

Using local and traditional building techniques to develop, implement and test a new Building Code protocol for the Caribbean, enabling resilience from the challenges of climate change reality

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STUDENT PAPER. The Eastern Caribbean in the West Indies is envisaged to experience an increase in climate-related damage between 22% and 77% by 2100. This threat from a changing climate is likely to exacerbate already existing vulnerabilities in the built environment. Building Codes are generally regarded as powerful regularity tools for increasing people's safety and resilience in housing but are not always adhered to in countries in the Eastern Caribbean, where resources and technical training are often scarce. The research project documented in this paper is part of the first author's Professional Doctorate in Sustainable Built Environment (DSBE), which proposes to mitigate this lack of adherence to Building Codes in lower income housing in Antigua and Barbuda, part of the Leeward Islands, Eastern Caribbean, by the development, implementation and testing of a protocol that it is hoped will facilitate compliance with building code standards already developed in the country. This could enhance resilience from the challenges posed by climate change. This change in approach, from a list-based Western approach to building code compliance, to a more flexible demonstrative approach, will also potentially unlock development loan finance to more – and better - lower income housing, and incentivize local builders to construct buildings that adhere to the building code in the first instance, as well as provide them with a pathway to do so.

Keywords: Climate Change mitigation, Housing, Building Code, Antigua, and Barbuda - Leeward Islands,

1 Introduction

Developing countries account for 93% of disaster-related fatalities, whilst experiencing 53% of all disasters [1]. At the same time, hazards due to climate change are becoming more intense and frequent, for example sea-level rise, cyclones, increasing temperatures and changing rainfall patterns [2].

In high-income countries, one of the main ways in which disasters are mitigated against in the built environment is through building codes, regarded as regulatory tools for increasing people's safety and buildings' resilience [3]. This is done by setting codified high standards for construction that incorporates best practice, and therefore leads to fewer sub-optimal outcomes when buildings are constructed [4].

Building codes are generally developed in developed countries such as the United Kingdom (UK) that have Building Regulations which encompass several documents. In the UK, there are Building Regulations for each of the devolved government administrations i.e., England, Northern Ireland, Scotland and Wales [5]. Building Regulation or Codes tend to be specific to the construction systems and materials used and available in the given countries that they relate to, and the relevant technical standards. If former protectorates of a developed country, such as is the case with Antigua and Barbuda and the UK, adapt and apply the developed country's Building Regulations or Codes, they are often less able to incorporate methods and materials indigenous to the developed country itself. These codes are also often hard to understand and interpret without technical training, meaning that builders in developing countries, such as in the Eastern Caribbean, often simply ignore the Building Codes [6].

This is particularly unfortunate as lower-income countries such as the Eastern Caribbean, whilst being less likely to have construction that follows appropriate Building Codes, are simultaneously particularly vulnerable to the changing climate [7]. Lower-income countries are also exposed to hazards (such as hurricanes, earthquakes, and volcanic eruptions) that are in fact envisaged to experience an increase in climate-related damage between 22% and 77% by 2100 [8].

The DSBE research project documented in this paper aims to help address this, by proposing the development of a new protocol that will facilitate compliance with Building Code standards, and thereby enhance resilience from the challenges posed by climate change. The case study for this research

are the Antigua and Barbuda Islands, part of the Leeward Islands, in the Eastern Caribbean.

2. Background and Related Work

In Antigua and Barbuda, the case study islands on which this paper focuses, the legal framework around Building Codes is comprehensive and subject to a positive process of improvement and iteration [9]. At present, the legal framework is as follows:

- The Architects Act (Professions) Act 2018 [10].
- The Engineers (Professions) Act 2018 [11].
- The Physical Planning Act 2003 [12].

These laws lay out the building standards and means by which legislation provides the framework for optimal outcomes in new construction, by regulating professionals involved in development, and setting safe and resilient standards for new construction. A new draft code is, in 2021, being debated in the Antiguan parliament. The proposed code, anticipated to come into the force at some stage in 2021, has been updated to incorporate well thought through and detailed principles regarding sustainability and resilience of new dwellings. It also, in supplementary documentation, incorporates comprehensive guidelines on how the code should be interpreted and applied [13].

3. Framing the Problem

Antigua and Barbuda was administered by the UK until 1981, and much of the country's legal framework originates in UK law [14]. It is therefore not surprising that the process by which these codes are translated into the built environment, and therefore building consent is obtained, is roughly equivalent, in the first instance, to the UK. The building code process involves a submission of the proposed plans to the Antigua and Barbuda Development Department which are reviewed by the department and, if acceptable, are approved as compliant with the building code legislation.

Construction then begins. However, once the plans are approved and construction has started, there is a significant lack of capacity on behalf of the local authorities to inspect properties when they are in the process of being constructed, to check if they are being built in line with the plans provided.

This is both due to a lack of funding, as well as a lack of locally available technical training [15].

The new code, which will come into force later this year, runs to four hundred pages, and this will only increase the complexity of adherence, and potentially lessen the likelihood of ensuring what is built complies, in many cases.

One of the main issues flagged by local stakeholders in terms of the lack of building code implementation is that there is no local “Contractors Act” in line with the Architects and Engineers Acts listed above – i.e., no qualifications are needed to become a builder or construct a dwelling. Therefore, when dwellings are constructed (the building types being investigated as part of the DSBE project) they ultimately do not comply with the relevant building codes, in the view of many in the country, as they are not constructed by suitably qualified Contractors. Incorporating a Contractors Act into law is, therefore, seen as the solution to the issue by many local stakeholders [16].

Such a Contractors Act would, however, logically increase costs in construction were it to come into force. This would potentially stand in the way of increasing affordable housing provision - an underlying challenge in almost all countries, particularly so in lower income ones such as Antigua and Barbuda. The problem therefore can be summed up as follows: Antigua and Barbuda follow the first part of the UK system, whereby plans are deposited initially, but not the second part of the UK system – as there is no follow up to check that what is built corresponds to the plans as approved. There is also no check on who can build, thus compounding the issue.

That this fundamental, and seemingly intractable, problem exists can be clearly demonstrated in the fact that, in Antigua and Barbuda, many houses that were damaged by Hurricane Irma (2017) did not adhere to the building codes, despite these being in place in law at the time [17]. Additionally, most Caribbean governments consider post-disaster reconstruction to be the responsibility of the homeowners, so communities destroyed by hurricanes are often rebuilt to poor standards, leaving further damage likely in future hurricanes [18]. The key issue to be addressed, as outlined by a World Bank finding in 2016, is, therefore, that the Antigua and Barbuda Development Control Authority is legally mandated to conduct physical inspections of completed dwellings under the country’s Physical Planning Act 2003, something which will continue in the new legislation [19], but in practice it rarely does so.

4. De-colonizing the Process

The problem as outlined above arises, arguably, partly since having been developed initially in high-income countries, Building Codes often have a prescriptive nature and dictate specific ways in which they have to be adhered to – as these are often easy to benchmark compliance against when using highly-trained building inspectors. This prescriptive method often hinders the use of indigenous building techniques and materials, and thus this approach often translates poorly onto lower income countries which, often lacking their own capacity to develop such frameworks from scratch, simply borrow the same approach – as well as sometimes drawing their legal frameworks in the first instance from higher income countries and, therefore, having this approach embedded into their own frameworks by virtue of their colonial history, such as is the case in Antigua and Barbuda [20].

In terms of “de-colonizing” the process, this paper argues for a more performance-based approach to Building-Code implementation, which defines the performance objective rather than a single solution, which should also make it easier to use local materials and constructional techniques. In order to mitigate some of the future likely damage from climate change, this paper therefore proposes an alternative way in which Building Codes are implemented in Antigua and Barbuda (and therefore potentially, in due course, the wider Eastern Caribbean) by developing a new performance-driven house-design protocol, to be adopted in local building-code implementation. This does not require any changes to the existing legal framework, but instead seeks to compliment it.

5. Financial Implications

There is a further significant problem that emerges from the issues outlined above. This has at its heart the fact that the lack of Building Code implementation in newly built lower income housing has significant financial implications: namely that local banks often refuse mortgages to lower income households wishing to construct new dwellings, on the grounds that they consider any lower income houses that are built are not likely to be suitable for mortgage security. It is assumed that they will not follow the Building Codes in place in the country, and there is no way to counter this assumption given the fundamental issues that often arise, as shown [21]. This lack of available finance creates further problems commonly associated with lower income communities in the Caribbean and elsewhere and makes sub-optimal housing outcomes even more likely.

6. Proposed Protocol

This paper proposed addressing these issues via the development of a protocol for lower income housing construction. This protocol will re-work aspects of indigenous housing types so as to make them resistant to high wind speeds and other hazards, by using more local materials, and also by embracing the latest *ad-hoc* engineering principles regarding resilience from extreme weather events [22]. Resilience will also be built into the protocol for post-disaster situations, such as in-built water storage.

Low carbon materials, as opposed to imported concrete, can also be extensively incorporated: at present most hurricane resistant housing relies heavily on concrete and rebar, both of which are carbon intensive. Materials such as Greenheart timber, Caribbean-grown and used commonly in Caribbean vernacular architecture, will be relied on in the protocol to reduce carbon emissions, whilst still retaining resilience against natural disasters such as hurricanes, and having the added advantage that local builders used to constructing lower income dwellings will be more familiar with these methods and materials. This protocol will adhere closely to the legal framework already in place in Antigua and Barbuda, including the proposed Building Code, and will ultimately aim to make adherence to the Code by local builders more likely and frequent, thus addressing one of the root causes of substandard housing.

By making this adherence more commonplace and easily demonstrable, this will also address the concerns of local banks over a lack of suitable mortgage security: once it can be shown that following the protocol leads to a dwelling that adheres to the local building code and this can be demonstrated to the bank in a straight-forward manner, without requiring extra capacity in the local development authority, then this will make lending against the property far more likely. This may not only unlock finance to more – and better – lower income housing, but also incentivize local builders to construct buildings that adhere to the Building Code in first instance, as well as provide them with a pathway to do so. This ultimately closely aligns with United Nations Sustainable Development Goal 11 [23], as it promotes access for all to adequate, safe and affordable housing; and to Goal 13, as it augments resilience to climate-related hazards and natural disasters [24].

6.1 Protocol Stage One: Clarifying the Problem

The first step will be to identify the key areas in which Building Codes are not adhered to in the existing built environment. This will consist of a stock-condition visual survey of low-income houses in Antigua and Barbuda, focussing on certain key aspects such as roofs and fixings [25]. This survey will use visual exterior survey techniques to identify the areas in which local houses are most likely to underperform during natural disasters. It will be based on a methodology developed by Prevatt and Masters [26]. The outcomes of this survey will inform the protocol subsequently developed.

6.2 Protocol Stage Two: Development

The second stage will consist of the development of the protocol by evaluating local construction techniques, through the reproduction of a prototype of the local vernacular house, sometimes referred to in the Eastern Caribbean as a “chattel house” [27]. This design will be redeveloped in a way that corresponds with the latest Building Code being drafted, which will also be analyzed in detail in conjunction with the development of this prototype. Its construction will then be separated into various stages, which will be mapped out in a clear way, which, if followed, will result in a final dwelling which adheres to the latest Code. Using this framework as a template, the process will be made into a step-by-step protocol in which local stakeholders can easily receive appropriate training, in a clear and unambiguous manner that facilitates compliance and, therefore, increases resilience in local communities. Part of the protocol will be a simple means of recording the construction process undertaken, to confirm it has been followed, and therefore rendering the dwelling ultimately more likely to be suitable mortgage security for a bank.

6.3 Protocol Stage Three: Engagement

The third and final stage will involve collaboration with two main stakeholder groups. The first group will be local banks. Once it can be clearly demonstrated that adherence to the protocol will lead to Building Code compliance, and this adherence can be clearly and unambiguously demonstrated, the subsequent aim will then be to engage with banks. If local banks can be persuaded to accept in principle that if a particular build follows the protocol as developed, then this would be a clear demonstration of

building code compliance, this would, therefore, result in a property of suitable mortgage security.

The second round of engagement will be local stakeholders, namely local builders familiar with local techniques. The protocol will be examined and refined, prior to producing a final version and, ultimately, delivery of a training programme capable of communicating the protocol to third parties.

7. Conclusions

This paper proposes a clear change in emphasis from western, list-based approaches to Building Code compliance, to a more flexible demonstrative approach, more able to adapt to local building techniques. This will enable the built environment in lower income communities in the Eastern Caribbean to, ultimately, be more resilient to the ravages of climate change, as well as unlocking finance for local affordable housing development, by helping to make banks more comfortable in lending against lower income housing projects.

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