

2011

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Recommended Citation

O'Neill, D., Gunnigan, L., Clarke, P.: Reducing the Cost of Upgrading Dublin City's Local Authority Housing Built Prior to the Introduction of the 1991 Building Regulations, through Lean Thinking/Lean Construction. *10th International Postgraduate Research Conference (IPRC) 2011*. University of on the 14th & 15th of September. doi:10.21427/v6v8-z830

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Reducing the cost of upgrading Dublin City's local authority housing built prior to the introduction of the 1991 building regulations, through lean thinking/lean construction.

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Abstract:

Local authorities in the Republic of Ireland are being required to upgrade their housing stocks. Due to the current economic recession local authorities, while receiving grants from central government, are struggling financially to upgrade their housing stocks. More cost efficiency is required when undertaking works. The research examines how the cost of upgrading Dublin City's local authority housing built prior to the introduction of the 1991 building regulations can be reduced through applying lean thinking. This paper proposes a lean model for the upgrading of local authority housing in Dublin City. The paper concludes with an outline of where monies are being wasted, and how this waste can be eliminated to leave a lean financial model for upgrading local authority housing.

Keywords: 1991 Building Regulations, Cost Efficiency, Lean Thinking/ Lean Construction, Local Authority Housing in the Dublin City, Upgrading.

1 Introduction

The aim of this paper is to establish a means by which the cost of upgrading Dublin City Council's local authority housing built prior to the introduction of the 1991 building regulations can be reduced. In examining the problem, the solution that is emerging centres on the development of a lean financial model. This paper gives an account of the research to date on an on-going Masters Degree level research project in Dublin Institute of Technology (DIT) which has been running since December 2009. The aim of this larger research project is to examine the cost savings to be achieved in the

upgrading of Dublin City's pre-1991 building regulations local authority housing through lean thinking/ lean construction. This is achieved through a two phased approach.

To address Phase 1, a comprehensive literature review was initially planned of Dublin City Council's local authority housing. This was planned to concentrate on the history, construction technology, and construction methods used in the construction of local authority housing in Dublin City, the reasons for upgrading the housing built prior to the introduction of the 1991 building regulations, the problems associated with upgrading the housing stock, and the identification of how Dublin City Council can capitalise on the successes and identify the failures of local authorities in the UK undertaking the upgrade of housing stocks. However, complete or specific data on the history, construction technology or construction methods were somewhat limited, so numerous sources other than literature were used to supplement the literature to piece together the information required.

Phase 2 examines the means by which lean thinking/lean construction can reduce the cost of upgrading the housing. In this phase the existing procurement methods are examined, along with where the perceived waste of money in the procurement of services for the upgrade of the housing stock exists. This phase was completed through the examination of four case studies of Dublin City's local authority housing. All case studies examined have been built prior to the introduction of the 1991 building regulations. The case studies were categorised, using external wall construction as the denominator. In order to introduce lean thinking/ lean construction to the upgrade of Dublin City Council's housing stock, an examination was conducted of the identity and application of lean philosophy internationally. This is then compared to the identity and application of the lean philosophy in Irish construction to date. At that point, the areas in which cost savings can be achieved through the application of lean philosophy can be identified.

At the time of writing this paper the following findings have been discovered:

- Compared with the three local authorities examined in the UK (Birmingham City Council, Cardiff City Council, and Stirling Council), Dublin City Council does not have comprehensive information on the history and construction of its housing stock.
- Costs can be reduced through design when upgrading the housing stock.
- Costs can be reduced by having pre award contracts with specialist suppliers of products and materials prior to entering into contracts with main contractors.
- Costs can be reduced through innovation in the procurement of services when upgrading housing.

2 Phase 1 Literature Review

2.1 Literature review

In the literature review to examine the history and building technology used in the construction of local authority housing in Dublin City, information was collected from Dublin City Council, South Dublin County Council, the National Building Agency, as well as numerous other organisations, academic papers, articles, books, and reports.

This identified the reasons for upgrading the housing built prior to the introduction of the 1991 building regulations and the problems associated with upgrading the housing stock in the Dublin region. This documentation was supplemented with information taken from industry magazines, and industry and government websites. Similar documentation was used to establish the comparison with the United Kingdom's local authority housing stocks and to identify how Dublin City Council can capitalise on the successes and identify the failures of local authorities in the UK undertaking the upgrade of housing stocks.

2.2 Introduction to Dublin City's local authority housing built prior to the 1991 building regulations

Research carried out by Dublin City Council on the City Council housing stock as part of a "Housing Energy Action Plan" found the Council housing stock to be a total of 27,761 units. This figure takes into account the dwelling types of apartment, house, and senior citizen accommodation (Dublin City Council, 2009). Since the Building Regulations came into effect on June 1st 1992, Dublin City's Local Authority Housing has been designed and built in accordance with the Building Regulations. The regulations were upgraded in 1997 and 2002. In 2008 revised regulations came into force. Prior to this housing was designed and built in compliance with the Dublin City Bye-Laws which were adopted by Dublin City Council on June 27th 1949. The Dublin City Bye-Laws were devised under The Public Health (Ireland) Act, 1878; The Public Health Acts; Amendment Act, 1890; and The Dublin Corporation Act, 1890. The Bye-Laws were made for the construction, alteration and conversion of buildings. They were set out with respect to the structure of buildings for securing stability, prevention of fires, purposes of health, ventilation, and drainage (Dublin Corporation, 1949). The Bye-Laws ceased to have effect after May 31st 1992, when the Building Regulations came into effect.

2.3 Reasons for upgrading the housing stock

In order for Dublin City Council's housing objective to be achieved, an upgrade of the Council's housing stock built prior to the introduction of the 1991 Building Regulations is essential. Due to the current constraints in public spending arising from the economic recession, the preservation of existing housing stock is essential in order to meet the target supply of housing over the coming years. The poor energy efficiency of housing stock built prior to the 1991 Building Regulations makes the upgrade works essential in the maintenance/preservation of existing stock, while a Building Energy Rating (BER) is required under the Energy Performance of Buildings Directive. At present Dublin City Council is being required to achieve a minimum BER of C1.

Due to the decrease in new build, one of the most active sectors of the Irish construction industry is renovation and energy upgrade. There have been a number of studies carried out on future employment and it is widely accepted that one potential source of future job creation may be the labour requirement from an extensive upgrade of local authority housing. This view is supported by the fact that competitive tendering and the public works contracts currently allow local authorities to get better value for money than at any other time in the past decade.

Throughout its history, the construction technology and methods used in the construction of Dublin City Council housing has varied and changed. There have been

numerous methods used to construct houses and apartments. Construction technology has also changed with the development and use of alternative materials, and the detailing and application of insulation becoming more critical.

Since the introduction of the 1991 Building Regulations there has been significant improvements in the energy performance of dwellings. Current Building Regulations require high levels of energy efficiency for new housing. However housing built prior to the introduction of the regulations was built to no/poor energy efficiency standards i.e. no insulation/minimal insulation in walls, floors, ceilings, as well as single glazing, inefficient boilers, stoves, and open fires. There have been a number of remedial works to improve the housing stock in the past, yet a large volume of the stock requires upgrading to modern living standards.

2.4 Problems associated with upgrading the housing stock

Dublin City's local authority housing stock requiring upgrade works needs to be upgraded more cost efficiently due to the limited funding available to the Council from both its own funds and funds granted by the Department of the Environment, Heritage & Local Government.

2.5 Capitalising on the successes, and identifying the failures of local authorities in the United Kingdom undertaking the upgrade of housing stocks

The Republic of Ireland is a small country with what is now a small construction sector that must look to overseas for comparisons in order to improve its construction practices. The United Kingdom's local authority housing stocks are the most compatible to Dublin City Council's local authority housing stock, when comparing housing outside of the Republic of Ireland. Dublin City is geographically close to the United Kingdom and shares a similar weather climate. The majority of Dublin City Council's housing stock has been built using traditional methods of construction. The United Kingdom's local authorities have similar methods of traditional construction, however non-traditional methods of housing construction were adopted in the post war era due to shortages of craftsmen skilled in traditional construction methods, as well as cheaper building costs and faster construction times. Dublin City Council also adopted a number of non-traditional construction methods in the 1960's and 1970's. Dublin City Council's housing stock and the housing stocks of local authorities in the UK have required significant refurbishment over the past decade in order to bring them up to modern standards. In recent times the shortage of funds due to the economic recession has affected the refurbishment and upgrade of Dublin City Council's local authority housing stock as well as local authorities housing stocks in the UK.

3 Phase 2 – Lean Construction

3.1 Methodology

In Phase 2 the existing procurement methods will be examined, through a review of public procurement procedures, and the public works contracts, as well as an examination of the municipal works division within the Council. In order to introduce

lean thinking/ lean construction to the upgrade of Dublin City Council’s housing stock, an examination was conducted of the identity and application of lean philosophy internationally.

3.2 Case Studies

3.2.1 Upgrade Programmes

The following table shows the upgrade programmes undertaken by local authorities in the countries listed. For each upgrade programme a local authority undertaking that programme has been selected to be examined. The local authorities undertaking the programmes were selected due to their willingness to provide information.

Country	Programme	Local Authority Housing Stock Examined
England	Decent Homes Standard	Birmingham City Council
Scotland	Scottish Housing Quality Standard	Stirling Council
Wales	Welsh Housing Quality Standard	Cardiff Council
England	Retrofit for the Future	Birmingham City Council

Table 1

In examining these programmes, the successes and failures of the local authorities undertaking the upgrade programmes was assessed for the purposes of identifying how Dublin City Council could better undertake the upgrading of its local authority housing stock.

5.2.2 Dublin City Council Local Authority Housing Case Studies

Case studies were selected on the basis of readily available information, such as documents, drawings, photos, and details of the construction technology and methods used in the construction of the case studies. The case studies examined were built using traditional construction methods, due to traditional methods of construction having been used to build the majority of Dublin City Council’s local authority housing. All case studies examined have been built prior to the introduction of the 1991 building regulations. They were categorised, using external wall construction as the denominator and concentrated on four methods of external wall construction:

- Apartments - solid concrete/cavity wall
- Apartments - solid concrete/masonry wall
- Houses - cavity wall
- Houses - solid concrete wall

For each case study a typical description of works would be prepared, describing typical works required to upgrade housing under the Energy Efficiency Programme, as well as

associated works. The cost of typical works required on each case study would be estimated, with a typical breakdown of costs presented.

4 Findings and Discussion

4.1 Housing Stock Survey & Housing Management Database

In the United Kingdom, the three local authorities examined have had detailed housing stock surveys undertaken, and had databases storing information on their housing stock and any remedial or upgrade works which had been carried out. At this time Dublin City Council does not have a detailed housing stock survey (Dublin City Council, 2011). The Housing Unit in their “Repair and Maintenance of Dwellings” document cite the first step in the development of a preventive maintenance programme is the collation of a database of the most up-to-date information available on all sections of the housing stock. The Housing Unit recommend for property overviews to be completed with estate manuals being completed on the basis of property overviews, and following the completion of property overviews and estate manuals, maintenance profiles addressing issues of housing maintenance (Brennan, 2000).

The year 2011 is a transitional year for the Social Housing Improvement Programme in Ireland, with the programme becoming more targets driven and cost effective. In order to set out improvement targets the Department of the Environment in association with local authorities intend to undertake an audit of 130,000 social housing units over the course of this year. The audit of the housing stocks will primarily involve a desktop exercise, based on information available in local authority databases, the ihouse system, as well as Building Energy Rating Assessments (Department of the Environment, Heritage & Local Government, 2011). In order for the cost efficient upgrade of its housing stock, Dublin City Council will have to undertake a detailed conditioning survey in order to get adequate information on its housing stock, prior to undertaking upgrade works.

There is a large volume of information available on UK local authority housing due to the documentation, maintenance and upkeep of records, by local authorities, government bodies, other organisations, and researchers. This is evident through the extensive information available on both traditional housing and non-traditional housing. From examining Dublin City’s pre 1991 local authority housing, it is evident that information on the old housing stock is not dealt with specifically in any one document hence information was collected from numerous sources to piece together the history and building technology of Dublin City Council’s local authority housing.

4.2 Design & Procurement

The Department of the Environment has identified the lack of clear uniform guidelines on the technical standards required for social housing (Department of the Environment, Heritage & Local Government, 2011). The Department published a technical guidance document in 2010, giving recommendations to local authorities upgrading housing. In Autumn 2011 a more detailed technical guidance document will be issued with clear standards and requirements to facilitate local authorities in preparing their 2012 programme (Department of the Environment, Heritage & Local Government, 2011).

Through the standardisation of technical requirements required to upgrade local authority housing, it is believed cost savings can be made, due to savings on time and money preparing technical specifications.

The Department of the Environment has previously tried to reduce the cost of design and management of housing projects under the Social Housing Investment Programme, by revising the arrangements for such projects through asking local authorities to utilise available in-house professional services to provide design and management for projects. Alternatively where in-house expertise was not available the Department asked local authorities to enter into a shared services agreement with another authority, or engage the National Building Agency (Department of the Environment, Heritage and Local Government, 2009). The reasons for revising the arrangements were to avoid the cost of engaging private consultants.

The Department of Finance are currently developing a maintenance and refurbishment contract for works such as refurbishment and upgrade works. This contract will be published by the end of 2011 (Department of Finance, 2011).

4.3 Supply Chain Management

Reduction in the cost of carrying out works on upgrade projects under the Energy Efficiency programme will be examined through the use of competitive tendering of specialists, prior to the award of contracts to main contractors. This research hopes to take advantage of the following methods of the procurement of specialists:

- Specialists named by Employer-Exempt Rule
- Specialists named by the Employer- without a separate tender competition
- Specialists named by the Employer-separate tender competition (Department of Finance, 2007)

4.4 Logistics

This research hopes to take advantage of Dublin City Council's power as a buyer of services from the construction industry. More specifically the research hopes to examine the cost savings that can be made from the purchase of services at any one time for the upgrade of housing.

5 Conclusion and Further Research

5.1 Conclusion

A large volume of information has been collected on a variety of topics which are related to this research. The areas are diverse in that they include the history of local authority housing in Dublin, history of the building regulations in Ireland, construction technology of housing in Dublin, information on upgrade programmes in Dublin/Ireland over the past twenty years, reasons for upgrading Dublin City's local authority housing, local authority upgrade programmes in the UK, case studies of local authority housing in Dublin, descriptions of works required to upgrade housing, cost of works required to upgrade housing, lean thinking/lean construction. Possible areas for cost savings to be

achieved have been identified. However the research is at an early stage as regards examining these areas in detail. This paper concludes that monies are being wasted through inefficiency in the following areas:

- Design & Procurement
- Supply Chain Management
- Logistics

The following is a preliminary outline of a lean financial model for the upgrading of local authority housing in Dublin City:

1. Survey housing stock, and calculate BERs (Preliminary BERs). Maintain and update a database.
2. Examine the works required to upgrade stock to BER of C1, hence maximising the grant given by the Department of Environment upon completion of the works.
3. Examine the materials and products required in detail i.e. various sizes of boilers and their quantity, various thicknesses of insulation, u values, and their quantities. Identify the number of windows and doors required with various specifications.
4. Examine the various routes of procurement. These categories will be divided into municipal works division for minor works, and contractors selected through competitive tendering.
5. Examine how pre award contracts could take advantage of the economies of scale. The local authority has a housing stock in excess of 27,000 units and should be able to take advantage of this.
6. Based on the information available prepare standardised specifications, with the tender documents.

5.2 Further Research

5.2.1 Further research of this area

The research is currently at the end of Phase 1, although a large volume of information has been collected for Phase 2. The next part of this research is to fully examine the lean philosophy within the context of the Irish construction industry, prior to applying it to the upgrade of Dublin City's local authority housing.

Feedback will be sought from management personnel within Dublin City Council as to what they think of applying lean principles in order to reduce the cost of upgrading Dublin City's local authority housing. The application of lean will mean a change from Dublin City Council's current work practices and processes as regards the upgrading of housing. Feedback from Dublin City Council will be essential in order to identify how the changes in work practices and processes would be managed, if the application of lean was to be implemented.

5.2.2 Recommendations for further areas of research associated with this area of research: Examining the construction of Dublin City's local authority housing

A comprehensive literature review was initially planned of Dublin City Council's local authority housing. This was planned to concentrate on the history, construction technology, and construction methods used in the construction of local authority housing in Dublin City. The information which was deemed to be most critical for the purposes of this research was information on the construction of the local authority housing built prior to the introduction of the 1991 building regulations. Prior to the research being undertaken, it was thought that Dublin City Council would have extensive and accurate information on the history of local authority housing in Dublin. However it was discovered that information on the construction technology and construction methods used to build local authority housing in Dublin City has been poorly documented over the past 124 years since the first local authority housing built at Benburb Street.

The reasons for this it is assumed are down to a number of factors, namely the experimental nature in the construction of the housing stock, with the design and technology changing over time. Also the local authority at the time of construction may not have seen the need to document and store information in case of the need for refurbishment at a later stage.

In examining the history of the housing stock, information was found in books, papers and articles, as well as on the internet. This information was compiled by historians, geographers, and journalists. However when examining the construction technology and construction methods used to build the housing stock, information had to be drawn from numerous sources, such as old drawings, sketches, books, articles, papers, informal communication, assumptions of building professionals. Some of the information collected on the construction technology and construction methods was taken from books written by authors who are not building professionals, so there may be inaccuracy as regards technical content. A large portion of the contractors employed to build local authority housing in Dublin City are no longer in business. The contractors that are still in business have published some documentation regarding the construction of local authority housing in Dublin. This information has been critical in the undertaking of this research.

Compared with the information available on the construction technology and construction methods used in the construction of local authority housing for the UK local authorities examined in this research, there is little information available on the construction technology and construction methods used in the construction of Dublin City's local authority housing.

The construction of local authority housing in the UK has been well documented with both in-house information, and external reports prepared by consultants providing detailed information on both the traditional and non-traditional methods of construction.

It is recommended that an area for further research, emanating from the research undertaken is the examination of the construction technology and construction methods used in the construction of local authority housing in Dublin City. This research may be broadened to encompass private housing in Dublin. However the area of local authority housing is diverse enough in scope for research to be undertaken.

From undertaking this research it is deemed that a person or persons undertaking research into the construction technology and construction methods used in the

construction of Dublin City's local authority housing would need both the appreciation for the history of the architectural design of the housing stock, as well as an advanced knowledge of construction technology, and construction methods.

5.2.3 *Recommendations for further areas of research associated with this area of research: Examining Lean thinking/Lean Construction in Ireland*

Lean thinking/lean construction is a philosophy which is based on the concepts of lean manufacturing. While undertaking research in DIT, it became clear that lean thinking/construction is seen by some in the Irish construction industry as a "buzz" word, or that it merely indicates doing works cheaply. There is however no obvious examples of the application of lean thinking/construction in the Irish construction industry which have been made public at this time which can dismiss lean from being a "buzz" word.

Some contractors have been accused of having the philosophy of building as cheaply as possible, with value suffering as a consequence, however it is inaccurate to title this philosophy "lean" (O'Neill, 2011).

It is recommended that an area for further research, emanating from the research undertaken is the examination of lean in Ireland.

6 Acknowledgement

This paper was prepared as part of a Master of Philosophy thesis and the authors would like to thank Dublin City Council for providing information for the purposes of this research, specifically Mr. Paul Dunne of Dublin City Council's Quantity Surveyors Division, Mr. Vincent Healy of the Housing Maintenance Section, and the architects in the City Architects Division.

The authors would also like to thank all the local authorities in the Republic of Ireland, and the United Kingdom who contributed information, as well as the numerous other contributors from the Republic of Ireland and the United Kingdom.

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