

Timber frame and masonry construction



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Modern construction comes in many forms, from traditional masonry, to precast concrete, to steel, and in recent times timber frame construction.

Timber frame and masonry construction are very similar looking buildings. Over the last thirty years in Ireland the main type used in domestic dwelling was masonry construction which consists of block inner leaf, cavity, insulation and a block outer leaf, externally finished normally with a brick or plaster rendered block. Over the last twelve years timber frame construction has grown to account for nearly forty percent of the market. Timber frame construction consists of an off site engineered building which arrives to site and the pieces are assembled to complete the unit. The external finish is similarly to masonry with brick or plaster rendered block. The reason for chosen this topic is to find why this change occurred. The purpose of this dissertation is to examine the Irish housing market over the last number of years, also to find out the reasons for timber frame construction becoming more popular.

Aim

To find out why the trend of building domestic housing in Ireland has changed from masonry construction to timber frame construction.

Objectives

- * To investigate the Irish housing market and find reasons for the trend change from masonry construction to timber frame construction.
- * To examine the reasons why timber frame construction has grown to the level it has over masonry construction.

* To examine the views of homeowners and property developers towards timber frame construction.

Literature Review

The primary data will be sourced from RGU database, Internet sites, RGU books and journals. Relevant Irish government reports and websites will also be looked at to gain an unbiased view. Also the views of the construction agencies in Ireland will be explored.

Research and methodology

The author plans on doing a comparison of the two construction types in order to achieve reasons for the shift in trend. The brief comparison case studies will include cost, time, heat and energy of both types of construction.

Questionnaires

Questionnaires provided the primary research for this dissertation. The author shall do up one and give it out to relevant homeowners and property developers to gain an insight into their views. By doing this the author will find out the market potential of timber frame construction.

Structure of Dissertation

Chapter One

This chapter explains the title of the dissertation, introduces the motivations and gives a background for the reasons for choosing this topic. The author

explains to the reader the aim and objectives of the dissertation and how they are going to be achieved.

Chapter Two

The literature review will investigate in trend in Irish construction. Current construction agencies reports will be looked to try and gain an insight to the change in trend. The author feels that this will achieve the first objection of this dissertation.

Chapter Three

This chapter will investigate the two building options with regard to cost, time, heat and energy. This will be done by a number of interviews and case studies. Areas looked at will be construction cost and life cycle costs. Also will include a case study of both types of construction where U-Values and Building Energy Rating will be achieved and assessed to gain an insight into why the trend shifted. The author feels that this will achieve the second objection of this dissertation.

Chapter Four

This chapter the opinions and views of homeowners and property developers towards timber frame construction and masonry construction are explored by means of a questionnaire. The author feels this will achieve the third objection of the dissertation.

Chapter Five

In this final chapter the conclusion provides a brief summary of the findings of the preceding chapters.

Literature Review

Background

Over 70% of homes in the developed world are timber frame homes. 60% of Scottish new dwellings are timber frame and overall in the United Kingdom timber frame accounts for 15% of new homes. Ireland is slowly following our neighbours. Over the last ten years Ireland has been experiencing a construction boom. Housing units completed in 2000 were 49,812 units growing to 62,686 in 2003, peaking in 2006 with 82,980 units completed. After 2006 the housing market in Ireland started to fall, numbers of units being built in 2007 were 71,356 continuing to fall in 2008 to 48,151 units and continuing to fall in 2009. (Central Statistics Office Ireland 2008)

Many housing estates and apartment blocks had been popping up in every city, town and village mainly around the commuter belt around the capital city of Ireland Dublin. Then slowly the rest of the country followed. In 1992 timber frame construction accounted for only 5% of the new dwelling market. Since then it has grown to enormous levels to account for 30% of total housing construction nationally (Construction Industry Federation 2009).

Typically these buildings were constructed by masonry construction, this consisted of a 300mm cavity wall with block inner leaf, insulation, cavity and a brick/block outer leaf finished with a plaster render. Over the last

seventeen years timber frame construction has shown steady growth.

Timber frame construction consists of an off site engineered building which arrives to site and the pieces are assembled to complete the unit. The external finish is similarly to masonry with brick or plaster rendered block. Some industry experts predict that by 2012 it will account for 50% of the new dwelling market.

“ The timber frame industry in Ireland has shown strength and resilience, despite these difficult economic times. When the upturn comes, timber frame construction will be presented with numerous opportunities.” (Maurice Buckley, CEO, NSAI – National Standards Authority of Ireland.)

Reasons for this happening?

Energy

In Ireland over the last number of years there has been a turn in attitude regarding the environment, which has in some part resulted in changes been implemented by the construction industry with regard to energy conservation. The main topic that has come to the fore on an Irish domestic level is the conservation of fuel and energy consumption. The construction industry has been identified as a considerable part of the national energy bill. Attitudes of developers and homeowner are changing to environmentally friendly buildings. Due to this timber frame construction has seen a steady growth. Timber frame is renewable building option, for every tree cut down two more are planted. The cost of turning the raw product into a building material is conceivably less than traditional methods.

“ Timber is the only sustainable renewable commercially viable building material. The production of concrete produces vast amounts of Carbon Dioxide (CO₂), which has a negative impact on the environment and contributes significantly to global warming.” (Irish Timber Frame Manufacturing Association 2009)

Speed

As the construction boom grew so did the need for housing and more importantly fast housing. One of the main factors for this turn towards timber frame is speed of construction. The frame of the building can be erected in a number of days which compared to typical masonry building is incredibly faster. This is due to the timber frame being constructed off site in a factory and delivered to site as a planned process of assembly. Masonry on the other hand takes a number of weeks to reach roof level whereas timber frame is erected in a number of days. Even in wet weather work can still continue as a scaffolding system is in place around the foundation, whereas blocks for masonry construction can only be laid in dry weather. Also with timber frame construction the building is weather proof much faster so internal works can begin much quicker. Also a lot of the slower work for plumbers and electricians such as first fixing is much easier done in a timber frame house. “ Timber frame has 30% shorter, more predictable construction time than brick and block” (UK Timber Frame Association 2009)

In masonry construction the use of wet trades in the build causes extra time needed for drying out. Because timber frame is a dry form of construction there is no drying out time which is a saving of a number of weeks. Also

because of this there is less likely a risk of cracking appearing on walls and ceilings for shrinking which can occur in masonry frequently.

Time scale for both for of construction

Standard Masonry Home

Weeks

Timber Frame Homes

Foundations

1

Foundations

Foundations

2

Foundations

Bricklayer Ground Floor

3

Erect Timber Frame Structure,

Fix & Glaze Windows

Bricklayer

4

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Felt, Battens, Tile Roof

Fix & Glaze Windows

5

Brickwork & First Fix

6

Roof Structure

7

Insulate

Felt, Battens. Tile Roof

8

Dry Line

First Fix

9

Second Fix

Plasterwork

10

Decorate, Move In

Plasterwork

11

12

2nd Fix, Plumber, Electrician

13

14

15

16

17

2nd Fix

18

19

Decorate, Move In

20

=

Drying out period

Taken from (Energy Efficient Homes Ireland 2009)

Cost

The cost of a timber frame house is similar to masonry built. Unlike masonry, costs of a timber frame build can be fixed long before the foundations are poured. This is due to most timber frame suppliers also fix the structure. So a fix price for a fixed solution. No rain days for wet trades or no additional costs.

“ This ensures that the additional expenses that spiral as a building progress can be eliminated.” (Irish Timber Frame Manufacturing Association 2009)

The number of persons need to fix the structure is lower than a masonry build, also with regard to time, time is money so the faster the build the cheaper for the developer and homebuilder. Also the hand over time for a complete dwelling is must faster so this will benefit developer’s cash flow and profitability. Due to the speed of construction on site security cost or greatly reduced.

Flexibility of Layout

Because timber frames internal walls being construction out of light weigh partition walls the internal space of a timber frame build is very flexible. Any mistakes in layout of internal walls is easily rectified, where as masonry internal wall would be particularly more difficult to correct.

Case Studies

Introduction

To get real reasons for the trend moving towards timber frame construction and to get a true indication of the cost difference in both timber frame and traditional masonry domestic construction the author looked at two key areas, construction costs and life cycle costs. In relation to construction costs the areas of preliminary costs; plant and equipment costs and site labour costs are looked at in greater detail.

Construction Costs

Preliminary Costs

Every construction project incurs preliminary costs. Preliminary costs are defined as,

“ Costs which are directly involved with the overall completion of a construction project” (Roy Chudley 2002)

These costs include items such as site management, insurance for the project, drivers and operatives. On larger sites where site cabins, offices, storerooms, toilets and canteens are required the costs incurred are also referred to as preliminary costs.

For each project there is an allowance set aside for preliminary costs. However in relation to timber frame construction these costs are included in the overall timber frame package. This is a result of the majority of the work required for timber frame construction being carried out off site, which in turn makes the budget costs a lot cheaper than traditional masonry. Derek Moore a director with Timberline building contractors Ltd Dublin states,

“ by pre-manufacturing the timber frame off-site, houses are constructed more cost effectively”. (Pick a Pro 2009)

To back up this point the Irish Timber frame manufactures association states “ this method of construction is not cheaper particularly if the builder hasn’t thought his practices through but because factory fabrication means much greater predictability, better controls and of course, a faster pace” (Irish Timber Frame Manufacturing Association 2009)

This is not the case for its traditional masonry counterpart as preliminary costs are required as a separate budget, this is due to the fact that all of the work required for traditional masonry is carried out on site. A majority of the preliminary budget for the traditional masonry method includes hire of plant and provision for skips and concrete silos on site etc. Another factor to be taken into consideration is the time period taken to construct a timber frame house, which is significantly lower than that of traditional masonry counterpart. Costs such as site supervision and the need for engineers and the like on site are greatly reduced.

Plant and Equipment Costs

Plant and equipment costs should be taken in to consideration when dealing with construction costs. Every project requires certain types of equipment and plant to carry out work to a conclusion. According to Colm Kilroy a quantity surveyor with Michael Higgins and associates in Galway, “ plant and equipment costs are a major part of all construction projects, the utilization of such equipment is vital as a lot of money can be wasted due to bad management and planning on site”. He continued to say “ if plant is required <https://assignbuster.com/timber-frame-and-masonry-construction/>

on site for a certain job it is vital that the site is ready for that equipment as once it arrives on site it has to be paid for.” (Colm Kilroy 2009)

The weather can also play a part in plant and equipment costs, adverse weather conditions can lead to a lot of equipment being left idle while the cost for having it on the site is still being charged. Obviously the weather conditions cannot be controlled by the project team but in periods of forecasted inclement weather the ordering of plant and materials should be avoided if possible.

Site Labour Costs

This area of site labour costs greatly differs with both methods of construction. A lot of the factors in relation to cost for the timber frame method of construction are all inclusive of the over timber frame package, the majority of the work to be carried out by specialised labour is completed in the factory and once the timber frame unit leaves for the site their work is finished.

This in turn reduces any call back costs, to complement this, the Irish timber frame manufactures association states that,

“ There are lower call back costs; any problems encountered can be eliminated immediately by the timber frame specialists before leaving the factory.” (Irish Timber Frame Manufacturing Association 2009)

The cost for the labour to rectify these problems is still inclusive of the timber frame package.

Traditional masonry construction is in comparison carried out differently with all the construction work associated with traditional masonry been carried out on site and with each individual trade requiring labour to carry out the work.

Cost Case Study

The author compiled a cost comparison from a construction contractor's point of view for the development of a timber frame and masonry domestic dwelling. The house plans used to carry out this comparison were based on a single house within a development of five similar houses, only the major elements of the structures were included in the pricing. The figures for the comparison were obtained from Barry Doyle a quantity surveyor with a Co Carlow company and John O Connell a construction contractor in Co Galway.

Cost Case Study Findings

Element

Timber Frame House

Masonry House

Raft Foundation

€ 3, 855. 50

€ 4, 602. 60

Supply and erection of timber frame Kit

€ 28, 114. 00

Block work

€ 3, 680. 00

€ 11, 460. 00

Roof

€ 5, 382. 00

€ 17, 535. 50

Windows and Doors

€ 11, 000. 00

€ 11, 000. 00

Plumbing

€ 5, 780. 00

€ 5, 780. 00

Electrical

€ 5, 275. 50

€ 5, 275. 50

Insulation

€ 3, 191. 00

€ 1, 946. 00

Supply & fit plasterboard

€ 3, 210. 00

€ 1, 821. 00

Plastering

€ 5, 815. 00

€7, 215. 00

Carpentry

€ 3, 575. 25

€ 4, 485. 00

External Works

€ 3, 275. 50

€ 3, 275. 50

Floor Screeds

€ 954. 50

€ 954. 50

Kitchen

€ 5, 500

€ 5, 500

Fireplaces

€ 2, 500

€ 2, 500

Total measured work excluding Vat

€ 91, 108. 25

€ 83, 350. 60

Main Contractors Profit

€ 4, 555. 41

€ 4, 167. 53

Vat @ 13. 5 %

€ 12, 299. 61

€ 11, 252. 33

Total

€ 107, 963. 27

€ 98, 770. 46

The timber frame house is more expensive to construct than its masonry counterpart. There is a cost difference of approximately €9, 000 between both methods to construct a single house taking the main structural elements in to consideration. For the development consisting of five houses where this house is located the total price difference in the construction of the five houses using both methods of construction can be up to €45, 000 to €50, 000. The following information shows the reasoning behind the price differences for the important elements of the construction.

Timber frame kit

This element looks to be very expensive but the majority of materials needed to complete the timber frame house including the labour needed for the construction are included.

Concrete raft foundation

The price of the raft foundation differs as there is less steel required in the raft for the timber frame house in comparison to the masonry built house, this leads to savings for both the labour and materials.

Block work

The difference in the price of the block work is due to the inner leaf and the internal walls of the timber frame house been constructed of timber.

Roof

The timber frame kit incorporates a majority of the roof in the over all package which leads to a massive price difference from the standard roof for the masonry dwelling.

Insulation

Due to the requirement for more insulation in the timber frame house there is a difference in price over its masonry counterpart.

Slabbing

As with the insulation due to the amount of timber stud internal partitions and timber inner leaf walls the timber frame dwelling requires more plaster board than the masonry method which increases both the amount of material and labour.

Plastering

The plastering element differs solely because of the reduced quantity of scratch coat required in the timber frame house.

Carpentry

The price difference in relation to carpentry is a result of a lot of the timber work coming pre fabricated as part of the timber frame kit, an example being the doors coming pre hung with ironmongery fitted and architrave already attached.

Main contractors Profit

The main contractors profit has been calculated on the standard percentage being 5%.

Life Cycle Costs

Introduction

Life cycle costs are commonly interpreted as, “ The operating costs of buildings over the forecast useful life attributed to them” (Bruceshaw 2009)

These costs include initial capital costs, occupation costs and operating costs. In relation to the building industry and in particular to the traditional masonry and timber frame methods of construction, life cycle costs are essential in deciding which is the overall cost effective method of construction is. In this chapter the author discusses areas such as the running costs and other costs that are involved with both forms of construction.

Design Differences and Alterations

From an aesthetic point of view timber frame and traditional masonry constructed dwellings when constructed look very similar, however timber frame houses,

“ Allow for more versatile designs than block built houses” (Pick a Pro 2009)

The question is once the house is constructed how easy is it to carry out modifications to the design. In relation to these alterations Kingspan Century state,

“ Due to the fact the inner leaf of your timber frame house is constructed of solid wood and plasterboard, and not concrete blocks and plaster, extensions and alterations generally have significantly reduced impact on the existing building”. (Kingspan Century 2007)

To further this statement MBS Timber frame Ltd state,

“ Because the interior of a timber frame house is made of wooden panels and plasterboard, alterations and extensions will not involve the mess and severe disruption of knocking down solid block walls, and all the other trials and tribulations that accompany this type of work”. (MBC Timber Frame 2009)

Alternatively the block work internal leaf of a masonry house has distinct advantages over its timber frame counterpart. Tasks such as fixing a shelf or curtain rail can be a tricky with the timber frame method,

“ There is no problem doing this in a masonry build home as all the walls are capable of holding shelves, curtain rails etc. it would be a simple matter of drilling the holes in the correct place and screwing your shelf into place” (Irish Concrete Federation 2009)

In comparison, with a timber frame house, according to John Meehan a carpenter with a Co Galway Company,

“ If you are installing a new kitchen or television unit, you may find that there are no grounds in the wall where you need a fixing. If in this situation if your fixing is put in place without finding a stud, the unit is sure to fall down under pressure”. (David Treacy 2009)

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Property Market and Selling Value

Influencing factors in relation to domestic construction include resale value and ease of sale. The traditional masonry constructed process has built up a reputation of been a good seller and a favourite with the Irish public, Galway auctioneer John Gilmore states,

“ Block built houses are easier to sell as people generally go for the trusted method, a lot of people inquiring about timber frame houses are wary and are not easily convinced as to its benefits” (Liam Gordon 2009)

The view of an Irish timber frame company is that,

“ Auctioneers and estate agents are generally of the opinion that not only is timber frame not an obstacle in selling a home, but on the contrary, is becoming more and more a major selling point. The energy efficiency of timber frame houses is becoming an increasingly valued characteristic”. (Kingspan Century 2008)

To reiterate this,

“ For mortgage purposes and insurance, most lenders and insurers rank timber frame equally with block work. As far as resale value is concerned, there appears to be no difference at all between the two systems. However some individuals have their own preferences, built up from their own experience or things they have heard about either system”. (Homebuilding and Renovating Magazine 2005)

Running Costs

The timber frame method of domestic construction encounters large savings over its traditional masonry counterpart. These savings result from the timber frame house having an allowance for insulation on both the external and internal walls; this differs considerably from the traditional masonry method where in most cases only the external walls contain insulation.

“ Because timber frame structures are extremely well insulated and have less mass than more traditional forms of construction, significant savings can be made in heating costs”. (Homebuilding and Renovating Magazine 2005)

A leading Irish timber frame company states,

“ Savings of between 30% and 40% on heating bills are fairly typical”.
(Devsan Timber Frame Homes 2009)

In relation to further savings in the future with timber frame,

“ It is estimated that the heating cost of a timber frame home can be 30% lower than that of a masonry dwelling, and the rapid rise in energy costs these costs look set to increase”. Sunday Business Post Newspaper 2007)

In conclusion the savings to be made with the timber frame method of domestic construction in relation to heating and energy use are extensive over its masonry counterpart

Time of Construction

Introduction

From a time to construct perspective the length of time it takes to build and finish both forms of construction differs. The construction of a traditional masonry dwelling has a longer time programme than its timber frame counterpart. The main factors contributing to the difference in construction times include.

Programme of works

The programme of works for both methods has a time difference of approximately seven weeks from foundation stage to decorating and moving in stage. Derek Moore of Timberline building contractors states,

“ In terms of build speed, timber frame can deliver a significant 30% reduction on traditional construction times, which affect cash flow and reduces local disturbance”. (Pick a Pro 2009)

The view of another Irish timber frame supplier is the construction time of both methods of construction is even larger depending on the building,

“ Construction time is cut by almost 40% as your timber frame structure is erected on site within days depending on size and complexity of building”. (Clark Group 2008)

Building Finishes

During the stage whereby the timber frame unit is erected the internal first fixing work can commence. This work can proceed inside the house as the masonry skin is being built, in comparison no internal work can commence on the masonry house while the block work element is being constructed.

The long drying out period associated with traditional masonry construction is also a disadvantage in comparison to the timber frame method.

“ Apart from the obvious labour saving, timber frame doesn’t need any drying-out time, unlike a standard masonry construction, which needs up to 1, 500 gallons of water to evaporate before it is dry”. (Sunday Tribune 2001)

To reiterate this a leading Irish timber frame supplier states,

“ Timber frame aids internal finishes, all walls are straight and plumb, corners are square and true. With timber frame there are less of the “ wet” trades, plasterboard needs only to be skimmed and paint, decorative materials and floor coverings can be applied sooner to dried surfaces”.
(Castle Timber Frame Homes 2009)

Heat Loss in Buildings

Introduction

For the purpose of this dissertation the author compared the U Value of the external walls of both a timber frame and masonry constructed dwelling, the author also decided to obtain the Building Energy Rating (BER) for both methods of construction so as to make an accurate comparison. Both the U Value calculation and the Building Energy Rating are based on the house plans. With the expertise of Michael Sweeney of Sweeney Energy the U Value and BER calculations were compiled and the results are as follows.

U-Value Calculation

A U-value is the term given to the measure of heat loss through sections of a building. It measures the rate that heat transmits through a component or structure when there is a difference in air temperature at both sides.

“ U Values are expressed in Watts per metre Kelvin which is the rate of heat transfer in watts through 1m² of the structure for one unit of temperature difference between the air on the two sides of the structure”. (Roy Chudley 2002)

U-Value Terms

The following are terms associated with the calculation of the U-Value.

Thermal Conductivity

“ It is the measure of a materials ability to transmit heat and is expressed as the energy flow in watts per square metre of surface area”. (Roy Chudley 2002)

Thermal Resistance

“ This is symbolized by the letter R, as representative of a materials thermal resistance achieved by dividing its thickness in metres by its thermal conductivity”. (Roy Chudley 2002)

Findings

Traditional Masonry Cavity Wall

Fabric

Thickness

Conductivity

Thermal Resistance

External Res.

0.04

Render

0.015

0.57

0.03

Ex. Block

0.1

1.33

0.08

Cavity

-

-

0.18

60mm Insulation

0.06

0.027

2.22

Internal Block

0.1

0.57

0.18

Plaster

0.015

0.43

0.03

Internal Res.

-

-

0.13

2.88

U-value =

0.35

W/m²K

Table Traditional Masonry U-Value Calculation

Timber Frame External Wall

Fabric

Thickness

Conductivity

Thermal Resistance

External Res.

-

-

0.04

Render

0.015

0.57

0.03

Ex. Block

0. 1

1. 33

0. 08

Cavity

-

-

0. 18

Insulation

0. 1

0. 021

4. 76

Plasterboard

0. 019

0. 25

0. 08

Internal Res.

-

-

0.13

5.29

Table Timber Frame U-Value Calculation

Timber Frame External Wall Cont.

Fabric

Thickness

Conductivity

Thermal Resistance

External Res.

-

-

0.04

Render

0.015

0.57

0. 03

Ex. Block

0. 1

1. 33

0. 08

Cavity

-

-

0. 18

Timber Studs

0. 1

0. 13

0. 77

Plasterboard

0. 019

0. 25

0. 08

Internal Res