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Evaluating how Ireland has improved Building Regulations Compliance and Energy Efficiency

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Abstract: This paper reports a study of evaluating the revised Building Control System in Ireland to establish if they have improved Building Regulations compliance and energy efficiency in the construction of new buildings. The new system of accountability ensures how all involved in the design and construction process are responsible for compliance in a comprehensive mandatory certification procedure, ensuring the design team, building contractor and subcontractors all certify compliance that the work is compliant with the Building Regulations. The research is practice based among building regulation certifiers' in Ireland to investigate the level of Building Regulations compliance since 2014 with the consequential improvements in energy efficiency. Research in Part L compliance has shown to be less than satisfactory, but since the new system was introduced, there is a high degree of accountability from both designers and constructors in the construction process. The findings suggest that the level of Building Regulations compliance have greatly improved, as certifiers are at risk of litigation from certification misstatement. Energy efficiency has improved in the construction of new buildings as Part L compliance is certified at design stage by the design certifier, construction is certified by the building contractor, sub-contractors and ancillary certifiers, and full compliance is certified by an assigned certifier who is responsible for overall compliance. The revised system provides responsibility on each certifier to detect and remedy non-compliant issues and the paper suggests a framework to assist certifiers' in determining the risks to reduce the risk of litigation.

Keywords: Building Regulations, Building Control, Compliance, Energy Efficiency.

Introduction and background

The Building Control regulatory system in Ireland changed with the enactment of the Building Control (Amendment) Regulations (BC(A)R) 2014 after thousands of dwellings were found to have structural defects caused by pyrite and high-rise buildings were found to have inadequate fire safety measures. Non-compliance with the Building Regulations were discovered in a Building Control system that permitted certificates of "substantial compliance" with the Building Regulations during construction and at completion of buildings or works. In some cases, building regulation certifiers' certified substantial compliance based on a visual inspection at the end of a project. Consequently, to improve compliance the Irish government enacted the Building Control (Amendment) Regulations 2014 to ensure buildings had to be designed, constructed and certified in accordance with the Building Regulations before, during and after construction.

BC(A)R 2014 introduced three new certifier roles with the "Design Certifier" having responsibility for overall design compliance, the "Ancillary Certifier" having responsibility for design or construction compliance and the "Assigned Certifier" being responsible for overall Building Regulations compliance based on certificates produced to him. The Design Certifier and Assigned Certifier must be a registered architect, registered building surveyor or chartered engineer and the Ancillary Certifiers are selected by the Assigned Certifier to certify compliance in the Inspection plan. Building Control in Ireland was transformed from a system

of substantial compliance to a stringent accountable system design and construction compliance.

Problem Identification and basic principle

The Building Control (Amendment) Regulations 2014 were introduced to formulate an improved system of Building Control and Building Regulations compliance in both design and construction, but the mandatory wording on the certificates of compliance puts the building regulation certifier at risk of litigation from certificate misrepresentation if the building or works are subsequently found to be non-compliant with Building Regulations.

Research by Keaveney and Compton (2016), indicated that 85% of respondents agreed the new regulations introduced in Ireland would improve the standards in construction from better supervision and inspection and having greater responsibility and accountability from all involved in the construction process. However, the perceived improvement in compliance may be because certifiers' have increased and improved site supervision inspections due to the risk of litigation from compliance certification.

As a rule, there are two basic defect types, which are defects that occur in design or defects that occur during construction. Under BC(A)R 2014, the design certifier or one of the ancillary design certifiers may be responsible for design defects, but defects that occur during construction may be the responsibility of the building contractor, subcontractor or ancillary certifier that certified the work. The law of a construction contract is largely based on contract where the subcontractor indemnifies the main contractor against their work. However, this procedure becomes complicated under BCAR 2014, where it is possible that the contractor, subcontractor and certifier can be held responsible or partly responsible for a defect, as the main contractor and subcontractor can allege that the ancillary certifier should have noticed the defect and is partly responsible. The certifier may have vicarious liability for consultants under his control and can be found responsible for their actions if they are negligent. "In many instances, architects are legally responsible for the conduct and performance of their consultants, just as they are for employees" (Demkin, 2008 p.357). The Assigned Certifier should therefore select experienced high-quality consultants to reduce risk of liability.

Certifiers' professional indemnity insurance may be impacted from litigation claims if buildings or works are subsequently found to be non-compliant with the Building Regulations. The president of the RIAI, John Graby, believes that *"Architects must be able to get professional indemnity insurance, and if the new duties imposed amount to a guarantee, then we have a problem"* (Lee, 2013, p.3). The regulations are therefore a threat to certifiers' professional indemnity insurance, as completion certificates must state that both design and construction is compliant with the Building Regulations, but this can be amount to certification misrepresentation when minor defects remain on completion or if latent defects subsequently occur.

The amount of certifiers' time has increased in the certification process and this cost has impacted on the overall cost of construction. Professional fees increased after the introduction of BC(A)R 2014, but fees were greater in small extensions and one-off houses as a ratio to overall cost than large projects. "It has been suggested that the additional hours required to fulfil the roles and services of DC¹ and AC² under BCAR SI.9, based on the construction of a one-off house with a completion programme of 40 weeks, would be in the

¹ Design Certifier

² Assigned Certifier

region of 155.5 hours over and above normal professional scope of service (Ramsey, 2014 p.14). Consequently, to reduce the cost of professional fees associated with building a dwelling or dwelling extension, the Irish government enacted the Building Control (Amendment) Regulations (BC(A)R) 2015 that allowed building owners to opt out of the mandatory professional design and certification procedure in the construction of single unit dwellings or extensions to dwellings.

Most building contractors' insurance are "all risk" in nature, but it is not a warranty or liability insurance. Exclusions commonly found in building contractor risk policies are wear and tear, deterioration, depreciation, loss, damage, defect, design error, design omission or remedying poor workmanship (Wedge, 2015). Consequently, there should be a mandatory requirement in BC(A)R 2014 requiring building contractors to take out latent defects insurance before the commencement of a project.

Design certifiers must be consciously aware of possible design defects when certifying building regulation compliance. In research conducted by Chong and Low (2006), they found in a 74 unit building survey, that the three most important design-related failures were moisture, weather impact and impacts from occupants. Design failures can be problematic for certifiers' as the mandatory wording in the certificate of completion by the assigned certifier is as follows: "I now confirm.....that all have exercised reasonable skill, care and diligence in certifying their work in the ancillary certificates scheduled" (DECLG, 2014). This wording on the certificates of completion by certifiers will give the legal profession armoury when taking a civil action against a certifier if the Building Regulations are non-compliant. The assigned certifier must certify that others involved in the project have exercised reasonable skill and care and if that fact is untrue, it leaves the assigned certifier in a precarious position when certifying full compliance.

Building Regulations Non-Compliance

There are many areas of construction where non-compliance can be found on a building site, but a study by Baiche, Walliman and Ogden (2006), list the main reasons and causes of building regulation non-compliance. They suggest that poor workmanship, ignorance of details or regulations, poor management, use of incorrect or non-certified materials, conflict or confusion between trades, pressure to complete work, changes to approved designs, unfamiliarity with design, complicated labour intensive details and lack of detailed calculations, but they argue that site operatives and site management have the responsibility for non-compliance and certifiers should not be enforcers but instead should be certifiers.

Compliance with the Fire Safety Regulations are reliant on the building contractor's ability and reliability to carry out the work responsibly and professionally with site visits from the certifier to ensure compliance, but the certifier can't be expected to be on site for all aspects of fire safety construction. In the UK, there is a perception that if the building is building regulation compliant, then it has to meet fire safety legislation, but the building may not be safe for occupants as the fire risk assessor "may not justify imposing insulation on all fire doors, nor restricting the amount of smoke production" (Jackman, 2006 p.58) as he cannot be responsible for the whole scenario, but is responsible only for the area of fire safety he is certifying. However, the situation in Ireland differs, as BC(A)R 2014 ensures the Design Certifier is responsible for fire safety design, while the building contractor and Ancillary Certifiers are responsible for fire safety construction.

Fire safety measures can be the most important element of Building Regulations compliance, as non-compliant fire safety construction in buildings can cause loss of life. Fire

stopping underlines the broad knowledge required by certifiers to be competent of identifying areas where fire safety measures are substandard. Research by Stewart (2009) indicate how subcontractors can interfere with fire stopping measures of fire compartmentation compliance, that include the plastering subcontractor, carpentry subcontractor, electrical subcontractor, mechanical subcontractor, ductwork subcontractor, brickwork subcontractor, fire door subcontractor and fire protection subcontractor. However, fire stopping measures can be compromised by a change of specifications not being communicated to all subcontractors or inexperienced installers. Therefore, site inspection certifiers must be vigilant to examine the work of both the main building contractor and the various subcontractors on site who have responsibility for installing or interfering with fire protection products.

To achieve Site Preparation and Resistance to Moisture Building Regulations compliance, certifiers must be aware of dangerous substances and the necessity to protect buildings from radon gas. Radon gas is a continuing health problem in Ireland, as “it amounts to 150 – 200 cancer deaths in Ireland per year” (Long and Fenton, 2011, p.96). Radon membranes are commonly used in buildings to protect the building occupants from radon gas entering from the ground, but can also protect from moisture entering through the floor. In a study between 1989 and 1992, radon gas was found in “*more than 10% of houses have radon levels greater than 200 Bq/m³*” (Radiological Protection Institute of Ireland, 2002, p.1) which are dangerously high levels of radon. One third of Ireland is deemed to be a high radon area, where a house located in a high radon area can have seven times the risk of a house in a low risk area (Fennell, et al., 2002). To make buildings compliant with radon membrane, it is necessary to pay great attention to detailing and workmanship. The moisture and air seal must bridge cavities in walls and make a cavity tray. Therefore, to ensure building regulation compliance, a radon specialist subcontractor should install the radon membrane to ensure gas tight seals around pipes and junctions in accordance to correct specifications and installation methods.

The Radiological Protection Institute of Ireland (RPII) radon map of Ireland is divided into 10km x 10km squares to portray an estimated level of radon gas in any area, but the levels of gas are only an estimated level and can vary greatly from the levels indicated on the RPII map. In a radon test of a dwelling in Castleisland, Co Kerry in 2003, it was found to have the highest level ever recorded radon gas measurement in a dwelling in Ireland at 49,000 Bq m⁻³, even though it is evident that it was situated on the RPII map at a low level radon area of between 10% - 20% of dwellings above 200Bq m⁻³ (Organo and Murphy, 2007). This shows how extremely high levels of radon gas can be found in a dwelling located a relatively low RPII radon gas area, illustrating how important how important it is for certifiers to ensure radon membranes are correctly installed in all areas.

In certifying Building Regulations compliance with Materials and Workmanship, the design certificate and certificate of completion should include compliance with the Construction Products Regulations (CPR), where all construction products must include the CE mark and Declaration of Performance (DOP) from the manufacturer. A certifier must ensure products bear the CE mark and must be used for the way it is intended. The Code of Practice suggests records should be kept for a minimum period of six years, the building regulations do not set a time limit and it is therefore advisable that certifiers should retain DOP, installation records and ancillary certificates for 10 years after completion. BC(A)R 2014 imposes a greater responsibility on design certifier where “fitness for purpose” is a significantly higher bar than “due skill and care” (Hegarty, 2015). Therefore, the situation in

Ireland it is quite different to the UK where market surveillance is monitored by the local trading standards agencies as opposed to the building control authorities in Ireland and architects in the UK have no responsibilities beyond specification leaving the building contractor solely responsible for compliance on site, while BC(A)R 2014 in Ireland ensures the Design Certifier is responsible for drafting the specifications and the Ancillary Certifiers are responsible for the implementation of the specifications on site.

The requirement to install ventilation in a building is a requirement under Part F Technical Guidance Document (TGD), but the common use of natural ventilation grilles can have a negative effect on energy efficiency. It is common for developers of housing developments, to install insulation in the external walls to satisfy the requirements of Part L TGD, while knocking out holes in the walls for vents to satisfy Part F TGD. They both satisfy the building regulations, but breaking out holes in the wall for ventilation is counter-productive in the conservation of fuel and energy. Developers will continue to construct large housing developments with natural ventilation wall vents, as mechanical ventilation can be regarded as an unnecessary expense. Mandatory legislation is necessary for mechanical ventilation installation to become standard practice, as mechanical ventilation in airtight buildings can have a great impact on energy efficiency. However, a study by Kinnane, Sinnott and Turner (2016) found that many airtight homes do not provide the air required changes to be building regulation compliant and purpose provided ventilation is necessary. Therefore, as airtight buildings are increasingly being designed and constructed, it is essential for certifiers that buildings are checked before completion to ensure ventilation is provided with the minimum air change requirements.

Compliance with Drainage and Wastewater Disposal should be carried out by competent certifiers with competence in wastewater design and installation. Septic tank systems have traditionally been used as a method of on-site wastewater treatment in rural areas of Europe, but many septic tanks in Ireland are leaking, not being maintained, polluting water sources where they are “designed to overflow between one and two metres below ground surface: consequently the topsoil does not feature in the equation” (Robins, 1998, p.3). It is widely accepted that “wastewater treatment plants and rural septic tanks continues to be the main source of water pollution in Ireland” (Callanan and Keogan, 2003 , p.220) and they are a “potential source of water pollution in headwater catchments” (Withers, et al., 2014, p.123). Consequently, many private waste water systems installed in one-off houses throughout Ireland are in poor condition, with inadequate supervision of the installation and maintenance of wastewater treatment systems. Therefore, to ensure compliance, certifiers’ should insist before installation, that a maintenance agreement is in place between the building owner and the manufacturer to ensure regular maintenance is maintained.

With building control systems in place in the UK, it may be considered surprising “that 80% of the estimated 1.5 million private sewage systems (PPS) in the UK are working inefficiently” (Brownlie, et al., 2015, p.131). Ireland also, have many wastewater treatment systems working inefficiently, as during a review by the Environmental Protection Agency (2015), between the 1st of June, 2013 to the 30th of June 2014, it was found that of 987 inspections, only 52% passed the inspection examination. In research conducted by Naughton and Hynds (2014), they found that only 32.6% of 722 respondents said that their wastewater treatment systems were de-sludged at least every two years. These statistics appear to indicate that many of the problems with septic tank pollution may come from unmaintained sewerage systems and show they may be working inefficiently in both the UK and Ireland.

Airtight testing in a building is a requirement of the building regulations and the required air change per hour is expected to improve with Part L TGD by 2020. In research carried out by Sinnott (2016), the greatest single leakage path was found to be in boxed-out waste and soil pipes from ground floor level to the unheated attic. Many of the existing passive wall vents were partially or fully obstructed, and many painted over several times caused rooms to be under ventilated. Consequently, with further improvements expected in Part L of the Building Regulations by 2020 and the construction of energy efficient buildings, design certifiers and ancillary certifiers will require a high degree of skill and knowledge to establish the causes associated with air tightness failure to certify passive houses and energy efficient buildings.

Thermal imaging can provide an indication of thermal bridging inefficiencies to highlight compliance issues. According to Colley (2012), an unpublished report commissioned by the SEAI in 2004, found a representative sample of 52 houses constructed between 1997 and 2002, had only 5% compliance of Part L after thermal imaging tests. However, according to Robinson (2016) when further testing was carried out on the same houses in Parts L, F and J, none of the 52 houses were fully compliant with building regulations. This outlines the stark reality that Ireland have a very small proportion of houses with full building regulations compliance. Before the introduction of BC(A)R 2014, the average home in Ireland is rated as a "D2" with only 0.5% being "A" rated (Curtis, Devitt and Whelan, 2014).

The government of Ireland enacted Part M TGD 2000 providing legislation to facilitate access and use for people with disabilities relating to dwellings, buildings other than dwellings, sanitary conveniences and audience or spectator facilities. Further legislation introduced in Part M TGD 2010, applied to both new and existing buildings. There are different regimes adopted for access and use of disabled persons throughout the world and a study by Prideaux and Roulstone (2009) found that Ireland, Malta and the UK took moderate reasonable adjustments to allow disability access in both old and new buildings. Therefore, while the access and use for people with disabilities were relatively straightforward relating to new buildings, extensions and modifications to existing buildings were not as straightforward.

The DHPCLG (2010) determines how Part M related to existing dwellings other than dwellings, to assist building designers in determining if Part M related to existing building extensions, historic buildings, material change of use, material alteration and to determine if it was practical to modify or provide an approach and access to comply with Part M. This shows how difficult it can be for certifiers to ensure building regulation compliance in existing buildings. Therefore, the access and use building regulations can be subject to interpretation regarding existing buildings as building designers often submit proposals to building control in disability access certificate applications for dispensation or relaxation of Part M TGD.

Research Methodology

The research involved the gathering and analysis of secondary data from Building Control Management System (BCMS) comprising of new projects that commenced throughout 31 local authorities in the Republic of Ireland over a six-month period between 1st of November 2017 and the 30th of April 2018. In total, 5,403 projects had commenced during that period, but for analytical purposes, 540 projects were selected at random which represented 10% of the total number. The purpose of this research was to evaluate the number of stakeholders involved in the process acting with dual responsibility to determine if the regulations are compromised to ensure compliance. It will examine the proportion of building owners that are operating as building contractors and the proportion of Design Certifiers that are also

acting as Assigned Certifiers. The Code of Practice for Inspecting and Certifying Buildings and Works recommends that the builder should be competent and on the Construction Industry Register Ireland, but there is no mandatory requirement on building owners to employ a registered building contractor to construct the building or works and some building owners are also acting as building contractors. The professional bodies of Royal Institute of Architects Ireland, Engineers Ireland and the Society of Chartered Surveyors Ireland recommend that the Assigned Certifier should be independently appointed without the additional responsibility of acting as Design Certifier, but this recommendation is not being widely implemented.

The research also involved a case study of the compliance issues studied in 9 projects for both domestic and commercial developments during a six-month period between the 1st of November 2017 and 30th of April 2018 and set out to establish the extent of compliance in accordance with BC(A)R 2014 and BC(A)R 2015.

Table 1. Analysis of BCMS Compliance Documentation required for Domestic and Commercial Developments

	BCMS Commencement Notice	Building Type	Floor Area	Design Certifier & Assigned Certifier
1	Commencement Notice with Compliance Documentation	1. Dwelling with competent builder 2. Restaurant Kitchen with competent builder 3. Dwelling Extension with competent builder	912m ² 692m ² 105m ²	Yes
2	Commencement Notice with Opt-Out Declaration	4. Dwelling with competent builder 5. Dwelling without competent builder 6. Dwelling extension with competent builder 7. Dwelling extension without competent builder	253m ² 195m ² 93m ² 45m ²	No
3	Commencement Notice without compliance Documentation	8. Filling Station Improvements with competent builder 9. Domestic Garage without competent builder	854m ² 62m ²	No

The research involved projects with compliance documentation, without documentation and dwellings and extension to dwellings with the Opt-Out declaration. The research is designed to evaluate the level of compliance found on each project.

Results and discussions

The analysis of the BCMS data and the case study of both domestic and non-domestic developments highlights the anomalies that exist to show compliance. The documentation required to show compliance under BC(A)R 2014 is comprehensive, whereas the building owners of single unit dwellings and extensions to dwellings that opt-out of the statutory requirements under BC(A)R 2015 may achieve compliance without professional services.

First: Building Control Management System Analysis

In analysing 540 projects on Building Control Management System as shown in Figure 1, it was found that 65% of building owners employed a building contractor, whereas 35% of building owners took on the additional responsibility of acting as building contractor. Of the 189 building owners who acted as building contractors, 69% of building owners worked on single dwellings or extensions to dwellings, whereas 31% of the building owners worked on buildings other than single unit dwellings. These results suggest that 35% of building owners have the dual responsibility of acting as building contractors in constructing their own dwellings and buildings other than dwellings. However, when excluding building owners constructing their own dwellings or extensions to dwellings, 11% of building owners acted as building contractors in constructing buildings other than dwellings. It is unlikely that these building owners are competent experienced registered building contractors and this analysis suggests how the non-mandatory requirement to appoint registered building contractors negates the effectiveness of the regulations.

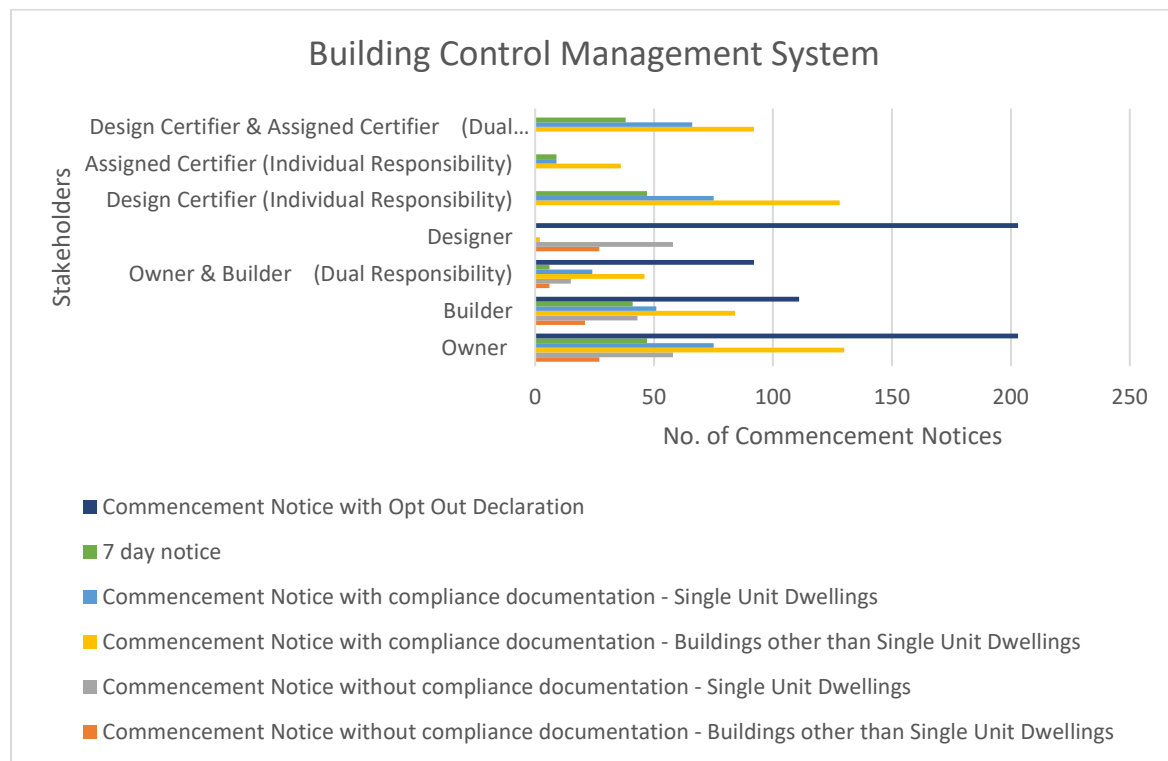


Figure 1. Analysis of 540 BCMS Projects throughout 31 local authorities in Ireland over a six-month period.

The research found that 250 of the 540 projects were buildings other than dwellings and 22% of those projects the building owner had appointed a Design Certifier and an Assigned Certifier with separate responsibilities, but 78% appointed a Design Certifier with the dual responsibility of Assigned Certifier. An Assigned Certifier with the additional responsibility of Design Certifier may have a degree of difficulty in defending their actions if a case of professional negligence or certificate of misrepresentation is alleged to have occurred when a building or works are subsequently found to be non-compliant with the Building Regulations. However, 73% of single unit dwelling building owners opted out of the statutory certification process and the remaining 27% opted into the statutory certification process. This implies that dwellings may continue to be constructed below the required standard of Building Regulations compliance.

Second: Case Study Analysis

The documentation required to show compliance in the BCMS depended on the type of commencement notice that was submitted. In the 9-project case study, the level of compliance found on sites as shown in Figure 2 were graded on the site inspections indicating the amount of construction compliance issues found to be correct on site and the material documentation required to show compliance. In analysing the compliance issues associated with buildings requiring compliance documentation, compliance was found to be correct during site inspections between 75% and 100%, averaging at 95%. This contrasted with projects where building owners opted out of the statutory regulatory system between 34% and 100%, averaging at 73%. Finally, in projects where compliance documentation was not required, compliance was found to be correct between 20% and 84% averaging at 66%.

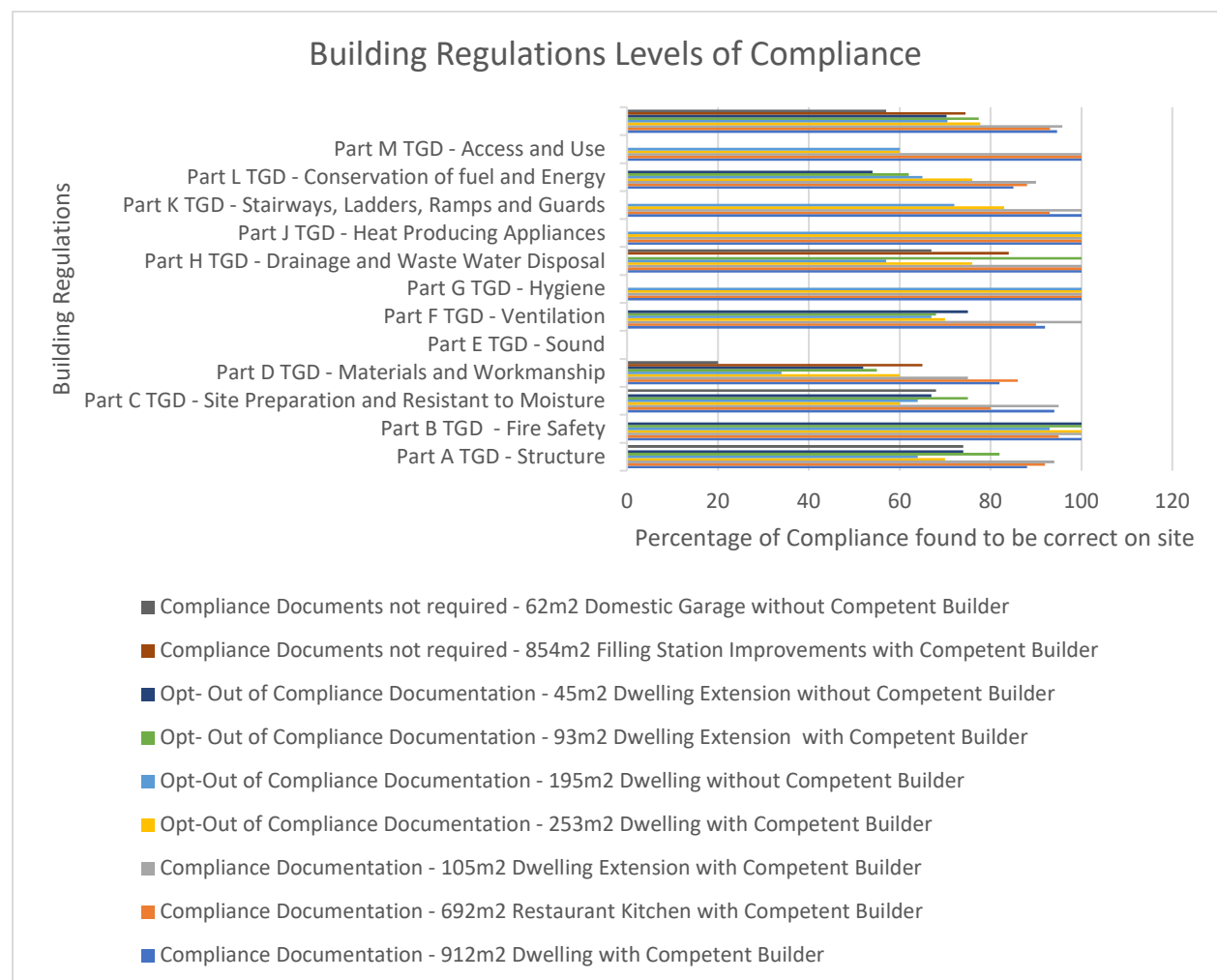


Figure 2. Levels of Compliance found to be correct in 9 construction projects during a 6-month period.

The level of compliance found in projects with compliance documentation was found to be greater than projects without compliance documentation due to the certifiers' inspection plan, a competent building contractor and accountable certificates from all involved in the design and construction process. In contrast, building owners who opted out of the statutory process that are building their own dwellings or extensions would not have the knowledge or skills to achieve the required level of compliance. In calculating the level of compliance attained, compliance issues outlined in Table 2 were noted at each site visit.

Table 2. Analysis of Compliance issues found on 9 construction sites in a 6-month period

Part A TDG (Structure) – Ground bearing suitability, foundations, reinforcement, concrete, steel, hardcore, blocks, roof structure, lintels, chimneys, stairs, floors and drainage.
Part B TGD (Fire Safety) – Fire stopping, Fire detection and alarm systems, access to buildings, cavity barriers, ducting, fire resisting eaves, party walls.
Part C TGD (Site Preparation and Resistance to Moisture) – Radon and DPC installation.
Part D TGD (Materials and Workmanship) – Material certification.
Part E TGD (Sound) – Not applicable on selected projects.
Part F TGD (Ventilation) – Wall vents, mechanical ventilation, Insulation covering vents.
Part G TGD (Hygiene) – Pipes and tanks not insulated properly.
Part H TGD (Drainage and Waste Water Disposal) Incorrect installation.
Part J TGD (Heat Producing Appliances) – Flues, location, size, burner.
Part K TGD (Stairways, Ladders, Ramps and Guards) – Balcony, Stair rail height, glass.
Part L TGD (Conservation of Fuel and Energy) – Cavities, Vapour control, cavity barriers, Insulation, thermal bridging, airtightness.
Part M TGD – (Access and Use) – Building access, ramps, steps, doors.

Figure 3 outlines the amount of inspections that correlate to the time involved in the project. The 912m² dwelling took 22 months to complete had a total of 92 site visits from the Architect, M&E Engineer and the Structural Engineer. The Inspection Plan provided a system of accountability that ensured how all involved in the design or construction process were responsible for their work.

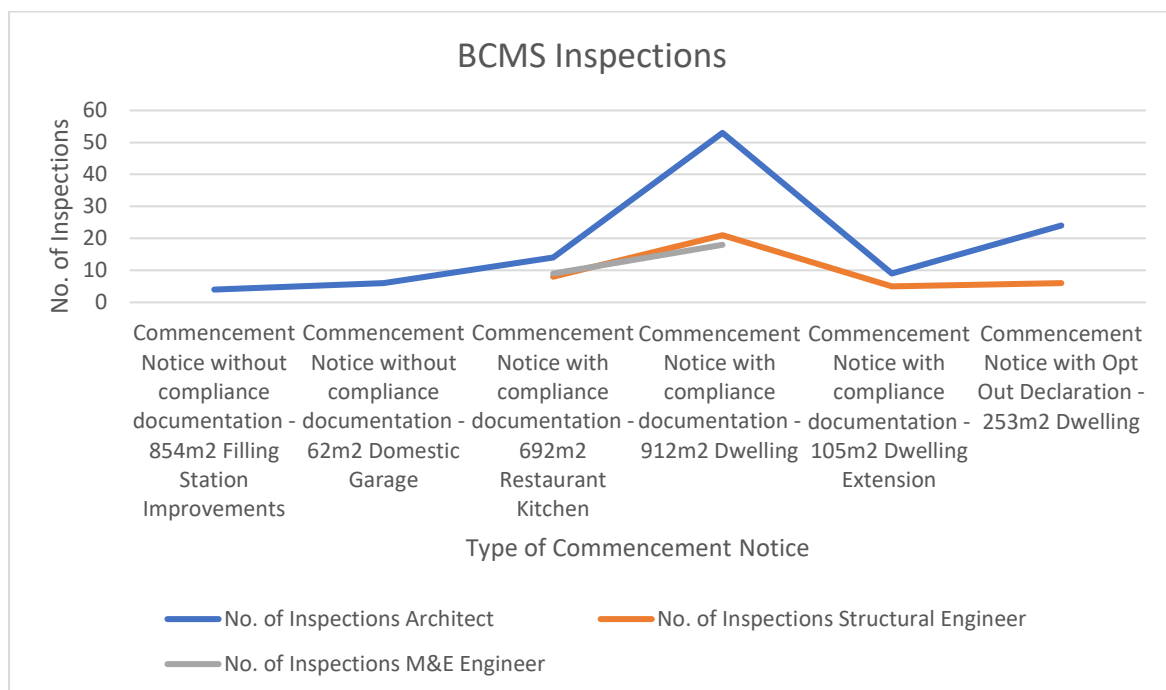


Figure 3. No. of Inspections required in 6 construction projects required to achieve compliance.

In adopting a methodological system of compliance, certifiers' can ensure compliance is achieved in both design and construction. It is essential that building contractors are competent and the certifiers are also competent to ensure a high level of compliance.

However, certifiers are advised to adopt a methodological framework as outlined in Table 3 to ensure the risk of litigation is minimised.

Table 3. Methodological Framework for Building Regulation Certifiers to show compliance

1	Record conversations, instructions and meetings.
2	Maintain and provide correspondence and certificates
3	Record action to verbal advice in writing
4	Ensure all ancillary certificates are in in accordance with the Inspection plan
5	Provide drawings, specifications, calculations and documents to show compliance
6	Record all inspections with notes and photographs.
7	Maintain detailed records of Inspection.
8	Record advice from Building Control Authority and action taken
9	Record disputes or differences between parties
10	Record and submit any changes in design to the local authority at completion

Conclusions

The research shows Building Regulations compliance and energy efficiency in Ireland have improved in buildings or works requiring compliance documentation due to the design and construction compliance requirements, the increased amount of supervision and inspections, the level of accountability and certification required by all involved in the design and construction process and the risk of litigation from certification misrepresentation. For example, an electrical contractor will certify that he installed the electrical system in compliance with the Building Regulations and the Mechanical & Electrical Engineer who supervised the installation will also certify that the electrical system was installed and commissioned in compliance with the Building Regulations. This system of double check accountability throughout the design and construction process ensures how Building Regulations compliance can be achieved with ancillary certificates from all involved in the design and construction process. The Inspection Plan coordinated by the Assigned Certifier ensures inspections are carried out by the Ancillary Certifiers at the relevant stages during the construction process to ensure compliance. The research highlights how projects with compliance documentation have inspections by competent persons and competent building contractors constructing the building can ensure a high level of compliance and energy efficiency as opposed to building owners who opt-out of the statutory certification process.

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