The following stages 6 to 9 are concerned with demonstrating how the impact of the proportional cost of building regulations vis a vis net construction costs, has had on gross development costs, thereby impacting development viability and purchaser affordability.

Stage 6 requires the collection and analysis of development cost data from the case study project and to incorporate this data into a post project development cost assessment. In stage 7, the development cost assessment is incorporated into a 2021 viability and affordability model. The purpose of this model is to determine the level of development viability and price affordability of the case study project and specifically in relation to the 3 bedroom semi-detached house. In stage 8, the viability and affordability model is adapted to establish and compare the cost effect of building regulations on the case study house, if the same house had been built to building regulations standards pertaining in 1991, 2001, 2011. The final stage 9 of the analysis process adapts the stage 8 models to reflect scenarios where the case study house is re-situated to different locations relative to their proximity to Dublin City.

4.2 PART 1: Stage 1 - Documents Contents Analysis

4.2.1 Step 1 – Identifying relevant building regulations documents

The first part of the documents contents analysis involves identifying, from the vast corpus of statutory building regulations documentation, the most relevant documents to be reviewed - insofar as building regulations cost effects on residential building costs are concerned. As established in the literature review, it is known that the first Technical Guidance Documents (TGDs) to the building regulations were published in December 1991 under statutory instrument S.I 306 of 1991. These original versions of the TGDs were arranged and issued in 12 parts according to function, (O'Cofaigh, 1993). The 12 books of TGDs were of various length, the shortest was Part D – Workmanship and Materials, which came with less than 3 pages of guidance, while the longest was Part B – Fire, running to over 113 pages in total. Section 5(2) of S.I 306 states that where building works are carried out in accordance with the TGDs, then this will indicate prima facie evidence of compliance with the relevant requirements of the building regulations. For the purposes of the documents contents analysis, these original versions of the published TGDs are deemed to be the most appropriate point from which to commence.

Since the TGDs were first published, there have been numerous revisions published. Many of the revised documents are far more expansive and illustrative than the original versions. Several of the TGDs have been revised up to 3 times. Part B – Fire and Part L – Conservation of Fuel and Energy, have each been updated over 5 times. Links to current and previous TGD versions are hosted on the website of the Department of Housing, Planning and Local Government (DHPLG). Table 4.1 below contains a summarised list of the building regulations TGDs and other statutory instruments that have been selected for review in the documents contents analysis process. Appendix B.1 contains a more expansive version of this list, detailing current and previous versions of the building regulations TGDs and other statutory documents. A number of ancillary technical documents that support and are referenced in the TGDs have also been reviewed and are on the B.1 list. These ancillary documents include mandatory codes of practice published by Irish Water and versions of the national rules for electrical installations in Ireland. Statutory instruments outlined in items 16 to 19 of B.1 cover regulations containing mainly procedural and administrative processes in relation to health and safety in construction, demolition and construction waste, energy performance criteria and building control functions. These instruments are primarily concerned with increases in management and administration input and were largely collected during the Pilot Study in 2016. Overall, there are 64 documents listed in B.1 as having been analysed.

Table 4.1 List of Statutory Documents selected for their contribution to house building costs

1	Part A Technical Guidance Documents – Structure
2	Part B Technical Guidance Documents - Fire safety
3	National Rules for Electrical Installations
4	Part C Technical Guidance Documents - Site Preparation & Resistance to Moisture
5	Part D Technical Guidance Documents - Material and Workmanship
6	Part E Technical Guidance Documents – Sound
7	Part F Technical Guidance Documents – Ventilation
8	Part G Technical Guidance Documents – Hygiene
9	Part H Technical Guidance Documents - Drainage and Waste Disposal
10	Irish Water Technical Documentation - Ancillary to Parts G and H
11	Part J - Technical Guidance Documents - Heat Producing Appliances
12	Part K - Technical Guidance Documents - Stairs, Ramps and Guards
13	Part L - Technical Guidance Documents - Conservation of Fuel and Energy
14	Acceptable Construction Details - Ancillary to Part L
15	Part M - Technical Guidance Documents - Access and Use
16	Building Control Regulations
17	Health and Safety in Construction Regulations
18	Environmental and Waste Regulations
19	Energy Performance Regulations

The statutory instruments that brought the TGDs into force have also been reviewed for due diligence purposes, but these have not been listed in B.1 for concision purposes. The documents research process also involved the examination of numerous EU directives documents, which are not listed in B.1. These were explored because of references to them within the listed documents and also where for instance in the case of EU directives they were the originating legislative framework precipitating the national statutory instrument. There were also a number of building regulations and TGDs that were reviewed and not listed in B.1, because they had been drafted to focus specifically on non-residential type buildings or because the primary outcomes of the regulation did little to effect residential construction costs.

4.2.2 Step 2 – Review of building regulations documents to identify key cost drivers

The next stage of the documents contents analysis involves systematically reviewing the contents of the TGDs outlined in Appendix B.1, together with their associated statutory instruments and ancillary codes of practices, to identify key regulations that have increased the cost to build a house. According to O'Cofaigh (1993), the building regulations TGDs replaced building byelaws in the Irish State on 1st June 1992. The Dublin Corporation Building Byelaws (1949) is a short 76 page document containing 113 conditions, outlining a mix of functional, performance and prescriptive requirements (Walsh, 2009). Using this building byelaws document as the effective baseline for residential construction building standards, up to 1991, the documents listed in Appendix B.1 are used to identify regulations that have superseded the byelaws and in the process, increased housing construction costs. This was an extensive analysis exercise, whereby each document was carefully reviewed in detail, one at a time, for building code references or prescriptive directions to improved standards of work, starting with the earliest versions of the TGDs and working through the revisions in chronological order. Saladina (2013, p.3) defines codes as representing words or short phrases that symbolically assign or capture relevance. Each key regulation as identified is listed with a brief description and record of the document reference. In some instances, the TGDs contained illustrative details, and these were also referenced. The full list of building regulations upgrades identified in the analysis can be found in Appendix B.2. An extract example from B.2 is outlined in Table 4.2 below.

Table 4.2 Extract from Appendix 2.2; Data Collection – Results of TGDs Analysis

TGDs: Part B - Fire Safety; 1991		**TGD Section Reference**
1	Compartment wall between dwellings 60/60 fire resistance	Table A1 + 3.2.4.2
2	Junction of compartment wall with roof - resilient firestop to u/s of roof and rockwool slabs to u/s of roof covering at least 1.5 m on each side	Diagram B3.2
3	Cavity barrier to be provided at the compartment wall junction	3.3.2 + Table 3.2
4	Fire resistance 30/15/15 of upper floor of 2 storey from underside	Table A1
5	Fire resistance 30/30/30 of roof from underside	Table A1

4.3 Stage 2 – Case Study

4.3.1 Step 1 – Identifying a suitable case study project

The first step of the case study stage involved the identification of a suitable project. As discussed previously, this was decided upon based on various criterion. From a data collection perspective, it was mainly based on identifying the most suitable project that the research could gain access to, with the required information, logically suited to the research idea and question (Sanders et al, 206). The data collection objective of the case study being instrumental in nature, involves the collection and analysis of mainly quantitative data relating to real construction and development costs of a typical estate built 3 bedroom semi-detached estate-built house. Once suitability was established and permission granted to access the required material, the next step was to gather and review the project drawings and the commercial and administrative documentation relating to the project.

4.3.2 Step 2 – Description of the case study project

The chosen case study project is a residential development of 34 two storey dwelling houses on a site measuring approximately 1.3 hectares and located just off the main street of a Dublin Commuter Town. The total floor area of the project is 4,240 square metres and comprises of 2 number 5 bed detached houses, 1 number 4 bed detached house, 18 number 4 bed semi-detached houses, 10 number 3 bed semi-detached houses and 3 number 3 bed terraced houses. Access to the site was via a previous phase of 68 houses of the same development. The project also included associated site development works, public open spaces, landscaping, roads, foul and surface water drainage systems, public utility infrastructure etc.

According to the developer/builder, all house types in the estate have been designed and built to provide for long term family accommodation that will serve to cater for the changing requirements of evolving households. The developer/builder adds that in keeping with the demands of todays sophisticated home buyer, the houses are generally spacious and meet minimum space standards for living and bedroom accommodation. Each house, including the 3 bedroom semi-detached type are designed with the potential to extend into the rear garden and attic trusses provide the potential for future upward extension. The houses are traditional masonry built, using concrete blockwork, timber cassette floors, and attic truss superstructures. The exteriors are generally finished in a heritage style brick at the front and monocouche render to the sides and rear. The windows are UPVC high performance, argon filled, low emissivity coated double glazed units and the roof is finished using concrete roof tiles with UPVC cladded eaves and rainwater systems. Internal walls generally comprise of timber stud partitions, plastered and painted with solid core doors sets, splay topped architraves and matching skirtings. The staircase structure is fitted with contemporary style balustrades. There are built-in wardrobes, high gloss fitted kitchens and middle price range sanitary fittings.

The energy efficiency rating of the houses are close to passive house standards, complying to a near-zero efficiency rating (NZEB) of A2. This is achieved through a combination of high levels of floor, wall and roof insulation, air tightness measures, photovoltaic panels, high efficiency boilers, three zone 24/7 programmable controls to heating, low energy demand driven mechanical ventilation systems and LED lighting, as well as smart systems link up to mobile phones.

The undeveloped site was greenfield, just off square in shape and had a very gradual slope from east to west**.** Only one side of the site had physical boundaries in place, the other three had no fencing. One side had a semi-dry ditch demarking the boundary. The residential density of the site at 26 units per hectare was broadly in line with residential density guidelines of 25 units to the hectare, as contained in the local area development plan (LAPD). The mix of house types was also broadly in line with the guidance obtained at pre-planning meetings with the local council. The design and layout of the houses reflected the overall form and layouts contained in the previous phases of the development and were designed to local government urban standards and the Quality Housing for Sustainable Standards (DEHLG, 2007).

Private open space is provided to each house mainly in the form of rear gardens, which enclose areas of not less than 60 and 75 square metres for 3 and 4 bedroom houses respectively. House boundary treatments are a mixture of fair face block walls and precast concrete post and plank fencing of not less than 1.8 metres height. Front areas are paved with permeable cobble lock paving, to accommodate 2 car spaces as required by the local authorities urban standards and front boundaries are separated with low brick walls or box plant hedging. The site is not located within a flood risk zone and therefore no significant flood ameliorating measures were required. As part of the planning application process, the site was analysed for risks from tidal, fluvial, pluvial, ground water and mechanical failures. Having ensured that house floor levels were set at not less than 500mm above the top water level of the onsite drainage systems, all residual risks to flooding were concluded as extremely low or negligible.

Tarmacadam estate roads and concrete footpaths are 5.50 metres and 2.0 metres wide respectively, designed and constructed in accordance with the Design Manual for Urban Roads and Streets, (DMURS, 2013) and catering for future connections to adjoining lands as well as safe movement for bin lorries, service trucks and emergency services. There is also a provision for some on-street parking. The landscaped public open spaces are 2,087 square metres, which is just over the minimum standard of 15% for residential developments. The main open space area of 1,776 square metres is centrally located for passive surveillance and security purposes.

The surface water drainage system is gravity designed as a sustainable urban drainage system, incorporating petrol interception, underground attenuation, swales, permeable paving and hydro-brake flow control restriction to limit runoff to 2.85 litres per second. Rainwater from roofs, hardstandings and estate roads are channelled through gullies and 100mm upvc carrier pipes to 225mm diameter main drains which are routed to pass through an underground attenuation structure, located in the main open space area, before connecting into an existing 375mm diameter surface water network recently built in the previous phase. Foul sewer drainage from the scheme is gravity designed to carry waste from the 34 dwellings through 100mm diameter upvc carrier pipes to boundary chambers, before discharging to 150 and 225mm diameter mains, before connecting into the existing 225mm diameter sewer network built in the previous phase.

Using a projected household demand rate of 150 litres per household, potable water is provided to the scheme via a 100mm diameter pipe system, spur connected into the previous phase. This usage calculation was based on water conservation measures such as low volume flush systems, aerated shower heads, Spray taps and leak detection measures through water metering. Electricity supply is provided to the site from existing overhead power lines via a new mini substation located adjacent to the site entrance, from which underground power cables distribute power through 100mm diameter upvc ducts to meter box termination points in all 34 houses. Street lighting was designed and installed to BS 5489-1:2013 category P4 by a specialist contractor incorporating 10 number 2.51 light flux luminaires mounted on 6.0 metre tall poles, dispersed to strategical locations throughout the estate roadway. Underground infrastructure for future broadband and satellite TV installations is provided by the provision of three 100mm diameter upvc ducts, provided in service trenches under footpaths. Natural Gas mains comprising straight 90 PE-80 pipework of 4 bar operating pressure is installed under the public footpaths and connected to each house to supply gas boiler heating systems. This gas main is connected to the existing 90 PE-80 gas main system installed in the previous phases. There were no reportable site abnormalities encountered during the build.

For completeness of description, a selection of project related drawings are contained in Appendix C. The drawings are architectural in nature and include the site layout, floor plans, a roof plan, cross sections, elevations, and typical construction details for the 3 Bedroom Semi-detached house type.

4.3.3 Step 3 – Collection and analysis of construction cost data from the case study

This step was about focusing in on the construction costs element of the Instrumental Case Study, which involved collecting and analysing the live construction costs for the project and then further breaking those costs down to isolate the costs particular to the 3 bedroomed semi-detached house unit.

The researcher had full access to all of the project specifications and drawings, which included planning drawings, detail construction drawings and as-built versions. These included drawings and reports prepared by all project consultants, including architects, civil and structural engineers, landscape consultants, mechanical and electrical services engineers, planning consultant and ecologists etc. The researcher also reviewed the project health and safety plan, quality assessment documents and the full suite of ancillary certificates. All of these documents were examined in detail, as were the various site administration records, such as site meeting minutes, contractor’s progress reports and weekly progress photographs.

The first part of the process involved the preparation of a full bill of remeasurement for the overall project in a format suitable for subsequent cost analysis. Unlike bills of remeasurement that are based on a previously prepared bill of quantities, this bill of remeasurement was based on actual subcontract final account records and materials invoices sourced from the developer/builders job files. The background process involved extensive engagement with the project quantity surveyor, the site manager, the construction manager and accounts department staff. Once the bill of remeasurement was completed, the detailed cost information was incorporated into the document and the overall project construction costs identified. The Bill of Remeasurement was now retitled as the Bill of Construction Costs.

Although the Bill of Construction Costs was based on the overall case study development, the cost data for house structures was gathered separately and allocated in separate sub-bills of construction costs for each house type. Total values for each house type are as summarised in Table 4.3 below. Following a systematic review, it was decided to apportion the total siteworks costs and the preliminaries costs, on an equal per house basis. The over-riding rationale for this was that firstly, the main siteworks elements were seen as critical to all 34 houses and therefore indivisible. Secondly, it was considered that insofar as external works around houses were concerned, the size of rear garden and front drive in areas were as much a function of location within the site layout as the width difference between a 3 bedroom and a 4 bedroom house. Finally, it was also considered that preliminaries were critical to all 34 units and indivisible, thereby avoiding a process of further analysis layers that was likely to show up only negligible differences. The net construction cost to build the scheme of 34 houses was established to be €6,891,939 excluding Value Added Tax (VAT). A summary of the Bill of Costs for the full project of 34 houses is contained in Appendix D.1. An abridged version of the Bill of Costs Summary is outlined in Table 4.3 below.

Table 4.3 Bill of Costs Summary - Abridged

	House Type -	**4 Bed Semi-D**	**4 Bed Detached**	***3 Bed Semi-D***	**3 Bed Terrace**	**5 Bed Detached**	**Total**
	Element	€	€	*€*	€	€	€
1	House	149,496	161,066	*128,583*	122,736	181,359	4,868,757
2	Siteworks	34,746	34,746	*34,746*	34,746	34,746	1,181,372
3	Preliminaries	24,759	24,759	*24,759*	24,759	24,759	841,811
		209,001	220,571	*188,089*	182,242	240,864	
	No of Units	X 18	X 1	*X 10*	X 3	X 2	
		3,762,021	**220,572**	***1,880,891***	**546,727**	**481,729**	**6,891,940**

4.3.4 Step 4 – Extract costs data specific to the 3 bedroom semi-detached house type

Once the full bill of construction costs was completed, the next step of the instrumental case study process involved isolating and apportioning the costs specifically relating to the 3-bedroom semi-detached house. The purpose of this was twin fold. The first purpose was so that the overall cost of the 3 bedroom semi-detached house could be established, and the second purpose was to have a cost breakdown specific to the 3-bedroom semi-detached house, from which to value the cost of each building regulations upgrade. Appendix D.2 contains a summary of the Bill of Costs specific to the 3-bedroom semi-detached house. This is followed by Appendices D.3, D.4 and D.5 which contain detailed bills of construction cost breakdowns relating to the house structure, siteworks and preliminaries elements. The fifth column 5 (shaded & *italics*) in Table 4.3 above, shows that the total cost to construct the 3 bedroom semi-detached house in the development was €188,089 excluding VAT.

4.4 Stage 3 - Combining the documents contents analysis and case study cost data

The process for combining the data collected from the documents contents analysis and from the case study was carried out in two distinct steps. The first step involved taking the data from Step 2 of the documents analysis process as contained in Appendix B.2 and restructuring the list of building regulations upgrades into a format similar to a series of bill of quantities pages, where each building regulations upgrade item is listed under its relevant TGD part and section reference, together with columns related to quantity, unit of measurement, cost rate and cost total. The purpose of the four additional columns was to enable the research to look at each building regulations upgrade within the context of the 3 bedroom house drawings, so that the work involved could be quantified and costed using the cost data taken from the case study costings. Where costs were taken from the case study costings and applied to the building regulations upgrade item, the reference number from the relevant part of the case study bill of construction costs is also noted for cross checking purposes. In cases where costs have been applied to a building regulations upgrade item from more than one part of the bill of costs, then additional rows are added to facilitate this.

The results of the 'combining of data process' is contained in an extensive schedule titled 'Building Regulations Upgrades Costed' and is contained in Appendix Section E.1. An extract taken from the schedule in E.1 is outlined in Table 4.4 below. This extract features one of the 68 regulation documents that were reviewed, costed, and outlined in Appendix E.1. In Table 4.4, the second column and last columns contain details and the reference of the cost driving regulation as identified in the TGD. The third column contains the quantity of the work item involved. The fourth column is the unit of measurement used and the fifth column is the cost rate for the work as identified in the bill of construction costs. The seventh column contains the reference number in the bill of construction costs.

Table 4.4 TGDs: Part B - Fire Safety; 1991 – extract from Appendix 5.1

	Provision	Quantity	Unit	Rate	Total €	Bill of Cost Ref	TGDs Reference
1	**Compartment wall between dwellings 60/60 fire resistance**						Table A1 + 3.2.4.2
A	215mm solid concrete blockwork in lieu of hollow block	74	M2	10.10	747.40	C1	
2	**Junction of compartment wall with roof - resilient firestop to u/s of roof and rockwool slabs to u/s of roof covering at least 1.5 m on each side**						Diagram B3.2
A	rockwool firestop packing	13	M	12.00	156.00	F10	
B	rockwool slabs 1.5 m wide	13	M	17.50	227.50	F11	
3	**Cavity barrier to be provided at the compartment wall junction**	6	M	8.50	51.00	B9	Table 3.2 + 3.3.2
4	**Fire resistance 30/15/15 of upper floor of 2 storey from underside**						Table A1
A	12.5m board in lieu of 9.5mm board	56	M2	3.00	168.00	S8	
5	**Fire resistance 30/30/30 of roof from underside**						Table A1
A	12.5mm board in lieu of 9.5mm board	56	M	3.00	168.00	S9	

Further detailed analysis was carried out on the cost data information contained in the 'Building Regulations Upgrades Costed Schedules'. The results of these analysis exercises are contained in Appendices E.2, E.3, E.4 and E.5 and are summarily described as follows. In Appendix E.3 the building regulations upgrade costs schedule is summarised to allocate costs into each individual TGD. A summarised version of Appendix E.3 is contained in Table 4.5 below. This Table establishes that the total cost of building regulations upgrades applicable to the 3 bedroomed semi-detached house as contained in the case study totalled €59,258 excluding VAT. It also provides further analysis details, such as, that Part L standards account for €16,621 or 28% of that amount. Appendix E.2, provides even more in-depth analysis, showing for instance how Part L costs have accumulated with each TGD update.

In Appendix E.3 the building regulations costs are analysed for viewing through a slightly different lens. This shows the building regulations costs apportioned and allocated to the major building elements of, house structure, siteworks and preliminaries. This summary shows, for instance, that the cost of building regulations upgrades apportionable to preliminaries costs was €10,205 or 17% of the total. In Appendix E.4, the building regulations upgrade costs are allocated into one of the three 10 year time zones within which they were introduced, between the periods 1991, 2001, 2011 and 2021. Finally in Appendix E.5, the building regulation upgrade costs are allocated into policy objective groups. Further analysis, extracts and summarisations of the findings contained within Appendices E.2 to E.5 are contained later in this chapter and in the next chapter under secondary findings.

Table 4.5 Building Regulations Upgrade Costs per Element

	Documents / Elements	€	%
1	Part A, TGDs – Structure	3,780.14	6.4%
2	Part B, TGDs – Fire Safety	3,110.90	5.2%
3	National Rules for Electrical Installations	945.00	1.6%
4	Part C, TGDs – Site Preparation and Moisture	2,751.16	4.6%
5	Part D, TGDs – Materials and Workmanship	510.00	0.9%
6	Part E, TGDs – Sound	1,240.25	2.1%
7	Part F, TGDs – Ventilation	3,881.50	6.6%
8	Part G, TGDs – Hygiene	616.00	1.0%
9	Part H, TGDs – Drainage and Waste Disposal	3,081.98	5.2%
10	Irish Water Technical Documents, ancillary to Parts G & H	2,105.93	3.6%
11	Part J, TGDs – Heat Producing Appliances	767.00	1.3%
12	Part K, TGDs – Stairs, Ramps and Energy	1,760.07	3.0%
13	Part L, TGDs – Conservation of Fuel and Energy	16,621.75	28.0%
14	Acceptable Construction Details, ancillary to Part L	1,370.20	2.3%
15	Part M, TGDs – Access and Use	7,638.07	12.9%
16	Building Control Regulations	3,804.46	6.4%
17	Health and Safety in Construction Regulations	4,185.57	7.1%
18	Environment and waste Regulations	592.09	1.0%
19	Energy Performance Regulations	495.50	0.8%
	Total Amount, excluding Value Added Tax	**59,257.56**	**100%**

4.5 Stage 4 – Ascertaining the proportional cost of building regulations within the overall construction costs to build a 3 bedroom semi-detached house

Stage 4 of the data collection and analysis process realises the first primary objective of the research study. This stage establishes the proportion of the overall construction cost of the case study typical 3 bedroom semi-detached house that can be attributed to building regulations upgrades since they were first implemented in Ireland. By establishing this proportion, the research can now either confirm or debunk the underlying argument of the research, which is that since their introduction in 1991, building regulations costs have substantially added to the cost of building a new home and to such an extent that they are one of a number of significant contributing factors to the housing crisis in Ireland.

In stage 2, step 4, it was established that the cost to build the 3 bedroom semi-detached case study house was €188,089 excluding VAT. In stage 3, it was established that the cost to comply with building regulations updates since 1991, as contained in the construction of the 3 bedroom semi-detached case study house was €59,258 excluding VAT. Table 4.6 below incorporates both outcomes into a percentage analysis assessment. By deducting the cost of building regulations from the overall cost to construct the house, it can be determined that the net cost to build the same house to standards pertaining in 1991 would be €128,832. By identifying this figure as the baseline percentage, Table 4.6 shows that over a 30 year period the cost to build the case study house has increased by 46%, solely as a result of building regulations. This is a milestone finding and a key step to addressing the 3rd objective of the research.

Table 4.6 Proportional Cost of Building Regulations Upgrades

	Proportional Cost of Building Regulations Upgrades	€ (ex VAT)	%
1	Construction Cost of a typical 3-bedroom semi-detached house if built to pre-building regulations / 1991 standards	128,832	100%
2	Total Building Regulations Upgrades Costs	59,257	46%
3	Construction Cost of 3-bedroom semi-detach house in 2021	188,089	146%

4.6 Stage 5 – Further analysing the costs of building regulations to ascertain the cost to construct the same 3 bedroom house to standards that applied in 1991, 2001 and 2011

Stage 5 of the data analysis process is carried out to establish, observe and comment on the gradual accumulation of building regulations costs over 30 years since Irish building regulations were first introduced. This is done by taking the total building regulations cost and separating those costs into the three 10 year periods in which the cost arose. The three periods are: -

1. Between 1991 and 2001
2. Between 2001 and 2011
3. Between 2011 and 2021

The full analysis and results are contained in Appendix E.4 and summarised in Table 4.7 below. The summarised results show that during the first 10 years, following the introduction of building regulation, between 1991 and 2001, the cost to construct a typical 3 bedroom semi-detached house increased by €26,214 excluding VAT. The analysis also shows that during the two subsequent 10 year periods, between 2002 to 2011 and 2012 to 2021, building regulations standards increased the net cost to construct the same house by €17,519 and €15,524 respectively.

Table 4.7 Building Regulation Upgrades Costs - periodic

	Building Regulation Upgrades Costs – periodic	€	%
1	In Period 1991 to 2001	26,214	44%
2	In Period 2002 to 2011	17,519	30%
3	In Period 2012 to 2021	15,524	26%
	Total Building Regulation Upgrades Costs	59,257	100%

If the increase in costs associated with each time period are added to the 1991 standards baseline cost of €128,831.41, then it can be established how much it would cost to build the same house today using the standards that applied in 2001, 2011 and 2021. This is illustrated in Table 4.8.

Table 4.8 Cost to build the same house today, using standards that applied in 1991, 2001 & 2011

	Cost to construct the Case Study House in 2021, using 1991, 2001 & 2011 Standards				
	Time Period	Baseline Amount	Building Regs Cost Increases	Increased Total Amount	Percentage Increase
1	1991 Base Year			128,831	100%
2	1991 to 2001	128,831	26,214	155,045	120%
3	2001 to 2011	155,045	17,519	172,565	134%
4	2011 to 2021	172,565	15,523	188,089	146%
			59,257		46%

4.7 PART 2: Introduction

The next part of the data collection and analysis process is concerned with taking the findings outlined in Table 4.8 and incorporating them into post development appraisal models and then into development viability and purchaser affordability assessment models, in order to establish whether building regulations costs have any effect on housing viability and affordability.

4.8 Stage 6 – Case study post development costs assessment

4.8.1 Development viability

In the literature review chapter, it was established that a private housing development will not be deliverable on viability grounds, if the total costs of the development are too high to provide a competitive return to the developer for properties satisfying demand in the local market at affordable prices and rental levels. SCSI (2017) explains project viability as occurring when total development costs are less than or equal to the project sale price and it therefore makes commercial sense to proceed.

4.8.2 Development assessment

The literature review also identified the 'Development Appraisal' process as the means for pre-determining whether a development will be viable or unviable (Calder, Austin-Crowe, 1983). The development appraisal process involves bringing together a combination of project variables into an evaluation analysis, based on financial information, some of which will be known and some estimated. When a project has been completed, the developer will determine the accuracy of the pre-development appraisal with actual cost and sales outcome figures to determine the success or otherwise of the venture. According to the case study developer, this is generally referred to as a Post Development Cost Assessment.

As part of the case study, a post development cost assessment for the project was developed, analysed and then adapted to extract the amounts applicable to the 3 bedroom semi-detached house. That extract from the post development cost assessment is outlined in Table 4.9 below. This established that the gross total cost to develop the case study house was €328,572. Table 4.9 also infers that in order for the project to have been viable, it was necessary for the case study house to have achieved a gross sale price equal to or greater than €328,572.

Table 4.9 Post Development Cost Assessment – applicable to 3 bedroom semi-detached house

Hard Construction Costs		**€**	**%**
A	House Structure	128,583	
B	Siteworks	34,746	
C	Preliminaries	24,759	
D	Sub-total	188,089	57.2
Soft Costs			
E	Professional Fees	11,285	3.4
F	Local Authority Levies	7,288	2.2
G	Irish Water Utility Contributions	5,975	1.8
H	Elec/Gas Utility Contributions	1,016	0.3
I	Social Housing – Part V	2,950	0.9
J	Sale, Legal & Marketing Costs	5,900	1.8
K	Land Acquisition Costs	31,250	9.5
L	Finance Cost (of borrowing)	8,995	2.7
M	Developer Margin	26,741	8.1
N	Value Added Tax	39,081	11.9
O	**Gross Total**	**328,572**	**100**

4.8.3 Overview of development assessment elements

The project descriptions and cost data from which the figures allocated to hard construction costs elements; house structure, siteworks and preliminaries were outlined in step 2 of stage 2. The makeup of the various non-construction costs, commonly referred to as soft costs are described as follows.

Professional fees outlaid on the case study project only applied to post planning services, as the site was purchased by the developer with planning permission. The fees were negotiated based on a certain level of house design repetition. Because the case study project was directly built by the developer/contractor there were no procurement administration costs incurred by the consultants, and this was reflected in their fees costs. Professional fees on the project were discharged to the Project Architects, Assigned Certifier, Civil and Structural Engineer, Mechanical and Electrical Engineers and Landscape Architect.

Local Authority Levies were made up of standard capital contributions of approximately €6700 per house plus a special contribution charge for future infrastructural works involving a new traffic light system at a road junction adjacent to the site. Public utility charges from bodies such as Irish Water, ESB Networks and Gas Networks Ireland charges were based on standard connection fees, with small additional infrastructure works charges levied by Irish Water for works carried out by their contractors outside of the site boundary.

Social housing within the development was provided to the local authority (LA) under Part V of the Planning and Development Act 2000. Under the Part V rules in 2021, LAs were entitled to acquire up to 10% of the residential units developed at a discounted price, based on 'existing use values' of the land on which the Part V units were built. In accordance with section 96 of the act, the area of the site to be reserved for Part V was decided by the LA. Under the provisions contained in the 2015 amendment act, there are up to 4 methods through which developers can fulfil their Part V obligations. In the case study project, the local authority chose to purchase 3 houses at market value less the difference between development site values and existing use values. This resulted in a saving to the local authority of just over €100,000 which in turn resulted in a cost of €2,950 plus VAT to be carried by each of the privately sold houses.

Sale, Legal and Marketing costs were accrued during the house selling process. In the case of agents and solicitors fees, these were agreed at a fixed amounts per house transaction.

Marketing costs were accumulated through advertising campaigns on social media and from advertisements taken out in local and national newspaper property supplements. Development branding, media brochures and photography costs were also incurred, as well as showhouse fit-out costs.

Land acquisition costs were the single biggest outlay in the development assessment apart from construction costs and VAT. This item covered the cost to buy the land with planning permission for 34 houses, together with the stamp duty charge of 2% and legal fees incurred during the acquisition. A point worth noting is that the site was acquired approximately 2 years before the first house sale was completed. Interestingly, according to the developers files and feedback from local estate agents, the cost of residential development land in the general area of the case study, had increased by around 40% in the 3 year period between site purchase and completion of the development.

Finance costs were incurred on the cost of the money used to purchase the site and to build out the development. In the case study project, the site was purchased using 50% developers equity and 50% pillar bank finance, serviced over 36 months at Euribor rates plus a bank margin. The funds required to build out the development were obtained 60% from the pillar bank and 40% from mezzanine finance sources. Interest rates paid on the mezzanine finance sources were between 8% and 11% . This resulted in a blended interest rate on construction activities of around 8%. By virtue of the development cashflow S curve effect, interest costs were lowest in the initial two thirds period of the construction works and this greatly helped to keep interest costs down. A further measure employed to keep interest costs down and to flatten out development risk was that the build was programmed into 2 overlapping phases of 15 and 19 units. This had the effect that sales from the first 15 houses were used to help finance the second phase of the project. Finance costs also included bank charges such as arrangements fees of 1% and fees to consultants hired by the bank during the loan approval, due diligence, and loan drawdown processes.

Developers Margin for the project stood at just over 10% of development costs excluding VAT. What stands out most in this figure was that it is less than the sum paid out in VAT and significantly less than the 12.5 - 15% minimum margin rate level ordinarily required by lending institutions at project feasibility stage. The developers margin covers office overheads and various other indirect cost profiles, such as, site replacement, company expansion and return on shareholder’s equity. VAT on new home sales is 13.5%, which works out at just under 12% of the overall development costs. By way of comparison, it is notable that VAT on new homes in the Northern Ireland and the rest of the UK is zero.

4.9 Stage 7 – Case study viability and affordability modelling

4.9.1 Viability model baseline

In stage 7, the development cost assessment, as developed in stage 6 and contained in Table 4.9 above is carried forward for use as a baseline viability model, on the basis that it represents a breakdown of the actual live development costs to deliver a typical 3 bedroom, estate built, semi-detached house in a typical Dublin Commuter Belt location. The gross total from Table 4.9 in the sum of €328,572 is thus incorporated into a model to determine the purchaser affordability level of the established live viable cost.

4.9.2 Purchaser affordability

It is noted in section 2.2.2.6.1 of the literature review, how as part of its goal to safeguard banking stability and long-term resilience in the Irish financial system, the CBI placed a series of macro prudential rules, which included setting limits above which a borrower could not go beyond when accessing a mortgage (IHBA, 2021). Under these measures, loan to income ratio rules limit the amount of money a person can borrow to a maximum of 3.5 times their gross income. They also place minimum percentage limits on the size of the deposit amount. Based on those rules, a couple, both earning the average industrial wage of €41,000 per annum, will have a combined salary of €82,000 and be allowed to borrow 3.5 times that amount, equating to €287,000. They will also be required to have saved a deposit of no less than 10% of the purchase price of their new home. Using the CBI lending criteria and incorporating the viable sale price of €328,572 for the case study house, the affordability model contained in Table 4.10 shows how a couple both earning the average industrial wage, who are in possession of a 10% deposit sum, will have a house purchasing capacity of only €319,857, leaving a shortfall of €8,715.

Table 4.10 Purchaser Affordability Model – current scenario for case study house

	House Built under Current Building Regulations Standards	**2021**
1.	Viable Sale Price	328,572
2.	Less Purchase Deposit	(32,857)
3.	Less Loan Available €41,000 x 2 x 3.5 Times	(287,000)
	Shortfall	- €8,715

It therefore follows that by using prevailing central bank of Ireland metrics for determining the affordability status of the 3 bedroom semi-detached case study house, based on the development viability assessment, that the gross sale price required by the developer can be considered to be marginally outside of the desired affordability parameter.

4.10 Stage 8 – Adapting the 2021 viability and affordability models to building regulations costs that applied in 1991, 2001 and 2011

4.10.1 Adapting the viability model

The next step in the viability modelling process is to ascertain the impact that incremental increases in building regulations costs have made. This is done by taking the baseline viability model for 2021 as outlined in Table 4.9 and adjusting the hard construction costs to reflect scenarios of; if the house was built today using building regulations standards that pertained in 2011, 2001 and 1991. In Tables 4.7 and 4.8 above, values were proportioned to the accumulated costs of building regulations into 10 year periods between 1991 and 2021. In Appendix 5.3 and 5.4, these values are further broken into the sub-elements of House construction, Siteworks and Preliminaries. By transferring the figures analysed in Appendices E.3 and E.4 and superimposing them into the baseline viability model, as outlined in Table 4.11 below, the research can establish and compare the incremental impact of building regulations costs over each 10 year period from 1991 to 2021.

Table 4.11 Development Viability Model - based on case study house location

Hard Costs – (Construction)		**1991**		**2001**		**2011**		**2021**	
		€	**%**	**€**	**%**	**€**	**%**	**€**	**%**
A	House Structure	84,432.32		105,280.90		115,471.50		128,583.70	
B	Siteworks	29,845.51		30,897.01		33,066.49		34,746.23	
C	Preliminaries	14,553.58		18,867.82		24,027.41		24,759.15	
D	Sub-total	128,831.41	52.0	155,045.73	54.7	172,565.40	56.1	188,089.08	57.2
Soft Costs									
E	Professional Fees	7,729.88	3.1	9,302.74	3.3	10,353.92	3.4	11,285.34	3.4
F	L.A Levies	7,288.23	2.9	7,288.23	2.6	7,288.23	2.4	7,288.23	2.2
G	Irish Water Utility	5,975.68	2.4	5,975.68	2.1	5,975.68	1.9	5,975.68	1.8
H	Elec/Gas Utility	1,016.00	0.4	1,016.00	0.4	1,016.00	0.3	1,016.00	0.3
I	Social Housing	2,950.00	1.2	2,950.00	1.0	2,950.00	1.0	2,950.00	0.9
J	Sale/Legal/Market	5,900.00	2.4	5,900.00	2.1	5,900.00	1.9	5,900.00	1.8
K	Land Acquisition	31,250.00	12.6	31,250.00	11.0	31,250.00	10.2	31,250.00	9.5
L	Finance Cost	6,985.12	2.8	7,874.31	2.8	8,468.58	2.8	8,995.14	2.7
M	Developer Margin	20,191.65	8.2	23,088.97	8.1	25,025.66	8.1	26,741.82	8.1
N	VAT	29,445.93	11.9	33,708.37	11.9	36,557.12	11.9	39,081.32	11.9
O	**Grand Total**	**247,564**	**100**	**283,400**	**100**	**307,351**	**100**	**328,572**	**100**

A summary comparison of the grand totals in Table 4.11 shows that the current total cost to deliver a typical 3-bedroom semi-detached estate built house, situated within the Dublin commuter belt, as per the case study is €328,572. To develop the same house today, but constructed to building regulations standards pertaining in 2011, the total gross delivery cost reduces to €307,351. If the same house is constructed to building regulations standards pertaining in 2001 and 1991, then the total gross delivery costs reduce to €283,400 and €247,564 respectively.

4.10.2 Adapting the Affordability Model

Using the CBI lending criterion, but now apply them to viability/affordability scenarios where the housing delivery costs are arrived at using the values outlined in the viability model contained in Table 4.11, it is found, as outlined in Table 4.12 below, that the capacity of the first time buyer to borrow, improves, the more that building standards are stripped back out of the equation. For instance, from an affordability shortfall of €8,715, based on the 2021 viable cost to build, the home purchasers affordability capacity improves to a surplus of €10,384, where the case study house is built using 2011 building regulations standards and increases to a surplus of €31,940 and €64,192 when the house is built to 2001 and 1991 respectively.

Table 4.12 Purchaser Affordability Scenarios for Case Study House - periodic

	House Built to Building Regulations pertaining in	**1991**	**2001**	**2011**	**2021**
1.	Viable Sale Price as Table 4.10	247,564	283,400	307,351	328,572
2.	Less Purchase Deposit	(24,756)	(28,340)	(30,735)	(32,857)
3.	Less Loan Available €41,000 x 2 x 3.5 Times	(287,000)	(287,000)	(287,000)	(287,000)
	Surplus/-Shortfall	64,192	31,940	10,384	-8,715

4.11 Stage 9 - Adapting the viability and affordability models to different site locations

4.11.1 The effect of different site locations on the land cost element

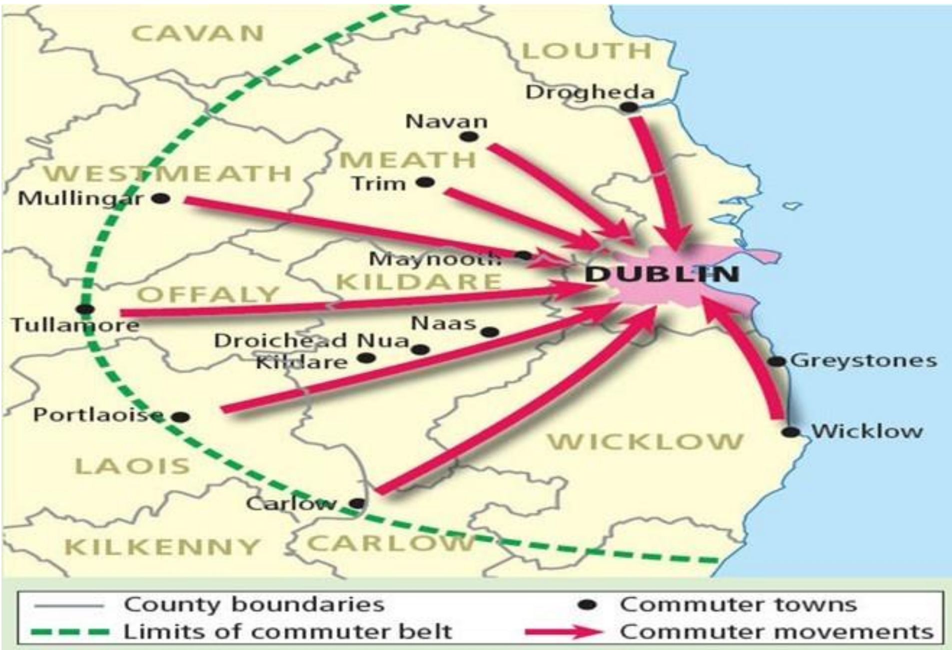
It was identified in the literature review and further illustrated in the post development cost assessment in Table 4.9, that after construction and taxation costs, land purchase is generally the third most significant cost in the delivery of housing. The literature review also noted that site location is a considerable variant in determining land values and residential development viability. Key factors determining the cost of land can vary, but generally have to do with zoning, distance from centres of economic activity, proximity to physical and social infrastructure, including utility services, transport links and amenities, as well as ground conditions (SCSI, 2020).

4.11.2 Basis for comparing the different case location settings

Figure 4.2 is a graphic map illustrating the regional influence of Dublin City, vis a vis the extent of its commuter belt area. The city is shaded pink, and the commuter belt area is located between it and the green hatched line. The lands located outside of the green hatched line are not located within the Dublin commuter belt area and despite been part of other economic regions, are for the purposes of this study considered as one homogenous zone. It follows, that when evaluating the impact of location in residential development viability and purchaser affordability models, the areas considered will be categorised as being located within one of the following: -

1. Outside the Dublin Commuter Belt
2. Within the Dublin Commuter Area – Case Study Location
3. In a Dublin City Suburb

Figure 4.2 The Dublin Commuter Belt Region



4.11.3 Estimating the average cost of land in the different site locations

There is a lack of official published data available on the cost of residential development land in Ireland and this includes areas in and around Dublin. In the following section, a number of scenarios are examined which are based on site locations with different site value characteristics, as explained in 4.11.1. Typical land price values for sites located in Dublin city suburbs and outside of the commuter belt area were accessed from on line development land reports, circulated by prominent estate agents, such as Cushman Wakefield (2021), Savills (2021) and Lisney (2021) and cross referenced to land search valuation files supplied by the case study developer.

4.11.4 Combined viability and affordability models based on 3 different locations

This is the final stage of the cost data collection and analysis process. It firstly involves taking the viability and affordability models in Tables 4.11 and 4.12 and combining them into a single model. The combined model is then reproduced a further two times, but both of these models are based on different site locations as explained in 4.11.2 above. In order to do this, the research substitutes the case study site cost figure of €31,250 with a different amount, which has been estimated to reflect a typical site value applicable to the each of the other 2 regional locations. Based on comparative land cost data reviews described in 4.11.3 above, it was considered that the following site values reflected a reasonable average assessment of typical site values in those locations. For the Dublin City Suburban site location, a figure of €95,000 per site unit for land acquisition was assessed and for the location outside of the Dublin Commuter Belt area the figure of €15,000 per site unit cost was chosen.

Table 4.13 is the combined Viability and Affordability Model based on the case study site. Tables 4.14 and 4.15 are the combined Models based on site locations in a Dublin City Suburb and Outside of the Dublin Commuter Belt respectively. In each model, the row containing figures for site acquisition costs is highlighted, because as previously explained, this is the main change in input cost data across the 3 models. There are other cost elements in the models that are proportionally affected, due to the changes in land costs. Lyons (2017, pp.12) refers to this as the soft costs multiplier effect. Those items in the model that display a cost change knock on effect are finance costs, developer’s margin and development sales VAT.

Table 4.13 Development Viability and Purchaser Affordability Model – based on Case Study Location inside Dublin Commuter Belt

Case Study House built to Building Regs Standards of year		1991 €	%	2001 €	%	2011 €	%	2021 €	%
A	Hard Construction Costs	128,831.41	57.0	155,045.73	59.2	172,565.4	60.4	188,089.08	61.3
B	Professional Fees	7,729.88	3.1	9,302.74	3.3	10,353.92	3.4	11,285.34	3.4
C	L.A Levies	7,288.23	2.9	7,288.23	2.6	7,288.23	2.4	7,288.23	2.2
D	Irish Water Utility	5,975.68	2.4	5,975.68	2.1	5,975.68	1.9	5,975.68	1.8
E	Elec/Gas Utility	1,016.00	0.4	1,016.00	0.4	1,016.00	0.3	1,016.00	0.3
F	Social Housing	2,950.00	1.2	2,950.00	1.0	2,950.00	1.0	2,950.00	0.9
G	Sale/Legal/Market	5,900.00	2.4	5,900.00	2.1	5,900.00	1.9	5,900.00	1.8
H	Land Acquisition	31,250.00	12.6	31,250.00	11.0	31,250.00	10.2	31,250.00	9.5
I	Finance Cost	6,985.12	2.8	7,874.31	2.8	8,468.58	2.8	8,995.14	2.7
J	Developer Margin	20,191.65	8.2	23,088.97	8.1	25,025.66	8.1	26,741.82	8.1
K	VAT	29,445.93	11.9	33,708.37	11.9	36,557.12	11.9	39,081.32	11.9
L/1	**Viable Sale Price**	**247,564**	**100**	**283,400**	**100**	**307,351**	**100**	**328,572**	**100**
2	Less Deposit	(24,756)		(28,340)		(30,735)		(32,857)	
3	Less Loan available	(287,000)		(287,000)		(287,000)		(287,000)	
4	**Affordability Surplus/Shortfall**	**+64,192**		**+31,940**		**+10,384**		**-8,715**	

Table 4.14 Developer Viability and Purchaser Affordability Model – based on location outside of Dublin Commuter Belt

Case Study House built to Building Regs Standards of year		1991 €	%	2001 €	%	2011 €	%	2021 €	%
A	Hard Construction Costs	128,831.41	57.0	155,045.73	59.2	172,565.4	60.4	188,089.08	61.3
B	Professional Fees	7,729.88	3.4	9,302.74	3.6	10,353.92	3.6	11,285.34	3.7
C	L.A Levies	7,288.23	3.2	7,288.23	2.8	7,288.23	2.5	7,288.23	2.4
D	Irish Water Utility	5,975.68	2.6	5,975.68	2.3	5,975.68	2.1	5,975.68	1.9
E	Elec/Gas Utility	1,016.00	0.4	1,016.00	0.4	1,016.00	0.4	1,016.00	0.3
F	Social Housing	2,950.00	1.3	2,950.00	1.1	2,950.00	1.0	2,950.00	1.0
G	Sale/Legal/Market	5,900.00	2.6	5,900.00	2.3	5,900.00	2.1	5,900.00	1.9
H	Land Acquisition	15,000.00	6.6	15,000.00	5.7	15,000.00	5.2	15,000.00	4.9
I	Finance Cost	6,010.12	2.7	6,899.31	2.6	7,493.58	2.6	8,020.14	2.6
J	Developer Margin	18,451.92	8.2	21,349.25	8.2	23,285.93	8.1	25,002.09	8.1
K	VAT	26,885.69	11.9	31,148.14	11.9	33,996.88	11.9	36,521.09	11.9
L/1	**Viable Sale Price**	**226,039**	**100**	**261,875**	**100**	**285,826**	**100**	**307,047**	**100**
2	Less Deposit	(22,604)		(26,188)		(28,583)		(30,705)	
3	Less Loan available	(287,000)		(287,000)		(287,000)		(287,000)	
4	**Affordability Surplus/Shortfall**	**+83,565**		**+51,312**		**+29,757**		**+10,657**	

Table 4.15 Developer Viability and Purchaser Affordability Model – based on location in a Dublin City Suburb

Case Study House built to Building Regs Standards of year		1991 €	%	2001 €	%	2011 €	%	2021 €	%
A	Hard Construction Costs	128,831.41	38.8	155,045.73	42.1	172,565.4	44.0	188,089.08	61.3
B	Professional Fees	7,729.88	2.3	9,302.74	2.5	10,353.92	2.6	11,285.34	3.7
C	L.A Levies	7,288.23	2.2	7,288.23	2.0	7,288.23	1.9	7,288.23	2.4
D	Irish Water Utility	5,975.68	1.8	5,975.68	1.6	5,975.68	1.5	5,975.68	1.9
E	Elec/Gas Utility	1,016.00	0.3	1,016.00	0.3	1,016.00	0.3	1,016.00	0.3
F	Social Housing	2,950.00	0.9	2,950.00	0.8	2,950.00	0.8	2,950.00	1.0
G	Sale/Legal/Market	5,900.00	1.8	5,900.00	1.6	5,900.00	1.5	5,900.00	1.9
H	Land Acquisition	95,000.00	28.6	95,000.00	25.8	95,000.00	24.2	95,000.00	4.9
I	Finance Cost	10,810.12	3.3	11,699.31	3.2	12,293.58	3.1	12,820.14	3.1
J	Developer Margin	27,016.72	8.1	29,914.05	8.1	31,850.73	8.1	33,566.89	8.1
K	VAT	39,489.94	11.9	43,752.38	11.9	46,601.13	11.9	49,125.33	11.9
L/1	**Viable Sale Price**	**332,008**	**100**	**367,844**	**100**	**391,795**	**100**	**413,016**	**100**
2	Less Deposit	(33,201)		(36,784)		(39,179)		(41,302)	
3	Less Loan Available	(287,000)		(287,000)		(287,000)		(287,000)	
4	**Affordability Surplus/Shortfall**	**-11,807**		**-44,060**		**-65,615**		**-84,715**	

Drawing from the contents of row L1 and row 4 of Tables 4.13 to 4.15 above, the summarised outcomes of the combined viability and affordability models for the three site locations are gathered together for analysis purposes. These are contained in Tables 4.16 and 4.17 below. In Table 4.16, the figure of €328,572 established as the viable sale price in the case study 'Post Development Cost Assessment' is identified as the baseline amount for comparison purposes. Using the baseline figure as a percentage index of 100, the comparison Table can be analysed, across vertical, and diagonal ranges to observe differences between the viable sale price associated with different building standard eras and sites locations. A cursory observation shows that when the typical estate built 3 bedroom semi-detached house is developed in the Dublin Suburb location using building standards from either of the periods 1991 to 2021, it would still have a higher sale price than the viability baseline.

Table 4.16 Development Viability Comparison

Case Study House built to Building Reg Standards of year		Viable Sale Price € 1991		Viable Sale Price € 2001		Viable Sale Price € 2011		Viable Sale Price € 2021	
1	**Outside Commuter Belt**	226,039	69%	261,875	80%	285,826	87%	307,047	93%
2	**Within Commuter Belt (Case Location)**	247,564	75%	283,400	86%	307,351	94%	328,572	100%
3	**Dublin City Suburb**	332,008	101%	367,844	112%	391,795	119%	413,016	126%

Similarly in Table 4.17, the affordability shortfall amount of -€8,715 established in the case study location as outlined in Table 4.10, is used as the baseline amount in the Affordability Comparison. A cursory observation shows that the Dublin City Suburb development location only comes close to affordability, if the case study house is constructed using 1991 building regulations standards. On the opposite end of the scale, the site located outside of the Commuter Belt is viable even when it is built to current building regulations standards. This is an obvious reflection of the land value effect.

Table 4.17 Purchaser Affordability Comparison

Case Study House built to Building Regs Standards of year		Surplus/Shortfall 1991 €	Surplus/Shortfall 2001 €	Surplus/Shortfall 2011 €	Surplus/Shortfall 2021 €
1	**Outside Commuter Belt**	+83,565	+51,312	+29,757	+10,657
2	**Within Commuter Belt (Case Location)**	+64,192	+31,940	+10,384	-8,715
3	**Dublin City Suburb**	-11,807	-44,060	-65,615	-84,715

4.12 Chapter Summary

This chapter explains from where the data was collected and how that data was analysed through a carefully developed 2 part, 9 stage process. It identifies building regulations as providing the units of analysis within a bounded context, and a case study as the instrument used to cost and analyse the UOA. The chapter then explains and demonstrates how data from the unit of analysis and instrument are brought together which enables the research to apply live construction and development costs to building regulations which have been identified as having tangible cost impact characteristics.

After collecting and bringing together the unit of analysis and instrument data through a 3 stage approach, the chapter then analyses the merged data in 2 dimensions, to ascertain the proportional cost of building regulations contained within the construction costs and development costs of a case study house. The first dimension is over periodic longitudinal time horizons and the second, over a cross section of adjacent regional locations. These analysis considered and synchronised development viability and purchaser affordability comparisons.

The next chapter examines and funnels the findings from this chapter into a thread of predetermined research questions, that are aligned to the research objectives that are concerned with achieving the aim of the research which is to explore how gradually accumulating building regulation costs have increased housing delivery costs, in order to understand the extent that this phenomenon has on development viability and purchaser affordability issues at the heart of the Irish Housing Crisis.

CHAPTER 5:

DISCUSSION ON FINDINGS FROM THE DATA ANALYSIS

5.1 Introduction

This chapter, is divided into two parts, each concerned with presenting the findings of the previous literature review and data collection and analysis chapters. The first part of the chapter deals with the targeted primary findings of the research and the second part deals with secondary findings. According to Perry (1998), factual and interpretative findings should be distinguished and that this objective can generally be achieved through chapter structuring. In that regard, the main focus of this chapter is to summarise, interpret and discuss the analysed data collected in chapter 4 with a view to applying those summaries and interpretations to the stated objectives, through the medium of the research questions. Following this, and also as suggested by Perry (pp.18), a discussion section is provided to gather and summarise the key primary findings.

In the second part of the chapter a separate collection of secondary findings emanating from the analysed data is summarised and discussed. The secondary findings are intended to outline notable outcomes that happened to emerge out of the data analysis. Creswell, (2013) suggests that research objectives should allow for the emergence of secondary findings not originally envisaged as part of the research. This is supported by Trafford & Leshem, (2008, p.145), where it is argued that even the most carefully planned research can throw up secondary findings that are noteworthy. The secondary findings are intended to provide additional understanding of the subject background and further justification for the underpinning theoretical framework. The secondary findings may also provide insights into the pursuit for ways to ameliorate the cost effects of building regulations and help to suggest pathways to further research on the overall topic of building regulations costs.

5.2 Primary Findings

5.2.1 Introduction

The aim of this research is to explore how gradually accumulating building regulation costs have increased housing delivery costs, in order to understand the extent that this phenomenon has on development viability and purchaser affordability issues at the heart of the Irish

Housing Crisis. As noted in section 1.4 of the Introduction chapter, the research objectives are refined into a series of connected research questions, devised as explicit means to resolving those objectives and thereby achieving the research aim (McCann, 2017). Table 5.1, below, sets out the link between the research objectives and the research questions. It also locates the chapter from where the information or analysed data used to resolve the question, may be found. In the following sections 5.2.1 to 5.2.7, the research question are considered individually under the headings of the research objectives that they fall under.

Table 5.1 Linking Research Objectives to Research Questions

	Research Objective	Responding Research Question	Chapter
1	To identify and understand the range of issues contributing to the Irish Housing crisis.	1. What issues can be identified in the review of existing literature as contributing factors to the Irish Housing Crisis?	Chapter 2
2	To ascertain from a review of literature if building regulations costs are considered a significant contributing factor to the Irish housing crisis.	2. Have building regulations costs been directly identified as a contributing factor in the literature?	Chapter 2
		3. Can building regulations costs be indirectly identified in the literature as a contributing factor to increased construction costs?	Chapter 2
3	To assess the impact of Irish building regulations costs on residential development viability and purchaser affordability.	4. Can building regulations specific to housing be identified and then assessed for their proportional impact on the construction costs of a typical estate built house, using live cost data?	Chapter 3 and Chapter 4
		5. Are building regulations costs a significant proportion of the overall cost to construct a typical estate built 3-bedroom semi-detached house?	Chapter 4
		6. Since Irish building regulations were first introduced in 1991 have their impact on overall construction costs gradually accumulated?	Chapter 4
		7. What is the current position of residential development viability and how does the current position compare to scenarios where accumulated building regulations costs are factored out of the cost base?	Chapter 4
		8. What is the current position of new homes purchaser affordability and how does the current position compare to scenarios where accumulated building regulations costs are factored out of the cost base?	Chapter 4
		9. What would be the effect on development viability and purchaser affordability if the case study development site was situated in alternative locations?	Chapter 4
4	To position the findings of the research with existing knowledge and literature on building regulation costs and the Irish housing crises	10. How does the findings of this research add to the existing knowledge and literature on buildings regulations and the Irish housing crisis?	Chapter 5

5.2.2 Research Objective No.1

To identify and understand the range of issues contributing to the Irish Housing crisis.

5.2.2.1 Research Question No.1

Research question No.1 responds to the first research objective by asking; what issues can be identified in the existing literature as contributing to the Irish housing crisis. One of the primary objectives of the literature review chapter was to identify those issues, and it opened by identifying the complexity and multi-dimensional nature of the housing market as a key starting point. It then acknowledged a confluence of systemic issues in the market, such as labour and supply chain shortages, planning system and land management failures, infrastructure deficits and credit constraints as seriously problematic. Turning to structural issues in the housing delivery system, the review points to Ireland's dynamic housing market and dualist rental market systems as playing into the collective difficulties.

It has been argued by some, including McCann (2020) that because a literature review involves the collection and synthesis of secondary data rather than empirical data, that its use as a tool for answering research questions is limited. Notwithstanding the rationale behind those arguments, it was considered at the outset of this study that in order to establish a credible purpose for the research, that a review of literature to establish the relevance of the purported research problem was an essential undertaking. The literature review has provided a firm basis for the research study to understand the workings of housing markets and building regulations in Ireland and internationally. With that understanding the review has also facilitated the identification of what are generally acknowledged to be the main factors contributing to the Irish housing crisis.

5.2.3 Research Objective No.2

To ascertain from a review of literature, if building regulations costs are considered a significant contributing factor to the housing crisis.

5.2.3.1 Research Question No.2

Research question No.2 seeks to ascertain whether building regulations costs are identified in the literature as a contributing factor to the housing crisis. This question formed an originating part of the decision to undertake this research study and was extensively discussed in the initial research proposal, interim assessment and interim evaluation stages of the research journey. In those earlier stages, preliminary literature reviews of academic papers, housing analysts and other sources, found little to connect building regulations costs with the growing affordability and housing supply crisis. In the literature review study carried out as part of this broader study, references to building regulations costs as a factor driving up construction costs are found and cited. These include Lyons (2015) calls for an audit of housing delivery costs to show where building regulations might be reviewed and financially streamlined. Comments were also made in Nowlan (2017), where he considered that Ireland's hallmark building standards should be linked to our ability to pay for them. Nowlan also made an interesting analogy of comparisons between economy and luxury car model specifications, and policy makers insistence that housing construction specifications in every instance have to match the luxury model. More recently, IHBA (2020) also point out that building regulations costs continue to increase year on year and especially energy efficiencies in building, which come at a cost. The above identifies acknowledgements that building regulations costs are a problematic issue in the current high levels of construction costs. However, they are just acknowledgements, without any background substantiation.

5.2.3.2 Research Question No.3

In research question No.3, the study is asked if building regulations costs can be indirectly identified in the literature as a contributing factor to increased housing construction costs. This question goes beyond question 2, by asking the research to consider if there is evidence embedded in the literature, which can be meta-analysed to further justify the case for the purported research problem. The answer to this question can be found in the contents of Table 2.11, which illustrates that when CSO data for national housing construction cost inflation is compared with SCSI housing construction cost increases, between 2016 and 2020, that the increased construction cost is over twice the rate of construction inflation for the same period. By bringing together both sets of separately published data, the literature review established that the substantial difference between the reported inflation increases and actual cost increases can be interpreted as being mainly due to improved housing design standards and building regulation costs.

The information uncovered in response to research question 3 provides that indirect substantiation can be found in a review of literature that building regulations can be considered a reason for high construction costs and therefore a contributing factor to viability and affordability issues, which are a contributing factor at the heart of the housing supply crisis.

5.2.4 Research Objective No.3

To assess the impact of Irish building regulations costs on residential development viability and purchaser affordability.

Research objective No.3 is addressed by following the steps outlined in the data collection and analysis process map in Figure 4.1. Those steps are also addressed and discussed in research questions 4 to 9 below.

5.2.4.1 Research Question No.4

Research question No.4 asks can building regulations, specific to housing be identified and then assessed for their impact on the construction costs of a typical estate built house, using live costs? The first part of this question can be linked back to discussions in section 4.1, where Miles et al explanation of the ‘unit of analysis’ is considered. This makes it clear that the ‘bounded context’, which in this case are the corpus of building regulations, are explicit and attainable for study, in order to subsequently explain the phenomenon of increases in construction costs associated with those regulations. Section 4.2.1 and the contents of Appendices B and E confirms that there is an extensive volume of published building regulations documentation, much of which is presented in such a way that it is possible to review the contents in order to establish that they have had an effect on house construction costs. By using the Dublin Corporation Building Byelaws (1949) document as an effective baseline for building standards in Ireland before building regulations were published in 1991, it is possible to systematically analyse the suite of building regulations TGDs and ancillary documents in order to identify regulations that have tangibly increased housing construction costs since then. Appendix B.2 and the extract from same, as set out in Table 4.2, illustrates how this was carried out. It therefore follows that for the purpose of objective 3, it is clearly feasible to identify a tangible bounded context around the suite of Irish building regulation documents, from which to examine costs through an instrumental case study.

The second part of question 4 wants to know if the impact of the identified building regulations can then be proportionally assessed in relation to the overall construction costs of a typical estate built house, using live cost data. In section 3.2.6.4 of the Methodology and

Methods chapter, the research explains the rationale for selecting an instrumental case study, as an appropriate means of collecting and analysing real live cost data from which to meet the objectives of the study. In Stage 2, sections 4.3.1 and 4.3.2 of the data collection and analysis chapter, the research also explains the main criteria used for selecting the particular case study project, supported by project drawings contained in Appendix C. In Section 4.3.3, the research outlines the nature of the case study documentation and information that the research had access to, and then goes on to explain the process used to extract the desired cost data and the 'bill of costs' format in which the extracted cost data was formatted, for subsequent analysis. A summary of the collected cost data is contained in Tables 4.2 and 4.3 in Appendices D.1. These tables established that real construction cost data from a live housing development project can be sourced and collected for further analysis.

The next step in the process of answering research question No.4 requires the research study to sub-analyse the cost data contained in Table 4.3 in order to allocate costs to individual house types, from where the cost to construct a typical 3-bedroom estate built semi-detached house can be extracted. This step also links the question back to the 'unit of analysis' study approach as explained by Miles et al (2014) and further considered by Yin (2018), where the inquiry is mostly interested in a particular part of the unit to be analysed. As in this case, it is the construction cost of the 3 bedroom semi-detached house type, part of the case study development that the research is concerned with. In section 4.3.4 it is explained how the bill of construction costs was prepared in such a way that it sub-divides the costs into the different house types within the development. In this way, it was possible to isolate a detailed breakdown for the 3 bedroom semi-detached house type. This showed that the all in cost to construct the 3 bedroom semi-detached house was €188,089 excluding VAT.

The final step in resolving question 4, involved identifying the proportion of the overall construction cost of the 3-bedroom semi-detached house that can be attributed to the cost of complying with building regulations, since their introduction in 1991. In section 4.4 the research explains how data from the documents contents analysis of Irish building regulations and cost data gathered from the instrumental case study were brought together in order to put real cost values on the building regulations identified as having cost increasing characteristics. The key finding from this exercise and the answer to question 4 is contained in Table 4.5, wherein it establishes that the total cost of building regulations applicable to the 3 bedroomed semi-detached house is €59,258 excluding VAT.

5.2.4.2 Research Question No.5

Research question No.5 asks whether building regulations costs are a significant proportion of the overall construction costs of a typical estate built 3 bedroom semi-detached house? This interpretative question is considered by comparing the figures deduced in the answer to research question No.4, which established that within the overall net construction cost of €188,089 to build the case study house, the amount attributable to building regulations is €59,258. This is a 32% proportion of the overall net amount. However, if the figure of €59,258 is deducted from the total figure of €188,089, it also tells us that if the same 3 bedroom semi-detached house was built today using building regulations standards as applied in 1991, then the cost to construct the house would be €128,832. Using that figure as a baseline amount, this indicates that the cost to construct a typical estate built 3 bedroom semi-detached house has increased by 46% since building regulations were first introduced in 1991. This increase can reasonably be interpreted as significant.

5.2.4.3 Research Question No.6

Research question No.6 asks if the impact of building regulations costs on construction costs have been gradual since their introduction in 1991? A simple analysis of the outcome to research question No.5 illustrates that a 46% increase in construction costs attributable to building regulations over 30 years is equivalent to an average increase of 1.53% per annum. over 30 years. However, a more thorough assessment of the gradual impact of building regulations costs on house construction costs, formed part of the data analysis process. In this assessment the overall cost figure of €59,258 was further analysed into the three 10 year period values within which the costs arose. Table 4.8 sets out the findings of that analysis, which found that the cost of construction due to building regulations rose by €26,214 between 1991 and 2001, by €17,519 between 2001 and 2011 and by €15,523 between 2011 and 2021. Using the 1991 construction cost of €128,831 as a baseline, the percentage increases were 20%, 14% and 12% of the baseline figure respectively. This indicates that following a significant cost impact within the first ten years of their introduction, building regulations costs appear to have settled into a relatively consistent cost accumulating rate of around 13% every 10 years or so. This observation is further supported by an even more detailed analysis of year one – 1991, which shows that in this 12 month period alone, building regulations costs increased construction costs by €10,852 or 8.2%. Viewed through a different lens, Table 4.8 also establishes that if the same typical estate built house were to be constructed in 2021 using the building regulations standards that applied in 1991, 2001, 2011 and 2021, then the costs to do so would be €128,831, €155,045, €172,565 and 188,089 excluding VAT respectively.

5.2.4.4 Research Questions No.7 and No.8

The previous 4 research questions have focussed on building regulations costs insofar as they impact on house construction costs. Research questions No.7 and No.8 seek to broaden the research, from an exploration of how building regulations costs can be shown to impact on construction costs, to now illustrate how they can have a wider effect, by establishing how they impact on development costs, development viability and on new home purchasers affordability. Because of the interactions between development viability and purchaser affordability, the findings in relation to one are intricately linked to the other. In acknowledgement of this, both these questions are tackled together. Research question No.7 and No.8 combined asks what is the current position of residential development viability and new homes purchaser affordability and how does the current position compare to scenarios where accumulated building regulations costs are factored out of the cost base?

In section 4.8.2 of chapter 4, the research explains how as part of the case study process, a post project development assessment was carried out to determine the overall final development costs of the project. Section 4.8.3 explained the background behind each development cost heading, such as professional fees and public utility costs, and also described how each cost heading was analysed to proportionally extract the values applicable to the 3 bedroom semi-detached house, in order to set up a distinct development assessment for the case house type. As outlined in Table 4.9, the post development cost assessment established that the viable cost to develop the case study house was €328,572 inclusive of VAT.

In section 4.9.2, it was found in Table 4.10, using prevailing central bank of Ireland metrics for determining the affordability status for a typical new house purchase, that the 3 bedroom semi-detached case study house was positioned marginally outside of the desired affordability limits. The shortfall amount was calculated to be €8,715. Sales results data supplied by the case study developer showed that the 3 bedroom semi-detached houses were sold at sale prices averaging €325,000 inclusive of VAT. This resulted in purchasers on average industrial earnings, having to raise €5,000 over and above the minimum 10% deposit monies, in order to complete a purchase. For first time buyers with tax clearance certification and prescribed minimum levels of income tax paid over the previous 4 years, a ‘help to buy’ tax rebate scheme may have assisted to reduce the deposit amount required and help bridge the affordability gap (revenue.ie, 2021).

Having addressed the viability and affordability position of the case study house as it currently stands, the second part of research questions 7 and 8 tackle how the current position compares to scenarios where accumulated building regulations costs are factored out of the cost base? This is achieved by comparing the current viability and affordability positions, as set out in Tables 4.9 and 4.10, with scenarios where the inputted construction costs are substituted to reflect the case study house if built today using building regulations standards that pertained in 2011, 2001 and 1991. Using Table 4.9 as a starting point and baseline from which to compare the effect of adjusting the construction cost data, Table 4.11 includes additional columns for each of the years 2011, 2001 and 1991. When the alternative construction cost data is incorporated, the comparison illustrates that viability targets are very different. Overall, it was found that when 2021 construction costs are adjusted to reflect costs applicable to building regulations standards that applied in 2011, 2001 and 1991, the gross viable sale price for the case study house reduces from €328,572 to €307,351, €283,400, and €247,564 respectively. In percentage terms, this represents a reduction of 6.5%, 14% and 25% respectively. When the adjusted viability targets using 2011, 2001 and 1991 building regulations costs were assessed for their effect on purchaser affordability, it was found in Table 4.12 that the affordability positions were also very different. Table 4.12 showed that while the current affordability position indicates a loan limit shortfall of €8,715, this changes to a surplus of €10,384, €31,940 and €64,192 where viability targets incorporated 2011, 2001 and 1991 building regulations costs respectively.

5.2.4.5 Research Question No.9

Research question No.9 asks what would be the effect on development viability and purchaser affordability if the case study development site was situated in alternative locations? Having demonstrated the impact of building regulations costs on a longitudinal time horizon (the first dimension), this question considers the impact of building regulations costs on a limited regional cross sectional basis (the second dimension). In practical terms, the purpose of this part of the investigation, is to establish how intensified or diluted the impact of building regulations costs are, on viability and affordability, the closer or further away from Dublin City a residential development is.

In section 4.11 a step by step process evaluates the impact of hypothetically re-situating the case study house to 2 different site locations. The alternative locations chosen were, one further from and one closer to Dublin City centre than the case study site. Referencing a graphic map of the Dublin Commuter Belt Region in Figure 4.3, the sites were categorised as being located within one of the following regions: -

1. Outside the Dublin Commuter Belt
2. Mid-point - within the Dublin Commuter Area – Case Study Location
3. In a Dublin City Suburb

Table 4.13 comprises a combined developer viability and purchaser affordability comparison model, based on the case study house, built to building regulations standards that applied in 2011, 2001 and 1991. This table is replicated in Tables 4.14 and 4.15 to represent the alternative site locations. The main input variable between each of the Tables 4.13, 4.14 and 4.15 is the land acquisition cost and consequential pro-rata adjustments to items such as developers margin and VAT. Tables 4.16 combines the data which illustrates the comparable differences between the three locations in respect of development viability, while Table 4.17 shows how the locational based viability scenarios impact on purchaser affordability.

It can be clearly seen in Table 4.16 that location can play a significant role in determining the viable sale price of a house. By a simple observation of the 2021 comparison, it can be seen that it is possible to develop the case study house in the region outside of the Dublin commuter belt area for 7% less than in the case study location. In the opposite direction it shows that in order to develop the case study house in the Dublin suburb location it would cost 26% more. Table 4.16 also shows that in the Dublin suburb location, it is more expensive to deliver the case study house, even using building standards that applied in 1991, than it is to deliver the same house to 2021 building regulations standards at the case study location.

Unsurprising, in relation to purchaser affordability, the impact of location is similar. As a consequence of the higher viable sale prices required in the Dublin city suburb location, Table 4.17 indicates that under LTI lending rules, a couple on the average industrial wage, would require to have access to €84,715 over and above the minimum required deposit level, in order to purchase the case study house built to current building standards. Even if the same house was built in the Dublin suburb area using 2011, 2001 and 1991 building standards, the same couple would still have to bridge a deposit shortfall of €65,615, €44,160 and €11,807 respectively. Purchaser affordability is shown to considerably improve when the case study house is located outside of the Dublin commuter belt area, as currently there is no shortfall required to be made up on the minimum 10% deposit. Table 4.17 also shows that the deposit surplus position greatly improves, when the house is constructed to earlier building regulations standards.

5.2.5 Research Objective No.4

To position the findings of the research with existing knowledge on building regulations and the Irish housing crisis.

5.2.5.1 Research Question No.10

Research question No.10 asks how the findings of this research study add to existing knowledge and literature on building regulations and the Irish Housing crisis? This final research question is the culmination point of the research journey's quest to achieve the aim of the research, which is to explore how gradually accumulating building regulation costs have increased housing delivery costs, in order to understand the extent that this phenomenon has on development viability and purchaser affordability issues at the heart of the Irish Housing Crisis. This research question and research objective will be considered, following an overview of key primary findings, extracted from the outcomes to research questions 1 to 9. Following is a summary of the key primary findings, outlined in an order which generally aligns with the progression of outcomes identified in the literature review and data collection and analysis chapters. The summary is followed by a discussion which considers how the primary findings position themselves with what is already known about building regulations and their impact on the Irish housing crisis.

5.3.1 Key Primary Findings

1. The complexity and multi-dimensional nature of the housing market, combined with a confluence of systemic issues, such as supply chain shortages, planning system and land management failures, infrastructure deficits and credit constraints are disparately

identified by a review of existing literature and discourse, as the main contributing factors to the Irish housing crisis. Structural issues in the housing delivery system, relating to Ireland's dynamic housing market and dualist rental market systems are also identified as playing into the collective difficulties. High housing delivery costs have also been identified as problematic.

2. According to a review of existing literature, building regulations cost have not been identified as a significant contributing factor to viability and affordability problems or to the Irish housing crisis.

3. According to a meta-analysis of data sourced in the existing literature, indirect evidence exists which demonstrates that in a recent 4 year period, between 2016 and 2020, housing construction costs have increased by over double the rate of published construction cost inflation.

4. Between 1991 and 2021, the average cost to construct a typical estate built 3-bedroom semi-detached house has increased by €59,257 (Excl VAT) or 46%, solely due to building regulations costs.

Table 4.6 Proportional Cost of Building Regulations Upgrades

	Proportional Cost of Building Regulations Upgrades	€ (ex VAT)	%
1	Construction Cost of a typical 3-bedroom semi-detached house if built to pre-building regulations / 1991 standards	128,832	100%
2	Total Building Regulations Upgrades Costs	59,257	46%
3	Construction Cost of 3-bedroom semi-detach house in 2021	188,089	146%

Another way to present this statistic is to state that of the total net construction cost of €188,089 to construct a typical estate built 3 bedroom house, building regulations costs account for €59,257 or 32% of the total sum.

5. A simple analysis of the increase in construction costs to construct the typical estate built 3 bedroom semi-detached house, due to building regulations would suggest that the average increase over 30 years between 1991 and 2021 was €1,975 or 1.53% per annum.

6. If the typical estate built 3 bedroom semi-detached house were to be constructed in 2021 using the building regulations standards that applied in 1991, 2001, 2011 and 2021, then the costs to do so would be €128,831, €155,045, €172,565 and 188,089 excluding VAT respectively. Using the 1991 construction cost of €128,831 as a baseline, this represents periodic cost increases of €26,214 or 20% between 1991 and 2001, €17,519 or 14% between 2001 and 2011 and €15,523 or 12% between 2011 and 2021.

Table 4.8 Cost to build house today, using standards that applied in 1991, 2001 & 2011

	Cost to construct the Typical estate built, 3 bedroom semi-detached house in 2021, using 1991, 2001 & 2011 Standards				
	Time Period	Baseline Amount	Building Regs Cost Increases	Increased Total Amount	Percentage Increase
1	1991 Base Year			128,831	100%
2	1991 to 2001	128,831	26,214	155,045	120%
3	2001 to 2011	155,045	17,519	172,565	134%
4	2011 to 2021	172,565	15,523	188,089	146%
			59,257		46%

7. Between 1991 and 2021, the average cost to develop a typical estate built 3-bedroom semi-detached house in a Dublin commuter belt town gradually increased from €247,564 to €328,572 which is equal to a gross increase of €80,008 (Excl VAT) or 32% over 30 years, due to building regulations costs.

Combined Extract from Tables 4.11 & 4.12 Development Viability & Affordability Models

Development Viability Model - based on case study house location in Dublin commuter belt								
	1991		**2001**		**2011**		**2021**	
	€	**%**	**€**	**%**	**€**	**%**	**€**	**%**
Hard Costs	128,831	52.0	155,045	54.7	172,565	56.1	188,089	57.2
Soft Costs	118,733	48.0	128,355	45.3	134,786	43.9	140,483	42.8
Total	**247,564**	**100**	**283,400**	**100**	**307,351**	**100**	**328,572**	**100**
Affordability	**64,192**		**31,940**		**10,384**		**(8,715)**	

8. Based on development costs incorporating construction costs, based on current and 1991 building regulations, as outlined in above Table 4.11 & 4.12 extracts, the affordability position of a couple earning the average industrial wage would experience a change from a current affordability ceiling deficit of €8,715 to a surplus of €64,192.

9. Development costs are substantially higher in the Dublin suburbs region and significantly lower in the regions located just outside of the commuter belt. As demonstrated in the Tables 4.16 & 4.17 extract below, when adjustments for building regulations costs are incorporated into development cost figures, viability and affordability remains a significant problem in the Dublin suburbs. This is so, even if the typical estate built 3 bedroom house were built to 1991 building standards. Viability and affordability is currently not an issue immediately outside of the Dublin commuter belt region, provided that demand and house prices in those locations are in harmony with the macro prudential settings.

Combined Extract from Tables 4.16 & 4.17 Development Viability & Affordability Regional Comparison

Case Study House built to Building Reg Standards of year		Price € 1991		Price € 2001		Price € 2011		Price € 2021	
		Viable Sale		Viable Sale		Viable Sale		Viable Sale	
1	**Outside Commuter Belt**	226,039	69%	261,875	80%	285,826	87%	307,047	93%
2	**Within Commuter Belt (Case Location)**	247,564	75%	283,400	86%	307,351	94%	328,572	100%
3	**Dublin City Suburb**	332,008	101%	367,844	112%	391,795	119%	413,016	126%
		Deposit Surplus/Shortfall		**Deposit Surplus/Shortfall**		**Deposit Surplus/Shortfall**		**Deposit Surplus/Shortfall**	
1	**Outside Commuter Belt**	+83,565		+51,312		+29,757		+10,657	
2	**Within Commuter Belt (Case Location)**	+64,192		+31,940		+10,384		-8,715	
3	**Dublin City Suburb**	-11,807		-44,060		-65,615		-84,715	

5.3.2 Summary of Primary Findings

Through a review of the existing literature, this research identified and discussed a number of housing sector issues that individually and in combination are acknowledged as contributing factors to the Irish housing crisis. The findings also established that beside those recognised issues, there is very little discussion or investigation in the literature, associating building regulations costs as a contributing factor to the Irish housing crisis or to international housing affordability crises generally. This study can therefore be considered to contribute an important addition to the literature, because it introduces original research in an area of the housing sector that can be shown to have a direct impact on housing supply, which is at the root of the Irish housing crisis and other international housing challenges.

Drawing from investigations into building regulations costs carried out in section 2.2.5.2.4 of the literature review, the study found through a meta-analysis of data from two separate sources, that indirect evidence existed to demonstrate how building regulations costs impact housing delivery costs, over and above what is currently reported and generally understood. This exercise also serves to support the argument of this study that costs associated with building regulations have stealthily accumulated, partially because they are not acknowledged in the basket of goods methodology for measuring annual increases in housing construction cost inflation as published by the CSO.

Moving from the literature review chapter to the data collection and analysis chapter. The findings then revealed, through the documents contents analysis and instrumental case study, that the extra over cost of building regulations, in the construction and development costs of a typical estate built 3 bedroom semi-detached house, could be identified in figures and percentage proportions. By determining through the data collection and analysis process, that building regulations costs are responsible for increasing the cost to construct and to develop a new house by 46% and 32% respectively, the research has clearly established that building regulations costs are a significant proportion in the overall delivery cost of new housing, which is at the root of the viability and affordability crisis, which are the central issues of the housing crises in Ireland and internationally. By exploring deeper into the advancement and timing of building regulations upgrades, the findings also demonstrated how building regulations costs have gradually accumulated and how those gradual improvements have served to undermine development viability and purchaser affordability over time.

In an assessment on the degree in which location can either intensify or dilute the impact of building regulations costs on a development, the findings showed that development costs are substantially higher in the Dublin suburbs region and significantly lower in the regions located just outside of the commuter belt. This would imply that the closer a development is to Dublin, the proportion of the total development costs that is building regulations costs will be less and the further away from Dublin, the opposite will be the case. As a result, viability and affordability remains an issue, the closer one gets to Dublin, even if the typical estate built 3 bedroom semi-detached house was built using 1991 building regulations standards.

5.4 Secondary Findings

5.4.1 Introduction

The secondary findings are so titled because they do not centrally connect with the list of research objectives and research questions as outlined in Chapter 1 and Table 5.1 above. While several of the secondary findings are worth emphasising in their own right, others are important because of the way in which they inform readers of the progression paths and contextual background around the collected data. By providing such background insights, they also serve to support the identification of Historical Institutionalism as an underlying theoretical framework of the study. The secondary findings are derived from taking a broader or deeper look into the collected data, and through the application of interpretative analysis (Saunders, 2016 pp.188) they provide the research with an opportunity to explain other circumstantial and practical effects of the building regulations that do not come across in the primary findings. The secondary findings are set out and discussed in the following sections 5.4.2 to 5.4.6.

5.4.2 Building regulations costs per main building elements

An analysis of the proportional cost of building regulations as they applied to each of the main building elements was carried out and are outlined in Appendix E.4. The main building elements into which building regulations costs were separated into are house structure, siteworks and preliminaries. Table 5.2 below is an extract taken from Appendix E.4.

Table 5.2 Building Regulations Costs Per Building Element - Periodic

	Building Element	**Percentage**	**1991 - 2001 €**	**2001 - 2011 €**	**2011-2021 €**	**Total €**
1	House Structure	75%	20,848	10,191	13,112	44,151
2	Siteworks	8%	1,052	2,169	1,680	4,900
3	Preliminaries	17%	4,314	5,159	731	10,205
	Totals	100%	26,214	17,519	15,523	59,257

According to the analysis presented in Table 5.2, the vast majority of building regulations costs are concentrated within the house structure itself, where €44,151 or 75% of the total costs are found. Almost half of the 75% came into effect during the first 10 year period, between 1991 and 2001. Siteworks accounted for the lowest concentration of building regulations costs at €4,900 or 8% of the total costs. Nearly half of the additional siteworks costs occurred during the second 10 year period, between 2001 and 2011. Building regulations costs associated with Preliminaries were €10,205 or 17% of the overall figure and 93% of these costs occurred between 1991 and 2011. Table 5.3 compares building regulations costs per building element, with the overall construction cost per element of the case study house. This breakdown shows how much each building element increased in cost since building regulations were introduced in 1991. House structure costs have increased by over half what they were in 1991. Siteworks costs have risen by 16% and Preliminaries have increased by a staggering 70%. In the following sections, the secondary findings drill a little deeper into the 70% increase in preliminaries costs, in order to establish why building regulations. have increased the costs of this element by so much.

Table 5.3 Building Regulations Costs – Building Elements Proportions

	Bill of Costs Summary Case Study House	**2021 Overall Construction Cost**	**Constructed to 1991 Regulations**	**Building Regulations Costs**	**Percentage of 1991 Costs**
	Building Element	€	€	€	%
1	House Structure	128,583	84,432	44,151	52%
2	Siteworks	34,746	29,846	4,900	16%
3	Preliminaries	24,759	14,554	10,205	70%
	Total (Excl VAT)	188,089	128,832	59,257	46%

5.4.3 Building regulations other than those found in the TGDs

In Ireland and internationally, building regulations are closely associated with TGDs published by government or their appointed bodies. Out of the established total construction cost of building regulations applicable to the case study house at €59,257, the proportion of this figure identified as coming directly from the TGDs was €46,703 or 79% of the total. The other 21% or €12,554 arose out of costs associated with ancillary documents and regulations such as National Rules for Electrical Installations, Irish Water technical documents, Acceptable Construction Details (ACDs) and dealing with procedures and processes related to building control, energy performance, waste regulations and health and safety on site.

5.4.4 Indirect Costs administering building regulations

Largely taken from work carried out in the Module 5 Pilot Study, Appendices F.1 to F.4 contain an analysis of the indirect costs associated with the management and administration of building regulations on the case study project. The data shows that very few of the indirect costs collected in Appendices F.1 to F.4 originate in the TGDs or ancillary technical documentation. Apart from procedural directions contained in the TGDs Part L energy efficiency regulations, most indirect building regulations costs derive from what can best be described as building control and operations regulations, which are mainly directed at building management processes and procedures. In this regard, the key regulations analysed were:

1. Building Control Regulations
2. Health and Safety in Construction Regulations
3. Environment and Waste Regulations
4. Energy Performance Regulations

The focus of this area of the data collection and analysis was to determine increases in management staff input and training costs for prescribed activities under the above list of regulations. The analysis also gathered data on costs incurred in relation to statutory levies, registration fees, and certification fees. In addition to these, the analysis outlines a range of costs associated with the Irish self-certification approach to building control compliance and the administration of health and safety processes. Costs under those categories include fees and such, required to cover newly created consultancy services, such as, Assigned Certifier, Ancillary Certifier, Project Supervisor for Design Process (PSDP) and Project Supervisor for Construction Stage (PSCS). Table 5.4 below, contains a combined summary of the additional management administrative input and indirect costs.

Table 5.4 Increases in Indirect Costs Summary

	Element	Building Control Regulations	Health & Safety in Const Regulations	Environment & Waste Regulations	Energy Performance Regulations	Summary
1	EH&S Manager	0%	44%	11%	0	55%
2	Site Manager	7%	27%	2%	3%	39%
3	Construction Manager	9%	18%	1%	3%	31%
4	Quantity Surveyor	3%	7%	1%	2%	13%
5	Training	FETEC Level 6	FETEC Level 6 Safepass & Skills	CIF C&D Environment	In Item 5, 3rd column	€205
6	Registration Fees & Levies	€30 per house	0	€168 per house	€215 per house	€413
7	Assigned Certifier Fee	€950 per house	0	0	In Item 5 3rd column	€950
8	Ancillary Certifier Fee	€500 per house Structural	0	0	In Item 5 3rd column	€500
9	Ancillary Certifier Fee	€370 per house M&E	0	0	In Item 5 3rd column	€370
10	PSDP Consultancy	0	€206 per house	0	0	€206
11	PSCS Consultancy	0	In item 1	0	0	Included in Item 1
12	P.I Insurance uplift	€50 per house	€38 per house	0	0	€94
13	Programme Prolongation	7.5%	2.5%	0	0	10%

Rows 1 to 4 of the Table 5.4 illustrates the extent to which various project management staff inputs have increased as a result of the necessity to manage the increased workload arising from the listed regulations. The biggest increase can be seen to apply to the Environmental, Health and Safety (EH&S) manager, who spent approximately 50% of her or his time solely managing E,H&S on the case study project. This micro statistic is a very telling one, because prior to the introduction of S.I 44 of 1993 and S.I 138 of 1995, employers were not required to appoint a PSCS, and Irish building contractors did not generally employ safety officers. The extensive list of tasks to be undertaken, coupled with the extent of coordination activity carried out by the EH&S officer as outlined in Appendix F.2 indicates a fully employed management role, solicitating input from the employer, the PSDP, direct operative staff, subcontractors and other members of the management team, in order to meet the objectives and prescribed tasks of the legislation. Regarding other management staff, there is an almost 40% additional time devotion to the management of building regulations procedures by site managers and 31% of additional time devoted by the construction manager at 31%. Overall, it was found that project management staff can spend almost 35% of their time managing the implementation of building regulations. This increase in management time, equated to an indirect construction costs increase on the case study project of approximately €69,850, which works out at around €2050 per house excluding VAT.

Appendices F.1 to F.4 also contain analysis on the effect that building control processes have brought to bear on the construction programme for the case study project. This part of the data analysis is summarised in line 13 of Table 5.4, where it is established that the programme of works was extended by 10%, over and above how long it would have taken if building control measures pertaining in 1991 had applied. Activities responsible for this prolongation include, waiting times for the local council to validate BCAR, which currently takes 2 weeks on average, the additional time it normally takes to test and commission more intricate M&E systems at 1 week, the impact of organising BCAR inspections at 3 days overall and efficiency losses due to strict adherence to regulatory operating systems, method statements, site inductions and toolbox talks at 1.25 weeks. Through an evaluation of the case study project's preliminaries analysis, in Appendix D.5, it was possible to identify and cost out the additional preliminaries arising from the additional activities, which were valued at €60,180 overall or €1,770 per house.

As well as creating the by now essential EH&S manager profession, the health and safety in construction regulations also created new consultancy roles to cover the services of PSCS and PSDP. On most medium sized projects, building contractors tend to carry out the PSCS role themselves and this is permitted by the legislation. In the case of the PSDP role, this is normally contracted out to a specialist consultant. The fee paid out for this service on the case study project was €7,000 excluding VAT, which equated to a cost of €205 per house. In relation to the professional roles newly created by BCAR, Table 5.4 shows that the case study project paid out €32,300 plus VAT or €950 per house for the services of an Assigned Certifier. This was added to by fees of €500 and €370 per house respectively for essential ancillary certification services provided by the structural engineering and M&E engineering consultants.

Statutory registrations fees, and levies costed into the project were found to be in the order of €14,050, which equated to €413 per house. It was calculated that professional insurance premiums associated with the case study project increased by approximately €3000 or around €88 per house. This increase was as a result of risks associated with BCAR certification and administrating the role of PSCS. Under the developers financial accounting system, certain training costs were assimilated into company overheads and were therefore not carried in the job costs. However, training costs entered against the project for Safepass, Construction Skills, FETAC and PSCS training as noted in the preliminaries CVR amounted to just over €7,000 or €205 per house.

5.4.5 Categorising building regulations costs based on their originating government policy objectives

Another lens from which to view the data is from the perspective of government policy objective categorisation. TGD Part L energy performance standards, are an example of building regulations, which have been borne out of government policy objectives to fulfil commitments made at EU level or at international climate conferences. Another example would be where new fire standards are introduced by legislators, in the aftermath of a fire related tragedy. Based on policy themes such as energy efficiency, fire safety and public health, the collected data was recoded and analysed. Extracted from Appendix E.5, Table 5.5 below identifies 8 main categories into which the collected building regulations costs have been re-allocated and compared. In Table 5.6, the percentage proportions of the categorised themes, within the overall construction costs of the case study house are then established and compared. In the following sections, key aspects and the costs associated with each of the 8 policy themes are considered.

Table 5.5 Building Regulations Costs Per Objective - Part 1

	Policy objective	€	Percentage
1	Structure & Occupant Health & Safety	9,568	16.1%
2	Fire Safety	4,055	6.8%
3	Occupant Comfort	1,240	2.1%
4	Energy Efficiency	22,369	37.7%
5	Public Health	6,396	10.8%
6	Universal Design	7,638	12.9%
7	Proving Compliance	3,804	6.4%
8	Construction Health & Safety	4,185	7.1%
	Total	59,257	100%

Table 5.6 Building Regulations Costs Per Objective as part of overall – Part 2

Policy objective		€	Percentage	Overall %
1	Cost of case study house built to 1991 building standards	128,832	100%	68.5%
2	Structure & Occupant Health & Safety	9,568	7.4%	5.1%
3	Fire Safety	4,055	3.2%	2.2%
4	Occupant Comfort	1,240	1.0%	0.6%
5	Energy Efficiency	22,369	17.4%	11.9%
6	Public Health	6,396	5.0%	3.4%
7	Universal Design	7,638	5.9%	4.1%
8	Proving Compliance	3,804	3.0%	2.0%
9	Construction Health & Safety	4,185	3.2%	2.2%
	Total	188,089	146%	100%

5.4.5.1 Energy efficiency

Since 1991, energy efficiency regulations have continuously evolved, primarily driven by EU directives. Considered the originating energy directive, the Energy Performance of Buildings Directive EPBD 2002/91 was transposed into Irish law through S.I 666 in 2006. EPBD 2002/91 kick started a progression path of improved energy standards. These are listed out in the literature review chapter, in the EU energy efficiency directives, since SAVE Table 2.22. As outlined in the energy performance standards contained in TGD Part L 2019, the case study house is required to meet a Building Energy Rating (BER) of A2. This high level of energy performance is referred to as a Near Zero Energy Building (NZEB). In order to meet with the criteria required to satisfy NZEB, the case study house was designed and built to incorporate very high levels of thermal insulation throughout the exterior envelope and under floors. This included windows and doors which were required to meet very low U-values of 1.20W/m2K or less. A default thermal bridging factor of 0.08 W/m2K was achieved through rigid adherence to the guidelines contained in the ACDs and air tightness measures were implemented to meet permeability test results of 5 m3/hr/m2 or less. A continuous low power mechanical extract ventilation system, a high efficiency gas boiler heating system, with 3 zone controls and photovoltaic roof panels completed the NZEB minimum criteria.

Building regulations costs in the case study house, identified as relating to energy efficiency objectives were €22,369 and represented 37.7% of the total cost of building regulations. In terms of the overall construction cost to build the case study house, compliance with energy performance regulations accounted for a sizable 11.9%. It is rooted in the data that, due to building regulations costs, the gross cost to develop the case study house increased by

€81,008 between 1991 and 2021. Because energy efficiency costs represent a 37.7% proportion of the root increase, it can be established that they also account for a relatively similar proportion of the increase in gross development costs, when pro-rata increases such as VAT, developers margin, finance costs are added. On this basis it can be determined that the gross cost of energy efficiency objectives as a proportion of the overall development costs of the case study house is €30,540 or 9.3%.

5.4.5.2 Structure and occupant safety

Building regulations relating to structure and occupant safety are primarily concerned with the health, safety and welfare of people occupying buildings. In the interpretative analysis contained in Appendix E.5, the objective of structure and occupant safety was deemed to cover the largest number of TGDs, including, Part A - Structure, Part C Site - Preparation and Moisture, Part D – Materials and Workmanship, Part J – Heat Producing Appliances and Part K – Stairs, Ramps and Guards. The construction provisions covered in the foregoing parts include prescriptive descriptions to structural materials and workmanship approach; radon gas and pyrite countering measures; requirements for access to attic plant; testing and commissioning of heating appliances; the provision of carbon monoxide alarms and minimum requirements in relation to stair, landings and handrails. Costs identified as relating to structure and occupant safety objectives were €9,568 and represented 16.1% of the total cost of building regulations. In terms of the overall construction cost to build the case study house, compliance with structure and occupant safety related regulations accounted for 5.1%.

5.4.5.3 Universal design

According to Preiser (2008) the intention of Universal Design is to make building exteriors and interiors accessible and usable by all citizens without regard for age, health or disability. Mainly through TGD Part M 2000 – Access and Use; building regulations requiring the provision of minimum widths to door, corridors, staircases and approaches to dwellings etc. have been introduced and gradually improved upon in order to enhance the quality of life through access for all to new dwellings. The requirement to incorporate a wheelchair accessible WC at ground floor level in dwellings has also placed universal design as a front and centre element in new homes design. Building regulations costs identified as relating to Universal Design objectives were €7,638 and represented 12.9% of the total cost of building regulations. In terms of the overall construction cost to build the case study house, compliance with universal design related regulations accounted for 4.1%.

5.4.5.4 Public health

Before building regulations were published in 1991, references to building control in Ireland were generally based on the 1949 Dublin Corporation Building Byelaws, published under the provisions of the Public Health Acts 1897 and 1890, as well as the Dublin Corporation Act 1890. Through their association with the public health acts, it almost goes without saying that historically, building byelaws were regarded as necessary public health protections for citizens. But in 1991, when the first national building control systems were introduced, they were seen as broadening the scope of building standards beyond those solely concerned with public health measures (Keane, 2003). Provisions contained in TGDs G – Hygiene and H - Drainage and Waste Disposal, put in place prescribed measures to improve plumbing practices and below ground floor drainage installations. Specific measures to separate foul and surface water removal from dwellings, including the provision of attenuation systems and strict codes of practice for the design and installation of water and wastewater systems are integral parts of policy objectives to improve public health in dwellings and building works generally. Costs identified as relating to public health objectives were €6,396 and represented 10.8% of the total cost of building regulations. In terms of the overall construction cost to build the case study house, compliance with public health related regulations accounted for 3.4%.

5.4.5.5 Proving of compliance

According to SCSI (2016b), the Building Control (Amendment) Act 2014 (BCAR) brought in a series of procedural measures for demonstrating proof of compliance with building regulations. Under BCAR comprehensive systems for monitoring, inspection and self-certification of building works are prescribed for administration by the various project parties, with passive operational oversight by building control authorities. Apart from introducing a number of prescribed procedures and activities, with the potential for delaying site operations, BCAR also created additional project party roles such as the Assigned and Ancillary Certifiers, which had the effect of increasing professional fees (Mason Hayes & Curran, 2015). BCAR proof of compliance objectives also added to professional indemnity insurance premiums and introduced third party testing verification to mechanical and electrical commissioning. Costs identified as relating to proof of compliance objectives encountered on the case study project were €3,804 and represented 6.4% of the total cost of building regulations. In terms of the overall construction cost to build the case study house, proving compliance with building regulations accounted for 2% of the overall.

5.4.5.6 Construction health and safety

While construction health and safety regulations may have very few tangible effects on the end product, they do have an effect on work methods, operating procedures and costs. The sequence of EU safety directives and Irish safety legislation is outlined in section 2.5.3.4 of the literature review. The relevant EU directive was 92/57/EEC and the key health and safety in construction regulations in Ireland were S.I. 44 of 1993 and S.I 138 of 1995. These important regulations introduced changes to the way in which construction workplaces were to be managed and operated. In 2006, S.I 504 regulations were brought in, giving greater detail and scope to construction health and safety work practices and procedural requirements. Objectives with tangible cost impact include management costs to administer health and safety systems, including organising health and safety plans, statutory appointments, and notifications, developing risk assessments and method statements, coordinating health and safety inspections, meetings, inductions, toolbox talks and training. Costs identified as relating to construction health and safety objectives were €4,185 and represented 7.1% of the total cost of building regulations. In terms of the overall construction cost to build the case study house, compliance with health and safety regulations accounted for 2.2% of the overall costs.

5.4.5.7 Fire safety

Fire Safety objectives in the case study house covered constructional provisions such as means of escape, fire resistant materials, electrical wiring safety, the provision of fire alarm systems and so on. Costs identified as relating to Fire Safety were €4,055 and surprisingly represented only 6.8% of the total cost of building regulations. In terms of the overall construction cost to build the house, compliance with fire regulations accounted for 2.2%.

5.4.5.8 Occupant comfort

Objectives relating to occupant comfort are mainly contained in TGDs Part E – Sound. These objectives are concerned with increasing the sound performance values of floors, walls, and roofs. Sound testing measures to ensure compliance also form part of the overall costs for this objective. While acknowledging that ventilation and energy efficiency are also very much associated with occupant comfort, costs associated with these elements were allocated to energy efficiency objectives. Insofar as ventilation is concerned, this was decided mainly because of the essential role that ventilation science now plays in residential air tightness strategies, heat recovery and heating systems generally. Costs identified as relating specifically to occupant comfort objectives were €1,240 and represented 2.1% of the total cost of building regulations. In terms of the overall construction cost to build the case study house, compliance with occupant comfort regulations accounted for 0.6%.

5.4.6 Key Secondary Findings

1. In the literature review it was established that in Ireland and in most industrialised countries, building regulations are mainly published in the form of TGDs.

2. Only 75% of building regulations costs are specific to the house structure cost elements, the other 25% are brought to bear in siteworks and preliminaries costs.

3. Almost 17% of increased construction costs associated with building regulations are preliminaries costs based.

4. Building regulations have increased indirect costs, particularly project management costs on new housing construction by approximately 70%.

5. The relatively new profession of EH&S manager has principally evolved out of the widening administrative scope of building regulations.

6. Only 79% of the total value of building regulations costs come directly from the TGDs. The other costs derive from regulatory standards such as those issued by Irish Water and contained in the National Rules for Electrical Installations, as well administrative regulations such as the Building Control Regulations.

7. Increased site activities and administrative procedures prescribed in building regulations are responsible for extending construction programme durations by as much as 10%. Because almost 50% of the delay to completion can occur at the latter stages of projects, the effect on loan interest costs for developers can be exponentially higher than extended preliminary costs.

8. Building control regulations such as BCAR have created new consultancy service roles, such as the Assigned Certifier and the Ancillary Certifier. They have also

created rigid site inspection frameworks and certification processes that currently add around 2% to the net construction cost of a new house.

9. Construction health and safety regulations have created new consultancy service roles such as the PSDP and the PSCS. They have also ushered in the relatively new profession of the EH&S manager and introduced practices and procedures which have been identified to add up to 2.2% onto the net construction cost of a new house.

10. Building regulations can be categorised into at least 8 government policy objective themes, as outlined in Tables 5.5 and 5.6.

11. Energy efficiency policies have contributed more to direct building regulations costs than any other government policy area. Table 5.6 shows that energy efficiency provisions have added €22,369 to the net construction cost of the case study house. The equates to almost 12% of the overall net construction costs or 9.3% of the overall development costs, when proportional add-ons such as VAT, finance costs and margin are added to the net amount.

5.4.7 Summary of Secondary Findings

The secondary findings provide the research with a number of background disclosures that offer the reader plausible insights into, for instance, why building regulations costs as a proportion of overall construction and development costs could have accumulated by so much without serious analysis or public comment. Government policy objectives that improve housing standards in relation to structure, occupant health, fire safety and public health are unlikely to be met with resistance from any quarter. Likewise, progressive moves to improve universal design and safeguard the environment through improved energy standards will be ‘waved through any day’. Public awareness as to the need to provide safe places of work and to ensure that building works are monitored for quality and standards are also unlikely to be called out on the grounds that they cost too much. By explaining the various cost centres, vis a vis separating direct and indirect costs, identifying where and how new management and consultancy roles have evolved and categorising regulation sources into the various government policy objectives from which they evolved; the secondary findings have thrown a light onto how so many building regulations costs have collectively accumulated, hidden in open view, so to speak.

Another key aspect of the secondary findings is that they serve to illustrate the alignment of the research with the concepts of Historical Institutionalism, critical junctures and path dependencies as the underlying theoretical framework for the research. The best example of this alignment is possibly attached to energy efficiency policies, which can be traced back to a number of critical junctures and path dependencies identified in the literature review. These include threads such as the 1950 Schuman Declaration, the 1958 Treaty of Rome and follow on European treaties, as well as Ireland's EEC entry in 1973. Parallel relevant key events also include the 1956 Suez Crisis and the 1973 Energy Crisis. UNFCCs including the Kyoto and Paris Accords, plus the subsequent roll out of EU energy directives and transposing national legislations are examples of the path dependencies that have continued to add to energy standards.

Assisted by the literature review's exploration of building regulations systems in other developed economies and worldwide, the secondary findings observed that TGDs are a widely used format for describing building regulations scope, contents and solutions. In this regard, it could be reasonably concluded that the research findings on the proportional impact of building regulations costs on the overall construction and development costs of typical estate built houses are transferable in principle to other national jurisdictions. This will be particularly so, in countries with similar climatic conditions as Ireland.

5.5 Chapter Summary

This chapter, which was presented in two parts, combines findings from the literature review chapter with the findings from the main data collection and analysis chapter, in response to 10 research questions, set to address the 4 research objectives and ultimately achieve the research aim, which is to explore how gradually accumulating building regulation costs have increased housing delivery costs, in order to understand the extent that this phenomenon has on development viability and purchaser affordability issues at the heart of the Irish Housing Crisis. The first part of the chapter achieves the research aim, by addressing the research questions and objectives and also by extracting and emphasising a number of the key primary findings. The key primary findings conclude that there are several, recognised issues contributing to the Irish housing crisis and that building regulations costs are not currently recognised in the literature or in discourses as one of those contributors. The key findings then concludes that because building regulations costs are such a significant proportion of the overall construction and development costs to deliver housing, and following illustrations that they have a direct bearing on viability and affordability in the location of the case study and across national regions, that they can be considered as a key contributing factor to the Irish housing crisis.

The second part of the chapter, culminated in a collection of key secondary findings extracted from the data. These provided background insights for the reader into why building regulations costs are of such high proportions to the overall delivery cost of housing and shed light into the divisible nature of the costs vis a vis, splitting out indirect costs, house structure costs and siteworks. The secondary findings also categorised building regulation costs into government policy background areas which brought them into effect. They also demonstrated how building regulations costs have gradually accumulated over time in the absence of close scrutiny.

CHAPTER 6

RESEARCH CONCLUSIONS

The end of all our exploring will be to arrive where we have started and to know the place for the first time: TS Elliott.

6.1 Introduction

The aim of this research is to explore how gradually accumulating building regulation costs have increased housing delivery costs, in order to understand the extent that this phenomenon has on development viability and purchaser affordability issues at the heart of the Irish Housing Crisis. This research conclusions chapter begins by summarising each of the preceding chapters, it then emphasises the key findings that underline how the research aim has been achieved. This is followed by a synopsis of the implications of the research findings for academic theory and practice and considers how the research adds to the existing literature on building regulations and the Irish housing crisis. It also sets out how the findings of the research provide original contributions to knowledge. The chapter then explains why the findings of a research on building regulations and the housing crisis in Ireland is transferable to other international jurisdictions. Finally, the chapter outlines areas where the potential for further research to build upon this study could exist.

The research was undertaken from January 2021 to January 2023 and focussed on four key objectives to achieve the aim. A frame of ten research questions was then established to convert the objectives into more narrowly defined investigatory parts. The research questions were then used to develop a data collection & analysis process map, from which primary data could be generated to address the objectives and to identify key secondary findings.

Chapter 1 (Introduction) sets out the background and justification for the research. It also contextualises the identified practice problem, summarises the proposed research strategy and touches on preceding work that was carried out in an earlier pilot study. The anticipated value of the research, the researcher’s positionality, professional doctorate approach and use of reflection on practice are also described. The chapter concludes with an outline of the research aim, objectives and questions, and a preview of the thesis chapters.

Chapter 2 (Literature Review) preformed a crucial role, as a general investigation platform, from which to understand where and how the research problem connects to broader contexts and theories on housing provision. The literature review focussed across mainly six themes, relating to housing markets, housing crises and building regulations systems in Ireland and Internationally. The literature review chapter informed the responses to 3 research questions, which addressed the first 2 research objectives. It also considered how the research problem stands in the context of current conceptions of housing supply theories, the broader housing market and societal issues. The literature review also identified through a meta-analysis of data from two separate sources, that indirect evidence existed to demonstrate how building regulations costs have impacted on housing delivery costs, over and above what is currently reported as housing cost inflation. Through an overview of global comparisons, focussing on international affordability crises and building regulations systems, the review considered how comparable Ireland's housing problems, building control systems and TGDs are to other countries. This part of the review determines that the findings of this research will be substantially transferable to many other national jurisdictions. The chapter concluded by setting out a case for how the proposed study will build upon what is already known about building regulations, housing supply constraint issues and other factors contributing to the Irish housing crisis and international affordability crises generally.

Chapter 3 (Methodology and Methods) started by outlining the researcher's assumptions and approach to the nature of knowledge and by defining the philosophical positions taken up by the research. It then considered theory development in approaches to methodological choice and described how Historical Institutionalism had emerged as an effective theory to underpin the research. This was explained in the context of how building regulations can be regarded as rules or institutions, undergoing continuous and incremental changes in path dependant processes, triggered by critical junctures, arising in the shape of dramatic or episodic events over time. This chapter then explained the rationale for the research methodology and use of abduction and mixed methods approaches. It also set out a justification for the choice of documents contents analysis and instrumental case study analysis as the most practical and effective research methods for use in the investigation. The chapter also outlined the limits and delimits of the study and ended by discussing the various ethical considerations to be managed in the execution of the research.

Chapter 4 (Data Collection and Analysis) explained from where and how the data was collected and analysed. It described and demonstrated how data from the building regulations

TGDs was identified as the units of analysis and illustrates how the case study house is used as the instrument to cost the unit of analysis. From this process the analysis then identifies the proportional cost of building regulations contained within the construction and development costs of the case study house. It then analyses that proportion through two further dimensions, the first, across periodic longitudinal time horizons and the second, across adjacent regions. The dimensional analysis allowed the research to consider and synchronise development viability and purchaser affordability across nine scenarios.

Chapter 5 (Findings from the Data Analysis) is presented in two parts. The first part focusses on the primary findings of the research. The second part reviews a number of key secondary findings. In Part 1, the study interprets the findings from the literature review conclusions and the data analysis findings to respond to the 10 research questions, chosen to address the 4 research objectives, set out to achieve the research aim. This part also extracts and emphasises a number of the key primary findings, which are absolutely clearcut. The second part of the chapter, identifies and discusses a number of secondary findings arising out of the data analysis, culminating in a compilation of key observations, which provide the reader with background insights, which amongst other things adds further justification to the research study.

6.2 Underlining findings that achieve the research aim

6.2.1 Addressing the research objectives

Table 5.1 in chapter 5 outlined the 4 research objectives and their connection to the 10 research questions which were devised as explicit means to addressing them. The table also references the chapter from where the questions are addressed. In response to the first 3 research questions, created to address the first 2 research objectives, the literature review established that there are a number of disparate issues acknowledged by academics, housing analysts and others as contributing factors to the Irish housing crisis, alongside which building regulations costs are not regarded to be of equal significance. In a collection of stepped responses to the next 6 research questions, the study addressed the third research objective. This was achieved by demonstrating how building regulations costs are a significant proportion of the cost to construct and develop a typical estate built 3 bedroom semi-detached house, and by so doing, the study also went on to illustrate how their impact are a considerable element in determining the viability and affordability of housing delivery in locations close to urban centres where new homes are needed. The fourth and final objective sought to position the findings of the research with existing knowledge on building regulations and the Irish housing crisis. This objective was addressed by demonstrating how the primary findings stand apart from and add to what is established in the literature review.

6.2.2 Synopsis of clearcut findings

The literature review established that building regulations costs are not generally considered by academics, housing analysts or media commentors to be a significant contributing factor to the Irish housing crisis. In opposition to those established views, the findings from the data analysis show that building regulations costs are a significant proportion of the overall construction and development costs to deliver housing and are therefore one of the significant contributing factors to the crisis. It establishes this by identifying that since 1991 when building regulations were first introduced, building regulations costs have been responsible for increasing the net cost to construct a typical estate built 3 bedroom semi-detached house by 46%. It was also identified that building regulations costs were responsible for increasing the gross development costs of the same house type, located in a Dublin commuter town by 33%. The research then also illustrates how building regulations costs have stealthily accumulated to gradually undermine development viability and purchaser affordability over time and that higher construction costs associated with building regulations have a direct bearing on viability and affordability issues across regions.

The secondary findings demonstrated the way in which building regulations costs have accumulated, hidden in clear sight, through gradual government policy objectives, aimed to establish popular but ultimately genuine improvements to how new homes are provided. It also highlighted how almost 20% of the cost additions have come by way of indirect costs and how the path dependent nature of the combination of building regulations updates strongly suggests that apart from the possibility of future innovations in MMCs, there is unlikely to be any imminent or future amelioration of those costs.

6.2.3 Triangulating the findings

Investigations into building regulations costs carried out in the literature review, found through a meta-analysis of data collected from two separate sources, that evidence exists to establish how building regulations costs impact housing delivery costs, over and above what is currently reported in government publications. By comparing the rate of construction inflation published by the CSO with the rate of construction cost increases published in SCSI research reports, over a similar recent 4 year period, between 2016 and 2020, the literature review identified that housing construction costs had increased by €28,650 which was 117% more than the reported construction inflation increases reported by CSO for the same period. The results from that comparison exercise also supported a central argument of this study, at an early stage of the research, that a structural housing cost problem exists.

6.3 Research contributions

Unlike in a PHD study, where a researchers attention may tend to focus on filling gaps in theoretical knowledge, a professional doctorate researcher is expected to concentrate on empirical research of perceived problems in their own area of practice (Bourner et al, 2001). According to Tenant (2010) professional doctorates are concerned with making research based knowledge contributions to practice. This research study has made contributions to new knowledge and to the existing literature, as now explained.

6.3.1 Contributions to knowledge

The findings will provide insights to practitioners, academics and industry observers who are struggling to understand why it is more difficult to deliver viable and affordable housing today than it was in previous years. This understanding is most particularly portrayed in the findings that building regulations costs have increased the cost of constructing and developing a typical estate built house by 46% and 32% respectively since 1991. The results are supported by the extent to which the research has gone to demonstrate how building regulations costs have gradually increased since 1991. The findings will also contribute to policy makers understanding of the extent of the viability problem, which could assist in the acceleration of future strategies to counterbalance those constraints, through more steadfast initiatives, such as tiered tax measures to facilitate development across regional locations and an acceleration in research on MMC and encouragement of their implementation into building processes. This new knowledge on the accumulating impact of building regulations can also be viewed as illustrating why future building regulations updates must be put through a more rigorous examination for cost impact and alternative approaches.

While providing an in-depth understanding of the extent of the impact of building regulations costs, this research also establishes the combined use of instrumental case study and documents contents analysis research as an appropriate multi method approach to inquiry relating to building regulations and costs. By following the data collection and analysis steps illustrated in the process chart in Figure 4.1, it will be possible for future Irish or international researchers in this field of study, to exactly replicate this methodological approach, in order to establish similar or alternative more nuanced findings, particular to their own set of contextual circumstances. Similarly, researchers in other fields, could also benefit from the use of this research approach to suit their research aims. In this regard, the research approach adopted by this study has contributed to knowledge generation theory, in relation to multi-method approaches, research strategy, and the significance of historical institutionalist theory to the research of building regulations and their impact on housing delivery.

In all the above regards, this study is clearly a contribution to theory and practice based knowledge.

6.3.2 Contribution to the existing literature

The existing literature identifies a number of housing sector issues that are individually and collectively acknowledged as contributing to the Irish housing crisis. The literature also indicates that beside those recognised issues, there is very little discourse associating building regulations costs with housing supply shortages or as a contributing factor to housing crisis in Ireland or internationally. This study can therefore be considered as providing an important contribution to literature, because it introduces broadly generalisable, original primary research in an area of the housing sector, concerned with building regulations, costs. viability, affordability and housing supply, which are at the root of the Irish housing crisis and other international housing challenges.

6.3.3 Transferability

The ultimate achievement of the aim of this research is essentially down to the measurement of the extent of the proportional impact of building regulations on the overall cost to construct and develop housing. This is achieved by analysing the building regulations TGDs – 'unit of analysis' within a 'bounded context' as expressed by Miles et al (2014) with the case study 'instrument' as expressed by Yin (2018). The literature review established that there are many similarities between Ireland's building control system and the systems operated in other countries. Because the identification of the extent of the research problem is essentially undertaken through a series of models based on proportionality, then it is clear that the findings of this research can be used to measure the impact of this problem in other international jurisdictions, especially those in similar climatic regions. The transferability of these findings are therefore suggested on the basis of a 'one rule fits many' rather than a 'one rule fits all' (Wetzstein, 2017).

Similarly, the research approach adopted by this study, as illustrated in the data collection and analysis process chart in Figure 4.1 and addressed in section 6.3.1 above, can be regarded as a fully transferable methodological approach to researching the proportion of building regulations costs in relation to overall construction costs, based on different contexts and conditions experienced in other countries. The research approach is also transferable for use in the research of proportional comparisons in other subject areas.

6.4 Recommendations for future research

Following on from the findings of this research study, there are a number of areas where further research recommendations can be made.

6.4.1 Innovation and MMCs to reduce building regulation costs

According to separate reports published by the Irish and UK Governments, it is suggested that innovation and MMC techniques have the potential to reduce construction costs and to speed up the delivery of projects by more than 20% (DHLGH, 2023) and (HCLGC, 2019). MMC generally describes approaches to constructing houses and other building types using modularisation and off site fabrication processes. There are a number of forms of MMC that are increasingly gaining traction in housing, these include, timber frame construction, panelised wall and roof components, bathroom and kitchen pods, MEP riser modules, plug and play modules and smart construction technologies. Apart from reducing costs and build times, it is well reported that MMCs can vastly improve building precision and quality through factory standard processes and also minimise waste through repetition and mass production.

There are a range of reported advantages for productivity and cost efficiencies to be exploited through innovation and MMCs, which could drive down the impact of building regulation costs associated with more traditional housing construction, as implemented in the case study house. However, there also appears to be a number of barriers that contribute to prevent MMCs from becoming more prominent in the housing sector. For instance, from the perspective of the SME developer of the case study house, the researcher observed that insurers concerns relating to fire risks, created obstacles in flexibility to scale up construction output when timber frame structures were being considered at tender stage. This was one of the deciding factors for the developer's decision to opt for a tradition block build approach instead of timber frame construction. Procurement complications and contractual considerations, such as insolvency risks in the supply chain, deposits and the ownership of off-site materials can also be a deterrent for smaller construction firms engaging with MMCs (AL Goodbody, 2021). RICS (2018) outlines several other perceived obstacles, which include, unfavourable funder and consumer perceptions, risk adverse decision making based on familiarity and perceptions of system inflexibility. Barriers to innovation and MMC may be better understood and in due course overcome with the benefit of future research.

6.4.2 A review of current building regulations

Another important area of focus for further research, would be to ascertain whether certain building regulations can, following careful consideration, be amended or possibly even omitted. Following are just three example areas within the corpus of regulations, which could be identified to policy makers, cost benefit analysed, and put forward as part of a package of ameliorating suggestions.

1. Consideration to amend requirements for every new house to provide a disabled toilet at ground floor level. This might for instance involve transferring the main bathroom downstairs or options to provide minimum numbers of houses with downstairs toilets as special needs designated dwellings within housing schemes.
2. Based on the principle that heat rises, to consider rationalising the current requirements for underfloor insulation to extend below the entire ground floor area in new houses,. This might involve going back to a perimeter floor insulation type solution, particularly in houses where underfloor heating is proposed.
3. Omitting drainage channels at entrance door thresholds, which are located at DPC level and where the ground is invariably sloping away in the other direction.

6.4.3 Conservation and sustainability research

There is an enormous potential to provide many tens of thousands of homes and to reinvigorate towns and city centres across Ireland, if vacant floors above street level shops and businesses can be viably transformed into liveable accommodation. A classic dilemma encountered in housing refurbishment projects is incompatibility between conservation standards and those concerned with fire, energy and access for all standards. Clear guidance in this area, may over time contribute to an increased take up by developers and private individuals to undertake residential refurbishment projects. But this alone will not release the numbers required to fully release the potential of this untapped resource. It appears that the only way in which these properties can be brought back into the housing system is if very significant grant aids are offered to property owners and developers or if measures were adopted in which sensibly considered relaxations in certain building standards were enacted specifically for this building class. Not only would such a measure increase the potential to provide scarce accommodation in these locations, but it would also contribute to slowing down the enduring decay and deterioration of many Georgian and Edwardian streets. A case study research based on a typical over the shop, living space scenario, using multi method research approaches used in this research study, could for instance, identify at what point relaxations in certain prohibiting building regulations might bring a refurbishment project into viability. Depending on its results, such a study has the potential to bring about enormous benefits to society, if acted upon by policy makers.

6.4.4 Development standards research

Table 1.1 of this thesis, contained a list of key boundaries of the research. Development management standards were noted as a delimit. Development management standards play an integral part in county development plans, as they set out minimum design standards for residential and other development category uses. The standards are set out to closely follow ministerial guidelines issued in accordance with section 28 of the 2000 Planning Act. Essentially, they are building regulations in all but name. Minimum housing design standards may have just as significant an impact on the viability of a residential development as building regulations and an investigative study similar to this research involving a comprehensive review of those standards would be a useful companion to this research.

Minimum housing design standards are very often tweaked or interpreted differently by planning authorities and it is suggested that a research study of this nature might consider focussing on the ministerial guidelines themselves. The intended focus of the research might be aimed at proposing alternative approaches to current compact growth and quantitative design standards. This could involve identifying possible reductions or the reshaping of minimum standards for public and private open spaces, where optimum daylight and sun aspect are not compromised. Proposals to reduce minimum separation distances between the backs and sides of houses might be considered, as well as the possibility of reducing public open spaces on brownfield sites, where developments are currently required to provide up to 10% of the site area.

External spaces may not be the only areas where cost and functionality could be rebalanced. For instance, interior design standards more appropriate to modern day living and demographics could better reflect the needs of people at various stages of life, instead of designing to a one size fits all. For instance, some local authorities in the greater Dublin area require ground floor to ceiling heights to be minimum 2.7 metres and minimum storage space of up to 9 square metres in an average sized 3 bedroom house. They also insist that the storage space is situated primarily off main circulation routes. A rationalisation of this design standard alone could potentially save up to 5% off the cost to construct a new house. A comprehensive financially appraised analysis of key design standards could highlight significant ways to improve housing densities and assist housing schemes to avoid recourse to the provision of more costly apartments in order to achieve prescribed site density levels.

6.5 Final reflections

This research study has successfully achieved the research aim, added new knowledge and built upon the existing literature surrounding building regulations and building regulation costs. It has identified the high cost of building regulations as presenting a practice problem, which has hidden in clear view of housing analysts, academics and policy makers. Taking a ‘we are where we are’ view, the research conclusions acknowledge that there is no logical case, in Ireland or elsewhere, for rolling back on the improvements that have been made in building standards, but also suggests that there is a case for further research in areas that improve our understanding of barriers to the implementation of innovative and MMC approaches, which have the potential to counterbalance the effect of building regulation costs. The research conclusions also suggest future research, incorporating a robust review of the corpus of current building regulations, in order to identify where rationalisations can be made.

Through findings taken from the literature review, the study also notes that while this research has identified building regulations costs as a significant contributing factor to the Irish housing crisis and international housing cries generally, there are several other systemic and structural issues effecting the Irish housing market, any one of which has the individual capacity to continue to significantly stymy housing supply. PILBAF is an acronym abbreviating the main systemic factors contributing to the crisis. These are planning issues, infrastructural deficits, land management failures, the banking system, the asset categorisation and financialisation of housing.

Finally, the proportionality approach taken in this research to the measurement and reporting of the impact of building regulations on construction and development costs, purports that two important assumptions can be made. The first is that the proportional impact of building regulations costs that is herein reported, is how things stand at the end of 2022. When, as is to be expected, further building regulations are introduced, then the proportion of building regulations costs within overall construction and development costs will increase. This will have the effect of further intensifying the viability and affordability challenges that already exist. The second assumption is that future construction inflation increases, will have little or no adjustment effect on the proportional impact of building regulations costs.

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APPENDICES

Appendices A

ETHICS MATTERS

Ethics Application: Panel Decision

ethics <ethics@salford.ac.uk>

Thu 24/06/2021 15:15

To: Alan Brunton <A.Brunton@edu.salford.ac.uk>
Cc: Amanda Marshall-Ponting <A.J.Marshall-Ponting@salford.ac.uk>; Rosa Arrigo <R.Arrigo@salford.ac.uk>

The Ethics Panel has reviewed your application: Examining the role that accumulative building regulations costs play in creating affordability and viability issues for new residential developments and how the issue contributes to the housing crisis in Ireland
Application ID:2019

The decision is: 1. Ethical Clearance

If the Chair has provided comments, these are as follows:

Please use the Ethics Application Tool to review your application.

Letter to Employer seeking permission to carry out an instrumental case study on two housing projects

Date: _____________

Dear Employer

I am undertaking a part-time doctoral research study at the University of Salford. My research project is an examination of the role that accumulated building regulations costs have played in creating affordability and viability issues for housing developments in Ireland.

As previously discussed, I would very much appreciate your permission to carry out an instrumental case study on a residential project recently developed by the company. The purpose of the case study will be to gather real construction and development cost data from a live or recently developed housing development. The cost data from the case study will be used to estimate the proportional cost of building regulations in the construction and development of a typical estate built 3 bedroom semi-detached house and through subsequent analysis to demonstrate how those identified proportional costs may be a significant contributor to the affordability and viability issues that are at the core of the housing crisis in Ireland.

Please note that all information provided by the case study will be treated with the strictest confidentiality and anonymously incorporated into the study, so that it will not be traced back to source. Furthermore, all data accumulated throughout the course of the research will be used only for the purposes of the research and subsequently stored in a securely locked cabinet located at my home.

If you agree to my request, I would appreciate if you would kindly sign and date this letter. Alternately you can respond by a separate letter on company letterhead confirming your consent.

Yours sincerely

Alan Brunton

Approved consent by the company

Director	Date
___________________	_________________

Appendices B

DOCUMENTS CONTENTS ANALYSIS

B.1 Documents Contents Analysis

Statutory Documents reviewed for their contribution to building costs

1 Part A Technical Guidance Documents - Structure
1.1 TGD-A 1991
1.2 TGD-A 1997
1.3 TGD-A 2012

2 Part B Technical Guidance Documents - Fire safety
2.1 TGD-B 1991
2.2 TGD-B 1997
2.3 TGD-B 2006
2.4 TGD-B 2017

3 National Rules for Electrical Installations
3.1 ECT 101: 2008
3.2 I.S 10101: 2020

4 Part C Technical Guidance Documents - Site Preparation & Resistence to Moisture
4.1 TGD-C 1991
4.2 TGD-C 1997
4.3 TGD-C 2020 Amendment

5 Part D Technical Guidance Documents - Material and Workmanship
5.1 TGD-D 1991
5.2 TGD-D 1997
5.3 TGD-D 2000
5.4 TGD-D 2013

6 Part E Technical Guidance Documents - Sound
6.1 TGD-E 1991
6.2 TGD-E 1997
6.3 TGD-E 2014

7 Part F Technical Guidance Documents - Ventilation
7.1 TGD-F 1991
7.2 TGD-F 1997
7.3 TGD-F 2002
7.4 TGD-F 2009
7.5 TGD-F 2019

8 Part G Technical Guidance Documents - Hygiene
8.1 TGD-G 1991
8.2 TGD-G 1997
8.3 TGD-G 2008
8.4 TGD-G 2011 Amendment

9 Part H Technical Guidance Documents - Drainage and Waste Disposal
9.1 TGD-H 1991
9.2 TGD-H 1997
9.3 TGD-H 2010
9.4 TGD-H 2016 Amendment

10 Irish Water Technical Documentation - Ancillary to Parts G and H

10.1 Wastewater Infrastructure Code Of Practice, July 2020
10.2 Wastewater Infrastructure Standard Details, July 2020 Revision 4
10.3 Water Infrastructure Code Of Practice, July 2020
10.4 Water Infrastructure Standard Details, July 2020 Revision 24
10.5 Quality Assurance Design Requirements Manual
10.6 Quality Assurance Field Inspection Requirements Manual

11 Part J - Technical Guidance Documents - Heat Producing Appliances

11.1 TGD - J 1991
11.2 TGD - J 1997
11.3 TGD - J 2014

12 Part K - Technical Guidance Documents - Stairs, Ramps and Guards

12.1 TGD - K 1991
12.2 TGD - K 1997
12.3 TGD - K 2013
12.4 TGD - K 2014

13 Part L - Technical Guidance Documents - Conservation of Fuel and Energy

13.1 TGD - L 1991
13.2 TGD - L 1997
13.3 TGD - L 2002
13.4 TGD - L 2007
13.5 TGD - L 2011
13.6 TGD - L 2019

14 Acceptable Construction Details - Ancillary to Part L

14.1 2011 - Thermal Bridging and Airtightness

15 Part M - Technical Guidance Documents - Access and Use

15.1 TGD - M 1991
15.2 TGD - M 1997
15.3 TGD - M 2000
15.4 TGD - M 2010

16 Building Control Regulations

16.1 Building Control Act 1990
16.2 Building Control (Amendment) Regulations S.I 80 of 2013
16.3 Building Control (Amendment) Regulations S.I 9 of 2014

17 Health and Safety in Construction Regulations

17.1 Safety Health and Welfare at Work Act 2005
17.2 Safety Health and Welfare at Work (Construction) Regulations, S.I 504 of 2006
17.3 Safety Health and Welfare at Work (Construction) Regulations, S.I 291 of 2013

18 Environmental and Waste Regulations

18.1 Waste Management Acts 1996 and 2001
18.2 Waste Management Regulations 2006, 2008, 2011 and 2015
18.3 National Construction and Demolition Waste Council - Best Practice Waste Guidelines 2006

19 Energy Performance Regulations

19.1 European Communities (Energy Performance of Buildings) Regulations S.I 666 of 2006
19.2 European Communities (Energy Performance of Buildings) Regulations S.I 243 of 2012

B.2 Data Collection - Results of Technical Guidance Documents Analysis

TGDs: Part A - Structure

A1	**1991**	
	Provision	**Document Section Ref**
1	Block 7N/mm2 when a storey is higher than 2.7 M	Diagram C8, note 2
2	Brick 7N/mm2 when a storey is higher than 2.7 M	Diagram C8, note 2
3	Wall lateral strapping & noggins to floors with 30x5mm galv @ NMT 2.0m c/c	Diagram C14 a+b
4	Restraint type joist hangers or longitudinal floor strapping	Diagram C14c
5	Wall lateral strapping & noggins to roof gables with 30x5mm galv @ NMT 2.0m c/c	Diagram C15 a-b
A2	**1997**	
1	Strap restraint or restraint type joist hangers to floor joists	1.1.3.24 (b)
2	Vertical strapping of wall plate to wall 30x5mm galv @ 2.0m c/c	Diagram 7c
3	Wall tie spacing 3 per M2 and every course at jambs	Diagram 9
A3	**2012**	
1	Parameters for notches & holes through floor joists - (Part L 2011 + 2019 press for cassette floors to contain services & ducting)	1.1.2.5
2	Clay bricks - Group 1 compressive strenght NLT 9N/mm2 + 13N/mm2 - Groups 1 + 2	1.1.3.5
3	Mortar Strenght class M4 - nominally 1:1:6	1.1.3.5
4	Wall ties should be austenitic steel	1.1.3.27
5	Wall tie spacing 4.9 per M2 and at 300mm c/c at verges & movement joints	1.1.3.27 + Diagram 9
6	Movement Joints - 18mm cell material and mastic seal	1.1.3.27 + Diagram 9

TGDs: Part B - Fire Safety

B1	**1991**	
1	Compartment wall between dwellings 60/60 fire resistance	Table A1 + 3.2.4.2
2	Junction of compartment wall with roof - resilent firestop to u/s of roof and rockwool slabs to u/s of roof covering at least 1.5 m on each side	Diagram B3.2
3	Cavity barrier to be provided at the compartment wall junction	3.3.2 + Table 3.2
4	Fire resistance 30/15/15 of upper floor of 2 storey from underside	Table A1
5	Fire resistance 30/30/30 of roof from underside	Table A1
B2	**1997**	
1	Stairways serving an upper floor should be enclosed by storey height construction. Open Plan acceptable with certain provisions	1.5.2(ii)
2	Fire detection and alarm system Grade D - LD2 to be provided	1.5.2(iii) + 1.5.5.2 + 3
3	Windows to bedrooms to acyt as a means of escape and provide minimum unobstructed opening of 500 x 850mm	1.5.6 + 1.5.8.2
4	Provide 50mm wire reinforced mineral wool at compartment wall eaves soffit junction	Diagram 13B
B3	**2006 (and 2006 reprint 2020)**	
1	No tangible cost implications	
B4	**2008 ETCI 101 Wiring Regulations**	
1	Isolator switches for concealed and built in Kitchen applianaces	Section 554
2	Individual RCBO on lighting circuit to wet room	Section 530 and 701
3	Bathroom zoning classification for electrical wiring and fittings	Section 701
4	Provide Downlighter with thermahoods	Section 530
B5	**2017 Volume 2 Dwelling houses**	
1	Grade D, LD2 smoke heat alarms to be provided in bedrooms	1.3.6.2
2	Electrical installation to ETCI National Rules	1.3.9.4
3	Cavity barriers at the eaves, top of gable and around all openings incl windows, doors, services boxes and vents	3.6.2
4	Provision for external isolation switch to PV panels	5.4.5.1
B6	**2020 - National Rules for Electrical Installations**	

1	I.S 10101 (7 Chapters containing 700 pages) replacing ET101	
2	RCDs now required in lighting circuits	411.3.4
3	Arc Fault Detection Devises (AFDDs) recommended to be mounted in Distribution Board	421.7/Annex 42B page 212
4	Cables to be rated Dca-s2,d2,a2 - for behavior in fire	527
5	A Type RCDs only in new installations - AC Types no longer acceptable	531.3.3
6	Surge Protection Devices (SPDs)to protect electronic equipment etc.	5.3.4
7	Section on Electrically Charged Vehicles	Part 722

TGDs: Part C - Site Preparation and Resistance to Moisture

C1	**1991**	
1	In all cases appropriate site investigations to be undertaken	2.2
2	Ground supported floor should be at least 150mm thick	3.1.4a + diagram 4
3	Hardcore below concrete should be minimum 150mm thick	3.1.4b + diagram 5
4	Damp proof membrane below slab turned up & lapped with cavity dpc	3.1.4c + diagram 5
C2	**1997**	
1	Radon Control - membrane, pipework, sumps and sealing penetrations	2.7 to 2.17
2	Concrete grade 20N/mm2 in ground supporting floors (10N in 1991)	3.1.4a(ii)
3	Hardcore specification; Pyrite and Radon control measures - Annex E of SR21 and T2 permeable grading for Radon gases	3.1.4b
C3	**1997- amendments 2020**	
1	Hardcore should be at least 200mm thick	3.1.4b
2	Hardcore should be gas permeable (T2 Perm - 4/40mm granular unbound)	3.1.4b+d
3	Blinding layer - as Annex E of SR21	3.1.4b
4	External wall cavities to be drained spaces	3.2.6

TGDs: Part D - Materials and Workmanship

D1	**1991**	
1	BS 8000 Workmanship on building sites - a comprehensive compendium of 16 part in 17 documents. Methods outlined in this document will demonstrate compliance	2.1
D2	**1997**	
1	Safety glass to be provided in unguarded glazing below 800mm	1.5
D3	**2000**	
1	Letter Plates - minimum dimensions 250x38mm	1.6
D4	**2013**	
1	Use of proper materials - definition revision, relating to CE and CPRs and harmonised market conditions (Brexit?)	D1
2	CFC free products	0.1
3	Safety glass to be provided in unguarded glazing in doors below 1500mm	1.5

TGDs: Part E - Sound

E1	**1991**	
1	Sound transmission performance values - 53db walls and 52db floors. Separating wall mass 415kg/m2 (solid)	Section 1, diagram 2 and A,B & C p.8
2	Filling joint between party wall and roof covering	Section 1 (p.9)
3	Plasterboard to ceiling below attic to be at least 12.5mm	Section 1 (p.9)
4	Joist hangers to floors lateral to party wall	Section 1 (p.9)
5	Filler piece in cavity wall along line of party wall	Section 1 (p.9)
6	Wrap pipes in ducts with minimum 25mm mineral fibre	Section 3 (p.19)
7	Seal junctions of ceiling and ducts with tape	Section 3 (p.19)
E2	**1997**	

1	No tangible cost implications - improved explanations generally	
E3	**2014**	
1	Independent sound testing pre-completion - minimum tests per house type	2.2.3 + table 3A and
2	Dry 13mm mineral wool quilted lining to separating walls - eliminating chases for sockets	3.4.3 + diagram 9
3	Cavitystop fillers to be moisture protected with dpc strip	3.4.3 + diagram 5+9
4	Masonry workmanship directions on coursing, toothing & wall ties	3.4.3 + diagram 9
TGDs Part F - Ventilation		
F1	**1991**	
1	Ventilation rates as compared to those outlined in DC Bye-laws	1.6 -1.19
2	Pitched roof ventilation continuous 10mm at eaves level -	2.12 + diagram 3
3	Pitched roof ventilation continuous 5mm at high level	2.14 + diagram 3
F2	**1997**	
1	Mechanical ventilation rates and overrun times to internal rooms	Table 2
F3	**2002**	
1	Kitchen mechanical extract ventilation 60 l/sec or cooker hood @ 30 l/sec	1.7c(i)
2	Bathroom mechanical extract ventilation 15 l/sec	1.8b(i)
F4	**2009**	
1	Tangible cost implications crystalised in 2019 document	
F5	**2019**	
1	Continuous mechanical extract ventilation or mechanical ventilation with heat recovery where air permeability is less than 5M3/h.m2	1.2 + diagrams 1 + 2
2	Ceiling space and boxing out for EAV ductwork	Diagrams 1 + 2
3	Wrapping duct in 25mm insulation in attic and with a thermal conductivity of .04W/mK	1.2.1.7 + diagram 1
4	MEV / MVHR Commissoning & validation process by independent accredited person	1.2.2.11
5	Background ventilation rates increased by 40% in habitable rooms to 7000m2 and Kitchens/utilities/bathrooms to 3500mm2	1.2.4.1 + table 3
TGDs: Part G - Hygiene		
G1	**1991**	
1	Kitchen sink must have a draining board	G1b
2	A suitable installation for the provision of hot water - central source or unit heaters to sink/bath/whbs	G1c
G2	**1997**	
1	Capacity of cold water cistern storage 212 Litres in up to 3 bed house	1.6
2	Cold water cistern to be covered - not airtight	1.7
3	Cold water cistern and service pipes & fittings to be insulated against frost	1.9
G3	**2008**	
1	No tangible cost implications	
G4	**2008 (amendments 2011)**	
1	Cold water supply through ground floor to be insulated and rodent proof and gas sealed. Dpm to be sealed at penetration	1.9.1 & Diagram 1
2	Cold water cistern - to insulation value of nlt 0.3W/m2K	1.9, diagram 3 + table 1
3	Cold water cistern to be screen ventilated and seated on moisture resistant board	Diagram 3
4	All pipework including overflow, situated outside thermal envelope should be insulated	1.9.3
5	WCs shall have a cistern of 6L maximum flush capacity with discernable dual rate flushing devises of 2/3 and 3/3	2.7

TGDs: Part H - Drainage and Waste Disposal

H1	**1991**	
1	Pipework through rising walls to have 50mm arch fron u/s of lintol and all around. Openings to be masked to prevent vermin OR bedded in with short length through wall and rocker pipe each side	A10b + diagram A1
H2	**1997**	
1	SW drainage should be adequately protected against accidental pollution - petrol interceptor	1.1.9e
2	Stacks serving WC should be NLT 100mm dia (75mm in 1991)	1.2.23
3	Drains carrying only waste water should have a diameter of NLT 100mm (75mm in 1991)	1.3.11
H3	**2010**	
1	Sustainable Urban Drainage System (SUDS) - reference	1.1.3.1a
2	Concentrate drainage from boiler to discharge to wastewater pipework	1.2.2.7
3	Disused drains should be disconnected & pipe still in use plugged	1.7.5
H4	**2010 (amendments 2016)**	
1	No tangible cost implications	
H5	**Irish Water - Wastewater Infrastructure Technical Documentation / Code of Practice July 2020**	
1	Private side inspection chamber within 1.0m of boundary (no carrier drains)	3.11.14
2	Solid concrete blockwork only permitted in manholes that are less than 1200mm depth. Blockwork must be 20N/mm2 with M20 mortar	3.12.1.6 + + STD-WW-09
3	Manholes up to 3.0 metres depth, must have a minimum internal dimension of 1200mm (previous standard 1200 x 750mm Table 3.4	3.12.2
4	Chambers & manhole covers shall be set in rapid hardening cementatios epoxy resin or polyester resin mortar and seated on class B engineering bricks in M30 strenght mortar.	3.12.9 + STD-WW-09
5	All sewers shall have a non degradable marker tape lated 300mm above the pipe crown	3.26
6	Minimum granular bed thickness of 200mm below pipes 150mm to 450mm diameter (was 100mm)	4.7 + STD-WW-07
7	Minimum pipe cover and surround of granular surround to flexible pipework to be 150mm (was 100mm) and increased to 300mm in trafficed areas	4.7 + STD-WW-07
8	Rocker pipes with flexible joints to be locacted on ingress and egress ends of manholes where pipes are greater than 150mm diameter	STD-WW-10C
H6	**Irish Water - Water Infrastructure Technical Documentation / Code of Practice July 2020**	
1	Watermain layouts shall be arranged in loops to avoid dead ends. To accommodate flushing of the network loops shall cover a minimum of 4 houses and 1 hydrant	STD-W-02
2	Watermains 100-150mm diameter shall be plastic blue pipe HDPE and MDPE (PE80) - UPVC pipes shall not be used	3.9
3	Butt fusion and electro fusion joints to polyethylene pipes, by appropriately trained and experienced operatives using pre-approved rigs, with real-time weld integrity data, GPS locator and download facility	3.10.2
4	Independent 3rd party certification of jointing	3.10.2
5	Destructive weld testing of joints	3.10.3
6	Bulk Meters supplied & fitted by IW in a chamber built by the developer, with an adjoining kiosk for a telemetry system if required	3.15.4
7	Hydrant, sluice valve and air valve chamber covers shall be set in rapid hardening cementatios epoxy resin or polyester resin mortar and seated on class B engineering bricks in M30 strenght mortar	3.18 + STD-W-15
8	Minimum granular bed thickness of 150mm below pipes of diameter less than 200mm (was 50mm)	4.8 + STD-W-13
9	Minimum pipe cover of to be 300mm minimum (was 100mm) - decreased to 200mm in grassed areas	4.8 + STD-W-13
10	Hydrant, sluice valve and air valve chamber if built in blockwork must be 215mm thick using 20N/mm2 blocks and M20 mortar	4.8 + STD-W-15

H7	**Irish Water - Quality and Field Inspection Requirements June 2017 (initial issue) and August 2020**	
	Quality Assurance Design Manual	QA. IW.CDS-5010-01
1	Pre-connection enquiry	Section 4
2	Connection application and offer	Section 8
	Quality Assurance Field Inspections Requirements Manual	QA. IW.CDS-5010-02
3	Pre construction meeting	Section 4
4	Inspection and Testing Plan	ditto
5	Quality Assurance Records	ditto
6	Logging inspections and Tests	Section 6.1
7	Facilitating IW field engineer inspections	Section 5.2
8	Certified final as-constructed drawings and documents	Section 7.1
9	Commissioning, Conformance Certification and Vesting	Sections 8-10
10	Final Inspections	Section 12
11	Self-lay Surety Bond costs	Section 12.1

TGDs: Part J - Heat Producing Appliances

J1	**1991**	
1	No tangible cost implications	
J2	**1997**	
1	No tangible cost implications	
J3	**2014**	
1	Carbon Monoxide Alarm, where are heat producing appliance is located and inside each bedroom or within 5 metres of the bedroom door	1.5.2
2	Walkways in roof spaces where appliances are located	1.7.1
3	Heat producing appliances serving the total dwelling should be commissioned and tested at completion and owner provided with user information	1.9.1 + 1.10.1

TGDs: Part K - Stairways, Ramps and Guards

K1	**1991**	
1	Top or bottom landing next to door - full width of stairs	1.1.15 + diagram 4
2	Stairways/ramps should be guarded at the sides where the total height exceeds 600mm	1.1.18
3	Guarding - should not allow a 100mm sphere pass through	1.1.19
K2	**1997**	
1	Top or bottom landing next to door - reduced to 400mm from width of stairs	1.1.10 + diagram 4
2	Guarding at windows (above 1400mm) to 800mm above floor level	2.4 + diagram 6
K3	**2013 supplement**	
1	Stair 900mm wide between handrails (as Part M) - was 800mm	Table 3
K4	**2014**	
1	Handrails 900mm above the pitch line - was 840mm	1.1.17 + Diagram 6
2	Safety restrictors to be provided on window opes above 1400mm	2.7 + Diagram 9

TGDs: Part L - Conservation of Fuel and Energy

L1	**1991**	
1	Double glazing 3.6W/m2K - where area of windows exceeds 20% of total floor area	1.3
2	Underfloor insulation - 25mm tk x 1.0m wide at building perimeter and at verticle edge of the floor slab	1.5
3	Central heating to be provided with clock controls and room thermostate or thermostatic radiator valves	2.2
4	Hot water storage cylinders to be insulated to 90W/m2 of surface area	3.2
5	Pipe insulation 40mm thick total in unheated areas to 0.045W/m2K	3.3a

6	U values of external wall construction of 0.45W/m2K - typically achieved with cavity walls and 65mm insulation	Example A1
7	U values of roof construction of 0.35W/m2K - typically achieved with 150mm mineral wool insulation	Example A7a + Table 6
L2	**1997**	
1	Thermal bridging detailing at reveals, heads & backs of cills	1.3.1 + Diagram 4 + App D
2	Limiting air infiltration detailing at external openings, loft hatch and pipes entering ducts and ceiling space	1.4 + Diagram 5
3	Draught sealing window sashes and door leaf	Diagram 5.2
4	Dwellings above 100m2 should have zone controls	2.2.1
5	Time controls for central heating systems	2.2.2
6	HW storage cylinders to be fitted with thermostatic controls	2.2.3
7	Hot water storage cylinders insulation requirements upgrade to 35mm PU-foam - ozone friendly	3.2
8	Heat pipes in hot press to be insulated to 0.035w/m2k minimum 15mm thickness for 1.0m from apparatus	3.3.2 + Diagram 11
L3	**2002**	
1	Air Infiltration - boxing concealing services to be sealed top and bottom	1.6.1e
2	U values of external wall construction of 0.27W/m2K - typically achieved with 40mm cavity wall with an 80mm insulation	A.2.1 + Diagram 8
3	U values of roof construction of 0.25W/m2K - typically achieved with 250mm mineral wool insulation	A.2.2 + Diagram 10
4	Underfloor insulation - 100mm thick throughout and at verticle floor edge 25mm thick - 0.7m2K/W and fully overlapped by cavity insulation	A.3.1 + Diagram 11
5	Provide proper access to cold water storage tank	B.5.1.1
6	Windows backstop U values 2.2 incl low e glass and 12 - 16mm argon filled double glazing	Table 28
7	External Doors U values 2.65 to 3.0 solid	Appendix E Table 2+
L4	**2007**	
1	Calculation of EPC and CPC levels using DEAP software to determine and demonstrate compliance with Part L (values improvement 40% on 2002)	0.1.2 and 1.1.1
2	Backstop U values of windows/door/rooflight to be 2.0 W/m2K if area is equal to 25% of floor area	1.3.2.4 and Table 1
3	Conformance with acceptable Construction Details ACDs - relied upon to allow backstop factor of 0.8 in DEAP calculations	1.3.3.2
4	Building Envelope Air Permeability to 10m3/h.m2	1.3.4.4
5	Air pressure testing - 5% per house type generally or 2 in less than 40 units	1.5.4.3 and Table 4
6	Gas Boiler minimum seasonal efficiency - raised to 86%	1.2.e and 1.4.1
7	Hot water cylinder factory applied insulation increased to 50mm thick PU zero ozone foam - 30kg/m2	1.4.4.2
8	Zoned heat controls, with separate temperature controls, boiler interlock wiring and thermostats in all rooms or rad stats	1.4.3.2
9	Commissioning & user information regimes	1.5.5
10	Heating pipes which are routed through a floor, wall or duct should be insulated	1.4.4.1
11	Stainless steel wall ties (not galv) 5 per M2	A2.1
L5	**2011**	
1	Calculation of EPC and CPC levels using DEAP software to determine and demonstrate compliance with Part L (values improvement 60% on 2005)	0.1.2.1
2	U values of windows/door/rooflight to be 1.6W/m2K if area is equal to 25% of floor area	1.3.2.4
3	Conformance with acceptable Construction Details ACDs - relied upon to allow backstop factor of 0.8 in DEAP calculations	1.3.3.2
4	Building Envelope Air Permeability to 7m3/h.m2 or 5m3/h.m2 if MEV installed	1.3.4.1
5	Air pressure testing - 5% / one per house type generally	1.3.4.4
6	Gas Boiler Efficiency - 90%	1.4.2.1
7	Hot water cylinder factory applied insulation increased to 50mm thick PU zero ozone foam - 30kg/m2	1.4.4.2

8	Zoned heat controls, with separate temperature controls, boiler interlock wiring and thermostats in all rooms or rad stats	1.4.3.2 + 2.2.3
9	Commissioning & user information regimes	1.5.5
10	Heating pipes which are routed through a floor, wall or duct should be insulated	2.2.4.1
11	U values of external wall construction increase to 0.21W/m2K - typically achieved with 40mm cavity wall with an 100mm insulation	Diagram A1
12	Stainless steel wall ties (not galv) 5 per M2	A2.1
13	Underfloor insulation - Still shown as 100mm thick but to higher density as increased U value to 0.31 W/m2K	A.3.3
L6	**2011 - Acceptable Construction Details:- Thermal Bridging & Airtightness**	
1	Seal between skirting board and floor with flexible sealant	1.02a
2	Cavity wall insulation at least 225mm below floor	1.02a
3	Perimeter insulation - minimum R-value of 1.0m2K/W (2002 was 25mm thick - 0.7m2K/W)	1.02a
4	Continue barrier on inner leaf of external wall through floor void	1.05
5	Seal floor joist shoe with flexible sealant	1.05
6	Bed wall plate on a continuous mortar bed	1.10
7	Seal all penetrations through attic ceiling with flexible sealant	1.10
8	Ensure gap between wall plate and eaves is completely filled	1.10
9	Apply flexible sealant between air barrier and windows/door frames	1.21 + 1.24
10	Proprietary cavity closer to head - 2.40m2K/W (with closer block) or 4.3 m2K/W or provide additional insulation to fill cavity	1.23
11	Proprietary cavity closer to reveal - 2.40m2K/W (with closer block) or 4.3 m2K/W with flexible sealant between it and blockwork	1.24 + 1.25
12	Proprietary cill back - 2.90m2K/W with flexible sealant between it and blockwork, below window board	1.26
L7	**2019 Dwellings**	
1	Step up in EPC and CPC achievable levels (values improvement 60% on 2005)	1.3.4.4
2	Building Envelope Air Permeability to 5m3/h.m2 or 3m3/h.m2 if MEV installed	1.3.4.4
3	Air pressure testing on all houses in scheme	1.3.4.4
4	Mechanical Ventilation & Heat Recovery Systems - minimum performance levels	1.4.5.2
5	Cavity insulation levels - increased U value to 0.21W/m2K	Diagram A
6	Underfloor insulation - increased U value to 0.21 W/m2K	A4
7	Access hatches to attics to be sealed and insulated	B5

TGDs: Part M - Access and Use

M1	**1991 and 1997**	
1	Part M up to 2000 do not apply to dwellings	0.3
M2	**2000**	
1	Area outside at the front door should be level 1200 x 1200mm	1.21
2	Approach to entrance at least 900mm wide have a slope of slope n.m.t 1:20 between landings, suitable for a wheelchair	1.21
3	Resistance to moisture - Grille channel across front door	consequence
4	Resistance to moisture - ensure integrity of drainage below floor level dpc	consequence
5	Corridors internally to have a clear passageway of 900mm	1.27 + Diagram 12
6	Minimum clear width of front entrance -775mm	1.23b
7	Doors to habitable rooms minimum clear width - 750mm	1.28
8	Saddleboards, bevelled and 10mm high maximum	1.28
9	Provide a wheelchair accessible WC at entry level	2.9 + Diagram 15
M3	**2010**	
1	The driveway should be at least 3.6m wide (was 3.0)	3.1.2.1b
2	Tapered steps should be avoided	3.1.2.5f
3	Maximum threshold height of 15mm - chamfered	3.2.2b
4	Minimum clear width of front entrance door - 800mm	3.2.2c

5	Doors to habitable rooms at entrance level minimum clear width - 775mm	3.3.2.1 + Table 4
6	Minimum dimensions of entry level WC increased to average 1450 x 1450mm, with headroom NLT 2100mm	3.4.2 + Diagram 34
W	**Building Control Regulations**	
1	Legislative & technical awareness	Instruments in Table 2.6
2	Awareness & understanding of continuous TGDs updates	as above
3	Files Management & keeping records	as above
4	BCAR – Professional Indemnity Insurance	as above
5	Assigned Certifier	SI 80 of 2013, Clause 6
6	Preparing and agreeing Preliminary Inspection Plan with Assigned Certifier	SI 80 of 2013 Clause 7 + SI 9 of 2014 Clause 9
7	Preparing and agreeing Inspection Notification Framework with Assigned Certifier	SI 80 of 2013 Clause 7 + SI 9 of 2014 Clause 9
8	Ancillary Certifier	SI 80 of 2013, Clauses 12, 13,15,17,19,20,22,24 + 27
9	Inspections in conjunction with Ancillary and Assigned Certifiers	SI 9 of 2014, Clause 5(4)
10	BCMS documentation control + collation	SI 9 of 2014, Clause 5(4)
11	System Testing & commissioning procedures	SI 9 of 2014, Clause 7
12	Commencement Notice	SI 9 of 2014, Clause 7
13	BCMS validation process	SI 9 of 2014, Clause 11(b)
14	Building Control Officer instructions - reference to PAS 2016	SI 9 of 2014, Clause 11(b)
X	**Health and Safety in Construction Regulations**	
1	Legislative & technical awareness	Instruments in Table 2.6
2	Files Management & keeping records	S.I 504 of 2006, Clause 3
3	PSCS Professional Indemnity Insurance - premium	as X.1 above
4	Appointment of PSDP - professional fees	S.I 504 of 2006, Clause 6
5	Appointment of PSCS	S.I 504 of 2006, Clause 6
6	Clients Safety File	S.I 504 of 2006, Clause 8, 13 + 21
7	Health & Safety Plan - develop & maintaining	S.I 504 of 2006, Clause 9 + 12
8	Notifications to HSA	S.I 504 of 2006, Clause 10 + 23
9	Risk Assessments & Method Statements	S.I 504 of 2006, Clause 16 + 17
10	Safety Coordination of Subcontracts	S.I 504 of 2006, Clause 17
11	Subcontract pre-appointment assessments	S.I 504 of 2006, Clause 17
12	Method Statement, planning, preparing & implementation	S.I 504 of 2006, Clause 17
13	Site Safety Advisor – more than 100 persons	S.I 504 of 2006, Clause 18
14	Safety awareness training – Safe.Pas Card	S.I 504 of 2006, Clause 19 + 25
15	Construction Skills Training – C.Skills Card	S.I 504 of 2006, Clause 19 + 25
16	Site Safety Representative - more than 20 persons	S.I 504 of 2006, Clause 23
17	Site Inductions	S.I 504 of 2006, Clause 25
18	Safety Awareness – Topical Toolbox talks	S.I 504 of 2006, Clause 25
19	Safety Officer Appointment	S.I 504 of 2006, Clause 26
20	Safety Management Meetings	S.I 504 of 2006, Clause 28
21	Prevention of Unauthorised Entry to Site	S.I 504 of 2006, Clause 30
22	Site Safety Inspections	S.I 504 of 2006, Clause 87
23	Evacuation Plan & Updating	S.I 504 of 2006, Clause 31
24	Personal Protection Equipment	S.I 504 of 2006, Clause 35
25	Roadworks Guarding & Lighting	S.I 504 of 2006, Clause 97
26	Amendments to S.I 504 of 2006	S.I 130 of 2008; S.I 423 of 2008; S.I 523 of 2010; S.I 461 of 2012; S.I 182 of 2013; S.I 526 of 2013

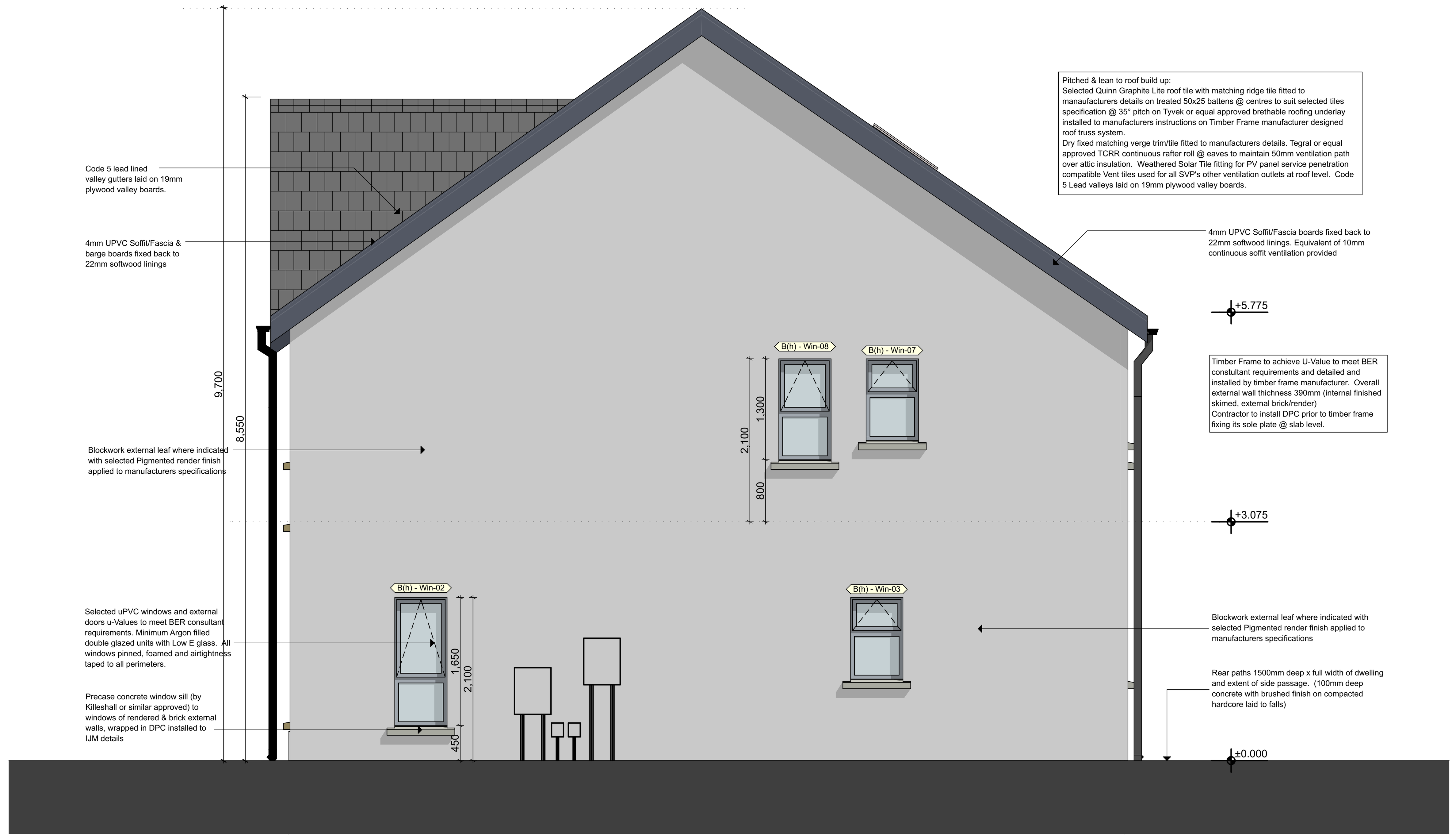
27	Code of Practice for Access & Working Scaffolding 1999 - Sections 1 - 7	Including updates 2009 & 2018
Y	**Environmental and Waste Regulations**	
1	Legislative & technical awareness	Waste Management Act 1996 and regulations made under the act
2	Files Management & keeping records	ditto
3	Best Management Practice	Various policies and Guidance Statements 1998, 2002, 2004 & 2006
4	Landfill Levy	Waste Management (Amendment) Act 2001, Clause 4(2)
5	Waste Manager	ditto, Clause 11(3)
6	Waste Storage Area	ditto, Clause 11(3)
7	Waste Management Plan and implementation	Guidelines on Waste Management Plans for C&D Projects – July 2006
8	Landfill Levy increase	Waste Management (Landfill Levy) (Amendment) Regulations 2008 + 2010, Clause 4(2)
9	Landfill Levy increase	Waste Management (Landfill Levy) (Amendment) Regulations 2011, Clause 4(2)
10	Landfill Levy increase	Waste Management (Landfill Levy) (Amendment) Regulations 2015, Clause 4(2)
Z	**Energy Performance Regulations**	
1	Legislative & technical awareness	Instruments list in Table 2.7
2	Awareness & understanding of continuous TGDs updates	ditto
3	Files Management & keeping records	ditto
4	Consultants BER Certification	SI 666 of 2006, Clause 7(4)a
5	Issuing authority registration Fees	SI 243 of 2012, Clause 14(1)
6	Coordinating Testing regimes	SI 183 of 2019

Appendices C

CASE STUDY DRAWINGS

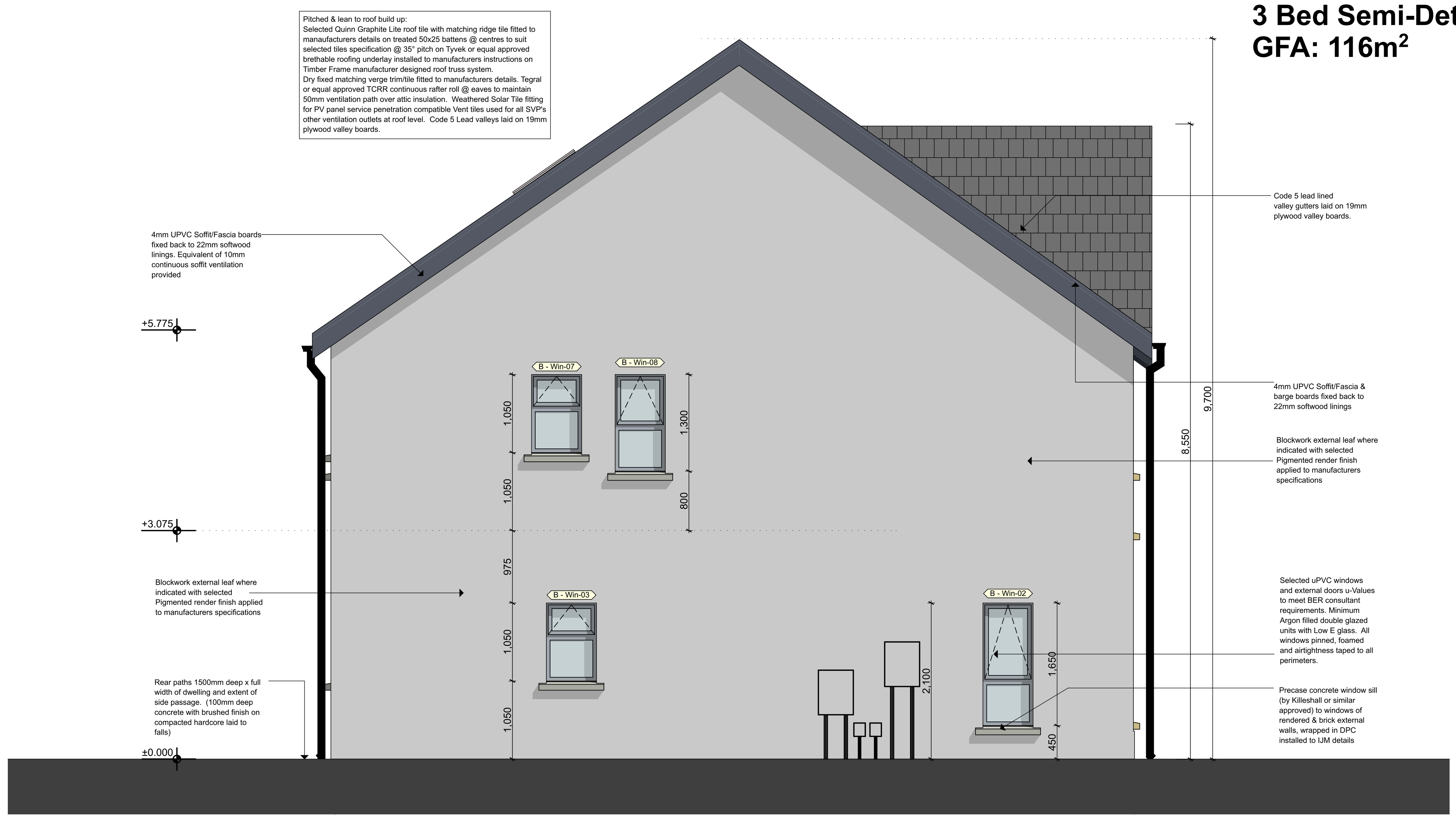
Traditional Build
3 Bed Semi-Detached
GFA: 116m^2

1:50 **Front Elevation**



1:50 **RHS Gable Elevation** **RHS**

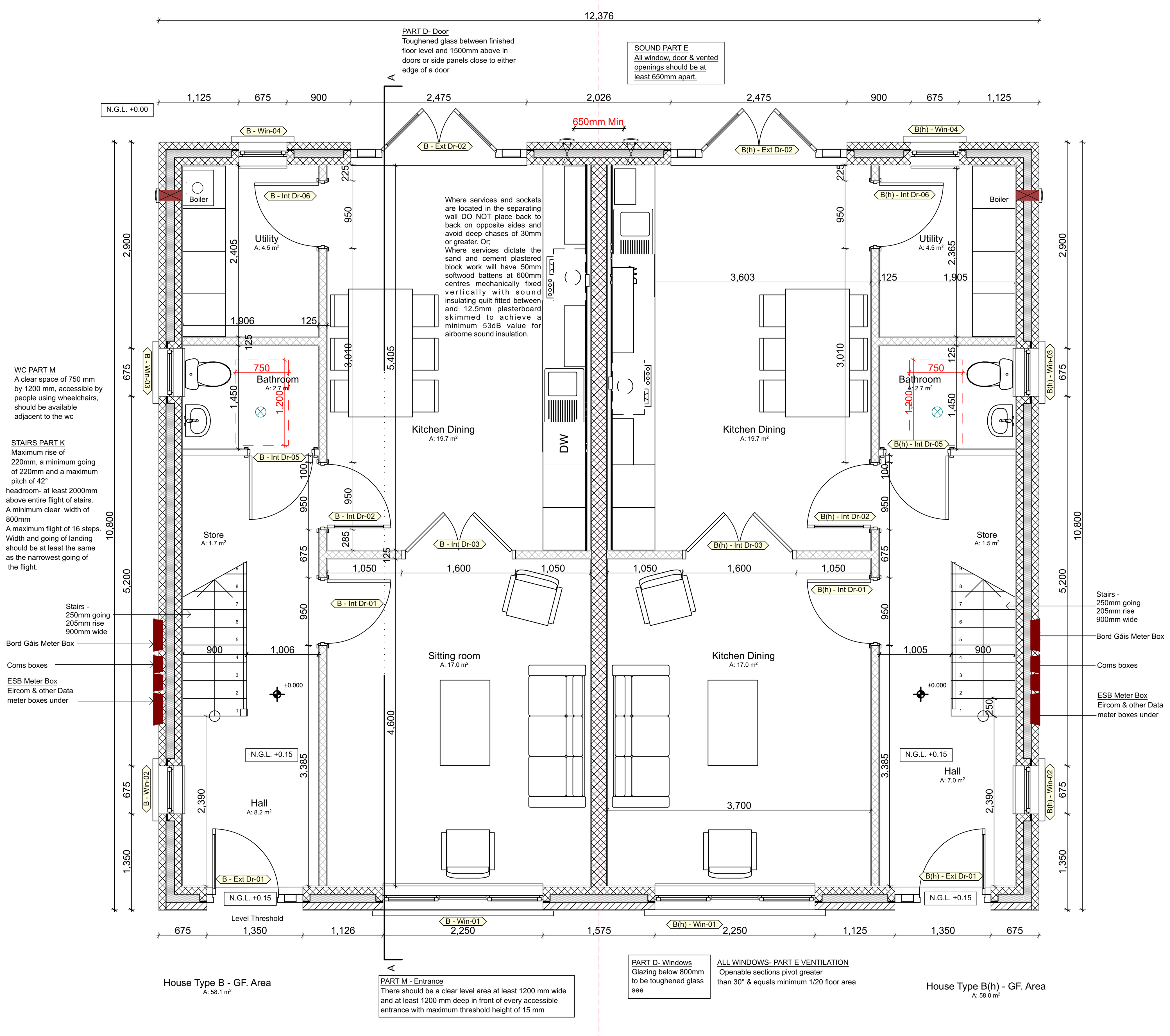
1:50 **Rear Elevation**



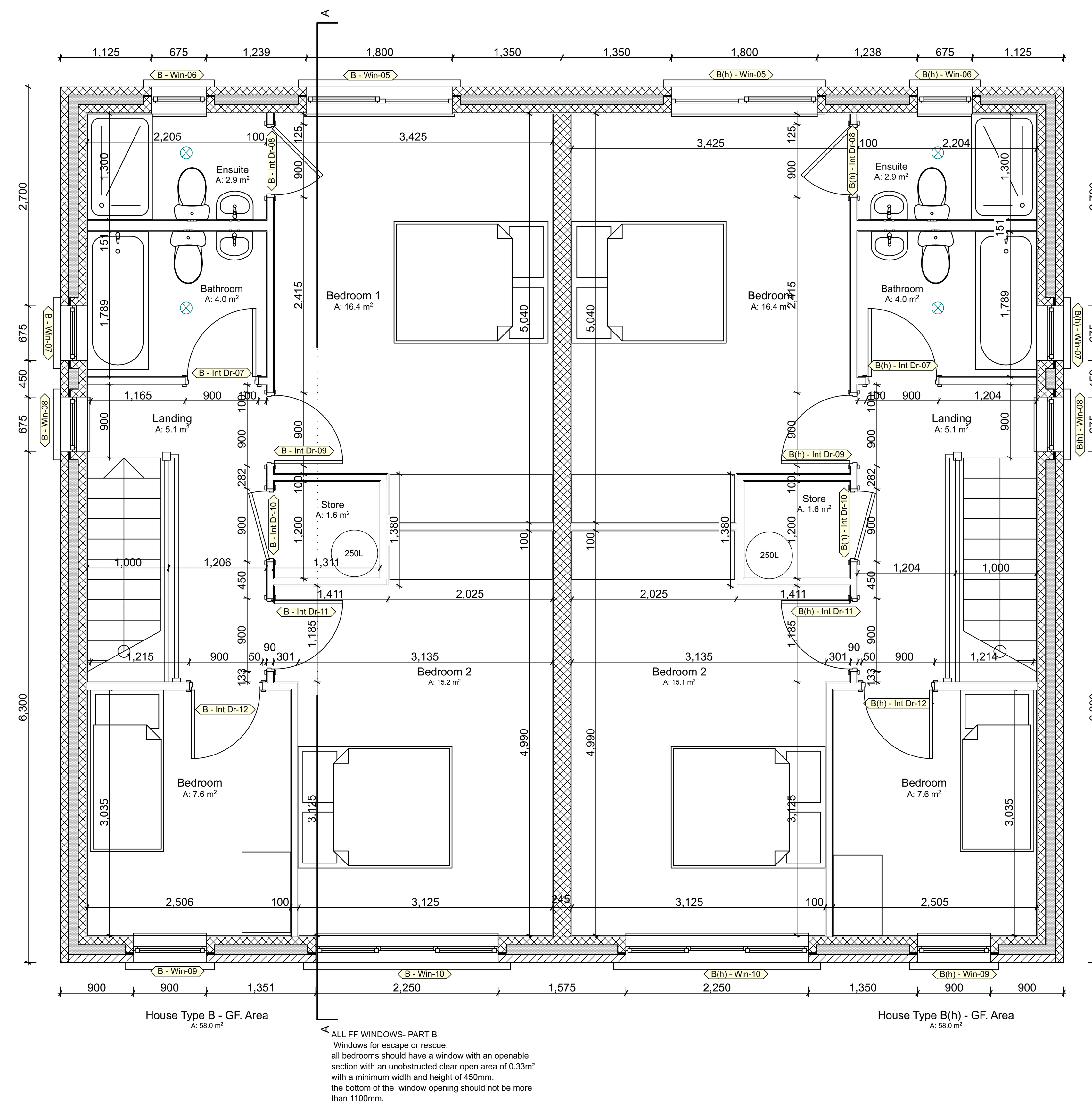
1:50 **LHS Gable Elevation**

Layout ID:	ARCHITECTURAL	Scale:	As Shown (@ A1)
		Job No:	
Project:	CASE 1	Series:	Construction
		Date:	JANUARY 2022
Drawing Name:	Elevations	Status:	Construction

THIS DRAWING TO BE READ IN CONJUNCTION WITH RELEVANT CONSULTANTS DRAWINGS - NOTIFY ARCHITECTS OF ANY DISCREPANCIES - CHECK DIMENSIONS ON-SITE - USE FIGURE DIMENSIONS ONLY -



1:50 Ground Floor

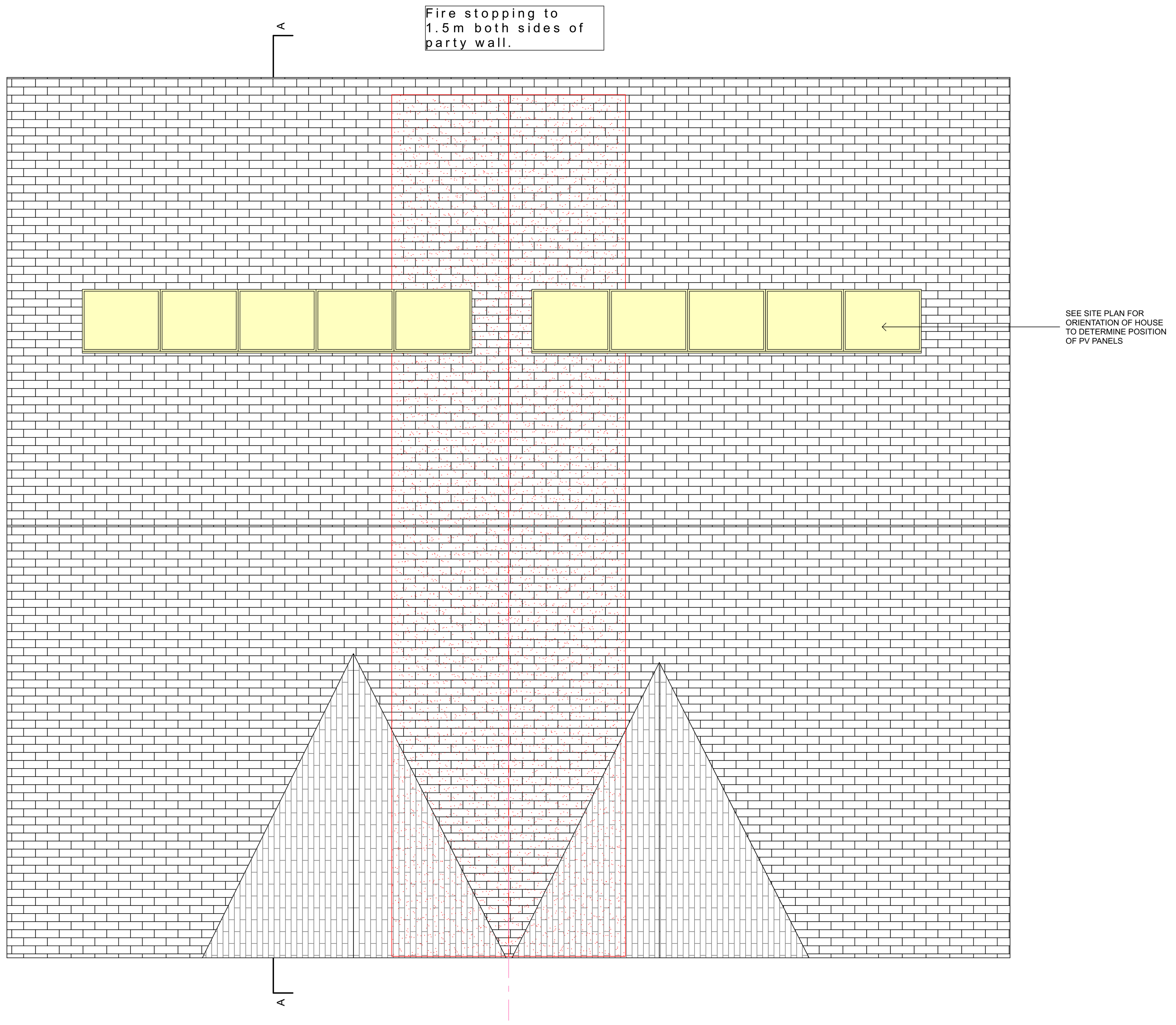


1:50 First Floor

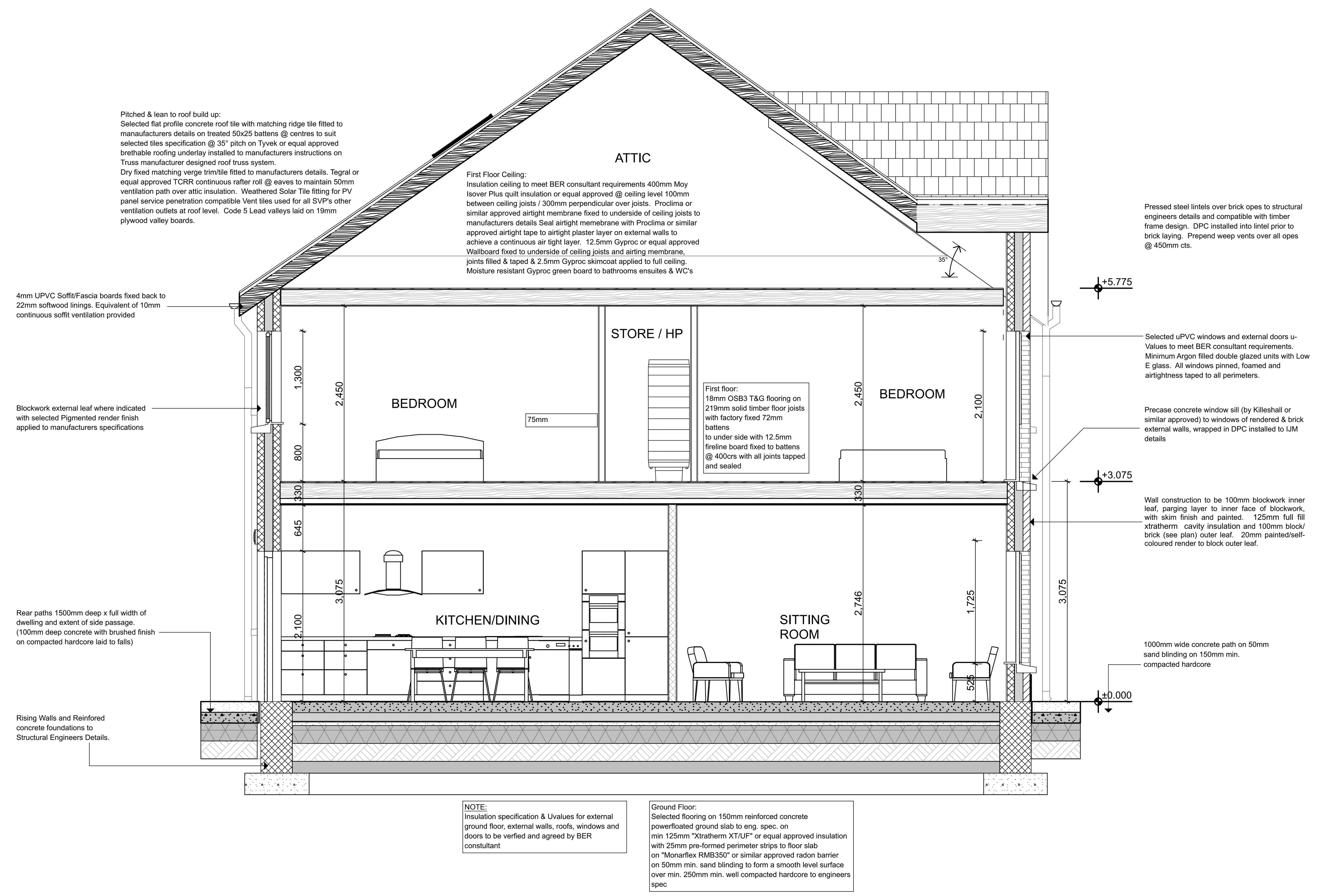
Traditional Build
3 Bed Semi-Detached
GFA: 116m^2

Layout ID:	ARCHITECTURAL	
Project:	CASE 1	
Drawing Name:	Ground and First Floor Plansc	
Scale:	As Shown (@ A1)	
Job No:		
Series:	Construction	
Date:	JANUARY 2022	
Status:	Construction	

THIS DRAWING TO BE READ IN CONJUNCTION WITH RELEVANT CONSULTANTS DRAWINGS - NOTIFY ARCHITECTS OF ANY DISCREPANCIES - CHECK DIMENSIONS ON-SITE - USE FIGURE DIMENSIONS ONLY -



1:50 Roof Plan



1:50 Building Section A

Traditional Build
3 Bed Semi-Detached
GFA: 116m²

Layout ID:	**ARCHITECTURAL**	Scale:	As Shown (@ A1)
		Job No:	
Project:	**CASE 1**	Series:	Construction
		Date:	JANUARY 2021
Drawing Name:	**Roof Plan and Section**	Status:	Construction

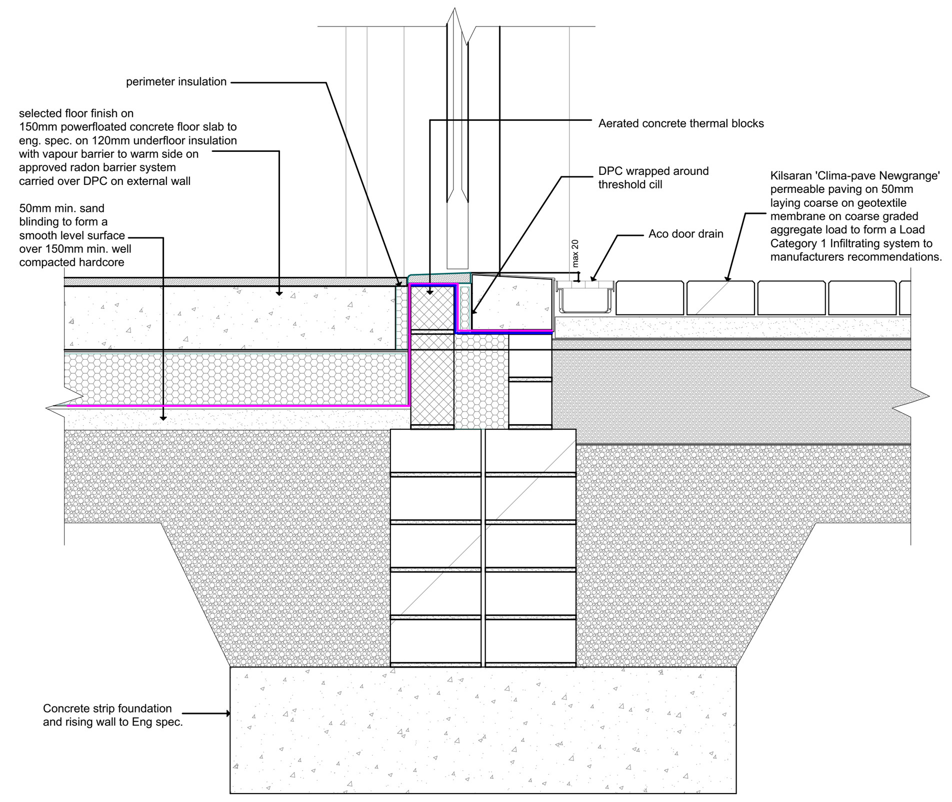
SCALE 1:250

Site Stream Layout

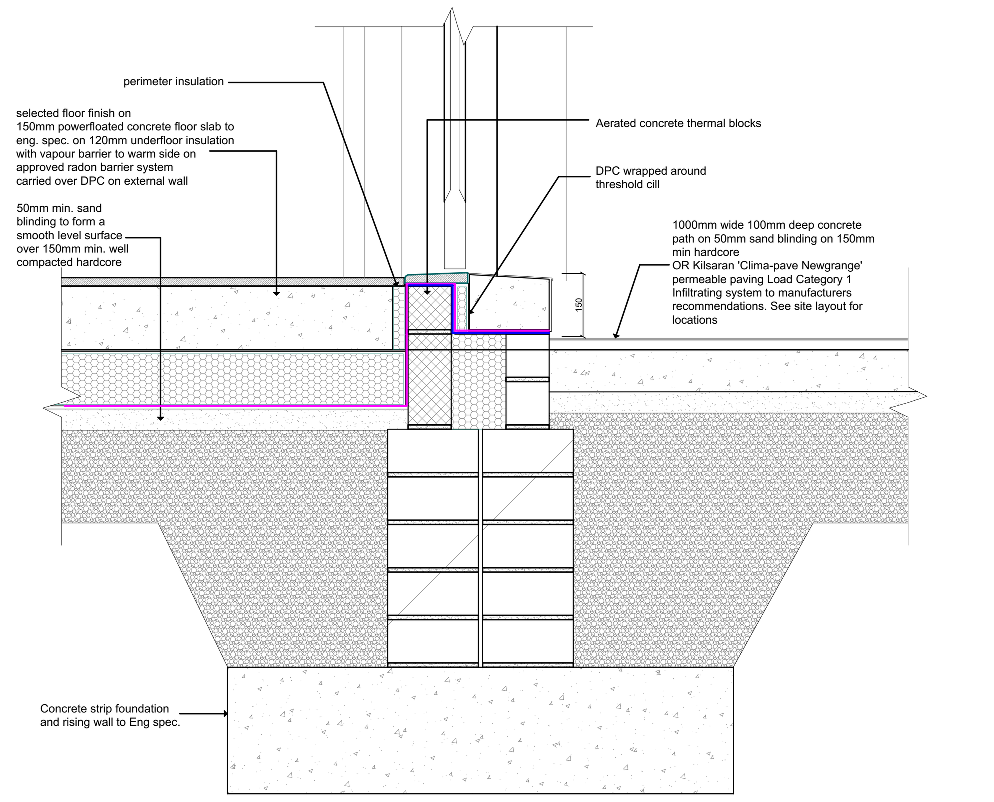
N

Construction	Layout ID:	**ARCHITECTURAL**	Scale:	As Shown
			Job No:	D-1602.
	Project:	**CASE 1**	Series:	Site
			Date:	January 2022
	Drawing Name:	**PARTIAL SITE LAYOUT**	Status:	Construction

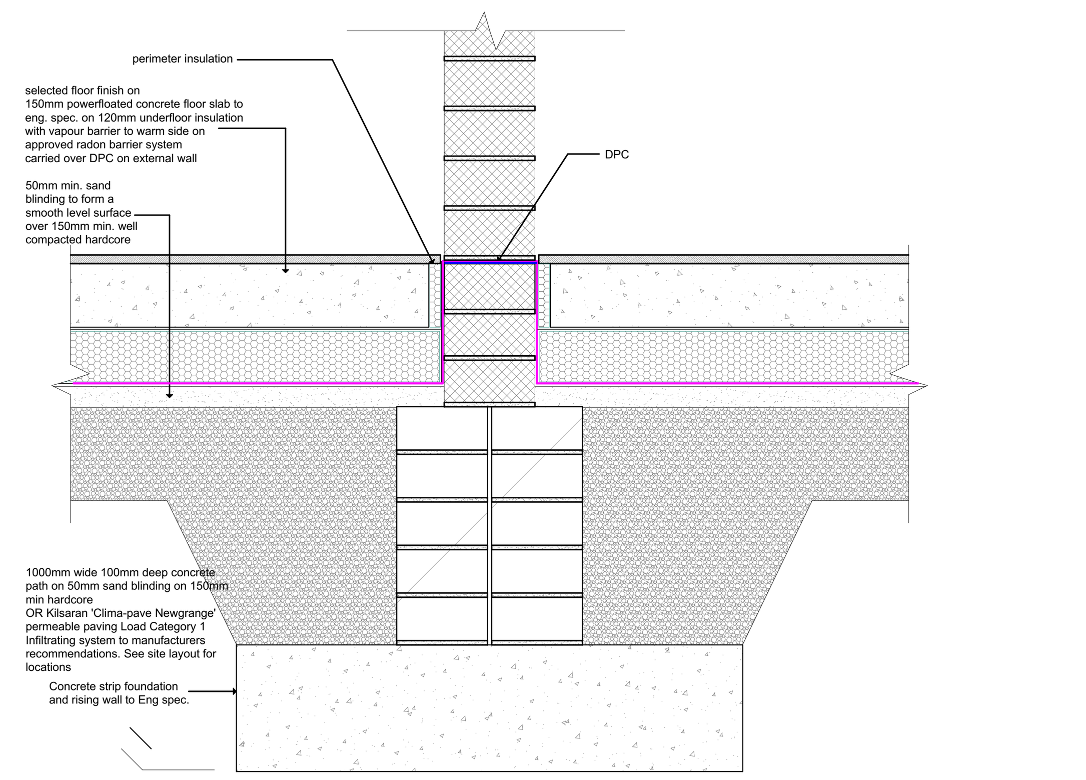
THIS DRAWING TO BE READ IN CONJUNCTION WITH RELEVANT CONSULTANTS DRAWINGS - NOTIFY ARCHITECTS OF ANY DISCREPANCIES - CHECK DIMENSIONS ON-SITE - USE FIGURE DIMENSIONS ONLY .



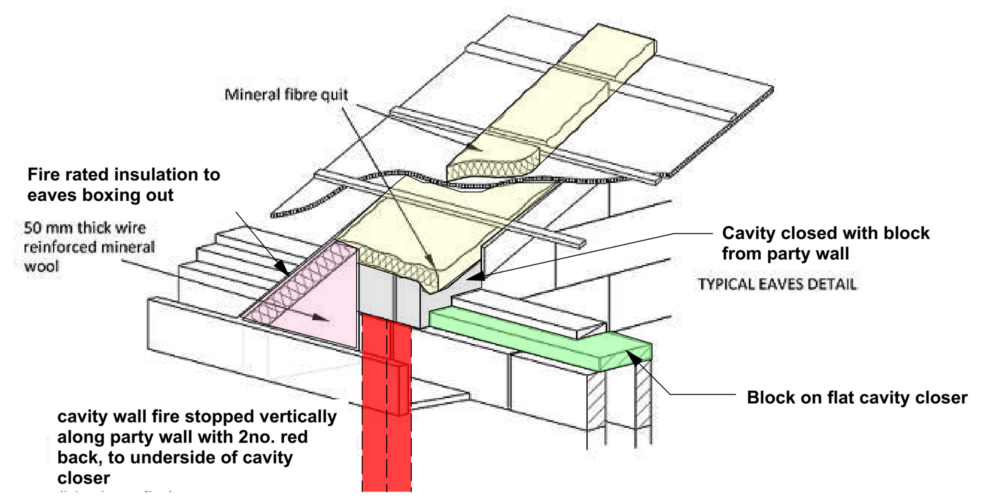
Typical Level Treshold Detail

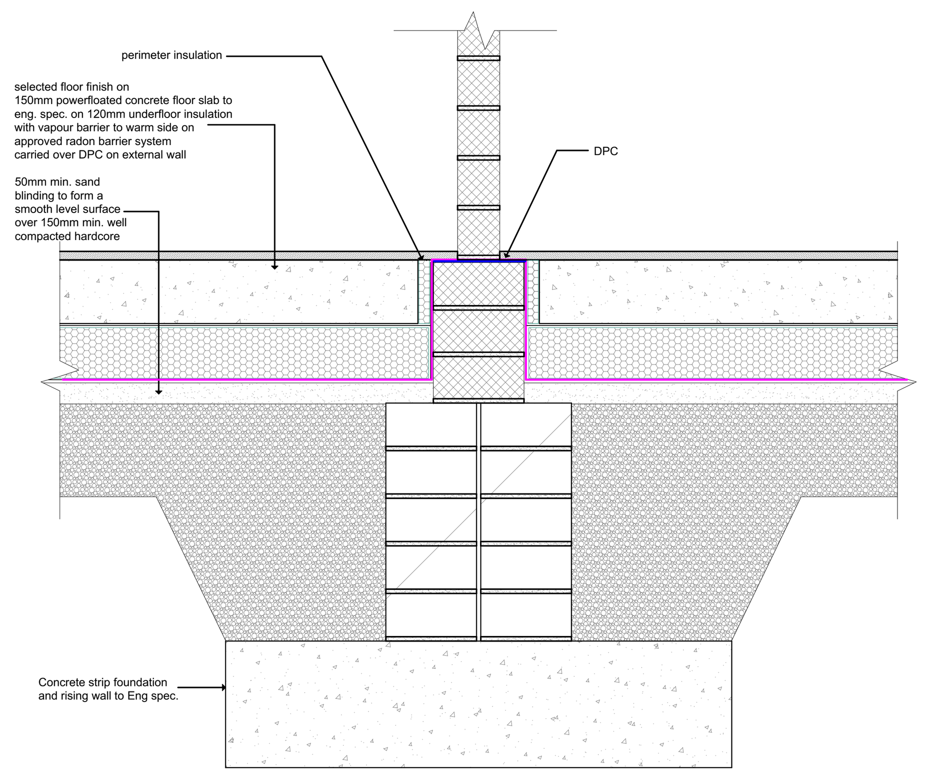


Typical Treshold Detail

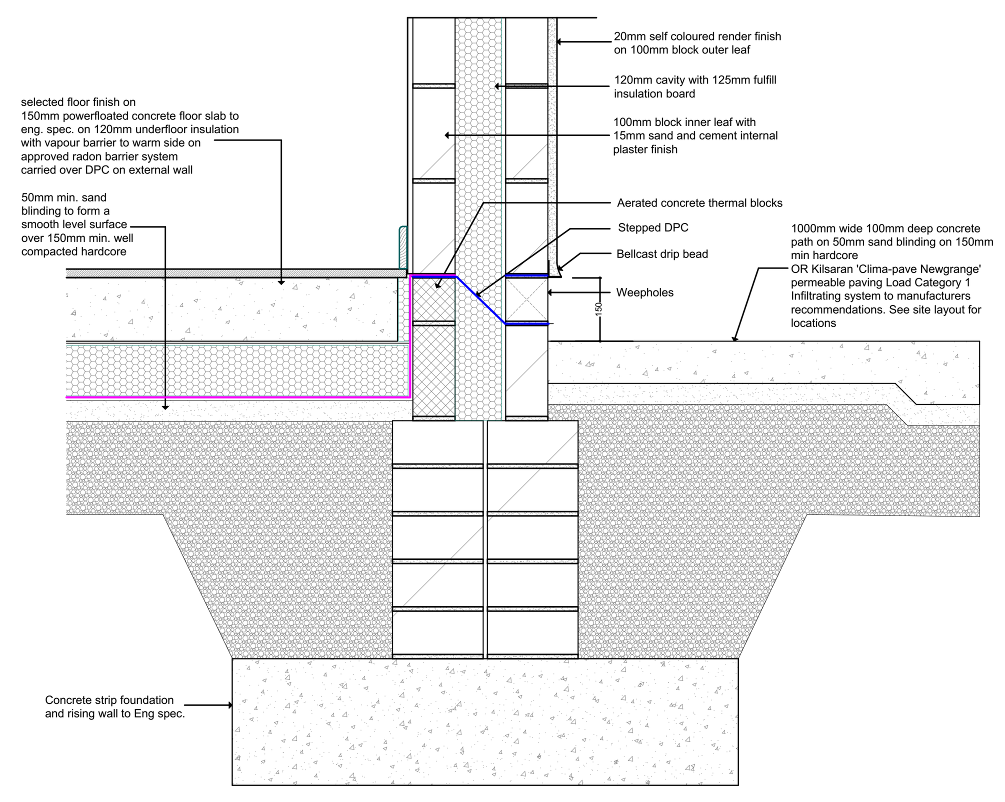


Typical Party Wall Detail

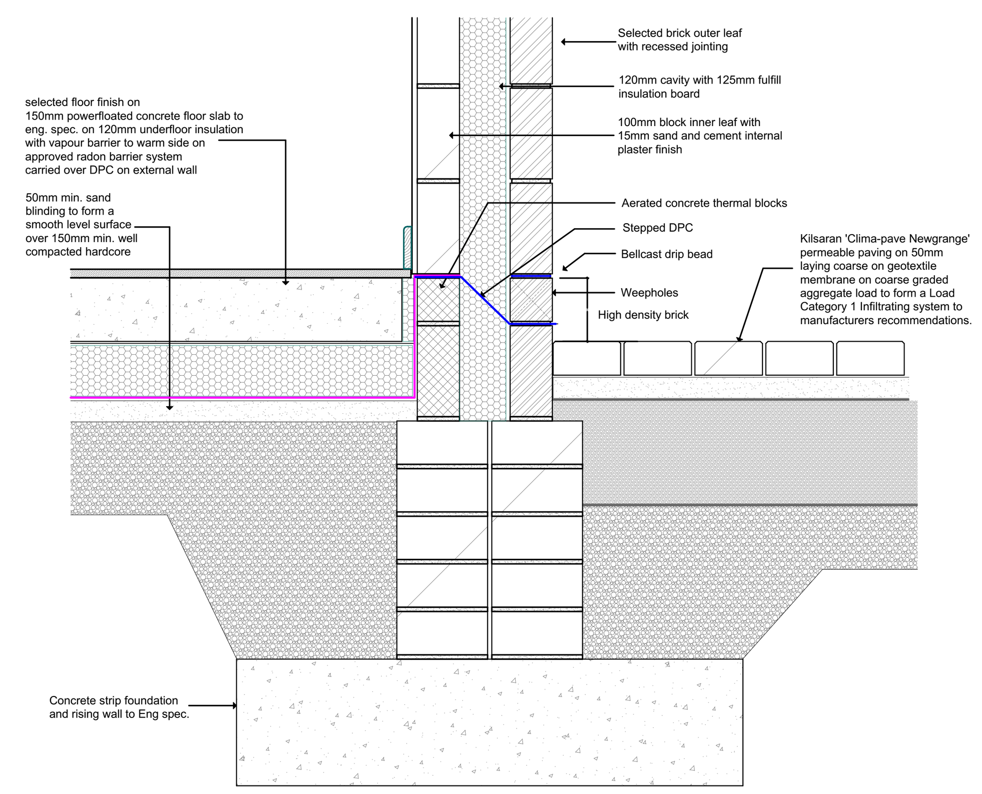




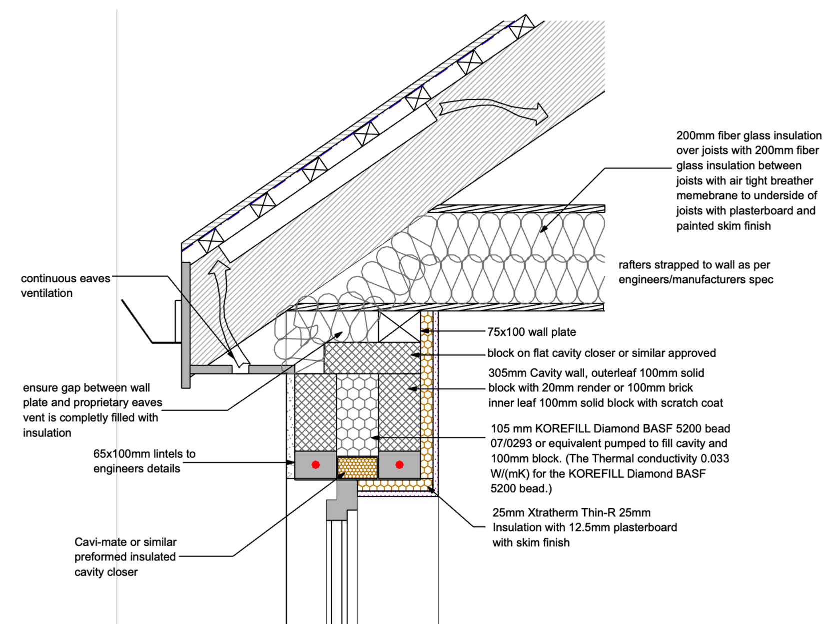
Typical Internal Wall Detail



External wall type 1



External wall type 2



Traditional Build
3 Bed Semi-Detached
GFA: 116m^2

GENERAL SEPECIFICATION - TO BE READ IN CONJUNCTION WITH STRUCTURAL AND M&E ENGINEERS' DRAWINGS

ALL DETAILS TO COMPLY WITH PART L TGD ACCREDITED CONSTRUCTION DETAILS.

INSULATION TO COMPLY WITH BER REPORT

MATERIALS & WORKMANSHIP

All materials must comply with the following:

- Irish or European Standards
- Product certification schemes
- Quality assurance scheme
- Irish board of Agreement Certificate
- Construction Product Directives (CE Marks)

All materials must be fixed in strict accordance with manufacturers printed details and workmanship and must be in accordance with BS8000: Workmanship on Building Sites: Part 1 - 16. Where materials, products and workmanship are not fully specified or described, they are to be: Suitable for the purpose stated or inferred and in accordance with recognised good practice.

Floor Construction

Foundations:
All foundations to be in accordance with engineer's specifications and details and to all requirements of TGD Section A. Concrete mix to be cube tested to Engineer's specification.

Foundations to be constructed at a minimum depth 600mm below finished ground level on level firm natural undisturbed ground of adequate ground bearing capacity to the approval of the Consultant Engineer.

Ground Bearing Floor
Topsoil and vegetable matter to be cleared from the site and floor to be filled with minimum 150mm/maximum 900mm clean sand blinded compacted hardcore to I.S.EN 13242:2002 and SR21:2004+A1:2007. A proprietary radon sump installed in accordance with manufacturers instructions with all associated vent pipes and caps beneath radon barrier per house unit.

Ground Floors:
New ground floor to be 150mm concrete slab with A98 mesh on 150mm selected PIR/Phenolic Insulation [Thermal Conductivity <0.023W/mK] with 30mm perimeter insulation at junction with rising walls on 'Monarflex RMB350' DPM/Radon Barrier or similar approved on 50mm sand blinding on 200mm well compacted hardcore material [pyrite free] to Engineer's detail and specification.
Provide 1 No. radon sumps and vent pipes with caps beneath radon barrier per house unit.

Upper Floors:
Floor to be constructed using a proprietary Metal web easi-joist system by Magtruss or similar approved. Joists to be installed to manufacturer's layout and details, typically 30mm deep @ 400mm centres. Joist ends to bear onto proprietary galvanised metal restraint joist hangers built into party wall or external walls.

The requirement for fire rating an upper floor of a 2-storey house is;
- 30 minutes for structure
- 15 minutes Integrity
- 15 minutes Insulation
- method of protection from exposure is from the underside,

i.e. ground floor ceiling

Upper Floors Contd.:

Generally, the manufacturers of the metal web joist system will advise on the fire protection that is required under the certification of their system. Usually this is achieved using plasterboard ceiling below and a tongue-and-grooved deck above the floor structure.

Flooring to be minimum 18mm tongue and groove OSB moisture resistant board or similar, laid in accordance with the manufacturer's instructions with a minimum 10mm expansion gap at the floor perimeter; all joints glued, and end joints supported by joist or noggin.

All gaps & all voids to be sealed to prevent any air leakage and fire stopped. Ceiling to receive 15mm plasterboard, joints taped and filled, perimeter bridging required, no bridged support at board joints.
Or 12.5mm type 1 plasterboard or similar in accordance with the manufacturers requirements and fixed in accordance with manufacturer's instructions. Ceiling finished with nominal 5mm (minimum of 3mm) plaster skim coat and painted.
Or 12.5mm fire line board, joints taped and filled, perimeter bridging required, no bridged support at board joints.

All penetrations to fire rated ceiling/first floor to be fire sealed. Downlighters to be fire rated or have fire hoods in addition any penetrations greater than 40mm must be protected to maintain the integrity of the wall/ceiling they penetrate. Fire collars etc to be used where required.

Attic Floor / Top Floor Ceiling
Mineral wool quilt or equivalent laid between timber ceiling joists and over across joists to provide thickness required to achieve U-Value required. Where Health and Safety and access to roof is an issue, a rigid platform should be laid over the mineral wool insulation. All insulation sizes and values to be based on complying with the requirements from the overall heat loss calculation in accordance with Part L of the Building Regulations 2011 or if modified those applicable at the time of construction. Ceiling finished with nominal 5mm (minimum of 3mm) plaster skim coat with vapour control layer where appropriate.

External Walls

New Rising Walls:
All rising walls to be in accordance with engineer's specifications and details.

350mm solid block rising wall to foundation level. Rising walls to be the full width of the supported wall and constructed with solid blocks to IS 20. Rising walls to be laid in mortar type (iii) to IS 325, and centred on foundations.
Services passing through rising walls should have 50mm clearance all round pipe to accommodate movement. Ducts should be provided where necessary to facilitate the introduction of services. For large openings a concrete lintel should be provided.

Cavity Wall Construction
Wall construction to be 100mm blockwork inner leaf, parging layer to inner face of blockwork, with skim finish and painted. 125mm full fill xtratherm cavity insulation and 100mm block/brick (see plan) outer leaf. 20mm painted/self-coloured render to block outer leaf.

Provide movement joints in walls greater than 12m in length to engineer's detail. Wall ties to be positioned @ 900 c/c horizontally and 450 c/c vertically and at 225 c/c around all opes.

Masonry Party Wall
Party wall to be constructed of single skin of skimmed and sand and cement plastered 215mm dense concrete block with mortar joints fully pointed up to the underside of the roof and fire stopped with mineral wool or other approved product to achieve a minimum 53dB value for airborne sound insulation. The party wall is to be bonded/tied to the inner leaf and the junction of cavities is to be fire stopped throughout its length with a block on flat or slate cavity closer.

Where services and sockets are located in the separating wall DO NOT place back to back on opposite sides and avoid deep chases of 30mm or greater. Or;
Where services dictate the sand and cement plastered block work will have 50mm softwood battens at 600mm centres mechanically fixed vertically with sound insulating quilt fitted between and 12.5mm plasterboard skimmed to achieve a minimum 53dB value for airborne sound insulation.

No joists or combustible materials to be built into party wall. Fire stopping to be applied to cavities in walls at junctions with party walls

External Walls Contd.:

External walls to achieve a minimum U-Value of 0.14w/sqmK in accordance with the requirements of TGD Part L
Lintols above opes to be to Engineer's detail and specification and installed in accordance with suppliers recommendations.
Provide stepped DPCs at head to all opes and junctions with flashings/ roofs
Cavities to be closed with fire rated cavity closers to recommendations of TGD Part B.

Windows & External Door
Doors/ windows to be selected PVC / Timber / Aluminium/Aluclad system with Low-E Argon filled double glazing to be fitted in accordance with window manufacturer's specification and requirements. Provide safety glass to all glazing below 800mm above FFL to first floor level. All windows to comply with requirements of TGD Part B, K, L.

Front door to comply with Part M 2010 with a minimum clear opening width of the entrance door to be 800mm. Means of Escape windows to open to minimum required clear width of 450mm. Escape windows must have minimum clear opening dimension of 0.33m² (typically 450mm wide x 750mm high) located within 800-1100mm above floor level to all bedrooms on any floor level and habitable rooms at upper floor levels.

Opening windows located 800mm above floor level must be provided with non-climbable containment/guarding or proprietary catches which should be removable (but child proof) to means of escape windows in the event of a fire. All gaps etc to containment/guarding should not exceed 100mm.

Rooflights to comply with Part B TGD 2017 , the distance from the eaves to the bottom of the opening section of the rooflight or, where the window is vertical, the vertical plane of the window, should not exceed 1.7 m measured along the slope of the roof.
The bottom of the window opening should be not more than 1100 mm and in the case of a rooflight not less than 600 mm above the floor, immediately inside or beneath the window or rooflight.
Velux Rooflights, Top hung with bottom fixed & centre pivot (refer to architect's schedule for sizes and locations) Internal finish, Nordic pine with white painted finish. External finish, Grey, nearest RAL 7043

Limiting Thermal Bridging Around External Openings
Thermal bridging around external openings will be provided in compliance with Acceptable Construction Details.

Roof Construction:

Roof to be constructed using specialist designed and manufactured trusses @ 600mm centres (max) to I.S.EN 1995-1:2005 Eurocode 5: Design of timber structures - Part 1. Trusses to be fixed and braced strictly in accordance with manufacturer's details and mechanically fixed to 100x75mm treated softwood wall plates via galvanised steel truss clips. 30x5x1000mm galvanised wall plate holding down straps required at 2m centres. Lateral restraint straps across at least 2 timbers as noted in wall section at ceiling and verge levels.

Roof covering to consist of interlocking clay roof tiles and associated ridge tiles fixed in accordance with the manufacturer details for pitch and exposure. Tiles to be fixed to 25x50mm softwood timber battens and roof timbers to be overlaid with a suitably certified un-tearable breathable roof underlay fitted in accordance with the manufacturer's details and terminated at eaves level onto a proprietary Upvc eaves skirt fitted in accordance with the manufacturers details. Roof verges to be fitted with a proprietary dry verge system fixed in accordance with manufacturer's instructions.

Lead work, flashing, soakers, valleys and gutters to be formed from Code 4/5 lead sheet in conformance with I.S.EN 12588: 2006 Lead and lead alloys, and fully supported on valley boards etc, and to have a minimum 150mm lap joints, and not to be fixed in lengths exceeding 1.5m. All lead surfaces to receive a coating of pantination oil applied in accordance with the manufacturer's instructions.

Selected roof windows and PV panels located on the roof to be installed in accordance with manufacturer's instructions and details.

Ventilation to Pitched Roofs
Roof insulation to be continuous with wall insulation but stopped back at eaves or at junctions with rafters to allow a 50mm air gap with installation of proprietary rafter roll ventilation strip. Cross ventilation to be provided by a proprietary eaves ventilation strip equivalent to 10mm continuous gap at eaves level (25mm in room in roof construction). Roof to be ventilated as per Part F Section 2 Building Regulations.

Air Permeability
Air leakage will be limited in the building fabric by sealing at all external door and window frames, service penetrations to walls, floors, joists and ceilings to be sealed both internally and externally with proprietary sealing products such as mastic sealants, expanding foam and approved tape. Pressure testing to be carried out in compliance with Part L 2019.

Sound Transmission
House Units to comply with all requirements of TGD Part E and Recommendation of BS8233:1999

Internal Timber Studwork Non-Load Bearing Partitions
Non-load bearing stud partitions are to be constructed of 75x35mm softwood timbers at 400mm vertical centres with head and sole plates and two rows of intermediate noggins. Internal studs shall be placed on a DPC at ground floor level and fixed to external and party walls using drilled screw fixings at the top and at each of the noggins. The stud shall be supported at intermediate floors/ceilings by a joist or noggins. Each side of the stud to receive a 9mm plasterboard and skim coat or alternatively 12.5mm or 15mm plasterboard where required. Wet areas to receive 12.5mm moisture resistant plasterboard and skim coat.

Internal Stairs
Proprietary timber stairs to be manufactured and installed in accordance with Part K of the building regulations. Stair pitch not to exceed 42°, rise and going to be equal on all steps and sized as per Part K. Stair to have a minimum headroom of 2000mm above stair pitch line and minimum stair width of 800mm. Handrail to be provided on one side of a flight at 840mm - 900mm above the pitch line and 900mm above any landing and should be continuous throughout their length with non-climbable vertical balustrading, no gaps to exceed 100mm.

Internal Doors
Internal doors to be selected panel door sets fitted in accordance with manufacturer's instructions.

Door widths to habitable rooms to be in accordance with Part M 2010, primarily 775mm clear opening where unobstructed corridor width is 1050mm and 800mm clear opening where unobstructed corridor width is 900mm. Door Handles at 900mm above floor level.
In three storey dwellings all doors to the escape route to be selected fire doors - FD30 fitted with proprietary mechanical self closers "Astra Perko Closer" and intumescent strip rebated around top & sides of door or frame/lining fitted in accordance with manufacturers details.

Joinery
Skirting Boards to all areas to be 150mm x 20mm high quality softwood with chamfered edge. Finish: Painted

Architraves: 75x25mm timber Architrave with chamfered edge. Finish: veneer/Paint to match associated door.

Drainage
All below ground drainage to be installed to Engineeer's detail and specification.

All BIGTs, GTs, AJs, manholes to be suitably located within the new ground finishes so as to not become trip hazards.

SVP Pipe Boxing
SVP pipe boxing to consist of soft wood framing adequately fixed and finished with 12.5mm plasterboard and skim coat; void to be filled with mineral fibre quilt for sound insulation and fire stopped in accordance with TGD B Volume 2 Dwellings 2017. Boxing to be sealed at ground floor ceiling and any intermediate ceilings. All gaps & all voids to be sealed to prevent any air leakage.

Foul and Rainwater Drainage System
Both storm and foul drainage to consist of 100mm diameter Upvc proprietary underground drainage laid at a minimum 1:80, surrounded in pea gravel a minimum of 900mm deep in drives and 400mm elsewhere. Where it is not possible to achieve these minimum covers, pipes shall be bedded and surrounded in concrete 150 mm thick.

Proprietary Upvc 450mm diameter inspection chambers to be provided at all changes of level and or direction. All gullies to be trapped and have rodding access where serving branches. Inspection chamber covers to be mechanically fixed and suitable for vehicular loads in drives.

Rainwater Drainage
Proprietary Upvc rainwater gutters and down pipe, size and number to be suitable for roof area to be drained and fixed in compliance with the manufacturers details and TGD Part H of the Building Regulations.

All gutters and rainwater goods to be nominally 80mm square section black UPVC with required brackets and fixings.

Space and Hot Water Heating
Space and hot water heating method to be to mechanical and electrical engineer's specification. Hot water cylinder to be insulated with minimum 50mm factory applied PU foam.
All space and hot water systems to be installed, commissioned, calibrated and certified by a suitably qualified/registered installer.

Renewable Energy System
All renewable energy systems to be installed in accordance with the design and specification of the mechanical and electrical engineer. Systems to provide the required level of 4 kWh/m^2/annum of electrical energy or 10 kWh/m^2/annum contributing to energy use for domestic hot water or space heating.
All renewable energy systems to be installed, commissioned, calibrated and certified by a suitably qualified/registered installer.

Mechanical Extract Ventilation
Mechanical ventilation to be provided to the requirements of TGD Part F 2009 and should be provided to the rooms listed below directly ducted to the outside air equivalent to the following rates:

Kitchen	30 litres per second over hob or 60 litres elsewhere
Utility Room	30 litres per second
Bathroom	15 litres per second
WC	6 litres per second (no bath or shower)

Mechanical ventilation to rooms without openable windows to be linked to light operation and have 15 minutes overrun and a 10mm gap under the door for air supply. Mechanical ventilation to be ducted in proprietary insulated ducts to outside through walls to proprietary vent or through roof space to proprietary roof tile or soffit vent.

Background Ventilation
Background or trickle ventilation is to be provided via trickle vents in windows. Where the minimum requirement of 5000mm² background ventilation to all habitable rooms and 2500mm² to kitchen and bathroom areas cannot be achieved additional ventilation should be provided by means of a background ventilator with internal hit & miss grille that can be manually adjusted with a sliding action allowing ventilation to be controlled as required and external water baffles prevent transfer of water across the cavity.

Smoke/Heat Alarms
All floors within houses to be provided with mains operated and battery backup fire detection and fire alarm, a minimum type LD2 system in accordance with I.S.3218 with suitably located interconnected detectors in all circulation areas that form part of the escape route, fixed at ceiling level not more than 7.5m from any habitable room door and in all high-risk areas such as kitchen and living rooms. Heat detectors should also be fitted in kitchens.

Carbon Monoxide Alarms
Carbon monoxide alarms to be installed to all dwellings in accordance with Technical Guidance Document Part J 2014.

Mains operated carbon monoxide alarm to be fitted in any room containing a gas or combustion appliance. Alarm to be positioned on the ceiling at least 300mm from walls and between 1m and 3m horizontally from the appliance. Carbon monoxide alarm to also be fitted on landings ensuring bedroom doors are within 5m of a detector.

Fixed Internal Lighting
All fixed internal lighting to be low energy light fittings, fitted with lamps which must have a luminous efficiency greater than 40 lumens per circuit-watt and a total output greater than 400 lamp lumens.

Wall/Ceiling Finishes Generally
New walls to be smooth finish painted / plasterwork with recessed flush 125mm Skirting and 75mm architraves HW painted. All new ceilings to be smooth finish painted plasterwork.

All bathrooms to be finished in plaster skim with selected tiled finish on 12.5mm moisture resistant plasterboard, taped and sealed.
Bathroom & Ensuite Full height tiling around bath & shower only.

Fixtures and Fittings
The detail design of fixtures and fittings shall be the subject of detail design and shall be agreed with the Client

Sanitary Fittings:
All sanitary fittings shall be of vitreous china from selected bathroom suite.

Kitchen Fittings:
All to be manufactured from moisture resistant MDF. Sink to be stainless steel with double bowl and drainer.

Built-in Wardrobes:
Where provided to be manufactured from MDF with hardwood veneer.

Layout ID:	ARCHITECTURAL	Scale:	As Shown (@ A1)
		Job No:	
Project:	CASE 1	Series:	Construction
		Date:	JANUARY 2022
Drawing Name:	Typical Detail	Status:	Construction

Appendices D

CASE STUDY BILL OF COSTS

D.1 Bill of Costs - Summary
Case Study – 34 Unit Residential Development

Area
4240 Sq.m

	34 ELEMENT	Type A/E 4 bed Semi-Detached	Type A2 - 4 bed Detached	Type B - 3 bed Semi-Detached	Type C - 3 bed Terrace	Type D - 5 bed Detached	Total
1	**House**	€	€	€	€	€	**€**
A	**Substructures**	17,554.00	18,095.00	**14,874.00**	14,070.00	22,100.76	569,218.53
B	**External Walls**	23,349.86	33,450.00	**19,785.00**	17,950.00	36,955.00	779,357.57
C	**Internal Walls**	9,109.81	6,362.00	**7,719.00**	7,950.00	7,770.38	286,919.36
D	**Air Tightness & Sound Tests**	2,344.19	1,460.00	**1,986.30**	1,878.93	1,682.31	72,519.87
E	**Floor Structures**	6,189.10	6,189.10	**5,244.20**	4,960.73	7,294.00	199,505.11
F	**Roof Structures**	5,477.81	5,477.81	**4,641.50**	4,390.61	7,228.00	178,121.14
G	**Windows & External Doors**	6,986.67	6,986.67	**5,920.00**	5,600.00	7,800.00	224,346.67
H	**Mastic Sealing**	608.97	675.00	**516.00**	488.11	724.00	19,708.84
I	**External Render**	4,808.64	8,995.00	**4,074.50**	3,854.26	9,996.00	167,850.36
J	**PVC Rainwater & Eaves**	1,176.05	1,485.00	**996.50**	942.64	1,813.74	39,074.28
K	**Roof Finishes**	4,967.97	4,967.97	**4,209.50**	3,981.96	6,067.75	160,567.77
L	**Roof Windows**	700.00	700.00	-	-	1,050.00	15,400.00
M	**Internal Door Supply**	2,580.00	2,580.00	**2,255.00**	2,133.11	2,951.00	83,871.32
N	**Ironmongery Supply**	201.00	201.00	**184.50**	184.50	245.50	6,708.49
O	**Joinery Timbers Supply**	1,063.11	1,063.11	**900.80**	852.11	1,298.45	34,360.25
P	**Joinery Carpentry Services**	2,804.58	2,804.58	**2,376.40**	2,247.95	3,425.44	90,645.74
Q	**Stairs Structures**	2,000.00	2,000.00	**1,975.00**	2,000.00	2,245.00	68,240.00
R	**Roof Insulation**	1,920.15	1,920.15	**1,627.00**	1,539.05	1,293.00	59,956.07
S	**Internal Plaster**	18,420.84	18,420.84	**15,608.50**	14,764.80	19,526.00	589,427.40
T	**Painting & Decoration**	4,995.70	4,995.70	**4,233.00**	4,004.19	6,101.62	161,464.16
U	**Floor & Wall Tiling**	1,555.00	1,555.00	**1,535.00**	1,452.03	1,899.24	53,049.55
V	**Wardrope Units**	2,200.00	2,200.00	**1,650.00**	1,650.00	2,687.02	68,624.05
W	**Kitchen & Utility Fittings**	4,750.00	4,750.00	**4,050.00**	4,050.00	4,950.00	152,800.00
X	**Sanitaryware Supply**	1,825.00	1,825.00	**1,821.00**	1,825.00	1,825.00	62,010.00
Y	**Mechanical Installation**	12,588.00	12,588.00	**12,080.00**	11,769.00	12,547.00	420,373.00
Z	**Electrical Installation**	7,018.00	7,018.00	**6,371.00**	6,371.00	7,350.00	230,865.00
Z1	**Photovoltaic Panels**	2,301.35	2,301.35	**1,950.00**	1,827.00	2,533.00	73,772.68
2	**Siteworks**						
A	**Site Development**	1,938.60	1,938.60	**1,938.60**	1,938.60	1,938.60	65,912.50
B	**Landscape Areas**	1,816.76	1,816.76	**1,816.76**	1,816.76	1,816.76	61,770.00
C	**Roads & Paths**	4,566.09	4,566.09	**4,566.09**	4,566.09	4,566.09	155,247.00
D	**External Works to Houses**	4,211.20	4,211.20	**4,211.20**	4,211.20	4,211.20	143,180.70
E	**Site Fittings**	165.88	165.88	**165.88**	165.88	165.88	5,640.00
F	**Site Boundaries**	7,160.44	7,160.44	**7,160.44**	7,160.44	7,160.44	243,455.00
H	**Watermain**	1,979.49	1,979.49	**1,979.49**	1,979.49	1,979.49	67,302.50
I	**Gas Services**	507.06	507.06	**507.06**	507.06	507.06	17,240.00
J	**Street Lighting**	730.96	730.96	**730.96**	730.96	730.96	24,852.50
L	**Comms & Power ducting**	1,287.00	1,287.00	**1,287.00**	1,287.00	1,287.00	43,758.00
M	**Surface Water Drains**	6,022.94	6,022.94	**6,022.94**	6,022.94	6,022.94	204,780.00
N	**Foul Drains**	4,359.81	4,359.81	**4,359.81**	4,359.81	4,359.81	148,233.50
3	**Preliminaries**	24,759.15	24,759.15	**24,759.15**	24,759.15	24,759.15	841,811.00
		209,001.19	220,571.65	**188,089.07**	182,242.33	240,864.59	
	X Number of units	*18*	*1*	***10***	*3*	*2*	
	Total Cost (Excluding VAT)	**3,762,021.35**	**220,571.65**	**1,880,890.74**	**546,727.00**	**481,729.17**	**€6,891,939.91**

D.2 Bill of Costs - 3 Bedroom House Extracted Summary

Case Study - 34 Unit Residential Development

House - Area Sq.m: 111

	ELEMENT	Type B - 3 bed Semi-Detached	Cost/sq.m	Percentage
1	**House - €128,583.70**	€	€	%
A	Substructures	14,874.00	134.00	7.9%
B	External Walls	19,785.00	178.24	10.5%
C	Internal Walls	7,719.00	69.54	4.1%
D	Air Tightness & Sound Tests	1,986.30	17.89	1.1%
E	Floor Structures	5,244.20	47.25	2.8%
F	Roof Structures	4,641.50	41.82	2.5%
G	Windows & External Doors	5,920.00	53.33	3.1%
H	Mastic Sealing	516.00	4.65	0.3%
I	External Render	4,074.50	36.71	2.2%
J	PVC Rainwater & Eaves	996.50	8.98	0.5%
K	Roof Finishes	4,209.50	37.92	2.2%
M	Internal Door Supply	2,255.00	20.32	1.2%
N	Ironmongery Supply	184.50	1.66	0.1%
O	Joinery Timbers Supply	900.80	8.12	0.5%
P	Joinery Carpentry Services	2,376.40	21.41	1.3%
Q	Stairs Structures	1,975.00	17.79	1.1%
R	Roof Insulation	1,627.00	14.66	0.9%
S	Internal Plaster	15,608.50	140.62	8.3%
T	Painting & Decoration	4,233.00	38.14	2.3%
U	Floor & Wall Tiling	1,535.00	13.83	0.8%
V	Wardrope Units	1,650.00	14.86	0.9%
W	Kitchen & Utility Fittings	4,050.00	36.49	2.2%
X	Sanitaryware Supply	1,821.00	16.41	1.0%
Y	Mechanical Installation	12,080.00	108.83	6.4%
Z	Electrical Installation	6,371.00	57.40	3.4%
Z1	Photovoltaic Panels	1,950.00	17.57	1.0%
2	**Siteworks - €34,746.23**			
A	Site Development	1,938.60	17.46	1.0%
B	Landscape Areas	1,816.76	16.37	1.0%
C	Roads & Paths	4,566.09	41.14	2.4%
D	External Works to Houses	4,211.20	37.94	2.2%
E	Site Fittings	165.88	1.49	0.1%
F	Site Boundaries	7,160.44	64.51	3.8%
H	Watermain	1,979.49	17.83	1.1%
I	Gas Services	507.06	4.57	0.3%
J	Street Lighting	730.96	6.59	0.4%
L	Comms & Power ducting	1,287.00	11.59	0.7%
M	Surface Water Drains	6,022.94	54.26	3.2%
N	Foul Drains	4,359.81	39.28	2.3%
3	**Preliminaries - €24,759.15**			
A	Supervision	7,989.88	71.98	4.2%
B	Health & Safety	571.47	5.15	0.3%
C	Attendances	5,492.94	49.49	2.9%
D	Site Accommodation & Consumables	508.82	4.58	0.3%
E	Site Enclosures	431.47	3.89	0.2%
F	Cleaning and Refuse Bins	1,557.35	14.03	0.8%
G	Site Services	411.18	3.70	0.2%
H	Security	545.59	4.92	0.3%
I	Scaffolding	3,317.65	29.89	1.8%
J	Plant	1,688.24	15.21	0.9%
K	Tests and Samples	90.44	0.81	0.0%
L	Developer Preliminaries	2,154.12	19.41	1.1%
	Total Cost (Excluding VAT)	188,089.08	1,694.50	100.0%

D.3 Bill of Costs – 3 Bedrom Semi-Detached House Case Study - 34 Unit Residential Development	Area 111 Sq.m

				€	€	€
A	**Substructures**					
1	Level & Compact Formation	105	m2	2.50	262.50	
2	Excavate trenches - ave depth 750mm	27	m3	8.00	216.00	
3	Disposal of excavated material	27	m3	26.00	702.00	
4	Disposal surface & ground water	1	item	100.00	100.00	
5	Formwork to sides of foundations	68	m	5.00	340.00	
6	Mesh in trenches - 1 layerof A393	27	m2	10.00	270.00	
7	Lean mix blinding in foundations	2	m3	105.00	210.00	
8	Concrete in foundations	9	m3	132.00	1,188.00	
9	Rising Walls - 375mm tk - av 900mm overall height	31	m2	75.00	2,325.00	
10	Rising Walls - 215mm tk - av 900mm overall height	13	m2	38.00	494.00	
11	Rising Walls - 100mm tk - av 900mm overall height	5	m2	20.00	100.00	
12	Forming & sealing opes for services thru rising walls	6	no	35.00	210.00	
13	DPC, width 100mm	21	m	1.00	21.00	
14	Weepholes - spaced	22	m	3.50	77.00	
15	RC Plinth - 500 x 700	1.5	no	150.00	225.00	
16	Concrete bed 35N grade 150mm depth	9	m3	150.00	1,350.00	
17	Powerfloat slab	56	m2	4.00	224.00	
18	Mesh - 1 layer of A252	56	m2	12.50	700.00	
19	Xtratherm under floor insulation - 125mm thick	56	m2	26.50	1,484.00	
20	Perimeter strip insulation - 150 x 25mm	31	m	7.50	232.50	
21	Radon barrier - Monoflex RMB350, incl over walls	68	m2	8.50	578.00	
22	E.O sealing around collars	8	no	12.00	96.00	
23	Radon sump	1	item	45.00	45.00	
24	Radon ducts, trenches, surrounds & backfill	6	m	25.00	150.00	
25	Bend & cap	1	item	45.00	45.00	
26	Hardcore SR21 Annex E fill material - av 225mm depth	13	m3	38.50	500.50	
27	Additional fill to make up levels - 225mm av	13	m3	38.50	500.50	
28	Backfill sides of foundations with Hardcore	12	m3	38.50	462.00	
29	Blind, level and compact h/c	56	m2	3.50	196.00	
30	Underfloor drainage- 100mm pipe in trench & surround	19	m	20.00	380.00	
31	Bends & connection to overground	5	no	15.00	75.00	
32	Masked opes in rising walls for drainage (single or combined)	3	no	35.00	105.00	
33	Short pipe through ope	5	no	25.00	125.00	
34	Rocker pipes & joints either side	10	no	25.00	250.00	
35	Underfloor water service pipe, insulation & trench	11	m	25.00	275.00	
36	Underfloor trench for gas pipework & cover plates	1	item	100.00	100.00	
37	Threshold channel and connection to carrier drains	1	item	260.00	260.00	
						14,874.00
B	**External Walls**					
1	100mm brickwork in cavity walls	38	m2	120.00	4,560.00	
2	100mm blockwork in cavity walls - outer leaf	107	m2	27.00	2,889.00	
3	100mm blockwork in cavity walls - inner leaf	145	m2	27.00	3,915.00	
4	Form cavity 150mm wide with S.S wall ties & weep holes	145	m2	5.00	725.00	
5	Kooltherm K8 cavity wall insulation 110mm tk	145	m2	26.50	3,842.50	
6	Cavity closers at window jambs	35	m	11.50	402.50	
7	Cavity closers at window heads	15	m	11.50	172.50	
8	Cill back c/w dpc + insulation	15	m	15.00	225.00	
9	Cavity barriers at party wall junction, eaves & verge	118	m	8.50	1,003.00	
10	Flexcell expansion strip in control joints	13	m	7.50	97.50	
11	Brickforce joint reinforcement below brick cills	4	no	35.00	140.00	
12	Steel lintel - 1650mm length	1	no	52.00	52.00	
13	Steel lintel - 1775mm length	1	no	62.00	62.00	
14	Steel lintel - 2100mm length	2	no	81.00	162.00	
15	HD Steel lintel insulated - 2850mm length	1	no	205.00	205.00	
16	RC Beams - 1250mm length	1	no	55.50	55.50	
17	RC Beams - 3500mm length	1	no	77.50	77.50	
18	Spanlite lintel - 914mm length	6	no	10.00	60.00	
19	Spanlite lintel - 1066mm length	4	no	11.00	44.00	
20	Spanlite lintel - 1219mm length	4	no	13.00	52.00	
21	Spanlite lintel - 1371mm length	4	no	14.00	56.00	
22	Spanlite lintel - 2286mm length	2	no	23.00	46.00	
23	Concrete Cills - 890mm length	2	no	20.00	40.00	

24	Concrete Cills - 1115mm length	2	no	23.00	46.00	
25	Concrete Cills - 2015mm length	1	no	41.00	41.00	
26	Ingranite Cills - 890mm length	1	no	40.00	40.00	
27	Ingranite Cills - 1565mm length	1	no	62.00	62.00	
28	Ingranite Cills - 2690mm length	2	no	216.00	432.00	
29	Ingranite Feature Entablature	1	item	100.00	100.00	
30	ESB & Gas Meter Boxes incl hockey sticks	2	no	50.00	100.00	
31	EIR & TV boxes incl hockey sticks	2	no	40.00	80.00	
						19,785.00
C	**Internal Walls**					
1	215mm blockwork in party walls	74	m2	54.00	3,996.00	
2	Cutting finish top of wall to 35 degree angle	12	m	54.00	648.00	
3	100mm timber stud partition	105	m2	25.00	2,625.00	
4	Intersections	1	item	175.00	175.00	
5	Forming & bolstering doorways	11	no	25.00	275.00	
6	Pipe casings, 75 x 44mm	10	m	15.00	150.00	
7	Insulation wrapping to SVP in casings	6	m	12.50	75.00	
8	Ditto, to waste pipes	13	m	4.75	61.75	
9	Stud wall, bath frame, 100 x 44mm	1	item	75.00	75.00	
						7,719.00
D	**Air Tightness & Sound Testing**					
1	Air tightness membrane & paste to ceiling juntions	102	m	6.50	663.00	
2	Ditto to around windows, doors & exterior apertures	65	m	6.50	422.50	
3	Seal pipes through ducts & ceilings	10	no	7.50	75.00	
4	Air Infiltration - ducts/boxing concealing services to be sealed top and bottom	4	no	15.00	60.00	
5	Seal below window board and between skirting & floor	114	m	3.00	342.00	
6	Seal floor joist shoes	56	m	3.55	198.80	
7	Air Tightness Testing & report	1	no	195.00	195.00	
8	Sound testing & report	1	no	30.00	30.00	
						1,986.30
E	**Floor Structures**					
1	Easi-Joist or similar floor cassette units - 304 x 70mm	154	m	21.22	3,267.88	
2	Trimmer Joist	4	m	25.00	100.00	
3	Strongbacks	57	m2	0.85	48.45	
4	Lateral restrainting - straps	12	no	8.50	102.00	
5	Noggins	24	no	4.50	108.00	
6	Restraint type joist hangers, incl sealing	52	no	6.00	312.00	
8	Metalwork - miscellaneous (subcontractor figure)	57	m2	2.66	151.62	
9	22mm T&G Chipboard Deck	57	m2	20.25	1,154.25	
						5,244.20
F	**Roof Structures**					
1	T1 Fink Trusses - 10.0 m span, 35 degree pitch, 600mm overhangs	11	no	195.00	2,145.00	
2	Peak Front Trusses & timbers - tapering	7	no	35.00	245.00	
3	Truss Clips	1	item	50.00	50.00	
4	Lateral restrainting - straps	16	no	8.50	136.00	
5	Noggins	32	no	4.50	144.00	
6	Bracing & ties	57	m2	4.00	228.00	
7	Tilting fillet	13	m	6.50	84.50	
8	Wallplate, mechanically fixed and on a mortar bed	12	m	15.75	189.00	
9	Wallplate strapping	10	no	10.50	105.00	
10	Rockwool firestop packing to u/s of roof felt	13	m	12.00	156.00	
11	Rockwool boards 1.5 m wide to either side	13	m	17.50	227.50	
12	Reinforced mineral wool at eaves junction of party wall	1	no	45.00	45.00	
13	Plywood backing & bracing to fascia / soffit - horizontal	9	m	18.50	166.50	
14	Plywood backing & bracing to fascia / soffit - diagonal	21	m	20.00	420.00	
15	Plywood backing & bracing to fascia / soffit - junctions	7	no	25.00	175.00	
16	Spreaders, WBP platform cistern base	1	no	125.00	125.00	
						4,641.50
G	**Windows & External Doors**					
	uPVC Double Glazed					
1	675 x 1050mm	4	no	185.00	740.00	
2	675 x 1300mm	1	no	230.00	230.00	

3	675 x 1650mm	1	no	290.00	290.00	
4	900 x 1300mm	1	no	305.00	305.00	
5	1800 x 1300mm	1	no	480.00	480.00	
6	2250 x 1575mm	1	no	650.00	650.00	
7	2250 x 2100mm	1	no	825.00	825.00	
9	2475 x 2100mm Terrace screen / d.doors	1	no	1,250.00	1,250.00	
8	1350 x 2100 hardwood front door, with side panel	1	no	1,150.00	1,150.00	
						5,920.00
H	**Mastic Sealing**					
1	Seal to window surrounds	52	m	4.50	234.00	
2	Seal to doors, expansion joints, service boxes	17	m	6.00	102.00	
3	Mastic sealing to Sanitaryware	45	m	4.00	180.00	
						516.00
I	**External Render**					
1	Weberpral D (or equal) - one coat colour render system - including beads/angles to reveals, belcast etc + sand & cement plinth	129	m2	30.50	3,934.50	
2	E.o for plinth on front elevation 38mm thick, splayed	7	m	20.00	140.00	
						4,074.50
J	**PVC Rainwater & Eaves System**					
1	Gutters	9	m	12.00	108.00	
2	Ends	3	no	8.50	25.50	
3	Outlet	2	no	13.00	26.00	
4	Downpipe	12	m	10.00	120.00	
5	Shoe	2	no	8.50	17.00	
6	Swan-neck	2	no	13.00	26.00	
7	Fascia / soffit - horizontal	9	m	18.50	166.50	
8	Fascia / soffit - diagonal	21	m	20.00	420.00	
9	Junctions	7	no	12.50	87.50	
						996.50
K	**Roof Finishes**					
1	Concrete roof tiles, battens & breather felt	86	m2	27.00	2,322.00	
2	Ridge tile	11	m	32.00	352.00	
3	Eaves courses	9	m	14.00	126.00	
5	Dry verge detail	21	m	17.50	367.50	
6	Cutting tiles, gutter board & lead flashing at intersection	12	m	65.00	780.00	
7	Roof ventilation continuous 10mm at eaves	9	m	8.50	76.50	
8	Roof ventilation continuous 10mm at ridge	11	m	10.50	115.50	
9	Proprietary roof tiles for EAV & SVP outlets	2	no	35.00	70.00	
10	Cover flashing	0	m	60.00	-	
						4,209.50
L	**Roof Windows**					
1	Rooflight 600 x 900mm	-	no	350.00	-	
						-
M	**Internal Doors Supply**					
	Solid core contemporary doors in red deal frame, morticed for door furniture & including hinges					
1	Doorsets, single 900 x 2050mm; 30 min rated	11	no	180.00	1,980.00	
2	Doorsets, double 1800 x 2050mm; 30 min rated	1	no	275.00	275.00	
						2,255.00
N	**Ironmongery Supply**					
1	Brush Chrome internal door Handles & mortice lock - Interlock	13	no	10.50	136.50	
2	E.o turn & release for WC/Bathrooms	3	no	5.00	15.00	
3	Floor stops - skirting	8	no	1.63	13.00	
4	Floor stops - floor	2	no	5.00	10.00	
5	External Door Numerals	1	no	10.00	10.00	
						184.50
O	**Joinery Timbers Supply**					
1	Spar shelving 50 x 22mm PAO	60	m	0.75	45.00	
2	Skirting boards 145 x 18mm half splayed top	51	m	2.50	127.50	
3	Skirting boards 120 x 18mm half splayed top	51	m	2.20	112.20	

4	Architrave 69 x 18mm half splayed top	126	m	1.85	233.10	
5	Window boards, 200mm wide, bullnosed (18 ends) and softwood grounds	8	m	13.50	108.00	
6	Non climbable window guard to front 1st floor window 2.25m wide	1	item	275.00	275.00	
						900.80
P	**Joinery Carpenter Services**					
1	Fixing bath panel	1	no	25.00	25.00	
2	Spar shelving - 2 shelves	1	item	120.00	120.00	
3	Skirting boards 150 and 125mm wide	102	m	5.00	510.00	
4	Window boards, 200mm wide, bullnosed	8	m	15.00	120.00	
5	Lower ceilings and fire detail in utility	7	m2	26.00	182.00	
6	Slab catchers to stairs	1	item	35.00	35.00	
7	Entrance soffit timbers	1	item	35.00	35.00	
8	Architraves	126	m	3.15	396.90	
9	Fitting composite single doorsets	11	no	50.00	550.00	
10	Fitting composite double doorsets	1	no	75.00	75.00	
11	Fitting brush chrome handleset & mortice lock	13	no	12.50	162.50	
12	Install attic stairs with Architrave	1	item	75.00	75.00	
13	Fitting door stops - skirting & floor	10	nr	10.00	100.00	
14	Fitting door numeral	1	nr	15.00	15.00	
						2,376.40
Q	**Stairs Structures and Attic Stairs**					
1	Straight flight, including banisters, newel posts etc.	1	item	1,500.00	1,500.00	
2	E.O for hardwood handrail	1	item	250.00	250.00	
3	Proprietary attic stairs & insulated hatch	1	item	225.00	225.00	
						1,975.00
R	**Attic & closed roof Insulation**					
1	300mm Rockwool Insulation	62	m2	13.50	837.00	
2	XT/Walk-R Loft Decking	10	m2	45.00	450.00	
3	Insulating service pipes in Attic & concealed ducts	36	m	4.75	171.00	
4	Insulating EAV ductwork	12	m	9.50	114.00	
5	Insulation to cistern	1	no	55.00	55.00	
						1,627.00
S	**Internal Plastering**					
1	Hardwall plaster to blockwork	121	m2	27.00	3,267.00	
2	Hardwall plaster to blockwork - in roofspace	20	m2	20.00	400.00	
3	Plasterboard 9.5mm board & skim to metal base on separating wall	54	m2	25.00	1,350.00	
4	Drylining frame & 13mm mineral wool quilted lining to separating walls - eliminating chases for sockets	54	m2	13.50	729.00	
5	Angle beads & reveal/heads	50	m2	13.00	650.00	
6	Plasterboard 9.5mm & skim to timber studs	210	m2	25.00	5,250.00	
7	E.o moisture resistant board to wet room areas	25	m2	27.50	687.50	
8	Plasterboard 12.5mm board & skim to G.floor ceiling	56	m2	27.50	1,540.00	
9	Plasterboard 12.5mm board & skim to F.floor ceiling	56	m2	27.50	1,540.00	
10	E.o moisture resistant board to wet room areas	9	m2	5.00	45.00	
11	E.o soil pipe boxings	1	item	150.00	150.00	
						15,608.50
T	**Painting & Decoration**					
1	Emulsion paint to Internal plastered walls	331	m2	5.00	1,655.00	
2	Ditto to Ceilings	210	m2	5.00	1,050.00	
3	Door leaf - pre-finished	44	m2	10.00	440.00	
4	Door linings	60	m	5.00	300.00	
5	Skirtings	102	m	4.00	408.00	
6	Window boards - short lenghts (9 units overall)	8	m	10.00	80.00	
7	Staircase	1	no	300.00	300.00	
						4,233.00
U	**Floor & Wall Tiling**					
1	Wall tiling - Bathrooms	21	m2	40.00	840.00	
2	Waterproof sealer over shower/bath wall	1	item	90.00	90.00	
3	Floor tiling - Bathrooms	8	m2	40.00	320.00	
4	Skirting Tile	7	m	15.00	105.00	
5	Leveling board to floor	8	m2	22.50	180.00	

						1,535.00
V	**Wardrope Units**					
	Contemporary Doors with veneer inner carcase					
1	Straight length 2000mm	2	no	650.00	1,300.00	
2	Straight length 1000mm	1	no	350.00	350.00	
						1,650.00
W	**Kitchen, Utility & Fittings**					
1	Kitchen Unit - straight length 5000mm	1	no	3,750.00	3,750.00	
2	Utility Counter tops - straight lengths 1 x 2600mm	1	item	300.00	300.00	
3	White goods	1	item	optional		
						4,050.00
X	**Sanitaryware - supply**					
1	WC	3	no	152.00	456.00	
2	WHB	3	no	115.00	345.00	
3	Shower & enclosure	1	no	545.00	545.00	
4	Bath & screen	1	no	375.00	375.00	
5	Mirror	2	no	50.00	100.00	
						1,821.00
Y	**Mechanical Installation**					
1	Heating System - Boiler distribution system & radiators	1	item	4,593.00	4,593.00	
2	Plumbing hot & cold water services	1	item	3,404.00	3,404.00	
3	Soils & wastes	1	item	473.00	473.00	
4	Sanitaryware installation	1	item	645.00	645.00	
5	EAV Ventilation	1	item	2,965.00	2,965.00	
6	MEV validation by independent accredited person	1	item	125.00	125.00	
						12,080.00
Z	**Electrical Installation**					
1	Earth, bond, label & testing	1	item	209.00	209.00	
2	General service - wiring, outlets & consumer unit	1	item	2,695.00	2,695.00	
3	General lighting - wiring, switches, pendants & fittings	1	item	2,021.00	2,021.00	
4	Fire alarm installation	1	item	632.00	632.00	
5	Security alarm wiring	1	item	161.00	161.00	
6	Data wiring & containment	1	item	298.00	298.00	
7	Wiring to mechanical power & controls	1	item	247.00	247.00	
8	Wiring to PV panel system	1	item	108.00	108.00	
						6,371.00
Z1	**Photovoltaic Panels**					
1	Black PV panels, bracket mounting system, weather proof cable entry AC invertors, fireman isolator & cabling					
	Average cost based on various orientations	1	item	1,950.00	1,950.00	
						1,950.00
	Total Construction Cost of House Type A (Excluding VAT)					€128,583.70

D.4 Bill of Costs - Siteworks
Case Study – 34 Unit Residential Development

Area
4240 Sq.m

A	**Site Development**				€	€
1	Undergrounding overhead ESB lines	91	m	28.50	2,593.50	
2	Clear site of trees and hedgerows at site entrance	74	m	97.00	7,178.00	
3	Strip topsoil 300mm depth - to spoil heaps	13,122	m2	1.00	13,122.00	
4	Disposal of topsoil on site	3937	m3	4.00	15,748.00	
5	Excavate to Reduce levels across site	1965	m3	5.00	9,825.00	
6	Disposal of excavated material on site	1965	m3	4.00	7,860.00	
7	Respread incl grading, falls etc	4793	m3	2.00	9,586.00	
						65,912.50
B	**Landscape Areas**					
1	Spread & level topsoil - rear/front gardens, 300mm depth	34	no	335.00	11,390.00	
2	Spread & level topsoil in open spaces	1974	m2	2.50	4,935.00	
3	Forming swale - include pea gravel	60	m	15.00	900.00	
4	Rake, seed & nurture	1974	m2	2.50	4,935.00	
5	Planting in front gardens	34	no	715.00	24,310.00	
6	Planting in open spaces	1	item	10,100.00	10,100.00	
7	Paths in open spaces - 1.0 m wide meandering	80	m	65.00	5,200.00	
						61,770.00
C	**Roads, Paths & Pavings**					
	Public Areas					
1	50mm tk Road Spec Asphalt - base course	1887	m2	13.50	25,474.50	
2	80mm tk Road Spec Asphalt - wearing course	1887	m2	15.00	28,305.00	
3	Raising irons for wearing course & regulating levels	1	item	1,980.00	1,980.00	
4	Road interface with other phases	1	item	1,275.00	1,275.00	
5	Thermo plastic paint - road markings	1	item	1,050.00	1,050.00	
6	Public footpath, 150mm depth with mesh, finished	868	m2	32.00	27,776.00	
7	Formwork to public footpaths	964	m	8.00	7,712.00	
8	Base Kerbs	614	m	13.00	7,982.00	
9	Finished Kerbs	125	m	17.50	2,187.50	
10	Hardcore cl 808 road sub base- 300mm depth	566	m3	38.50	21,791.00	
11	E.o to make up levels	377	m3	38.50	14,514.50	
12	Hardcore cl 808 paths sub base- 150mm depth	217	m3	38.50	8,354.50	
13	Level & compact to cross falls	2738	m2	2.50	6,845.00	
						155,247.00
D	**External Works to Houses**					
1	Concrete paths - sides & rear, 100mm depth (23m2 av)	782	m2	24.10	18,846.20	
2	Formwork 100mm high to paths (17m av)	578	m	8.50	4,913.00	
3	Hardcore cl 808 paths sub base- 400mm ave depth	313	m3	38.50	12,050.50	
4	Permeable Paving in driveways (av 45m2)	1530	m2	45.00	68,850.00	
5	Capping layer hardcore 150mm depth	230	m3	39.50	9,085.00	
6	Permeable grade hardcore 350mm depth	536	m2	43.50	23,316.00	
7	Terram geotextile membrane	1530	m2	4.00	6,120.00	
						143,180.70
E	**Site Fittings**					
1	Road signage	3	item	250.00	750.00	
2	Other - playground equipment/features/direction signs	1	item	4,890.00	4,890.00	
						5,640.00
F	**Site Enclosures / boundaries**					
1	Trench excavation & disposal/backfill	473	m3	25.00	11,825.00	
2	Side shutter edge of fdn	1050	m	8.00	8,400.00	
3	Concrete in foundations	157	m3	132.00	20,724.00	
4	Mesh in foundations	525	m2	10.00	5,250.00	
5	Rising walls - 215mm solid blockwork	80	m2	38.00	3,040.00	
6	Rising walls - 325mm solid blockwork	314	m2	52.00	16,328.00	
7	Blockwork in 215mm hollow - fair faced	1050	m2	40.00	42,000.00	
8	Piers to last	201	no	53.00	10,653.00	
9	Concrete copings	270	m	25.00	6,750.00	
10	E.O for Ingranite copings	73	m	45.00	3,285.00	
11	Ingranite pier caps	6	no	125.00	750.00	
12	Brickwork facework	346	m2	120.00	41,520.00	
13	Brick cappings	255	m	30.00	7,650.00	
14	Low garden walls complete - to end houses	74	m	255.00	18,870.00	
15	Post & plank fence	34	no	1,190.00	40,460.00	
16	Gates & side panels	34	no	175.00	5,950.00	
						243,455.00

	Site Services					
H	***Watermain***					
1	Watermain trench, bed, cover & backfill	385	m	17.50	6,737.50	
2	E.o road crossings	5	no	200.00	1,000.00	
3	100mm HDPE pipe watermain	385	m	27.00	10,395.00	
4	Bends and T junctions	9	no	75.00	675.00	
5	Thrust blocks	12	no	85.00	1,020.00	
6	Hydrant, chamber & marker plate	3	no	750.00	2,250.00	
7	Sluice Valve, chamber & marker plate	6	no	750.00	4,500.00	
8	Scour Valve, chamber & marker plate	1	no	750.00	750.00	
9	Air Vent	1	no	750.00	750.00	
10	Bulk Meter, Chamber & Kiosk	1	no	6,630.00	6,630.00	
11	Ancillary fittings for connections, incl SV & Hydrant	1	item	1,650.00	1,650.00	
12	Meter log installation & test procedures	1	item	1,150.00	1,150.00	
13	I.W charge for meter & inspections	1	item	385.00	385.00	
14	Cleansing system & testing, as required by IW	1	item	2,390.00	2,390.00	
15	Connection to extg mains in Berford Site 1	1	item	1,350.00	1,350.00	
	House connections					
16	Combined service trench to house, blind & backfill	340	m	15.00	5,100.00	
17	Hydrodare to sink	680	m	10.00	6,800.00	
18	Meter /boundary box including electro fusion joints connecting polyethylene pipes	34	no	275.00	9,350.00	
19	Destructive weld testing and independent 3rd party certification of joints	34	no	130.00	4,420.00	
						67,302.50
L	***Gas Services***					
1	Gas trench, blind & backfill	403	m	20.00	8,060.00	
2	E.o road crossings	5	no	200.00	1,000.00	
3	100mm gas pipe, incl bends/tees/blanks etc - (by others)	385	m	-		
4	Breaking out & make good for connection in Berford Ph.1	1	item	1,350.00	1,350.00	
	House connections					
4	Combined service trench to house, blind & backfill	340	m	15.00	5,100.00	
5	Prepare for working pipe to wall box	34	no	20.00	680.00	
6	Builders work for Gas connections	1	item	1,050.00	1,050.00	
						17,240.00
I	***Street Lighting***					
1	Street Lighting trench, bed, cover & backfill	287	m	20.00	5,740.00	
2	E.o road Crossings	2	m	250.00	500.00	
3	100mm ducts	287	m	7.50	2,152.50	
4	Bends/tees etc	28	no	20.00	560.00	
5	Lighting pillar & chambers complete	6	no	500.00	3,000.00	
6	Light column bases complete	9	no	150.00	1,350.00	
7	Street Lighting	1	item	11,550.00	11,550.00	
						24,852.50
J	***Telephone, Broadband & ESB Power***					
1	Combined trench, bed, cover & backfill	403	m	40.00	16,120.00	
2	100mm Eir/Virgin duct, incl bends/tees etc	1209	m	7.50	9,067.50	
3	125mm ESB duct, incl bends/tees/draw wires etc	403	m	8.50	3,425.50	
4	ESB mini-pillar & chambers complete	3	no	955.00	2,865.00	
5	Eir/Virgin Access chambers complete	3	no	740.00	2,220.00	
	House connections					
6	Combined service trench to house, blind & backfill	340	m	15.00	5,100.00	
7	50mm pipe, trench to house	340	m	6.50	2,210.00	
8	Hockey stick bend	34	no	20.00	680.00	
9	Prepare for working pipe to wall boxes	34	no	30.00	1,020.00	
10	Builders work for ESB, Eir & Virgin connections	1	item	1,050.00	1,050.00	
						43,758.00
	Drainage					
M	***Surface Water***					
	Excavate trenches, disposal, bed, surround & backfill					
1	500 - 1000mm depth	136	m	35.00	4,760.00	
2	1000 - 1500mm depth	401	m	55.00	22,055.00	
3	1000 - 1500mm depth incl 225mm perforated land drain	130	m	100.00	13,000.00	
4	Surface & ground water disposal	1	item	1,100.00	1,100.00	
	UPVC Pipes					
5	100mm diameter	272	m	11.00	2,992.00	
6	150mm diameter	45	m	25.00	1,125.00	
7	225mm diameter	219	m	38.00	8,322.00	
	Saddle Junctions					
8	100/225mm connections	34	no	100.00	3,400.00	

9	150/225mm connections	11	no	110.00	1,210.00	
10	Road Gullies	11	no	400.00	4,400.00	
	Manholes					
11	1000 to 1500mm depth	8	no	1,250.00	10,000.00	
12	1500 to 2000mm depth	1	no	1,750.00	1,750.00	
13	E.O for Hydrobrake	1	no	1,750.00	1,750.00	
14	Connection to existing MH in Berford Ph.1	1	no	2,500.00	2,500.00	
15	Bypass Interceptor NSBE010, class 2	1	no	2,750.00	2,750.00	
16	Testing, commisioning & CCTV survey	1	item	2,450.00	2,450.00	
	Attenuation System					
17	Stormcell MC-4500, volume 310m3 - supply & install	1	no	34,100.00	34,100.00	
18	Installation of system including Geosynthetic wraps	1	no	5,150.00	5,150.00	
19	Excavation of pit	702	m3	5.00	3,510.00	
20	Perimeter stone	236	m3	35.00	8,260.00	
21	Backfill above stone	156	m3	4.00	624.00	
22	Disposal of surplus excavated material on site	546	m3	4.00	2,184.00	
	Surface - Carrier					
	Excavate trenches, disposal, bed, surround & backfill					
23	less than 500mm	544	m	15.00	8,160.00	
24	500 - 1000mm depth	544	m	35.00	19,040.00	
	UPVC Pipes complete, incl connections etc					
25	100mm diameter	1088	m	11.00	11,968.00	
26	Bends, splay branches, junctions etc	34	packs	95.00	3,230.00	
	Accessories complete, incl bends/connections etc					
27	Gully trap	102	no	95.00	9,690.00	
28	A.J	102	no	150.00	15,300.00	
						204,780.00
N	***Foul - Main***					
	Excavate trenches, disposal, bed, surround & backfill					
1	500 - 1000mm depth	90	m	35.00	3,150.00	
2	1000 - 1500mm depth	91	m	55.00	5,005.00	
3	1500 - 2000mm depth	317	m	85.00	26,945.00	
4	Marker tape	498	m	0.25	124.50	
5	Surface & ground water disposal	1	item	490.00	490.00	
	UPVC Pipes					
6	100mm diameter	272	m	11.00	2,992.00	
7	150mm diameter	87	m	25.00	2,175.00	
8	225mm diameter	139	m	38.00	5,282.00	
	Saddle Junctions					
9	100/150mm connections	34	no	100.00	3,400.00	
10	100/225mm connections	11	no	110.00	1,210.00	
	Manholes					
11	1000 to 1500mm depth	1	no	1,250.00	1,250.00	
12	1500 to 2000mm depth	5	no	1,750.00	8,750.00	
13	2000 to 2500mm depth	1	no	2,250.00	2,250.00	
14	Connection to existing MH in previous phase	1	no	1,500.00	1,500.00	
15	Testing, commisioning & CCTV survey	1	item	2,450.00	2,450.00	
	Foul - Carrier					
	Excavate trenches, disposal, bed, surround & backfill					
16	less than 500mm	544	m	15.00	8,160.00	
17	500 - 1000mm depth	544	m	27.50	14,960.00	
18	Marker tape	1088	m	0.25	272.00	
	UPVC Pipes complete, incl connections etc					
19	100mm diameter	1088	m	11.00	11,968.00	
20	Bends, splay branches, junctions etc	34	packs	95.00	3,230.00	
	Private side Manholes with concrete aprons					
21	500 to 1000mm depth	34	no	550.00	18,700.00	
	Accessories complete, incl bends/connections etc					
22	B.I.G.T	102	no	85.00	8,670.00	
23	A.J	102	no	150.00	15,300.00	
						148,233.50
	Total Cost of Siteworks (Excluding VAT)					€1,181,371.70

D.5 Bill of Costs - Preliminaries
Case Study – 34 Unit Residential Development

13 Months (56 Weeks)

A	Supervision	No	Time %	Item	Rate €	Amount €	Total €	Gross %
1	Contracts Manager	56	33%	weeks	1800	33,264.00		
2	Site Manager	56	100%	weeks	1550	86,800.00		
3	Commercial Manager	56	33%	weeks	1800	33,264.00		
4	Site Quantity Surveyor	56	100%	weeks	1200	67,200.00		
5	Site Engineer / junior manager	56	33%	weeks	1100	20,328.00		
6	Health Safety & Environment Officer	56	50%	weeks	1100	30,800.00		
7	M&E Coordinator	56	0%	weeks	1100	0.00		
							271,656.00	32.27%
B	**Health & Safety**							
1	PPE & Equipment	56	100%	weeks	45	2,520.00		
2	Protective Netting	18	100%	blocks	325	5,850.00		
3	Barriers & Cones	1	100%	Item	1100	1,100.00		
4	Training – incl Safepas + C. Skills	1	100%	item	7500	7,500.00		
5	Appoint Safety Rep	1	100%	Item	0	0.00		
6	Appoint Site Safety Advisor	1	100%	Item	0	0.00		
7	Evacuation Drills	1	100%	item	500	500.00		
8	Pest Control	56	100%	weeks	35	1,960.00		
							19,430.00	2.31%
C	**Attendances**							
1	Housekeeping & Cleaning GO	1	100%	56	1105	61,880.00		
2	General Operatives	1	100%	56	1105	61,880.00		
3	Teleporter Driver	1	100%	56	1125	63,000.00		
							186,760.00	22.19%
D	**Site Accommodation & Consumables**							
1	Office Cabins	3	100%	56	30	5,040.00		
2	Canteens	2	100%	56	25	2,800.00		
3	Drying Rooms	1	100%	56	25	1,400.00		
4	Toilets	2	100%	56	30	3,360.00		
5	Stores	3	100%	56	25	4,200.00		
6	Office Furniture & stationery	1	100%	Item	500	500.00		
							17,300.00	2.06%
E	**Site Enclosures**							
1	Hoarding	78	100%	m	115	8,970.00		
2	Heras fencing	1	100%	item	1000	1,000.00		
3	Entrance Gates	1	100%	No	1500	1,500.00		
4	Compound Hardstanding & Access	1	100%	item	2100	2,100.00		
5	Silo bases	2	100%	no	550	1,100.00		
							14,670.00	1.74%
F	**Cleaning and Refuse Bins**							
1	Sparkle Clean	34	100%	no	275	9,350.00		
2	Protecting surfaces	1	100%	item	750	750.00		
3	Refuse skips	1	100%	56	450	25,200.00		
4	Enviro bins	1	25%	56	325	4,550.00		
5	Bin Separation Area	1	100%	item	500	500.00		
6	Road Sweeper	1	100%	56	225	12,600.00		
							52,950.00	6.29%
G	**Site Services**							
1	Temporary Electrics	1	100%	item	1500	1,500.00		
2	Electrical Power	1	100%	56	125	7,000.00		
3	Water Connection	1	100%	Item	1000	1,000.00		
4	Broadband	1	100%	56	50	2,800.00		
5	Mobile Phones	2	100%	56	15	1,680.00		
							13,980.00	1.66%

H	**Security**							
1	Night Security call outs / specific	1	100%	Item	5,000.00	5,000.00		
2	Netwatch installation	1	100%	Item	2350	2,350.00		
3	Netwatch monitoring	1	100%	56	200	11,200.00		
							18,550.00	2.20%
I	**Scaffolding**							
1	Scaffold Hire – by block	18	100%	blocks	4500	81,000.00		
2	GA3 inspections & Dayworks	1	50%	56	1100	30,800.00		
3	Mobile Towers	1	100%	item	1000	1,000.00		
							112,800.00	13.40%
J	**Plant**							
1	Small plant & Tools	1	100%	56	75	4,200.00		
2	Diesel tank & fill	1	100%	56	100	5,600.00		
3	Generators	1	100%	56	100	5,600.00		
4	Dumper	0	100%	56	110	0.00		
5	Teleporter Forks	2	100%	56	375	42,000.00		
							57,400.00	6.82%
K	**Tests and Samples**							
1	Concrete Cubes	34	100%	units	50	1,700.00		
2	CBRs on sub grade	4	100%	No	250	1,000.00		
3	Sample brick panels	3	100%	No	125	375.00		
							3,075.00	0.37%
L	**Developer Preliminaries**							
1	P.I for PSCS role	1	100%	item	1500	1,500.00		
2	P.I for BC(A)R obligations	1	100%	item	1500	1,500.00		
3	Commencement Notice Fees	34	100%	units	30	1,020.00		
4	Assigned Certifier	1	100%	34	950	32,300.00		
5	Ancillary Certifier - Civil & Structure	1	100%	34	510	17,340.00		
6	Ancillary Certifier - Mech & Elec	1	100%	34	370	12,580.00		
7	PSDP	1	100%	item	7000	7,000.00		
8	PSCS - incl in supervision	1	100%	item	0	0.00		
9	BER Certification & Part L Reports	1	100%	34	155	5,270.00		
10	BER Issuing Authority Fees	1	100%	34	370	12,580.00		
11	Geotechnical Investigation & Topo	1	100%	item	7500	7,500.00		
12	Archaeological tests, attendances & report	1	100%	item	17860	17,860.00		
							73,240.00	8.70%
	Total Preliminaries Cost 2022	Excl VAT					841,811.00	100.00%

Appendices E

COMBINED DATA FROM STAGE 1 AND STAGE 2

E.1 Building Regulations Upgrade Costed

TGDs: Part A - Structure

	Provision	Quantity	Unit	Rate	Total €	CVR Reference	TGD Section Ref
A1	**1991**						
1	Blocks 7N/mm2 when a storey is higher than 2.7 M	4720	no	0.07	330.40	A9-12 + B2-3	Diagram C8, note 2
2	Bricks 7N/mm2 when a storey is higher than 2.7 M	2580	no	0.05	129.00	B1	Diagram C8, note 2
3	Wall lateral strapping & noggins to floors with 30x5mm galv @ NMT 2.0m c/c						Diagram C14 a+b
a	Straps	12	no	8.50	102.00	E4	
b	Noggins	24	no	4.50	108.00	E5	
4	Restraint type joist hangers or longitudinal floor strapping	52	no	4.00	208.00	E6	Diagram C14c
5	Wall lateral strapping & noggins to roof gables with 30x5mm galv @ NMT 2.0m c/c						Diagram C15 a-b
a	Straps	16	no	8.50	136.00	F4	
b	Noggins	32	no	4.50	144.00	F5	
A2	**1997**						
1	Restraint type joist hangers to floor joists	52	no	4.00	208.00	E6	1.1.3.24 (b)
2	Vertical strapping of wall plate to wall 30x5mm galv @ 2.0m c/c	10	no	10.50	105.00	F9	Diagram 7c
3	Wall tie spacing 3 per M2 and every course at jambs		no case change applied				Diagram 9
A3	**2012**						
1	Parameters for notches & holes through floor joists - (Part L 2011 + 2019 press for cassette floors to contain services & ducting)						1.1.2.5
a	Easi-Joist floor cassette 300 x 72 @ 400mm centres	154	m	11.22	1,727.88	E1	
2	Clay bricks - Group 1 compressive strenght NLT 9N/mm2 and 13N/mm2 - Groups 1 + 2	2580	no	0.05	129.00	B1	1.1.3.5
3	Mortar Strenght class M4 - nominally 1:1:6		no case change applied				1.1.3.5
4	Wall ties should be austenitic steel	528	no	0.12	63.36	B4	1.1.3.27
5	Wall tie spacing 4.9 per M2 and at 300mm c/c at verges & movement joints	428	no	0.50	214.00	B4	1.1.3.27 + Diagram 9
6	Movement Joints - 18mm cell material and mastic seal	13	m	13.50	175.50	B10	1.1.3.27 + Diagram 9

TGDs: Part B - Fire Safety

	Provision	Quantity	Unit	Rate	Total €	CVR Reference	TGD Section Ref
B1	**1991**						
1	Compartment wall between dwellings 60/60 fire resistence						Table A1 + 3.2.4.2
a	215mm solid concrete blockwork in lieu of hollowblock	74	m2	10.10	747.40	C1	
2	Junction of compartment wall with roof - resilent firestop to u/s of roof and rockwool slabs to u/s of roof covering at least 1.5 m on each side						Diagram B3.2
a	rookwool firestop packing	13	m	12.00	156.00	F10	
b	rockwool slabs 1.5 m wide	13	m	17.50	227.50	F11	
3	Cavity barrier to be provided at the compartment wall junction	6	m	8.50	51.00	B9	3.3.2 + Table 3.2
4	Fire resistence 30/15/15 of upper floor of 2 storey from underside						Table A1
a	12.5m board in lieu of 9.5mm board	56	m2	3.00	168.00	S8	
5	Fire resistence 30/30/30 of roof from underside						Table A1
a	12.5mm board in lieu of 9.5mm board	56	m	3.00	168.00	S9	
B2	**1997**						
1	Stairways serving an upper floor should be enclosed by storey height construction. Open Plan acceptable with certain provisions		no case change applied				1.5.2(ii)
2	Fire detection and alarm system Grade D - LD2 to be provided	1	item	220.00	220.00	Z4	1.5.2(iii) + 1.5.5.2 + 3

3	Windows to bedrooms to act as a means of escape and provide minimum unobstructed opening of 500 x 850mm			no case change applied			1.5.6 + 1.5.8.2
4	Provide 50mm thick wire reinforced mineral wool at compartment wall eaves soffit junction	1	no	45.00	45.00	F12	Diagram 13B
B3	**2006 (and 2006 reprint 2020)**						
1	No tangible cost implications			no case change applied			
B4	**2008 ETCI 101 Wiring Regulations**						
1	Isolator switches for concealed and built-in appliances	5	no	55.00	275.00	Z3	Section 554
2	Individual RCBO on lighting circuit to wet room	1	no	25.00	25.00	Z3	Section 530 and 701
3	Bathroom zoning classification for electrical wiring and fittings	1	no	25.00	25.00	Z3	Section 701
4	Provide Downlighter with thermahoods	4	no	20.00	80.00	Z3	Section 530
B5	**2017 Volume 2 Dwelling houses**						
1	Grade D, LD2 smoke heat alarms to be provided in bedrooms	1	item	220.00	220.00	Z4	1.3.6.2
2	Electrical installation to ETCI National Rules			no case change applied			1.3.9.4
3	Cavity barriers at the eaves, top of gable, party wall junction and around services boxes and vents	118	m	8.50	1,003.00	B9	3.6.2
4	Provision for external isolation switch to PV panels	1	item	105.00	105.00	Z3	5.4.5.1
B6	**2020 - National Rules for Electrical Installations**						
1	I.S 10101 (7 Chapters containing 700 pages) replacing ET101			no case change applied			
2	RCDs now required in lighting circuits	1	item	25.00	25.00	Z3	411.3.4
3	Arc Fault Detection Devises (AFDDs) recommended to be mounted in Distribution Board	1	item	75.00	75.00	Z2	421.7/Annex 42B page 212
4	Cables to be rated Dca-s2,d2,a2 - for behavior in fire	1	item	225.00	225.00	Z2 + Z3	527
5	A Type RCDs only in new installations - AC Types no longer acceptable	1	item	10.00	10.00	Z2	531.3.3
6	Surge Protection Devices (SPDs) to protect electronic equipment etc.	1	item	60.00	60.00	Z2	5.3.4
7	Section on Electrically Charged Vehicles - cable to exterior outlet	1	item	145.00	145.00	Z2	Part 722
TGDs: Part C - Site Preparation and Resistance to Moisture							
C1	**1991**						
1	In all cases appropriate site investigations to be undertaken						2.2
a	Soil laboratory tests & reports	1	item	176.47	176.47	P.L11	
b	Archaeological tests, attendance & reports	1	item	525.29	525.29	P.L12	
2	Ground supported floor should be at least 150mm thick						
a	Allow additional 50mm thick concrete	56	m2	8.00	448.00	A17	3.1.4a + diagram 4
3	Hardcore below concrete should be minimum 150mm thick						
a	Allow additional 50mm thick hardcore	56	m2	1.95	109.20	A27	3.1.4b + diagram 5
4	Damp proof membrane below slab turned up & lapped with cavity dpc	68	m2	2.50	170.00	A22	3.1.4c + diagram 5
C2	**1997**						
1	Radon Control - membrane, pipework, sumps and sealing penetrations						2.7 to 2.17
a	Radon membrane extra over dpc	68	m2	6.00	408.00	A22	
b	collars of underground services & angle seals	8	no	12.00	96.00	A23-25	
c	Radon Sump, pipework, bend & cap, incl trench & backfill	1	item	240.00	240.00	A24-26	
2	Concrete grade 20N/mm2 in ground floors (10N in 1991)	56	m2	1.50	84.00	A17	3.1.4a(ii)
3	Hardcore specification; Pyrite and Radon control measures - Annex E of SR21 and T2 permeable grading for Radon gases	56	m2	3.00	168.00	A27-28	3.1.4b
C3	**1997- amendments 2020**						
1	Hardcore should be at least 200mm thick						3.1.4b
a	additional 50mm hardcore	56	m2	1.95	109.20	A27	

2	Hardcore should be gas permeable (T2 Perm - 4/40mm granular unbound)	56	m2	0.75	42.00	A27-28	3.1.4b+d
3	Blinding layer - as Annex E of SR21	56	m2	1.75	98.00	A30	3.1.4b
4	External wall cavities to be drained - weep hole slots @ 1.2m c/c	22	m	3.50	77.00	A15	3.2.6
TGDs: Part D - Materials and Workmanship							
D1	**1991**						
1	BS 8000 Workmanship on building sites - compendium of 16 part in 17 documents. Methods outlined in this document will demonstrate compliance			no case change applied			2.1
D2	**1997**						
1	Safety Glass to be provided in unguarded glazing below 800mm						1.5
a	SG in lower panes of GF front windows 2.25 x 1.6m	1	no	90.00	90.00	D6	
b	SG in lower panes of FF front windows 2.25 x 0.8m	1	no	60.00	60.00	D7	
c	SG in front door lower side panel glazing 0.3 x 0.9m	1	no	15.00	15.00	D8	
d	SG in terrace doors 2.5 x 2.1m	1	no	285.00	285.00	D9	
D3	**2000**						
1	Letter Plates - minimum dimensions 250x38mm			no case change applied			1.6
D4	**2013**						
1	Use of proper materials - definition revision, relating to CE and CPRs and harmonised market conditions (Brexit?)			no case change applied			D1
2	CFC free products			no case change applied			0.1
3	Safety glass to be provided in unguarded glazing in doors below 1500mm						1.5
a	SG in front door glazing panel 0.35 x 1.3m	1	no	45.00	45.00	D8	
b	SG in front door lower side panel glazing 0.3 x 0.9m	1	no	15.00	15.00	D8	
TGDs: Part E - Sound							
E1	**1991**						
1	Sound transmission performance values - 53db walls and 52db floors. Separating wall mass 415kg/m2 (solid)			no case change applied			Section 1, diagram 2 and A,B & C p.8
2	Filling joint between party wall and roof covering			Cost in B1.2 above			Section 1 (p.9)
3	Plasterboard to ceiling below attic to be at least 12.5mm			Cost in B1.5 above			Section 1 (p.9)
4	Joist hangers to floors lateral to party wall			Cost in A1.4 above			Section 1 (p.9)
5	Filler piece in cavity wall along line of party wall			Cost in B1.3 above			Section 1 (p.9)
6	Wrap pipes in ducts with minimum 25mm mineral fibre						Section 3 (p.19)
a	to SVP pipework	6	m	12.50	75.00	C8	
b	to waste pipes to SVP	13	m	4.75	61.75	C9	
c	to services pipework	16	m	4.75	76.00	R3	
7	Seal junctions of ceiling and ducts with tape	102	m	2.00	204.00	S3	Section 3 (p.19)
E2	**1997**						
1	No tangible cost implications - improved explanations generally			no case change applied			2.2.3 + table 3A and
E3	**2014**						
1	Independent sound testing pre-completion - minimum tests at least 4 + 5% of units above 40	0.1	no	295.00	29.50	D6	3.4.3 + diagram 9
2	Drylining frame & 13mm mineral wool quilted lining to separating walls - eliminating chases for sockets	54	m2	13.50	729.00	S4	3.4.3 + diagram 5+9
3	Cavity closers to be moisture protected with dpc strip	65	m	1.00	65.00	B6-8	3.4.3 + diagram 9
4	Masonry workmanship directions - coursing, toothing & wall ties			no case change applied			
TGDs Part F - Ventilation							
F1	**1991**						
1	Ventilation rates as compared to those outlined in DC Bye-laws			no case change applied			1.6 -1.19

2	Pitched roof ventilation continuous 10mm at eaves level -	9	m	8.50	76.50	K7	2.12 + diagram 3
3	Pitched roof ventilation continuous 5mm at high level	12	m	10.50	126.00	K8	2.14 + diagram 3
F2	**1997**						
1	Mechanical ventilation rates and overrun times to internal rooms	1	item	55.00	55.00	Y5	Table 2
F3	**2002**						
1	Kitchen mechanical extract ventilation 60 l/sec or cooker hood @ 30 l/sec	1	item	325.00	325.00	W1	1.7c(i)
2	Bathroom mechanical extract ventilation 15 l/sec	1	item	115.00	115.00	Y5	1.8b(i)
F4	**2009**						
1	Tangible cost implications crystalised in 2019 document			no case change applied			
F5	**2019**						
1	Continuous mechanical extract ventilation or mechanical ventilation with heat recovery where air permeability is less than 5M3/h.m2	1	item	2795.00	2,795.00	Y5	1.2 + diagrams 1 + 2
2	Ceiling space and boxing out for EAV ductwork			Cost in A3.1 above			Diagrams 1 + 2
3	Wrapping EAV ducting in 25mm insulation in attic and proprietary roof outlet						1.2.1.7 + diagram 1
a	insulation	12	m	9.50	114.00	R4	
b	proprietary roof tile outlet	1	item	100.00	100.00	K9	
4	MEV validation process by independent accredited person	1	item	125.00	125.00	Y6	1.2.2.11
5	Background ventilation rates increased by 40% in habitable rooms to 7000m2 and Kitchens/utilities/bathrooms to 3500mm2	5	no	10.00	50.00	G1-9	1.2.4.1 + table 3
TGDs: Part G - Hygiene							
G1	**1991**						
1	Kitchen sink must have a draining board	1	no	25.00	25.00	W1	G1b
2	A suitable installation for the provision of hot water - central source or unit heaters to sink/bath/whbs						
a	emersion heater	1	no	125.00	125.00	Y2	G1c
G2	**1997**						
1	Capacity of cold water storage 212 Litres in up to 3 bed house	1	item	25.00	25.00	Y2	1.6
2	Cold water cistern to be covered - not airtight	1	lid	45.00	45.00	Y2	1.7
3	Cold water cistern and service pipes & fittings to be insulated against frost						1.9
a	Insulation to cistern	1	no	35.00	35.00	R5	
b	Insulation to attic services pipework	36	m	4.75	171.00	R3	
G3	**2008**						
1	No tangible cost implications			no case change applied			
G4	**2008 (amendments 2011)**						
1	Cold water supply through ground floor to be insulated and rodent proof and gas sealed. Dpm to be sealed at penetration						1.9.1 & Diagram 1
a	pipe insulation	11	m	5.00	55.00	A33	
b	seal rising wall	1	no	35.00	35.00	A18	
2	Cold water cistern - to insulation value of nlt 0.3W/m2K	1	no	20.00	20.00	R5	1.9, diagram 3 + table 1
3	Cold water cistern to be screen ventilated and seated on moisture resistant board	1	no	65.00	65.00	F16	Diagram 3
4	All pipework including overflow, situated outside thermal envelope should be insulated			Cost in G3.b above			1.9.3
5	WCs shall have a cistern of 6L maximum flush capacity with discernable dual rate flushing devises of 2/3 and 3/3	1	item	15.00	15.00	X1	2.7
TGDs: Part H - Drainage and Waste Disposal							
H1	**1991**						

1	Pipework through rising walls to have 50mm arch fron u/s of lintol and all around. Openings to be masked to prevent vermin or bedded in with short length through wall and rocker pipe each side						A10b + diagram A1
a	mask ope both sides	5	no	15.00	75.00	A32	
b	short pipe length through ope	5	no	22.50	112.50	A33	
c	rocker pipes & joints	10	no	22.50	225.00	A34	
H2	**1997**						
1	SW drainage should be adequately protected against accidental pollution - petrol interceptor	0.03	no	3750.00	112.50	SW.M15	1.1.9e
2	Stacks serving WC should be NLT 100mm dia (75mm in 1991)						1.2.23
a	extra over for bigger pipe	8	m	4.50	36.00	Y3	
3	Drains carrying only waste water should have a diameter of NLT 100mm (75mm in 1991)	67	m	4.50	301.50	SW.M23-26 + SW.N15-18	1.3.11
H3	**2010**						
1	Sustainable Urban Drainage System (SUDS) - reference						1.1.3.1a
a	attenuation systems	€63,916	x	0.03	1,917.48	SW.M17-22	
b	extra over for permeable paving in driveway	42	m2	6.00	252.00	SW.D4	
2	Concentrate drainage from boiler to discharge to wastewater pipework	1	item	50.00	50.00	Y3	1.2.2.7
							1.7.5
H4	**2010 (amendments 2016)**						
1	No tangible cost implications			no case change applied			
H5	**Irish Water - Wastewater Infrastructure Technical Documentation / Code of Practice July 2020**						
1	Private side inspection chamber within 1.0m of boundary (no carrier drains)	1	no	550.00	550.00	SW.N19	3.11.14
2	Solid concrete blockwork only permitted in manholes less than 1200mm depth. Blockwork must be 20N/mm2 with M20 mortar	0.44	manholes	90.00	39.60	SW.M11-12 + SW.N10-12	3.12.1.6 + STD-WW-09
3	Manholes up to 3.0 metres depth - minimum internal dimension of 1200mm (previous standard 1200 x 750mm Table 3.4)			no case change applied			3.12.2
4	Chambers & manhole covers shall be set in rapid hardening cementatios epoxy resin or polyester resin mortar and seated on class B engineering bricks in M30 strenght mortar.	0.44	manholes	95.00	41.80	SW.M11-12 + SW.N10-12	3.12.9 + STD-WW-09
5	All sewers shall have a non degradable marker tape laid 300mm above the pipe crown	47	m	0.25	11.75	SW.N4 + SW.N18	3.26
6	Minimum granular bed thickness of 200mm below pipes 150mm to 450mm diameter (was 100mm)						4.7 + STD-WW-07
a	Trench & bed to 150mm pipe	4	m	3.15	12.60	SW.M6 + SW.M7	
b	Trench & bed to 225mm pipe	11	m	4.75	52.25	SW.N7 + SW.N8	
7	Minimum pipe cover and surround of granular surround to flexible pipework to be 150mm (was 100mm) and increased to 300mm in trafficed areas						4.7 + STD-WW-07
a	Extra 50mm surround to 150mm pipe	2.56	m	2.85	7.30	SW.M6 + SW.M7	
b	Extra 50mm surround to 225mm pipe	4.09	m	4.30	17.59	SW.N7 + SW.N8	
8	Rocker pipes with flexible joints to be locacted on ingress and egress ends of manholes where pipes are greater than 150mm diameter	0.44	no	22.50	9.90	SW.M11-12 + SW.N10-12	STD-WW-10C
H6	**Irish Water - Water Infrastructure Technical Documentation / Code of Practice July 2020**						
1	Watermain layouts shall be arranged in loops to avoid dead ends. To accommodate flushing of the network loops shall cover a minimum of 4 houses and 1 hydrant						STD-W-02
	Watermain including trench	3.25	m	47.00	152.75	SW.H1 + SW.H3	
	Bends	0.23	no	75.00	17.25	SW.H4	
	Thrust blocks	0.28	no	85.00	23.80	SW.H5	
	T connections	0.05	no	75.00	3.75	SW.H4	

2	Watermains 100-150mm diameter shall be plastic blue pipe HDPE and MDPE (PE80) - UPVC pipes shall not be used						3.9
	100mm watermain	11.32	m	10.00	113.20	SW.H3	
3	Butt fusion/electro fusion joints to polyethylene pipes, by appropriately trained and experienced operatives using pre-approved rigs, with real-time weld integrity data, GPS locator and download facility	1	item	125.00	125.00	SW.H14	3.10.2
4	Independent 3rd party certification of jointing	1.00	no	46.67	46.67	SW.H15	3.10.2
5	Destructive weld testing of joints	0.06	item	1500.00	90.00	SW.H15	3.10.3
6	Bulk Meters supplied & fitted by IW in a chamber built by the developer, with an adjoining kiosk for a telemetry system if required						3.15.4
	Bulk meter chamber & kiosk	0.03	item	6500.00	195.00	SW.H10	
	Appropriate fittings for connections, incl SV & Hydrant	0.03	item	1650.00	49.50	SW.H11	
	Meter log installation & test procedures	0.03	item	1152.00	34.56	SW.H12	
	I.W charge for meter & inspections	0.03	item	382.53	11.48	SW.H13	
7	Hydrant, sluice valve and air valve chamber covers shall be set in rapid hardening cementatios epoxy resin or polyester resin mortar and seated on class B engineering bricks in M30 mortar	0.35	no	45.00	15.75	SW.H6-10	3.18 + STD-W-15
8	Minimum granular bed thickness of 150mm below pipes of diameter less than 200mm (was 50mm)						4.8 + STD-W-13
	Trench & bed to 150mm pipe	11	m	2.00	22.00	SW.H1	
9	Minimum pipe cover to be 300mm minimum (was 100mm) - decreased to 200mm in grassed areas						4.8 + STD-W-13
	Extra 200mm surround to 100mm pipe	11	m	2.50	27.50	SW.H1	
10	Hydrant, sluice valve and air valve chamber if built in blockwork must be 215mm thick using 20N/mm2 blocks and M20 mortar	0.35	no	25.00	8.75	SW.H6-10	4.8 + STD-W-15
H7	**Irish Water - Quality Assurance Field Requirements June 2017 (initial issue) and August 2020**						
1	Quality Assurance Design Manual						
2	Quality Assurance Field Inspections Requirements Manual						
a	Construction Manager	0.09	weeks	1800.00	162.00	P.A1	
b	Site Manager	0.09	weeks	1550.00	139.50	P.A2	
c	Commercial Manager/Quantity Surveyor	0.03	weeks	1800.00	54.00	P.A3	
d	Cost of Surety Bond	1	item	70.69	70.69		
TGDs: Part J - Heat Producing Appliances							
J1	**1991**						
1	No tangible cost implications						
J2	**1997**						
1	No tangible cost implications						
J3	**2014**						
1	Carbon Monoxide Alarm, where heat producing appliance is located and inside each bedroom or within 5 metres of the bedroom door	1	item	193.38	192.00	Z4	1.5.2
2	Walkways in roof spaces where appliances are located						1.7.1
	Loft decking - XT walk on	10	m2	45.00	450.00	R2	
3	Heat producing appliances serving the total dwelling should be commissioned and tested at completion and owner provided with user information	1	item	125.00	125.00	Y1	1.9.1 + 1.10.1
TGDs: Part K - Stairways, Ramps and Guards							
K1	**1991**						
1	Landing next to door opening - full width of stairs	0.71	m2	1158.00	822.18	A-Z1	1.1.15 + diagram 4
2	Stairways/ramps should be guarded at the sides where the total height exceeds 600mm			no case change applied			1.1.18
3	Guarding - should not allow a 100mm sphere pass through						1.1.19

	Additional spindles	15	no	12.50	187.50	Q1	
K2	**1997**						
1	Landing next to door - reduced to 400mm from width of stairs	item K1.1 x -52%		-	427.53	A-Z1	1.1.10 + diagram 4
2	Guarding at windows (above 1400mm) to 800mm above floor level - 2.25m wide to 1st floor window	1	item	315.00	315.00	O6	2.4 + diagram 6
K3	**2013 supplement**						
1	Stair 900mm wide between handrails (as Part M) - was 800mm	0.64	m2	1158.00	741.12	A-Z1	Table 3
K4	**2014**						
1	Handrails 900mm above the pitch line - was 840mm	6	m	8.05	48.30	Q1	1.1.17 + Diagram 6
2	Safety restrictors to be provided on window opes above 1400mm	7	no	10.50	73.50	G1-7	2.7 + Diagram 9
TGDs: Part L - Conservation of Fuel and Energy							
L1	**1991**						
1	Double glazing 3.6W/m2K - where area of windows exceeds 20% of total floor area						1.3
a	pane of glass	21	m2	45.00	945.00	G1-7	
b	hermetical sealing	21	m2	25.00	525.00	G1-7	
2	Underfloor insulation - 25mm tk x 1.0m wide at building perimeter and at verticle edge of the floor slab	20	m2	8.00	160.00	A19	1.5
3	Central heating to be provided with clock controls and room thermostat or thermostatic radiator valves						2.2
a	clock control	1	no	90.00	90.00	Y1	
b	thermostatic valve controls	6	no	45.00	270.00	Y1	
c	electrical wiring	1	item	110.00	110.00	Z7	
4	Hot water storage cylinders to be insulated to 90W/m2 of surface area	1	item	75.00	75.00	Y1	3.2
5	Pipe insulation 40mm thick total in unheated areas to 0.045W/m2K	22	m	4.75	104.50	C8 + R3	3.3a
6	U values of external wall construction of 0.45W/m2K - typically achieved with cavity walls and 65mm insulation	145	m2	12.50	1,812.50	B5	Example A1
7	U values of roof construction of 0.35W/m2K - typically achieved with 150mm mineral wool insulation	62	m2	7.50	465.00	R1	Example A7a + Table 6
L2	**1997**						
1	Thermal bridging detailing at reveals, heads & backs of cills						1.3.1 + Diagram 4 + Appendix D
a	reveals & heads	49	m	10.50	514.50	B6-7	
c	cills	16	m	9.50	152.00	B8	
2	Limiting air infiltration detailing at external openings, loft hatch and pipes entering ducts and ceiling space						1.4 + Diagram 5
a	Loft hatch seal	4	m	5.00	20.00	Q3	
b	Seal pipes through ducts & ceilings	10	no	7.50	75.00	D3	
3	Draught sealing window sashes and door leaf	64	m	6.00	384.00	G1-9	Diagram 5.2
4	Dwellings above 100m2 should have zone controls	1	item	190.00	190.00	Y1	2.2.1
5	Time controls for central heating systems			Costed in L2.4			2.2.2
6	HW storage cylinders to be fitted with thermostatic controls	1	item	105.00	105.00	Y1	2.2.3
7	Hot water storage cylinders insulation requirements upgrade to 35mm PU-foam - ozone friendly	1	item	25.00	25.00	Y1	3.2
8	Heat pipes in hot press to be insulated to 0.035w/m2k minimum 15mm thickness for 1.0m from apparatus	8	m	4.50	36.00	Y1	3.3.2 + Diagram 11
L3	**2002**						
1	Air Infiltration - ducts/boxing concealing services to be sealed top and bottom	4	no	15.00	60.00	S8-9	1.6.1e

2	U values of external wall construction of 0.27W/m2K - typically achieved with 40mm cavity wall and 80mm insulation						A.2.1 + Diagram 8
a	Wall insulation increase by 15mm	145	m2	4.50	652.50	B5	
3	U values of roof construction of 0.25W/m2K - typically achieved with 250mm mineral wool insulation						A.2.2 + Diagram 10
a	roof insulation increase by 100mm layer	70	m2	6.00	420.00	R1	
4	Underfloor insulation - 100mm thick throughout and at verticle floor edge 25mm thick - 0.7m2K/W and fully overlapped by cavity insulation						A.3.1 + Diagram 11
a	100mm insulation	56	m2	12.65	708.40	A19	
b	25mm perimeter insulation	31	m	6.00	186.00	A20	
5	Provide proper access to cold water storage tank			Costed in J3.2			B.5.1.1
6	Windows U values 2.2 incl low e glass and 12 - 16mm argon filled double glazing	21	m2	35.00	735.00	G1-8	Table 28
7	External Doors U values 2.65 glazed to 3.0 solid	1	item	105.00	105.00	G9	Appendix E Table 2+
L4	**2007**						
1	Calculation of EPC and CPC levels using DEAP software to determine and demonstrate compliance with Part L (values improvement 40% on 2002)						0.1.2 and 1.1.1
a	Provide PV panels to meet DEAP requirements	1	item	1150.00	1,150.00	Z1.1	
b	Electrical connections	1	no	108.50	108.50	Z8	
2	Backstop U values of windows/door/rooflight to be 2.0 W/m2K if area is equal to 25% of floor area	21	m2	15.00	315.00	G1-8	1.3.2.4 and Table 1
3	Conformance with acceptable Construction Details ACDs - relied upon to allow backstop factor of 0.8 in DEAP calculations			no case change applied here - see L7			1.3.3.2
4	Building Envelope Air Permeability to 10m3/h.m2			no case change applied			1.3.4.4
5	Air pressure testing - 5% per house type generally or 2 in less than 40 units	1	no	30.00	30.00	D6	1.5.4.3 and Table 4
6	Gas Boiler minimum seasonal efficiency - raised to 86%	1	item	190.00	190.00	Y1	1.2.e and 1.4.1
7	Hot water cylinder factory applied insulation increased to 50mm thick PU zero ozone foam - 30kg/m2	1	item	50.00	50.00	Y1	1.4.4.2
8	Zoned heat controls, with separate temperature controls, boiler interlock wiring and thermostats in all rooms or rad stats	1	item	150.00	150.00	Y1	1.4.3.2
9	Commissioning & user information regimes	1	item	75.00	75.00	Y1	1.5.5
10	Heating pipes which are routed through a floor, wall or duct should be insulated	82	m	4.00	328.00	Y1	1.4.4.1
12	Stainless steel wall ties (not galv) 5 per M2			Cost in A3.4 above			A2.1
L5	**2011**						
1	Calculation of EPC and CPC levels using DEAP software to determine and demonstrate compliance with Part L (values improvement 60% on 2005)						0.1.2.1
a	Providing PV panels to meet improved DEAP requirements	1	item	495.00	495.00	Z1.1	
2	Backstop U values of windows/door/rooflight to be 1.6W/m2K if area is equal to 25% of floor area	21	m2	20.00	420.00	G1-8	1.3.2.4
3	Conformance with acceptable Construction Details ACDs - relied upon to allow backstop factor of 0.8 in DEAP calculations			no case change applied here - see L7			1.3.3.2
4	Building Envelope Air Permeability to 7m3/h.m2 or 5m3/h.m2 if MEV			no case change applied			1.3.4.1
5	Air pressure testing - 5% / one per house type generally	1	no	25.00	25.00	D6	1.3.4.4
6	Gas Boiler minimum seasonal efficiency - raised to 90%	1	item	175.00	175.00	Y1	1.4.2.1

7	Zoned heat controls, with independent time controls, should be provided	1	item	180.00	180.00	Y1	1.4.3.2 + 2.2.3.4
8	U values of external wall construction increase to 0.21W/m2K - typically achieved with 40mm cavity wall with an 100mm insulation						Diagram A1
a	Wall insulation increase by 20mm	145	m2	6.00	870.00	B5	
10	Underfloor insulation - U value increase to 0.21W/m2K - shown as 100mm thick as guided in 2002 (density increased)	56	m2	4.00	224.00	A19	A.3.3
L6	**2011 - Acceptable Construction Details:- Thermal Bridging & Airtightness**						
1	Seal between skirting board and floor with flexible sealant	107	m	3.50	374.50	D5	1.02a
2	Cavity wall insulation at least 225mm below floor						1.02a
a	Addition 75mm insulation below floor	23	m	2.00	46.00	B5	
3	Perimeter insulation - minimum R-value of 1.0m2K/W (2002 was 25mm thick - 0.7m2K/W)						1.02a
a	insulation product upgrade	23	m	1.50	34.50	A20	
4	Continue barrier on inner leaf of external wall through floor void						1.05
a	Plaster or tape seal wall 250mm wide	23	m	6.90	158.70	S1	
5	Seal floor joist shoe with flexible sealant	56	no	3.50	196.00	D6	1.05
6	Bed wall plate on a continuous mortar bed	12	m	6.00	72.00	F8	1.10
7	Seal all penetrations through attic ceiling with flexible sealant			Costed in L2.2			1.10
8	Ensure gap between wall plate and eaves is completely filled	12	m	1.50	18.00	F8	1.10
9	Apply flexible sealant between air barrier and windows/door frames	65	m	6.50	422.50	D2	1.21 + 1.24
10	Proprietary cavity closer to head - 2.40m2K/W (with closer block) or 4.3 m2K/W or provide additional insulation to fill cavity			Costed in L2.1			1.23
11	Proprietary cavity closer to reveal - 2.40m2K/W (with closer block) or 4.3 m2K/W with flexible sealant between it and blockwork			Costed in L2.1			1.24 + 1.25
12	Proprietary cill back - 2.90m2K/W with flexible sealant between it and blockwork, below window board						1.26
a	seal below window board	16	m	3.00	48.00	D5	
L7	**2019 Dwellings**						
1	Step up in EPC and CPC achievable levels (values improvement 60% on 2005)						1.3.4.4
a	Increase PV panels area or resort to heat pumps	1	item	675.00	675.00	Z.1.1	
b	U values of windows/door/rooflight down to 1.2W/m2K	21	m2	35.00	735.00	G1-8	
2	Building Envelope Air Permeability to 5m3/h.m2 or 3m3/h.m2 if MEV			no case change applied			1.3.4.4
3	Air pressure testing on all houses in scheme						1.3.4.4
a	Air test	1	no	195.00	195.00	D7	
b	Less amount in item L.4.5 above			-	25.00	D7	
4	Mechanical Ventilation & Heat Recovery Systems - minimum			no case change applied			1.4.5.2
a	MEV / HRV system independent testing	1	no	150.00	120.10	Y5	1.2
5	Cavity insulation levels - increased U value to 0.18W/m2K						
	Increase thickness or upgrade insulation product	145	m2	5.75	833.75	B5	Diagram A
6	Underfloor insulation - increased U value to 0.18 W/m2K						
a	Increase thickness or upgrade insulation product	56	m2	5.75	322.00	A19	A4
7	Access hatches to attics to be sealed and insulated	1	item	55.00	55.00	Q3	B5
TGDs: Part M - Access and Use							
M1	**1991 and 1997**						
1	Part M 1991 and 1997 do not apply to dwellings			no case change applied			0.3

M2	**2000**						
1	Area outside at the front door should be level 1200 x 1200mm						1.21
a	Hardcore	2	m2	6.00	12.00	SW.D6	
b	transition from level to to falls - 1.2 m length	1	no	105.00	105.00	SW.D4	
c	treat ground level either side to ensure 150mm below dpc	6	m	5.00	30.00	SW.B1	
2	Approach to entrance at least 900mm wide have a slope of slope n.m.t 1:20 between landings, suitable for a wheelchair						1.21
a	Excavation & removal - 500mm depth	6	m2	17.50	105.00	SW.A5-6	
b	hardcore fill - 450mm depth	6	m2	19.25	115.50	SW.D6	
c	Paviors laid to falls	6	m2	45.00	270.00	SW.D4	
3	Resistance to moisture - Grille channel across front door						consequence
a	Grille channel with end & outlet 1.2 m length	1	no	155.00	155.00	A32	
b	100mm drainage pipe incl trench routing to AJ	3	m	35.00	105.00	A32	
4	Resistance to moisture - ensure integrity of drainage below floor level dpc			no case change applied			consequence
5	Corridors internally to have a clear passageway of 900mm						1.27 + Diagram 12
a	Using stairway minimum width as a guide (as Part M) - was 800mm - then corridor is wider by 100mm	1.026	m2	1158.00	1,188.11	A-Z1	
6	Minimum clear width of front entrance -775mm			no case change applied			1.23b
7	Doors to habitable rooms minimum clear width - 750mm			no case change applied			1.28
8	Saddleboards, bevelled and 10mm high maximum			no case change applied			1.28
9	Provide a wheelchair accessible WC at entry level	3.1488	m2	1737.00	5,469.47	A-Z1	2.9 + Diagram 15
M3	**2010**						
1	The driveway should be at least 3.6m wide (was 3.0)			no case change applied			3.1.2.1b
2	Tapered steps should be avoided			no case change applied			3.1.2.5f
3	Maximum threshold height of 15mm - chamfered			no case change applied			3.2.2b
4	Minimum clear width of front entrance door - 800mm						3.2.2c
a	Width increased by 50mm - 7%	1	item	43.00	43.00	G9	
5	Doors to habitable rooms at entrance level minimum clear width - 775mm						3.3.2.1 + Table 4
a	Width increased by 25mm - 3.5%	5	no	8.00	40.00	M1 + P9	
6	Minimum dimensions of entry level WC increased to average 1450 x 1450mm, with headroom NLT 2100mm			no case change applied			3.4.2 + Diagram 34
W	**Building Control Regulations**						
1	Legislative & technical awareness						Instruments in Table 2.6
a	Construction Manager	0.033	weeks	1800.00	59.40	P.A1	
b	Site Manager	0.033	weeks	1550.00	51.15	P.A2	
c	Commercial Manager/Quantity Surveyor	0.033	weeks	1800.00	59.40	P.A3	
2	Awareness & understanding of continuous TGDs updates			Costed in W.1 above			as above
3	Files Management & keeping records			Costed in W.1 above			as above
4	BCAR – Professional Indemnity Insurance	1	item	44.12	44.12	P.L2	as above
5	Assigned Certifier	1	item	950.00	950.00	P.L4	SI 80 of 2013, Clause 6
6	Preparing and agreeing Preliminary Inspection Plan with Assigned Certifier						SI 80 of 2013 Clause 7 + SI 9 of 2014 Clause 9
a	Construction Manager	0.033	weeks	1800.00	59.40	P.A1	
b	Site Manager	0.033	weeks	1550.00	51.15	P.A2	
7	Preparing and agreeing Inspection Notification Framework with Assigned Certifier			Costed in W.6 above			SI 80 of 2013 Clause 7 + SI 9 of 2014 Clause 9
8	Ancillary Certifier						SI 80 of 2013, Clauses 12, 13, 15, 17, 19, 20, 22, 24 + 27

a	Ancillary Certifier - Civil & Structure	1	item	510.00	510.00	P.L5	
b	Ancillary Certifier - Mech & Electrical	1	item	370.00	370.00	P.L6	
c	Contracts Manager managing civils subcontract ancillary certifier	0.033	weeks	1550.00	51.15	P.A1	
9	Inspections in conjunction with Ancillary and Assigned Certifiers						SI 9 of 2014, Clause 5(4)
a	Construction Manager	0.0165	weeks	1800.00	29.70	P.A1	
b	Site Manager	0.033	weeks	1550.00	51.15	P.A2	
10	BCMS documentation control + collation						SI 9 of 2014, Clause 5(4)
a	Construction Manager	0.033	weeks	1800.00	59.40	P.A1	
b	Site Manager	0.0165	weeks	1550.00	25.58	P.A2	
c	Commercial Manager/Quantity Surveyor	0.0165	weeks	1800.00	29.70	P.A3	
11	System Testing & commissioning procedures						SI 9 of 2014, Clause 7
a	Site Manager	0.033	weeks	1550.00	51.15	P.A2	
12	Commencement Notice	1	no	30.00	30.00	P.L3	SI 9 of 2014, Clause 7
13	BCMS validation process						SI 9 of 2014, Clause 11(b)
a	Supervision	3	weeks	142.68	428.04	P.A	
b	Attendances	3	weeks	98.09	294.27	P.C	
c	Site Accommodation	3	weeks	9.65	28.95	P.D	
d	Site Services	3	weeks	7.35	22.05	P.G	
e	Site Security	3	weeks	9.90	29.70	P.H	
14	Building Control Officer instructions - reference to PAS 2016						SI 9 of 2014, Clause 11(b)
a	Provide spare comms duct in electrical utilities trench	12	m	18.50	222.00	SW.J2	
b	Distribution network within dwelling for reception of digital	1	item	297.00	297.00	Z6	
X	**Health and Safety in Construction Regulations**						
1	Legislative & technical awareness			Costed in X2 below			Instruments in Table 2.6
2	Files Management & keeping records						S.I 504 of 2006, Clause 3
a	Construction Manager	0.083	weeks	1800.00	149.40	P.A1	
b	Site Manager	0.083	weeks	1550.00	128.65	P.A2	
c	Commercial Manager/Quantity Surveyor	0.083	weeks	1800.00	149.40	P.A3	
d	H,S & E Officer	0.083	weeks	1100.00	91.30	P.A6	
3	PSCS Professional Indemnity Insurance - premium	1	item	44.12	44.12	P.L2	as X.1 above
4	Appointment of PSDP - professional fees	1	item	205.88	205.88		S.I 504 of 2006, Clause 6
5	Appointment of PSCS			Costed in X2 above			S.I 504 of 2006, Clause 6
6	Clients Safety File						S.I 504 of 2006, Clause 8, 13 + 21
a	Construction Manager	0.083	weeks	1800.00	149.40	P.A1	
b	Site Manager	0.083	weeks	1550.00	128.65	P.A2	
c	H,S & E Officer	0.083	weeks	1100.00	91.30	P.A6	
7	Health & Safety Plan - develop & maintaining						S.I 504 of 2006, Clause 9 + 12
a	Construction Manager	0.041	weeks	1800.00	73.80	P.A1	
b	Site Manager	0.041	weeks	1550.00	63.55	P.A2	
c	H,S & E Officer	0.041	weeks	1100.00	45.10	P.A6	
8	Notifications to HSA						S.I 504 of 2006, Clause 10 + 23
a	Construction Manager	0.01	weeks	1800.00	18.00	P.A1	
b	H,S & E Officer	0.01	weeks	1100.00	11.00	P.A6	
9	Risk Assessments & Method Statements						S.I 504 of 2006, Clause 16 + 17
a	Site Manager	0.083	weeks	1550.00	128.65	P.A2	
b	H,S & E Officer	0.083	weeks	1100.00	91.30	P.A6	
10	Safety Coordination of Subcontracts						S.I 504 of 2006, Clause 17
a	Construction Manager	0.033	weeks	1800.00	59.40	P.A1	
b	Site Manager	0.033	weeks	1550.00	51.15	P.A2	
c	H,S & E Officer	0.033	weeks	1100.00	36.30	P.A6	
11	Subcontract pre-appointment assessments						S.I 504 of 2006, Clause 17
a	Commercial Manager/Quantity Surveyor	0.033	weeks	1800.00	59.40	P.A3	
b	H,S & E Officer	0.033	weeks	1100.00	36.30	P.A6	

12	Method Statement, planning, preparing & implementation							S.I 504 of 2006, Clause 17
		H,S & E Officer	0.083	weeks	1100.00	91.30	P.A6	
13	Site Safety Advisor – more than 100 persons				Costed in X2 above			S.I 504 of 2006, Clause 18
14	Safety awareness training – Safe.Pas Card							S.I 504 of 2006, Clause 19 + 25
a		Direct staff	0.25	no	199.00	49.75	P.B4	
b		Subcontractors staff	0.25	no	199.00	49.75	A-Z1	
15	Construction Skills Training – C.Skills Card							S.I 504 of 2006, Clause 19 + 25
a		Direct staff	1	item	171.00	171.00	P.B4	
b		Subcontractors staff	1	item	171.00	171.00	A-Z1	
16	Site Safety Representative - more than 20 persons				Costed in X2 above			S.I 504 of 2006, Clause 23
17	Site Inductions							S.I 504 of 2006, Clause 25
		Site Manager	0.041	weeks	1550.00	63.55	P.A2	
		H,S & E Officer	0.041	weeks	1100.00	45.10	P.A6	
18	Safety Awareness – Topical Toolbox talks							S.I 504 of 2006, Clause 25
a		Site Manager	0.017	weeks	1550.00	26.35	P.A2	
b		H,S & E Officer	0.017	weeks	1100.00	18.70	P.A6	
19	Safety Officer Appointment				Costed in X2 above			S.I 504 of 2006, Clause 26
20	Safety Management Meetings							S.I 504 of 2006, Clause 28
a		Construction Manager	0.075	weeks	1800.00	135.00	P.A1	
b		Site Manager	0.05	weeks	1550.00	77.50	P.A2	
c		H,S & E Officer	0.05	weeks	1100.00	55.00	P.A6	
21	Prevention of Unauthorised Entry to Site				no case change applied			S.I 504 of 2006, Clause 30
22	Site Safety Inspections							S.I 504 of 2006, Clause 87
a		H,S & E Officer	0.17	weeks	1100.00	187.00	P.A6	
23	Evacuation Plan & Updating							S.I 504 of 2006, Clause 31
a		H,S & E Officer	0.017	weeks	1100.00	18.70	P.A6	
b		Drills	1	item	29.41	29.41	P.B7	
24	Personal Protection Equipment		1	item	246.18	246.18	P.B1+2	S.I 504 of 2006, Clause 35
25	Roadworks Guarding & Lighting		1	item	32.35	32.35	P.B3	S.I 504 of 2006, Clause 97
26	Amendments to S.I 504 of 2006				no case change applied			S.I 130 of 2008; S.I 423 of 2008; S.I 523 of 2010; S.I 461 of 2012; S.I 182 of 2013; S.I 526 of 2013
27	Code of Practice for Access & Working Scaffolding 1999 - Sections 1 - 7		1	item	905.88	905.88	P.I2	including updates 2009 & 2018
Y	**Environmental and Waste Regulations**							
1	Legislative & technical awareness				Costed in Y2 below			Waste Management Act 1996 and regulations made under the act
2	Files Management, records and administration							ditto
a		Construction Manager	0.017	weeks	1800.00	30.60	P.A1	
b		Site Manager	0.034	weeks	1550.00	52.70	P.A2	
c		Commercial Manager/Quantity Surveyor	0.017	weeks	1800.00	30.60	P.A3	
d		H,S & E Officer	0.083	weeks	1100.00	91.30	P.A6	
3	Best Management Practice				Costed in Y2 above			Various policies and Guidance Statements 1998, 2002, 2004 & 2006
4	Landfill Levy - €19 per Tonne		3	tonnes	19.00	57.00	P.F3 + P.F4	Waste Management (Amendment) Act 2001, Clause 4(2)
5	Waste Manager				Costed in X2 above			ditto, Clause 11(3)

6	Waste Storage Area							ditto, Clause 11(3)
		Increase area of site compound	1	item	29.41	29.41	P.B3 + P.F5	
		Pest Control	1	item	41.18	41.18	P.B8	
7	Waste Management Plan and implementation							Guidelines on Waste Management Plans for C&D Projects – July 2006
a		H,S & E Officer	0.083	weeks	1100.00	91.30	P.A6	
8	Landfill Levy increase to €30 per Tonne		3	tonnes	11.00	33.00	P.F3 + P.F4	Waste Management (Landfill Levy) (Amendment) Regulations 2008 + 2010, Clause 4(2)
9	Landfill Levy increase to €50 per Tonne		3	tonnes	20.00	60.00	P.F3 + P.F4	Waste Management (Landfill Levy) (Amendment) Regulations 2011, Clause 4(2)
10	Landfill Levy increase to €75 per Tonne		3	tonnes	25.00	75.00	P.F3 + P.F4	Waste Management (Landfill Levy) (Amendment) Regulations 2015, Clause 4(2)
Z	**Energy Performance Regulations**							
1	Legislative & technical awareness				Costed in Z3 below			Instruments in Table 2.7
2	Awareness & understanding of continuous TGDs updates				Costed in Z3 below			ditto
3	Files Management & keeping records							ditto
a		Construction Manager	0.033	weeks	1800.00	59.40	P.A1	
b		Site Manager	0.033	weeks	1550.00	51.15	P.A2	
c		Commercial Manager/Quantity Surveyor	0.033	weeks	1800.00	59.40	P.A3	
4	Consultants BER Certification		1	no	155.00	155.00	P.L9	SI 666 of 2006, Clause 7(4)a
5	Issuing authority registration Fees		1	no	60.00	60.00	P.L9	SI 243 of 2012, Clause 14(1)
6	Coordinating Testing regimes							
		Construction Manager	0.033	weeks	1800.00	59.40		SI 183 of 2019
		Site Manager	0.033	weeks	1550.00	51.15		
	Total Cost (Excl VAT)					59,257.56		

E.2 Building Regulations Upgrade Costed Summary

		€	Total €
1	**Part A Technical Guidance Documents - Structure**	**€**	**Total €**
1.1	TGD-A 1991	1,157.40	
1.2	TGD-A 1997	313.00	
1.3	TGD-A 2012	2,309.74	
			3,780.14
2	**Part B Technical Guidance Documents - Fire safety**		
2.1	TGD-B 1991	1,517.90	
2.2	TGD-B 1997	265.00	
2.3	TGD-B 2006	-	
2.4	TGD-B 2017	1,328.00	
			3,110.90
3	**National Rules for Electrical Installations**		
3.1	ECT 101: 2008	405.00	
3.2	I.S 10101: 2020	540.00	
			945.00
4	**Part C Technical Guidance Documents - Site Preparation & Resistence to Moisture**		
4.1	TGD-C 1991	1,428.96	
4.2	TGD-C 1997	996.00	
4.3	TGD-C 2020 Amendment	326.20	
			2,751.16
5	**Part D Technical Guidance Documents - Material and Workmanship**		
5.1	TGD-D 1991	-	
5.2	TGD-D 1997	450.00	
5.3	TGD-D 2000	-	
5.4	TGD-D 2013	60.00	
			510.00
6	**Part E Technical Guidance Documents - Sound**		
6.1	TGD-E 1991	416.75	
6.2	TGD-E 1997	-	
6.3	TGD-E 2014	823.50	
			1,240.25
7	**Part F Technical Guidance Documents - Ventilation**		
7.1	TGD-F 1991	202.50	
7.2	TGD-F 1997	55.00	
7.3	TGD-F 2002	440.00	
7.4	TGD-F 2009	-	
7.5	TGD-F 2019	3,184.00	
			3,881.50
8	**Part G Technical Guidance Documents - Hygiene**		
8.1	TGD-G 1991	150.00	
8.2	TGD-G 1997	276.00	
8.3	TGD-G 2008	-	
8.4	TGD-G 2011 Amendment	190.00	
			616.00
9	**Part H Technical Guidance Documents - Drainage and Waste Disposal**		
9.1	TGD-H 1991	412.50	
9.2	TGD-H 1997	450.00	
9.3	TGD-H 2010	2,219.48	
9.4	TGD-H 2016 Amendment	-	
			3,081.98
10	**Irish Water Technical Documentation - Ancillary to Parts G and H**		
10.1	Wastewater Infrastructure Code Of Practice, July 2020	742.78	
10.2	Wastewater Infrastructure Standard Details, July 2020 Revision 4	included above	
10.3	Water Infrastructure Code Of Practice, July 2020	936.96	
10.4	Water Infrastructure Standard Details, July 2020 Revision 24	included above	
10.5	Quality Assurance Design Requirements Manual	426.19	

10.6	Quality Assurance Field Inspection Requirements Manual	included above	
			2,105.93
11	**Part J - Technical Guidance Documents - Heat Producing Appliances**		
11.1	TGD - J 1991	-	
11.2	TGD - J 1997	-	
11.3	TGD - J 2014	767.00	
			767.00
12	**Part K - Technical Guidance Documents - Stairs, Ramps and Guards**		
12.1	TGD - K 1991	1,009.68	
12.2	TGD - K 1997	- 112.53	
12.3	TGD - K 2013	741.12	
12.4	TGD - K 2014	121.80	
			1,760.07
13	**Part L - Technical Guidance Documents - Conservation of Fuel and Energy**		
13.1	TGD - L 1991	4,557.00	
13.2	TGD - L 1997	1,501.50	
13.3	TGD - L 2002	2,866.90	
13.4	TGD - L 2007	2,396.50	
13.5	TGD - L 2011	2,389.00	
13.6	TGD - L 2019	2,910.85	
			16,621.75
14	**Acceptable Construction Details - Ancillary to Part L**		
14.1	2011 - Thermal Bridging and Airtightness	1,370.20	
			1,370.20
15	**Part M - Technical Guidance Documents - Access and Use**		
15.1	TGD - M 1991	-	
15.2	TGD - M 1997	-	
15.3	TGD - M 2000	7,555.07	
15.4	TGD - M 2010	83.00	
			7,638.07
16	**Building Control Regulations**		
16.1	Building Control Act 1990	included below	
16.2	Building Control (Amendment) Regulations S.I 80 of 2013	included below	
16.3	Building Control (Amendment) Regulations S.I 9 of 2014	3,804.46	
			3,804.46
17	**Health and Safety in Construction Regulations**		
17.1	Safety Health and Welfare at Work Act 2005	included below	
17.2	Safety Health and Welfare at Work (Construction) Regulations, S.I 504 of 2006	3,279.69	
17.3	Safety Health and Welfare at Work (Construction) Regulations, S.I 291 of 2013	905.88	
			4,185.57
18	**Environmental and Waste Regulations**		
18.1	Waste Management Acts 1996 and **2001**	332.79	
18.2	Waste Management Regulations **2006, 2008** and 2010	124.30	
18.3	Waste Management Regulations **2011** and **2015**	135.00	
18.4	National Construction and Demolition Waste Council - Best Practice Waste Guidelines 2006	included above	
			592.09
19	**Energy Performance Regulations**		
19.1	European Communities (Energy Performance of Buildings) Regulations S.I 666 of 2006	324.95	
19.2	European Communities (Energy Performance of Buildings) Regulations S.I 243 of 2012	60.00	
19.3	European Communities (Energy Performance of Buildings) Regulations S.I 183 of 2019	110.55	
			495.50
	Total Cost (Excl VAT)		59,257.56

E.3 Building Regulations Upgrade Costs apportioned to Main Elements

	Document	House €	Siteworks €	Preliminaries €	Total €
1	**Part A TGDs - Structure**	3,780.14			3,780.14
2	**Part B TGDs - Fire safety**	3,110.90			3,110.90
3	**National Rules for Electrical Installations**	945.00			945.00
4	**Part C TGDs - Site Preparation & Resistence to Moisture**	2,049.50		701.76	2,751.26
5	**Part D TGDs - Material and Workmanship**	510.00			510.00
6	**Part E TGDs - Sound**	1,240.25			1,240.25
7	**Part F TGDs - Ventilation**	3,881.50			3,881.50
8	**Part G TGDs - Hygiene**	616.00			616.00
9	**Part H TGDs - Drainage and Waste Disposal**	498.50	2,583.48		3,081.98
10	**Irish Water Technical Documents**		1,679.74	426.19	2,105.93
11	**Part J - TGDs - Heat Producing Appliances**	767.00			767.00
12	**Part K - TGDs - Stairs, Ramps and Guards**	1,760.07			1,760.07
13	**Part L - TGDs - Conservation of Fuel and Energy**	16,621.75			16,621.75
14	**Acceptable Construction Details - Part L**	1,370.20			1,370.20
15	**Part M - TGD Acess and Use**	7,000.57	637.50		7,638.07
16	**Building Control Regulations**			3,804.46	3,804.46
17	**Health and Safety in Construction Regulations**			4,185.57	4,185.57
18	**Environmental and Waste Regulations**			592.09	592.09
19	**Energy Performance Regulations**			495.50	495.50
	Total Cost (Excl VAT)	44,151.38	4,900.72	10,205.57	59,257.66

E.4 Building Regulations Upgrade Costs withing time periods

		1991-2001	2001-2011	2011-2021	Total
		€	€	€	€
1	Part A Technical Guidance Documents - Structure	1,470.40	-	2,309.74	3,780.14
2	Part B Technical Guidance Documents - Fire safety	1,782.90	-	1,328.00	3,110.90
3	National Rules for Electrical Installations		405.00	540.00	945.00
4	Part C TGDs - Site Preparation & Resistence to Moisture	2,424.96		326.20	2,751.16
5	Part D TGDs - Material and Workmanship	450.00		60.00	510.00
6	Part E TGDs - Sound	416.75		823.5	1,240.25
7	Part F TGDs - Ventilation	257.50	440.00	3,184.00	3,881.50
8	Part G TGDs - Hygiene	426.00	190.00		616.00
9	Part H TGDs - Drainage and Waste Disposal	862.50	2,219.48		3,081.98
10	Irish Water Technical Documentation			2105.93	2,105.93
11	Part J - TGDs - Heat Producing Appliances			767.00	767.00
12	Part K - TGDs - Stairs, Ramps and Guards	897.15		862.92	1,760.07
13	Part L - TGDs - Conservation of Fuel and Energy	6,058.50	7,652.40	2910.85	16,621.75
14	Acceptable Construction Details - Ancillary to Part L		1,370.20		1,370.20
15	Part M - TGDs - Access and Use	7,555.07	83.00		7,638.07
16	Building Control Regulations		3,804.46		3,804.46
17	Health and Safety in Construction Regulations	3,279.69	905.88		4,185.57
18	Environmental and Waste Regulations	332.79	124.30	135	592.09
19	Energy Performance Regulations		324.95	170.55	495.50
	Total Cost (Excl VAT)	26,214.21	17,519.67	15,523.69	59,257.57

Building Regulations Upgrade Costs withing time periods (Part 2)

Element Proportions			€	€	€	€
House	75%	of total	20,848.47	10,190.60	13112.2	44,151.27
Siteworks	8%	of total	1,051.50	2,169.48	1679.74	4,900.72
Preliminaries	17%	of total	4,314.24	5,159.59	731.74	10,205.57
Totals			26,214.21	17,519.67	15,523.68	59,257.56

E.5 Building Regulations Upgrade Costs per Objective

	Document	Cost €	Regulations Objective
1	**Part A TGDs - Structure**	3,780.14	Structure & Occupant Health & Safety
2	**Part B TGDs - Fire safety**	3,110.90	Fire Safety
3	**National Rules for Electrical Installations**	945.00	Fire Safety
4	**Part C TGDs - Site Preparation & Moisture**	2,751.16	Structure & Occupant Health & Safety
5	**Part D TGDs - Material and Workmanship**	510.00	Structure & Occupant Health & Safety
6	**Part E TGDs - Sound**	1,240.25	Occupant Comfort
7	**Part F TGDs - Ventilation**	3,881.50	Energy Performance
8	**Part G TGD - Hygiene**	616.00	Public Health
9	**Part H TGDs - Drainage and Waste Disposal**	3,081.98	Public Health
10	**Irish Water TDs - Ancillary to Parts G and H**	2,105.93	Public Health
11	**Part J - TGDs - Heat Producing Appliances**	767.00	Structure & Occupant Health & Safety
12	**Part K - TGDs - Stairs, Ramps and Guards**	1,760.07	Structure & Occupant Health & Safety
13	**Part L - TGDs - Conservation of Fuel & Energy**	16,621.75	Energy Performance
14	**Acceptable Construction Details - Ancillary to Part L**	1,370.20	Energy Performance
15	**Part M - TGDs - Access and Use**	7,638.07	Universal Design
16	**Building Control Regulations**	3,804.46	Proof of Compliance
17	**Health and Safety in Construction Regulations**	4,185.57	Worker Health & Safety
18	**Environmental and Waste Regulations**	592.09	Public Health
19	**Energy Performance Regulations**	495.50	Energy Performance
	Total Cost (Excl VAT)	59,257.56	

Building Regulations Costs Upgrade per Objective (Part 2)

		€	%
A	Structure & Occupant Health & Safety	9,568.37	16.1%
B	Fire Safety	4,055.90	6.8%
C	Occupant Comfort	1,240.25	2.1%
D	Energy Performance	22,368.95	37.7%
E	Public Health	6,396.00	10.8%
F	Universal Design	7,638.07	12.9%
G	Proof of Compliance	3,804.46	6.4%
H	Worker Health & Safety	4,185.57	7.1%
	Total	59,257.57	100%

Appendices F

REGULATIONS INDIRECT COSTS

F.1 Building Control Regulations – Indirect Costs

Activity	Statutory Instrument	Clause Reference	Indirect Cost	Direct Cost	Input to Preliminaries	Effect on Programme
1. Legislative & technical awareness	Instruments list in Table 2.6		✓	✓	Included below	None
2. Awareness & understanding of continuous TGDs updates	ditto		✓	✓	CM + SM + QS x 2% and Training	None
3. Files Management & keeping records	ditto		✓	✓	Included above	None
4. PSCS – Professional Indemnity Insurance	ditto			✓	Premium fees	None
5. Assigned Certifier	SI 80 of 2013	Clause 6		✓	Consultants fees	Included in item 9 below
6. Preparing and agreeing Preliminary Inspection Plan with Assigned Certifier	SI 80 of 2013 SI 9 of 2014	Clause 7 Clause 9	✓		CM + SM x 1%	None
7. Preparing and agreeing Inspection Notification Framework with Assigned Certifier	SI 80 of 2013 SI 9 of 2014	Clause 7 Clause 9	✓		CM + SM + QS x 1%	None
8. Ancillary Certifier	SI 80 of 2013	Clause 12,13,15,17, 19,20,22,24 & 27		✓	Consultants fees, CM x 2% and specialist prelims cost	Included in item 9 below
9. Inspections in conjunction with Ancillary and Assigned Certifiers	SI 9 of 2014	Clause 5(4)	✓		CM 1% + SM 2%	Production x 1%
10. BCMS documentation control + collation	SI 9 of 2014	Clause 5(4)	✓		CM 2% + SM 1% + QS 1%	None
11. System Testing & commissioning procedures	SI 9 of 2014	Clause 7	✓		SM x 2%	Production x 2.5%
12. Commencement Notice	SI 9 of 2014	Clause 7	✓		Registration fees	none
13. BCMS validation process	SI 9 of 2014	Clause 11.4(b)	✓		None Directly	Completion x 3 weeks (average 2 weeks = 4%)
14. Building Control Officer Instructions	SI 9 of 2014	Cited by L.A	✓	✓	Included in item 2 above	None

Summary Analysis	**Input specifically to Building Control Regulations**
1. Contracts Manager (CM)	9% input
2. Site Manager (SM)	7% input
3. Quantity Surveyor (QS)	3% input
4. Programme extended	7.5%
5. Training	Building Regs FETEC Course (allowed elsewhere)
6. Registration Fees	Commencement Notice €30 per unit
7. Professional Fees	Assigned Certifier €950 per unit
	Ancillary Certifier – Structural €500 per unit
	Ancillary Certifier – M&E €370 per unit
8. P.I Insurance	Premium uplift €50 per unit - estimate

F.2 Health and Safety in Construction Regulations – Indirect costs

Health and Safety in Construction Regulations	Statutory Reference	Statutory Reference	Indirect Cost	Direct Cost	Input to Preliminaries	Effect on Programme
1. Legislative & technical awareness	S.I 504 of 2006	S.I 526 of 2013	✓		Training	None
2. Files Management & keeping records	Clause 3	Clause 3	✓		SO+CM+SM+ QS x 5%	None
3. PSCS – Professional Indemnity Insurance	Clause 6	Clause 6.1b		✓	To cover PSCS service	None
4. Appoint PSDP	Clause 6	Clause 6.1a	✓	✓	Fees and Admin	None
5. Appoint PSCS	Clause 6	Clause 6.1b	✓	✓	Fees and Admin	None
6. Clients Safety File	Clause 8,13 + 21	Clause 3 + 21	✓		SO+CM+SM x 5%	None
7. Health & Safety Plan - develop & maintaining	Clause 9 + 12	Clause 9	✓		SO+CM+SM x 2.5%	None
8. Notifications to HSA	Clause 10 + 23	Clause 10 + 22	✓		SO+SM x 0.5%	None
9. Risk Assessments & Method Statements	Clause 16 + 17	Clause 16 + 17	✓		SO+ SM x 5%	None
10. Safety Coordination of Subcontracts	Clause 17	Clause 17c,d + e	✓		SO+SM+CM x 2%	None
11. Subcontract pre-appointment assessments	Clause 17	Clause 17	✓		SO+QS x 2%	None
12. Method Statement, planning, preparing & implementation	Clause 17	Clause 17	✓		SO x 5%	Production - 2%
13. Site Safety Advisor – more than 100 persons	Clause 18	Clause 18	✓		S.O	None
14. Safety Awareness Training – Safe.Pas Card	Clause 19 + 25	Clause 19.1 + 25		✓	Training	None
15. Construction Skills Training – C.Skills Card	Clause 19 + 25	Clause 19.1 + 25	✓	✓	Training	None
16. Site Safety Representative - more than 20 persons	Clause 23	Clause 23	✓	✓	SO & Training	None
17. Site Inductions	Clause 25	Clause 25c	✓	✓	SO+SM x 2.5%	Production - 0.2
18. Safety Awareness – Topical Toolbox talks	Clause 25	Clause 25		✓	SO+SM x 1% Output Cost	Production - 0.1%
19. Safety Officer Appointment	Clause 26	Clause 26	✓	✓	SO	None
20. Safety Management Meetings	Clause 28	Clause 28	✓		SO,CM+SM x 3%	None
21. Prevention of Unauthorised Entry to Site	Clause 30	Clause 30		✓	Barriers / Equipment	None
22. Site Safety Inspections	Clause 87	Clause 30-34, 36,52 + 87	✓	✓	SO x 10%	Production - 0.2%
23. Evacuation Plan & Updating	Clause 31	Clause 31 + 45	✓	✓	SO x 1%	None
24. Personal Protection Equipment	Clause 35	Clause 35		✓	Equipment	None

25. Roadworks Guarding & Lighting	Clause 97	Clause 97	✓	✓	Equipment, procedures & training	None
26. Amendments to S.I 526 of 2013		S.I 130 of 2008			No tangible cost	None
Ditto		S.I 423 of 2008			No tangible cost	None
Ditto		S.I 523 of 2010			No tangible cost	None
Ditto		S.I 461 of 2012			No tangible cost	None
Ditto		S.I 481 of 2012			No tangible cost	None
Ditto		S.I 182 of 2013			No tangible cost	None
27. Code of Practice for Access & Working Scaffolding 1999		updated 2009 & 2018, Sections 1 - 7			Maintaining Scaffolder + Weekly GA3 + SM time in item 2 above	None

Summary Analysis	**Input specifically to Health & Safety**
1. Safety Officer (SO)	44.5% input
2. Site Manager (SM)	26.5% input
3. Contracts Manager (CM)	17.5% input
4. Quantity Surveyor (QS)	7% input
5. Scaffolder	70% of project duration
6. Programme extended	2.5%
7. Training	Managing Safety in Construction & PSCS Management Course €1050 + €950 every 3 years / 34 units Safepas Course – average €100 per unit C.Skills course – average €340 per unit
8. GA3 inspection weekly	70% of project duration – average co
9. Professional Fees	PSDP €206 per unit
10. Equipment	PPE, Signage & barriers
11. P.I Insurance	Premium uplift €44 per unit

F.3 Environment and Waste Regulations – Indirect Costs

Activity	Statutory Instrument	Clause Referenc e	Indirect Cost	Direct Cost	Input to Preliminaries	Effect on Programme
1. Legislative & technical awareness	Waste Management Act 1996 and regulations made under the act		✓	✓	Included below	None
2. Files Management & keeping records	ditto		✓	✓	EHSO x 5% , SM x 2%, CM + QS x 1% plus Training	None
3. Best management practice	Various policies and Guidance Statements 1998, 2002, 2004 & 2006		✓		Included above	None
4. Landfill levy	Waste Management (Amendment) Act 2001	Clause 11(3)		✓	Levy €19/Tonne at rate - 0.2T/M3	None
5. Waste Manager	ditto			✓	Included above	None
6. Waste Storage Area	ditto			✓	Compound Area expansion	None
7. Waste Management Plan and implementation	Guidelines on Waste Management Plans for C&D Projects – July 2006		✓		EHSO Officer x 5%	None
8. Landfill levy	Waste Management (Landfill Levy) (Amendment) Regulations 2008	Clause 4(2)		✓	Levy increased to €20/Tonne	None
9. Landfill levy	Waste Management (Landfill Levy) (Amendment) Regulations 2010	Clause 4(2)		✓	Levy increased to €30/Tonne	None
10. Landfill levy	Waste Management (Landfill Levy) (Amendment) Regulations 2011	Clause 4(2)		✓	Levy increased to €50/Tonne	None
11. Landfill levy	Waste Management (Landfill Levy) (Amendment) Regulations 2011	Clause 4(2)		✓	Levy increased to €75/Tonne	None

Summary Analysis **Input specifically to Building Control Regulations**

1. Environment + H&S Officer 11% input
2. Site Manager (SM) 2% input
3. Contracts Manager (CM) 1% input
4. Quantity Surveyor (QS) 1% input
5. Training CIF Environmental Regs Course €950 x 3 staff every 5 years divided by 34 units
6. Levy Fees From 01.06.15 - €75 per tonne

F.4 Energy Performance Regulations – Indirect Costs

Energy Performance Regulations	Statutory Instrument	Clause Reference	Indirect Cost	Direct Cost	Input to Preliminaries	Effect on Programme
1. Legislative & technical awareness	Instruments list in Table 2.7		✓	✓	Included below	None
2. Awareness & understanding of continuous TGDs updates	ditto		✓	✓	Included below	None
3. Files Management & keeping records	ditto		✓	✓	CM + SM + QS x 2% and Training	None
4. Consultants BER Certification	SI 666 of 2006	Clause 7(4)a	✓	✓	Fees and coordination	None
5. Issuing authority registration Fees	SI 243 of 2012	Clause 14(1)		✓	Fees	None
6. Coordinating Testing Regimes	SI 183 of 2019		✓	✓	CM + SM x 1% and Training	

Summary	**Input specifically to Building Control Regulations**
1. Contracts Manager (CM)	3% input
2. Site Manager (SM)	3% input
3. Quantity Surveyor (QS)	2% input
4. Training	CIF Building Regs Course €1150 x 3 staff every 5 years divided by 34 units
5. Professional Fees	Ber certification €155 per unit SEAI registration €60 per unit