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Governing Urban Transformation

Building Retrofit Best Practice

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Author declaration:

I James Davorn confirm that this report is based on my own work and that I am happy with both my own and my partner's Shaquille Baker contribution to the final submitted version.

Table of Contents

Executive Summary

This report examines the forms of retrofit within thermal insulation and how they can be applicable to the Greater Manchester Combined Authority (GMCA). Retrofit as a concept is explored as is the general importance of retrofit to the urbanising world, we then make this applicable to the overall research.

Three case study cities are examined; Baltimore in the United States, Glasgow and Newcastle, both of which are in the United Kingdom. Each scheme of retrofit is analysed for the positive and negative elements of the project and how it can be applicable for the GMCA.

Due to an inability to perform hands on research ("I'd maybe explain why there was an inability") this research, in order to generate data: examines grey literature as well as academic journals. Nevertheless, we were still capable of providing an in depth analysis of the concept of retrofit as well as the projects implemented within the chosen cities.

1.0 Introduction

The objective of this report is to advise newly elected mayor Andy Burnham and the Greater Manchester combined authority in implementing a new, efficient and collaborative framework to successfully retrofit the declining terraced housing stock within Greater Manchester.

Heightened greenhouse gas emissions (GHGs) and global climate change led The World Business Council for Sustainable Development (2013) to enforce an energy reduction of 77% within the building sector by 2050.

A failure to implement new policy and governance within Greater Manchester will mean the Home Energy Conservation Act (2016) will fail to meet its target in reducing Carbon emissions by 2020 within domestic properties (LCEA, 2011).

This report will highlight and analyse three domestic housing retrofit projects within the cities of Baltimore, Glasgow and Newcastle. It will then conclude by suggesting the lessons the Greater Manchester authority can learn from both the successes and failures of each retrofit project.

2.0 Understanding the Importance of Retrofitting

2.1 Introductory Discussion

The following section will state what building retrofitting is, why building retrofit matters, the challenges of successfully executing a building retrofit project and why building retrofitting matters in Greater Manchester.

2.2 What is building retrofit?

The concept of building retrofit is discussed in depth within the works of Asadi et al (2011). The growing boundaries on land use due to new policy, in conjunction with the mounting concerns of sustainability has subsequently led to a boom within the building retrofit market, both within Europe and globally. Asadi et al (2011) further the discussion by recognising 'several technological/constructive options are available to improve energy efficiency and indoor environmental quality in buildings.

Abel and Elmorth (2007) define retrofitting as a systematic reconfiguration of socio-technologies of energy in the existing built environment and infrastructure, reducing carbon emissions within urban areas, cities such as Manchester and its surrounding capacities (Greater Manchester). Many urban areas are seeking a 'fix' that allows an upscale retrofit activity of repair and maintenance into strategic and systemic retrofit programmes that transform existing cities (Hodson and Marvin, 2016). A key part of achieving resilient cities is the transition toward a future that is low carbon, energy efficient, green and overall, sustainable (Muldoon-Smith et, al 2014).

2.3 Why Building Retrofit matters?

A constant rise in the production of GHGs, from a multitude of outlets has intensified the process of climate change, particularly global warming. Raman(2010) reinforces this claim; he articulates the industrial revolution (150 years ago) among other man made activities are mostly responsible for the deterioration of the natural environment. The Intergovernmental Panel on Climate Change (IPCC) (2001) certify this concern, by highlighting the Third Assessment Report, which presents statistics illustrating 'the atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have grown by about 31%, 151% and 17%, respectively, between 1750 and 2000.' Therefore, increased population within urban areas, in unification with global industrialisation has inconceivably led to records highs of GHGs within the atmosphere; thus a detrimental impact on the environment such as further global warming and climate change (Gupta, 2005). In order to reduce emissions, the UK government has set an ambitious target to achieve 1 million deep retrofits each year by 2020 (UK Green Business council, 2014).

Building retrofit strategies have been implemented in an attempt to meet international and domestic climate change targets. The International Energy Agency (2013) labelled the residential sector the largest energy consumer as well as the largest Carbon Dioxide (CO2) emitter in the United Kingdom. In turn, a shift in policy and governance was implemented in order to reduce emissions. Now embedded within a strict carbon reduction plan, the UK have responded by moving to a more energy efficient, low carbon economy (Committee of

Climate Change, 2015), while also recognising the long term benefits of housing retrofit projects as a mitigation strategy.

Though retrofitting can bring huge economic, political and social benefits to local areas and governments, this process does face several challenges as discussed in the works of Kelly (2009). He strongly asserts that there's still no clear route-map and there's an absence of an agreed framework of action for the implementation of rolling out large-scale development schemes, especially within the UKs urban areas. Moreover, Goldman (2010) mentions there's limited competition within the insulation and glazing industry which means there's a shortage of retrofit products, as well as workers to carry out projects on a larger scale.

Within Greater Manchester, many attempts have been made to improve energy performance within terraced housing. The Department for Business, Energy & Industrial Strategy (2017) states 1,302 households (low income, vulnerable, fuel poor households) have been assisted through energy efficient measures, predominantly external wall insulations. Though efforts have been made to improve insulation within homes, a more efficient and cost effective framework needs to be adapted and implemented in Greater Manchester.

3.0 Methodology

This report is a study of building retrofit case studies on terraced houses. The following section will explore and justify the research methods used in order to suggest new and/or alternative strategies to improve the thermal insulation of existing domestic building stock in Greater Manchester.

In order to find the most appropriate and useful retrofit cases studies, the report engaged with a secondary qualitative documents such as grey literature and academic journals. Qualitative research is an explanatory research method. Grey literature can be defined as any material that cannot be retrieved via a traditional index or electronic database is grey literature (McKimmie and Szurmak, 2002).

Grey literature created the scope to view several different domestic retrofit case studies. Using policy documents available at Manchester central library , Google scholar and J stor we were able to access 29 different case studies (within the UK and US) discussing the challenges and successes of domestic retrofitting. This was done in a systematic way.

1) Highlighting the problem
2) Highlighting an industrial city similar to Manchester
3) Selecting a thermal insulation strategy which could potentially be applied to Greater Manchester .

Though time consuming, data collected was reliable and rich in information. However, a limitation of this method was that few retrofit case studies were are available detailing the results of large scale terraced housing projects. In turn, our final case study focuses on just one terraced house.

Academic journals were used as another research method. This is complimentary to the previous method. Academic journals are credible and peer reviewed as recognised in the works of Berens and Van Riel (2004). To further justify this method, journals discuss and outline explanations and claims that have been made in grey literature reports within detail.

We were systematic in our approach to using and finding journals.

1) Understanding the challenge highlighted in grey literature
2) Using Google Scholar and J Stor to comprehend challenges/successes discussed in case studies
3) Using Journals to certify claims made within the report.

A key limitation of academic journals has been identified within this report. The use of journals limit the control over the research and findings, such as findings may not be accurate, or research on the topic of interest may not be covered in enough depth.

The cities of Baltimore, Glasgow and Newcastle were chosen due to their similarity to the Greater Manchester area. As seen in Table 1, the similar climate and issues surrounding their post-industrial future make these cities ideal for Greater Manchester to learn from. These cities were chosen from a wide geographical range allowing the report to narrow down to the most geographically similar city. Additionally, the housing stock is all the

selected cities are predominantly terraced housing allowing for easy comparison in relation to retrofitting. Within this report, only domestic building stock has been analysed, as Greater Manchester is predominantly a residential region post industrialisation, thus the main building stock that will be retrofitted is domestic. In order to judge the success of each project, it will be important to evaluate the uptake, innovation and implementation of each project. A project can be deemed a success if it meets all these criteria.

Table 1. Comparison of Selected Cities

City	Category	Figure
Baltimore	Population (2016)	620,961
	Unemployment (%)	5.7
	Annual Precipitation (Inches)	40.7
Glasgow	Population (2016)	600,060
	Unemployment (%)	8.7
	Annual Precipitation (Inches)	44.0
Newcastle	Population (2016)	295,200
	Unemployment (%)	6.6
	Annual Precipitation (Inches)	27.2
Greater Manchester	Population (2016)	2,800,000
	Unemployment (%)	7.3
	Annual Precipitation (Inches)	34.1

4.0 Findings

4.1 Baltimore

Located in the state of Maryland of the United States, Baltimore is the first city subject to analysis. In 1950, Baltimore housed 950,000 residents many of whom worked in the manufacturing and shipping industry (Polèse & Stren 2000). Once these industries began to decline, thousands of Baltimore residents were made unemployed; Baltimore's housing stock subsequently deteriorated. As forementioned, residential sectors are responsible for huge outputs of GHGs and must become more energy efficient. Baltimore is facing huge issues due to the low income of local residents. Therefore, a few major strategies have been implemented to help retrofit much of Baltimore's housing stock to make it more energy efficient. One such strategy is the BeSMART Home Loan Programme (BSHLP). The BSHLP offers financing to help improve energy efficiency by upgrading within the home. Within these energy efficiency approaches, a major aspect is the insulation of attics, floors and walls. In order to qualify for the BSHLP, participants must be homeowners within Maryland, have a credit score of 640 or greater and a debt-to income ratio of up to 50% (Lambert & Carter 2014). If participants meet all these requirements they qualify for financing up to $30,000. The savings of BSHLP are estimated at 15-25%. This is an extraordinary saving for the local residents of Baltimore as it helps drastically reduce the cost of energy usage through thermal insulation strategies. Additionally, Baltimore's average credit rating was 667 in 2016, so the vast majority of Baltimore residents should qualify for this scheme. 1,646 houses within Baltimore were upgraded by BSHLP showing the success (Lambert & Carter 2014).

Despite the benefits, there are some crucial issues with BSHLP. One problem is that the BSHLP is a financing scheme, and not a charitable donation. The scheme requires people to repay the loan at a rate of 4.99% interest. This is unfathomable to some Baltimore residents who simply cannot afford to spend huge amounts of money on retrofit strategies. Consequently, the BSHLP isolates some of the Baltimore community and cannot be seen as a success in this aspect. In relation to Manchester, Baltimore is a very similar city. Both previously industrial powerhouses they now face issues with unemployment, which is affecting their local economies. Additionally, both even face similar climactic challenges as annual rainfall is above 30 inches in both cities. Consequently, from Baltimore, the GMCA can learn that the strategies put in place within Baltimore have been successful to an extent, though not for all the Baltimore population. Therefore, GMCA must alter their models of retrofit to help incorporate those is lower income households and not exclude them from future developments. This can be done through grants instead of loans, or subsidising any retrofit work within Manchester.

4.2 Glasgow

Another city to assess in terms of retrofit strategies is Glasgow. Positioned in central Scotland, Glasgow shares many similarities with Manchester and Baltimore (Bramley & Kirk 2005). Another former industrial city, Glasgow's main industries were shipping and engineering (Marsden 1992). Similar to Baltimore, following the reduction in these industries, large amounts of the population lost their jobs and have since struggled for sustainable income (Keeble 1980). Comparable to Baltimore, the Glasgow housing stock has deteriorated since. Therefore, Glasgow is faced with parallel issues to Baltimore; attempting to retrofit poor housing to help reduce the GHG output within the city. A strategy implemented by the city of Glasgow is the Future City (Taylor Buck & While 2017). Glasgow won funding of £24 million from the Technology Strategy Board to explore ways to make Glasgow safer and more sustainable. Subsequently, the city has invested large amounts of this funding in retrofit strategies to reduce energy consumption and improve the lives of local residents. The Future City Project, carried out in collaboration with Scottish Power, incorporates technology and sustainable strategies to help people save money. The retrofit strategies used mainly focus on wall and attic insulation to reduce heat loss. Additionally, the scheme is installing sensors to measure the successes of insulated houses against those not insulated. This provides information for effective the retrofit strategy has been. Consumers can also use a mobile app to help explore their building's performance against benchmarks and see how they can save money.

In terms of success, the Future City is clearly unique and innovative. The sensors have been set up all across the city to provide not just residents with data but also landlords. This can put pressure on them to improve retrofitting in the city as well. The unification with technology is not revolutionary however; the citywide implementation scale is truly unique. Despite the obvious benefits of the Future City Project there is one crucial issue. There is very little data regarding actual usage of the systems and little information of how much has actually been retrofitted. Consequently, it is difficult to judge to what extent the Future City Project has been effective in actually retrofitting properties. Despite this, clearly there are some aspects GMCA can learn from. The collaboration with technology can drastically improve the identification of those in need within Greater Manchester. However, this introduces monetary issues. Technological strategies such as this are likely to be expensive and the GMCA budget may not be able to incorporate such styles. However, Glasgow and Greater Manchester share many similarities such as similar terraced housing stock and a similar climate with annual rainfall again over 30 inches. Thus, if the budget for GMCA was able to incorporate Glasgow's technological approach it could be applicable to a city such as Manchester.

4.3 Newcastle

The final city this report will assess is Newcastle upon Tyne, located in the North East England (Wells, 2008). Similar to both Glasgow and Baltimore, Newcastle was also an industrial city. In the works of Van Winden (2010) Newcastle was once recognised as a world leader in shipbuilding, heavy engineering, and mining. However, as illustrated in the city of Baltimore and Glasgow the city did suffer from deindustrialisation, figures from 1981 state that unemployment within this sector reached 60% and have declined since (Hollands, 1997). High levels of unemployment in combination with low levels of government investment resulted in a declining and unsustainable housing stock. Due to decline of the primary sector Dawley et al (2014) understands the residential sector to be the largest emitter of GHGs within Newcastle. As a response Newcastle City Council (2010) committed to the Climate Change Strategy, launched in 2010. This included 'the domestic housing work stream', along with different energy-related initiatives, such as existing infrastructure retrofitting schemes (Davoudi and Brooks, 2012). Therefore, attempts have been made by Isos Housing Group to help implement a 'roll out' retrofit framework within Newcastle, North Tyneside to reduce GHG emissions and increase the energy efficiency from domestic households.

According to Newcastle City Council (2012), the house was equipped with modern technology, which aimed to reduce its carbon emissions as well as the residents' energy bills. Isos Housing Group manages almost 17,000 homes across the North East (Isos Group Strategic Plan, 2016). Though only one terraced house was retrofitted in this instance it provides a potential framework that can be rolled out on a larger scale. Tanner (2011) states the resident would save 'around £1,150 per year, or £22 per week… Now work on the house is complete, Isos calculates the resident will only have to pay £1 for every £5 they were spending on energy bills.' The retrofit included solar panels, a combined boiler and air-source heat pump to heat water and vacuum insulation panel (VIP) technology used in the walls, floors and doors (Isos Group Strategic Plan, 2016). A VIP is made of a micro-porous core structure which is evacuated and sealed in a thin, virtually gas tight envelope bag (Simmler and Brunner, 2004). Thus, it can carry out highly efficient insulation and a fraction of the thickness of cut to fit insulation material (Tanner, 2011).

Though huge benefits have been seen from this retrofit, it is small-scale singular project, thus making it difficult to judge. Furthermore, considering the size of the residence, this was an expensive project, and rolling out on a larger scale could prove to be beyond the GMCA budget. Yet, GMCA could take much away from this project. The implementation of new initiative technologies can allow residents to keep track and monitor their energy usage, undergoing small-scale projects also allow room for trial and error.

As Greater Manchester and Newcastle share similarities in terms of climate and terraced housing stock, these new and progressive methods could certainly be implemented if within the budget. Furthermore, working in conjunction with the government would be sensible way to maximise funds for investment.

5.0 Conclusion

This report set out to investigate the implementation strategies used within retrofit. Additionally it set out to advise GMCA on their retrofit practice and how they could learn from the successes and failures of previous urban projects.

The cities of Baltimore, Glasgow and Newcastle have all been successful to an extent and GMCA can learn from this. Baltimore were able to finance residents, Glasgow effectively combined technology with retrofit strategies whilst Newcastle illustrated monetary saving through retrofit practice. In order for GMCA to build the perfect model for Greater Manchester they must incorporate all the positive aspects of each these projects into one enhanced model. If GMCA follow this, then performing wide scale retrofit implementation within Greater Manchester should be straightforward in comparison to previous cities attempts.

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