Data and Systems for Resilient Housing in Dominica

Final Report: Survey of Existing Housing

March 2025

CDRI
Coalition for Disaster Resilient Infrastructure

GREEN CLIMATE FUND

Build Change

Acknowledgements

Ministry of Housing

The survey was led by Permanent Secretary Dr. Kyra Paul, together with Tracy Peltier (Project Coordinator) and Larissa Frederick (Project Assistant). The survey team consisted of:

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National Employment Program: Fermine Carriere, Trecia Corbette, Marcus Daniel, Jasmine Diolen, Darryine Esprit, Alida Elizee, Delma Henderson, Ken Joseph, Bryson Williams.

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EXECUTIVE SUMMARY

Executive Summary: Introduction, Findings and Data Analysis

Introduction. The Ministry of Housing, in partnership with Build Change and with funding from the Coalition for Disaster Resilient Infrastructure and the Green Climate Fund, has conducted an extensive survey of 527 existing houses in Dominica. The survey provides a comprehensive and systematic assessment of current housing vulnerability to natural and climate hazards. The results highlight the progress and gaps in resilient housing since Hurricane Maria, as well as set the baseline against which the success of housing programs can be measured.

This report summarises the survey approach and findings, together with recommendations for next steps.

Key findings: There is a significant opportunity to reduce disaster risk with housing retrofits focused on structural improvements to roofs and timber houses, particularly for the poorest families:

1. **63% of roofs are highly vulnerable.** This increases to 70% when considering only the households with increased socioeconomic vulnerability.
2. **89% of timber houses are highly vulnerable.** This increases to 100% when considering only the households with increased socioeconomic vulnerability.
3. **No masonry walls or slab roofs were found to be highly vulnerable.**

Implication of the findings. Comparing these findings against the 2017 post-Hurricane Maria Building Damage Assessment (BDA) highlights that significant progress, a 14% reduction, has been made in reducing vulnerability in the housing sector.

However, this reduction is largely as a result of new construction of masonry houses with slab roofs. Comparing the BDA data for timber houses and galvanize roofs, there is little change in the physical vulnerability of the existing housing stock. A targeted approach for retrofitting existing housing is needed.

Reliability of the findings. This dataset is a statistically viable sample (95% confidence level) that is representative of the geographic distribution of housing in Dominica, as well as of housing typologies and size. Several key challenges in the survey implementation process have impacted the quality of the data (see pages 21-22 for details), however the results should be considered a reliable basis upon which decisions can be made.

Executive Summary: Recommendations

Develop a retrofit program focused on roofs and timber houses. The survey found galvanize roofs and timber houses to have the highest vulnerability. Retrofitting is a cost effective way to reduce disaster risk: 78% of galvanize roofs are highly vulnerable, but can be retrofitted for approximately XCD $11,000 - $16,000 (16% of cost of new construction). 89% of timber houses are highly vulnerable, but can be retrofitted for approximately XCD $40,000 (37% of cost of new construction)[1].

Offer retrofit grants to the poorest households. Households with increased socioeconomic vulnerability have higher rates of physical vulnerability, but less (or no) capacity to pay for retrofits.

Explore options for subsidies and affordable loans. Homeowners' financial capacity and willingness to pay for home improvements is low: only 55% of households save money, of which less than half save regularly and less than a quarter save for home improvements. 21% reported they could invest up to XCD $5,000 and 17% could invest up to XCD $20,000. Appetite for loans is low: less than a third of homeowners took a loan to build their home. A better understanding of options for subsidies or affordable loans that suit household budgets is needed.

Allow homeowners to adopt a progressive approach to home retrofits. Retrofit interventions do not all have to be executed at once; they can be grouped into packages that are applied incrementally. The benefit of an incremental approach is that it spreads the cost out over time while still reducing disaster risk.

Provide retrofit technical assistance and training to homeowners and builders. Engineers and builders in Dominica already have expertise in habitability improvements and home repairs, especially post-hurricane, that are relevant to structural retrofits. However, large-scale, standardized structural home retrofits have not yet been integrated into the construction sector. To strengthen industry capacity, development of a builder training and certification program alongside the retrofit initiative is recommended. This could also attract builders from the wider Caribbean region, enhancing regional expertise in resilient construction.

Create an enabling environment for home retrofitting. Consider making the permitting requirements for home strengthening less onerous, for example: reduce or remove fees for homes retrofits, or reduce required level of documentation.

INTRODUCTION

- Overview of project and this report
- Purpose of the survey
- Compilation and assessment of existing data
- Conceptualization and design of the questionnaire
- Implementation of the data collection

Overview of the CDRI-funded project

Data and Systems for Resilient Housing Programs in Dominica

Project description

In 2018, the Government of Dominica acknowledged the existential threat climate change poses to the country and set the vision of transforming Dominica into the world's first climate-resilient nation.

Recognizing the risk posed to housing, a key target is for 90% of the housing stock in Dominica to be built or retrofitted to resilient building codes.

Significant progress has been made with the construction of ***new*** resilient housing as part of recovery efforts post-Hurricane Maria and Government social housing programs. However, less progress has been made in addressing the vulnerability in the ***existing*** housing stock, and data is not available to assess the scale of the problem or to inform potential solutions.

This project seeks to address the current gaps and challenges preventing Dominica from increasing the resilience of the existing housing stock by:

1. **Collecting data to determine a statistically viable baseline describing the condition of existing housing, against which the success and progress of improvement programs can be measured.**
2. Developing guidance for strengthening and upgrading existing housing in Dominica, that can be used by homeowners and builders.
3. Designing a Government-led home strengthening program to preventively mitigate the exposure of vulnerable existing houses to natural hazards and their increasing severity due to climate change.

This report summarises the approach and findings from the national housing survey conducted as part of the project, together with recommendations for next steps.

Overview of the Green Climate Fund (GCF) project

Study on Socioeconomic, Demographic, and National Climate Resilient Housing Data for Enhancing the National Climate Resilient Housing Programme in Dominica

This report also includes important findings for the Governments GCF funded project.

The Government of Dominica has a highly complementary project running in parallel with the work with Build Change and CDRI.

To avoid duplication of effort and burdening homeowners with numerous independent surveys, the GCF survey questionnaire was combined with the CDRI project survey.

The main objectives of the GCF project are as follows:

- To gather accurate and up-to-date socioeconomic and demographic data from target communities.
- To assess the climate resilience requirements for housing developments, taking into consideration local environmental conditions and climate vulnerabilities.
- To formulate recommendations based on the gathered data that will enhance the implementation of the national climate resilient housing programme.
- To prepare a comprehensive report that includes the gathered data, analysis, and recommendations.
- To conduct a validation workshop to present the findings and recommendations to stakeholders for feedback and further inputs.

Purpose of the survey:

To assess the exposure and vulnerability of Dominica's existing housing stock

In order to assess the exposure and vulnerability of Dominica's existing housing stock, **the survey was designed to collect:**

- **Structural data** to inform physical vulnerability through analysis of the capacity to resist hurricanes and earthquakes
- **Socioeconomic data** to inform social vulnerability
- **Geospatial data** to facilitate comparison against existing hazard and exposure maps

The survey also included data collection for the Socioeconomic, Demographic, and National Climate Resilient Housing Data Study financed by the Green Climate Fund.

At the request of the Ministry, the survey consolidated data collection on aspects of **habitability or green building** (such as water and sanitation, natural lighting, ventilation, energy efficiency) in just one question to reduce the length of the survey and to avoid duplication of other ongoing survey work.

The survey results gathered have been analyzed in order to:

1. **Determine a baseline** against which the success of interventions to increase the resilience of the housing sector can be measured. A minimum of 380 surveys were required[1] to ensure statistically significant sample size (with 95% confidence level and 5% margin of error) for the total housing stock of 25,000 homes.
2. **Make and prioritize recommendations** to inform design of resilient-housing improvement programs in accordance with international best practice.
3. **Inform development of home retrofit guidance materials.** Subsequent phases of the project focus on the production of three sets of manuals: an awareness manual aimed at non-technical persons, a prescriptive technical manual for construction professionals (builders and contractors) and a supervision and inspection manual for quality control agents.

[1] Calculation of sample size requirements

Survey approach and methodology

Summary of findings from the compilation and assessment of existing data

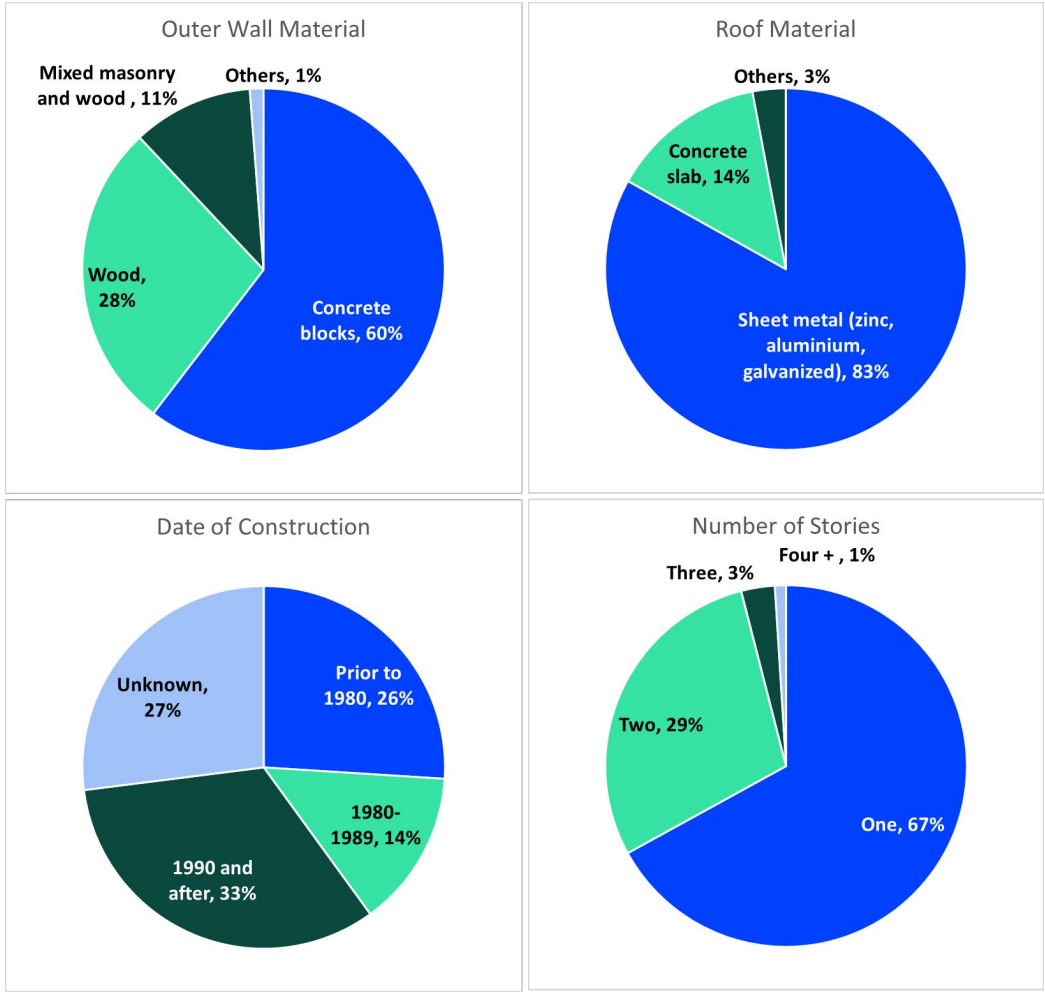
Two major data sets already exist for housing in Dominica:

- 2010 National census (Dominica Central Statistics Office)
- 2017 Post-Hurricane Maria Building Damage Assessment (UNDP), which includes data from the assessment of status of over 25,000 houses.

Both data sets were used as a guide to determining criteria for the housing sample. The Building Damage Assessment was also used as a historic baseline (see Pages 27-29 for comparison of the two data sets).

Key conclusions from the existing data sets used to determine the criteria for the survey sample:

- Concrete masonry wall systems with metal sheet/galvanize roofs are the dominant housing typology
- The large majority (over 95%) of houses are one or two stories
- Houses with timber walls suffered the most damage during Hurricane Maria
- Houses with masonry walls and a slab roof experienced the least damage during Hurricane Maria

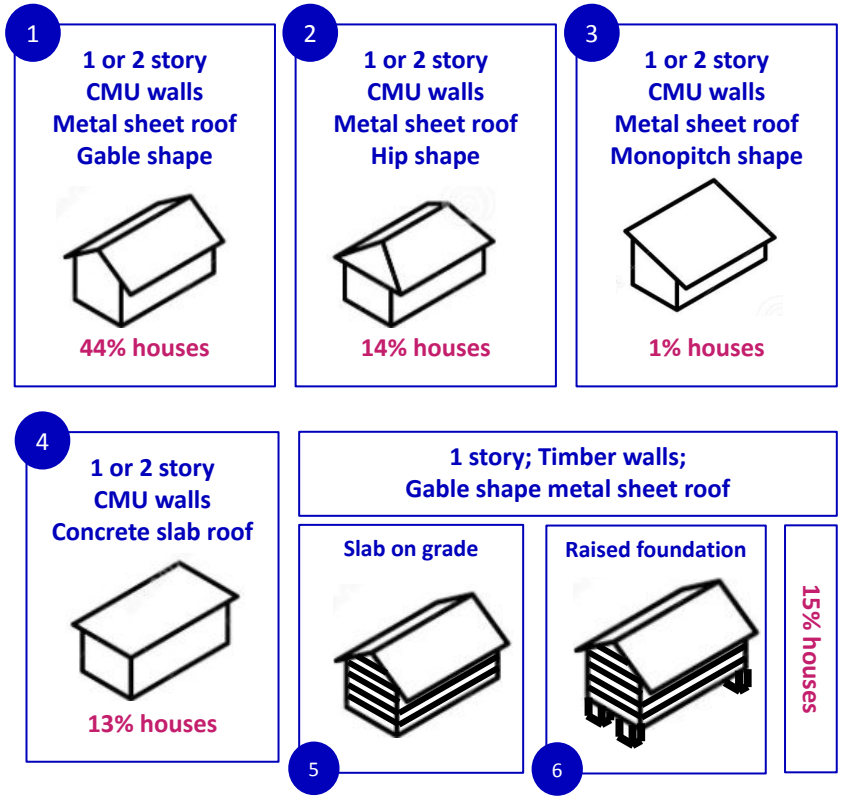


For complete details of the review of existing data, refer to Annex 2: Housing stock data report

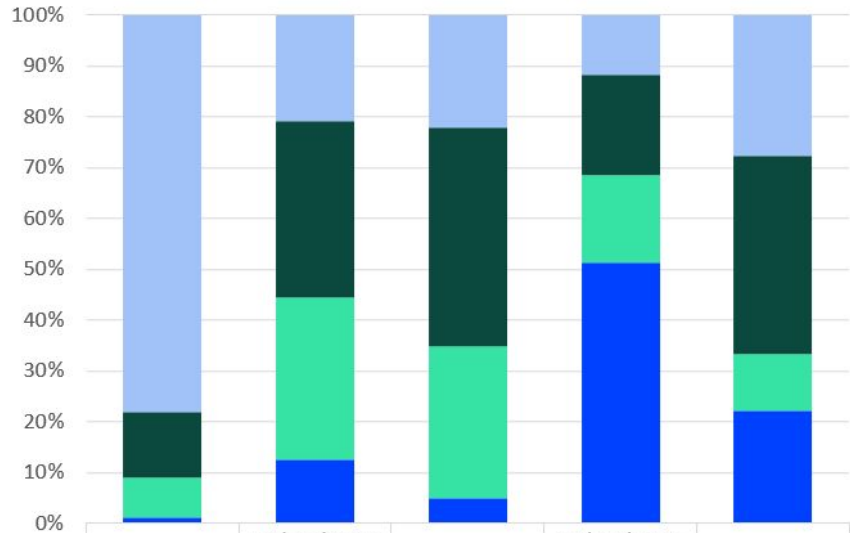
Survey approach and methodology

Summary of findings from the compilation and assessment of existing data

Six building typologies account for approximately 85% of the housing stock in Dominica.



Timber houses and houses with galvanize roofs were the worst affected by Hurricane Maria in 2017



	RC/ Masonry Walls			Timber Walls	
	Reinforced Concrete Roof	Galvanize or Improved Galvanize Sheet Roof	Shingle Roof	Galvanize or Improved Galvanize Sheet Roof	Shingle Roof
Minimal Damage	2893	3882	36	613	5
Minor Damage	469	6378	70	1041	7
Major Damage	292	5929	49	900	2
Completely Destroyed	47	2322	8	2679	4

Build Change

Survey approach and methodology

Conceptualization and design of the survey questionnaire

The survey consisted of four forms

The survey questionnaire was separated into four distinct forms:

- General information
- Socioeconomic and demographic survey
- Site and surroundings
- Housing survey

This allowed the survey teams to work in parallel while at the house, with one person interviewing the homeowner to collect the socioeconomic and demographic data, while others investigated the site and surrounding area, and others considered the structural and habitability conditions of the house.

> GENERAL INFORMATION
> SOCIO-ECONOMIC & DEMOGRAPHIC DATA
>> Data of Interviewee
>> House and site ownership data
>> Family Data
>> Income data, Expenses, Savings
>> Housing Use and general info
>> Community organization and Participation
>> Modifications / Extensions
>> Experience with past Events
> SITE & SURROUNDINGS SURVEY
> HOUSING SURVEY
>> Structural Survey
>>> Structural Classification - Typology
>>> Damage and Deterioration
>>> Detailed Structural Evaluation
Masonry walls
Timber walls
Timber Roof Evaluation
Slab Roof Evaluation
>> Habitability Survey
>> Appendages Survey

For complete details of the survey questionnaire, refer to Annex 3: Survey Questionnaire

Survey approach and methodology

Implementation of the survey data collection

Establishment of survey targets

The data sample sought to represent the general population by considering three key criteria:

1. **Known contributors to higher vulnerability:**

   Kalinago. The indigenous minority comprise only 4% of the total population, however they particularly vulnerable to extreme weather and climate change due to their lower than national average socioeconomic status and their geographic location on the eastern side of the island.

   Timber houses. Based on the 2017 UNDP building damage assessment following Hurricane Maria, timber houses are know to have significantly higher physical vulnerability than masonry houses.

2. **Location:** Based on data from the Central Statistics Office on the number of houses in each parish and each enumeration district, the following targets were set.

Parish	Proportion of housing stock (2010 census)	Proportion of Sample		
		Target	Actual	*Difference Target - Actual*
St. Andrew	14%	13%	8%	*+5%*
St. David (excl. Kalinago)	4%	4%	15%	*-3%*
Kalinago Territory		8%		
Roseau	21%	19%	25%	*+3%*
St. George (excl. Roseau)	9%	8%		
St. Joseph	9%	8%	7%	*+1%*
St. John	11%	10%	10%	*0%*
St. Mark	3%	3%	7%	*-5%*
St. Patrick	11%	10%	4%	*+6%*
St. Paul	14%	13%	8%	*+5%*
St. Peter	2%	2%	2%	*0%*
St. Luke	2%	2%	2%	*0%*

For complete details of the survey implementation, refer to Annex 4: Survey Implementation Plan

Survey approach and methodology

Implementation of the survey data collection

Establishment of survey targets

3. **Structural typology:** The proportion of various building types were estimated based on data from the 2017 UNDP Building Damage Assessment and the 2011 census.

   The target for the survey sample set was to approximately follow the estimated proportions of the total housing stock, with one key difference: to include a higher proportion of houses with slab roofs. The rate of slab roof construction has dramatically increased on the island since 2017 due to their increased hurricane resistance.

Typology	Estimated proportion of housing stock	Proportion of sample	*Difference Actual - sample*
Masonry walls, timber gable roof	44%	44%	*+3%*
Masonry walls, other light roof	15%		
Mixed masonry/timber walls, light roof		18%	
Masonry walls, slab roof	10%	23%	*+13%*
Timber walls, slab on ground	15%	6%	*-1%*
Timber walls, raised foundation		8%	
Other		1%	*+1%*

Selection of houses

Houses were randomly selected by the field survey teams based on the targets for the number of houses in each Parish and Enumeration District, and the targets for housing typology.

The Central Statistics Office has assigned identification numbers to all houses in Dominica based on their location according to Parish and enumeration district. However, their housing database does not also include housing typology data.

Each group of surveyors was assigned a target number of houses within each enumeration district, which were chosen at random by the individuals based on availability of homeowners and building typology targets.

For complete details of the survey implementation, refer to Annex 2: Survey Implementation Plan

Survey approach and methodology

Implementation of the survey data collection

Survey teams

Each survey team comprised a team leader, typically a Housing Officer from the Ministry of Housing, accompanied by 1-2 contractors through the National Employment Program and 1-2 students from the Dominica State College.

Coordination of the survey teams was led by the CDRI Project Coordinator, Tracy Peltier, and all surveyors were also in communication with the Build Change team to resolve questions related to the survey questionnaire or the data collection app, BCtap.

Surveyor training

A total of 26 surveyors received training. The training comprised an in person, desk based session on 24th May 2024, which was led virtually by Build Change. The presentation gave details on the survey objectives, the questionnaire, and the app and concluded with an example exercise.

The first two weeks of data collection served as continued training, as the surveyors were in close communication with Build Change to resolve any questions in the field or bugs in the survey app.

For complete details of the survey implementation, refer to Annex 2: Survey Implementation Plan

Survey approach and methodology

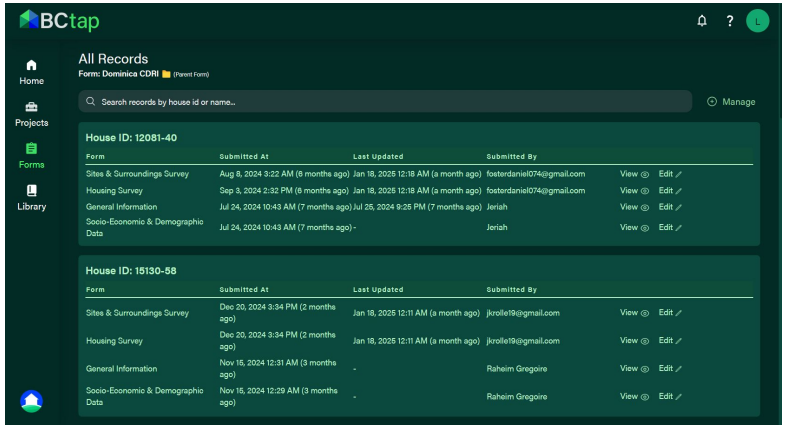
Implementation of the survey data collection

Digital implementation using BCtap

Data was collected using the BCtap mobile app. This allowed for which allowed for significant time savings during the post-processing of data as it was already in a workable digital format.

The app was designed for low/no internet connection and tested on a range of mobile devices. Improvements could be made to resolve issues with cloud synchronization and functionality on devices with low internal storage capacity.

Prior to launch, the app was tested by the surveyors in the field with around 70 test records. This was vital to ensuring the survey questions were understood and appropriate for the local context. It also identified technical bugs in the app that could be resolved before launch.



For complete details of the survey implementation, refer to Annex 2: Survey Implementation Plan

DATA ANALYSIS

- Overview of the data set
- Implementation challenges that affected data quality
- Classification of physical and socioeconomic vulnerability

Data analysis

Overview of the data set

Number of houses surveyed: 527

A total number of 527 houses were surveyed, far exceeding the minimum target number of 400 houses.

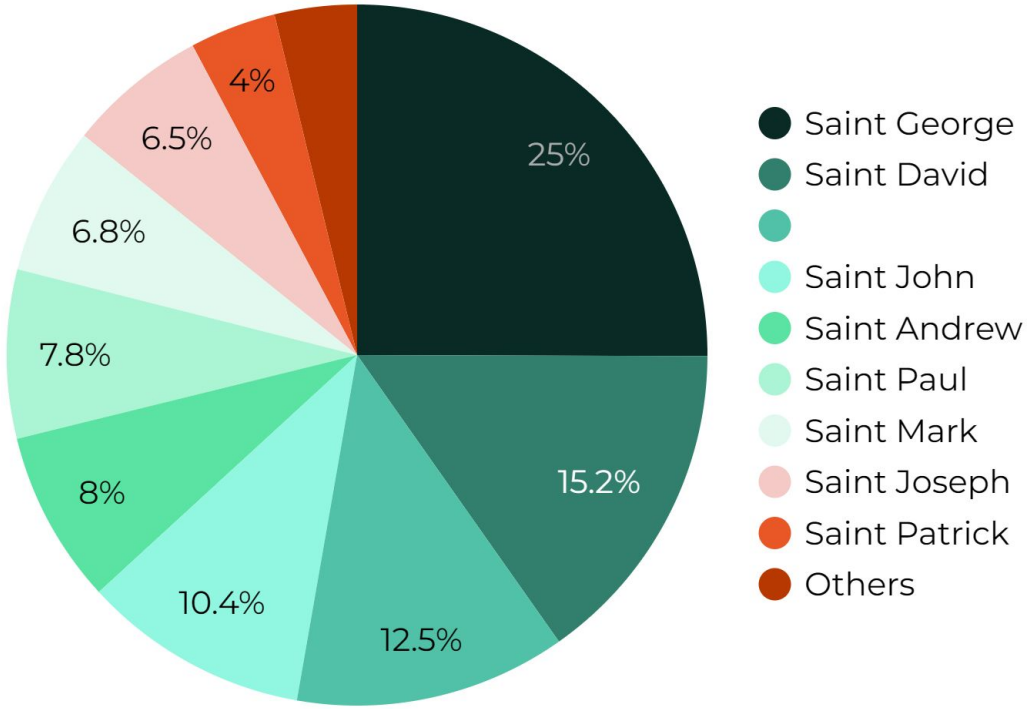
This is a statistically viable sample set. Based on 26,085 houses in Dominica (2011 census), a minimum data set for a statistically viable sample is 380 houses (95% confidence level).

Additionally:

- Percentage of female respondents: **53%** (target 50%)
- Percentage of Kalinago respondents: **10%**
- The proportion of housing surveys in each parish was **within 6%** of the actual proportion of houses.

Refer to page 11 for details of why the surveyed sought to target a higher proportion of female and Kalinago respondents, and to ensure a representative geographic distribution.

Housing location by parish

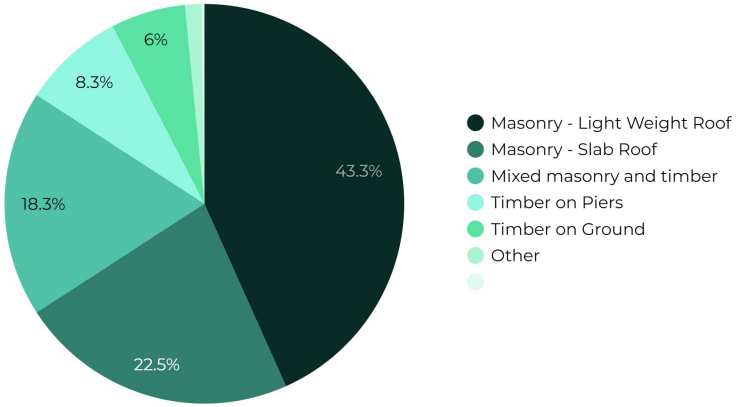


Data analysis

Overview of the data set

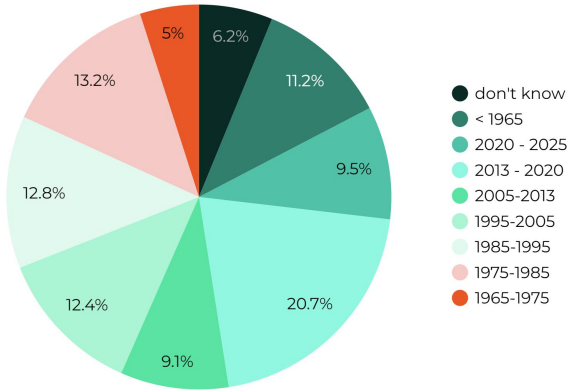
Building typology

Approximately representative of the estimated proportion of building types within the total housing stock, based on data from the 2011 census, the 2017 Building Damage Assessment, and knowledge of how construction practices have changed since 2017 (refer to page 12 for further details).



Date of construction

Building age is as expected for the country. Data is not available from previous surveys for comparison.



Number of storeys, roof shape and house size

Survey sample is comparable to the 2017 damage assessment data. Slight increases in the number of two storey buildings and hip roofs are in line with expectations.

	2025	2017 BDA	Diff.
Number of storeys			
1	66%	67%	-1%
2	32%	30%	2%
3+	2%	3%	-1%
Galvanize roof shape			
Gable	64%	69%	-5%
Hip roof	29%	24%	4%
Monoslope	4%	3%	1%
Other	4%	4%	0%
House size			
Small (< 500 sqft)	26%	31%	-5%
Medium (500-1200 sqft)	42%	40%	1%
Large (1200 - 2500 sqft)	16%	22%	-6%
Extra Large (> 2500 sqft)	17%	7%	10%

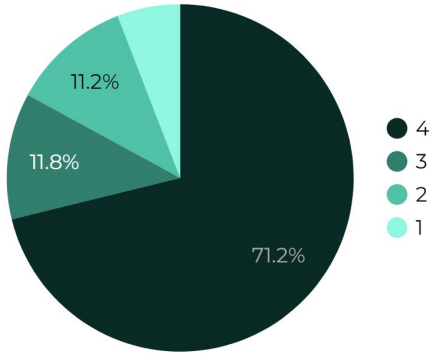
Data analysis

Implementation challenges that affected data quality

1. Homeowner unwillingness to participate

Many homeowners were unwilling to allow the surveyors inside their homes, and/or were not comfortable responding to questions asking for personal information.

As a result, the team did not reach the upper target to survey 600 houses and there are gaps in the survey data. Key gaps relate to the detailed structural survey, which required the surveyor to observe elements within the house, and the socioeconomic survey as homeowners were often reluctant to respond to questions related to their household finances.

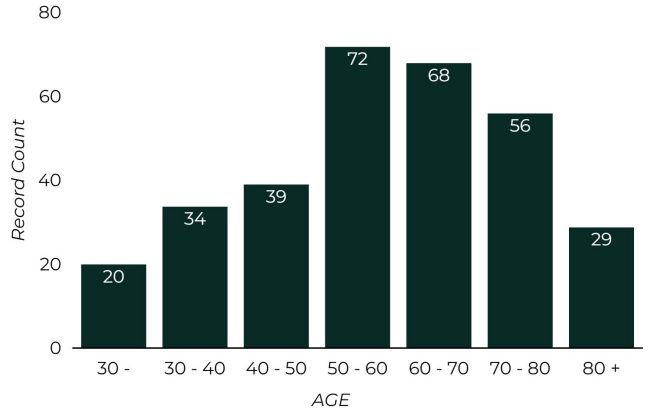


Number of forms completed for each house as an indication of data gaps

2. Survey timing

As much as possible, surveys were conducted during the evenings and at weekends when homeowners, particularly younger, working homeowners, were more likely to be home. However, many surveys were conducted during normal working hours (Monday - Friday, 8am - 4pm). As a result it is likely that there is a higher than average proportion of elderly, retired, or unemployed homeowners in the data set.

It is not possible to confirm this as there is no data available on the age of homeowners in Dominica.



Age of respondents

Data analysis

Implementation challenges that affected data quality

3. Building inspections limited to visual assessments

Many of the design and construction details that determine a building's physical resistance to natural hazards are hidden in a finished home. For example steel reinforcement in concrete elements is no longer visible, or timber roof framing is concealed by a ceiling.

Destructive testing or inspections were not possible to include on the survey, so many structural questions either had to be estimated based on the visual information or left unanswered.

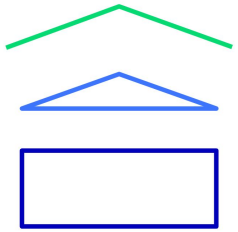
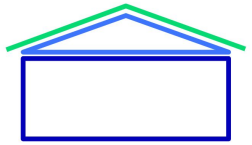
4. Length of survey and non-mandatory questions

The survey questionnaire was intentionally comprehensive to maximise the return on investment of mobilising a nationwide housing survey. However, the length led some surveyors to rush through the form making errors or skipping questions, lowering the quality of the data. It also made the app slower to synchronize which contributed to some of the data synchronization issues in BCtap.

Data analysis

Physical vulnerability classification methodology

Each structural deficiency identified in the survey was assessed based on the extent to which it increases the vulnerability of the house, and then grouped into major components.

Housing typology	Retrofit packages	Target sample size
Masonry house with galvanize roofs		**Basic roof:** Includes roof covering condition, roof drainage. Number of deficiencies assessed: 10
		Advanced roof: Includes roof framing, roof connection to walls. Number of deficiencies assessed: 22
		Walls & foundations: Includes everything below the ring beam. Number of deficiencies assessed: 17
Masonry house with slab roofs		**Full building:** Includes slab roof, walls and foundations. Number of deficiencies assessed: 19
Timber houses		**Full building:** Includes roof, walls and foundations. Number of deficiencies assessed: 31

Data analysis

Physical vulnerability classification methodology

Approach to classification of physical vulnerability

1. **Identification of design and construction deficiencies**
   A comprehensive list of the observed deficiencies was created for each building type and all construction elements, from foundations to the roof. Site related hazards were also considered.

2. **Organization of deficiencies**
   Construction elements and their associated deficiencies were grouped into packages, based on their impact on the structural performance of the building.

3. **Vulnerability rating system**
   Each deficiency was assigned into one of three vulnerability levels: low, medium, or high.

   - **Low vulnerability:** Deficiencies that have minimal impact on structural integrity and do not significantly weaken the building.
   - **Medium vulnerability:** Deficiencies that may compromise individual structural elements or cause damage, but are of secondary importance for hurricane and seismic safety and do not threaten overall building stability.
   - **High vulnerability:** Deficiencies that could lead to partial or total structural collapse that pose a serious risk to occupants' safety and increases the likelihood of severe losses.

4. **Overall Package Vulnerability**
   Determined by analyzing the vulnerabilities of individual deficiencies within each structural package.

   If any one deficiency within a package was rated as *high vulnerability*, the entire package was classified as high vulnerability as the failure of that specific construction element could cause serious damage or even collapse of the entire building.

For complete details of the physical vulnerability classification, refer to Annex 7:

Data analysis

Socioeconomic vulnerability classification methodology

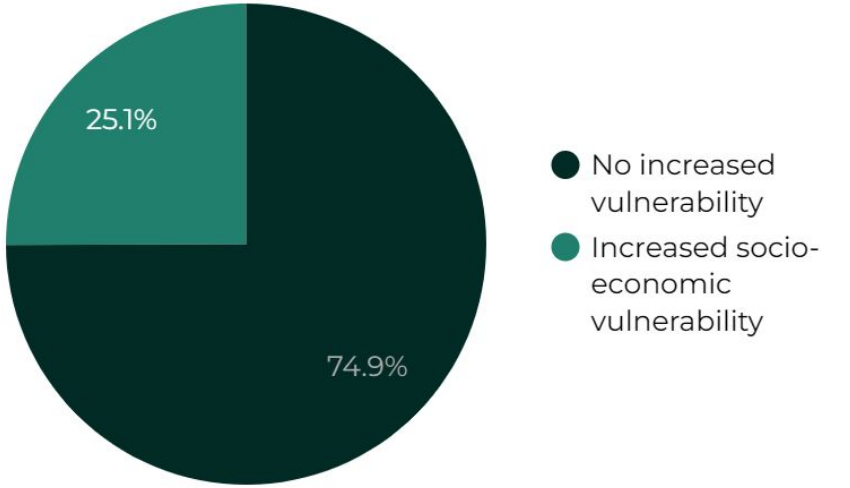
Definition of increased socioeconomic vulnerability

Increased socioeconomic vulnerability is known to compound physical vulnerability and increase overall risk as, for example, low income, unemployment or a high number of dependents limit a family's ability to invest in their housing.

To explore the interaction between socioeconomic and physical vulnerability, a factor referred to as increased socioeconomic vulnerability was defined as a household meeting three or more of the following criteria:

- Monthly income = XCD $1,000 or less
- Highest level of education = primary
- Employment status = unemployed
- Receives social security support = yes
- Family type = single-parent family
- Occupants with disabilities = yes
- Occupants with chronic illness = yes
- Habitability of the dwelling = poor condition
- Average space per person living in the house < 100 sq.ft

Based on this definition, 25% of households surveyed were considered to have increased socioeconomic vulnerability in Dominica. This tallies with the 2022 estimated poverty rate of 28.8% by UN OCHA, with data from the Government of Dominica.



Proportion of households with increased socioeconomic vulnerability

FINDINGS

- Key findings - physical and socioeconomic vulnerability
  - Overview of the data set
  - Comparison with the 2017 UNDP Building Damage Assessment
  - Masonry houses
  - Timber houses
  - Site hazards
- Key findings - socioeconomic
  - Household income, expenditure and savings
  - Insurance
  - Household preferences and financial capacity for home improvements
  - Land tenure
  - Homeowner preferences and perceived vulnerability

Key findings

Comparison of findings against the 2017 Building Damage Assessment

Significant progress towards a resilient building stock has been made since Hurricane Maria.

Overall, the total proportion of highly vulnerable houses in the building stock has dropped by approximately 14%.

Only 37% of the houses built since 2017 have high vulnerability, a significant and commendable reduction considering 63% of the total housing stock (houses with any age) have high vulnerability (see Page 30).

However, the reduction in vulnerability has come from a shift in new construction practices towards building masonry houses with reinforced concrete slab roofs. There has been no significant reduction in the vulnerability houses with galvanize roofs built since Hurricane Maria. This reinforces the need to continue with continue with new construction best practices, while starting to address the vulnerability in the existing housing stock through a retrofit program focused on galvanize roofs.

BDA data comparison methodology

The 2017 UNDP Building Damage Assessment that was carried out immediately post-Hurricane Maria can be considered as a baseline. The BDA categorised damage levels into four categories: minimal damage, minor damage, major damage, and completely destroyed. To allow for a direct comparison with this survey, minimal damage was considered equivalent to Medium Vulnerability, and anything worse than minimal damage was considered equivalent to High Vulnerability.

73% of houses suffered more than minimal damage in Hurricane Maria. Considering these as highly vulnerable indicates that there has been a 14% reduction in physical vulnerability thanks to resilience efforts post-Hurricane.

	2017 BDA	2025	% Diff.
Timber houses	90%	89%	-1%
Masonry houses	66%	63%	-4%
All houses	**73%**	**63%**	**-14%**

Key findings

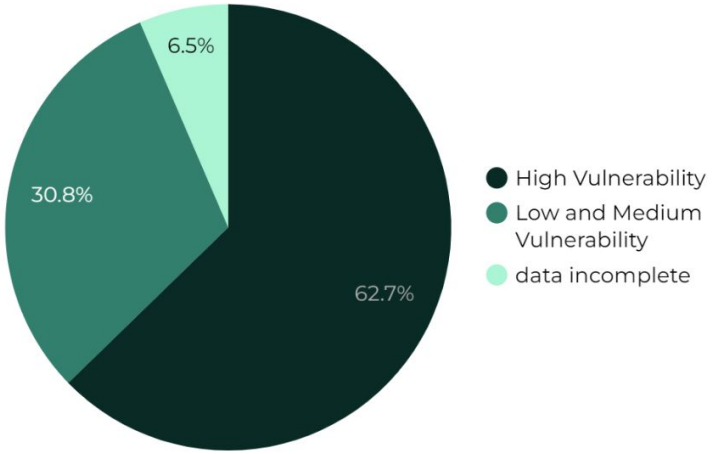
Comparison of findings against the 2017 Building Damage Assessment

The increase in resilience since Hurricane Maria is due to new construction, existing housing still needs improvement

Comparing houses built since 2017 with the total housing stock, the proportion with high vulnerability has significantly decreased from 63% to 37%.

However, this overall reduction is due to a significant increase in new construction of masonry houses with reinforced concrete slab roofs. 23% of houses of any age have a slab roof, whereas 58% of houses built since 2017 have a slab roof (see Page 29).

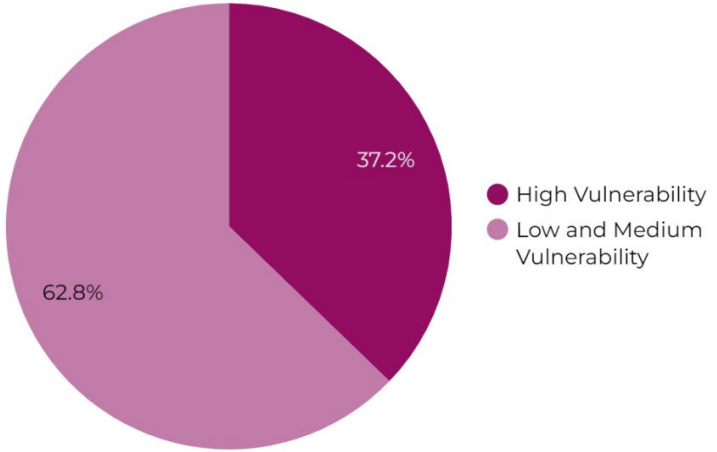
Correspondingly, there has been a large drop in the proportion of new masonry houses with galvanize roofs. Importantly, those that have been built since 2017 do not have a lower proportion of high vulnerability houses. In fact it is actually slightly higher (80% highly vulnerable masonry houses with galvanize roofs built since 2017, compared to 78% highly vulnerable masonry houses with galvanize roofs of all ages, see Page 29).



Whole building vulnerability,

all housing types,

all building ages



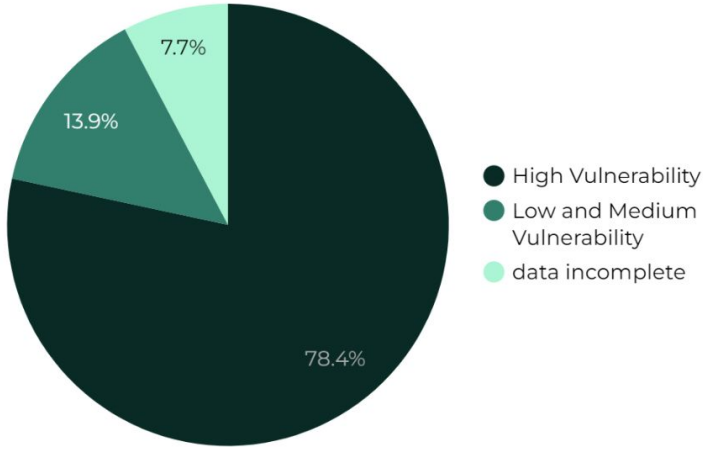
Whole building vulnerability,

all housing types,

built after Maria (2017-2025)

Key findings

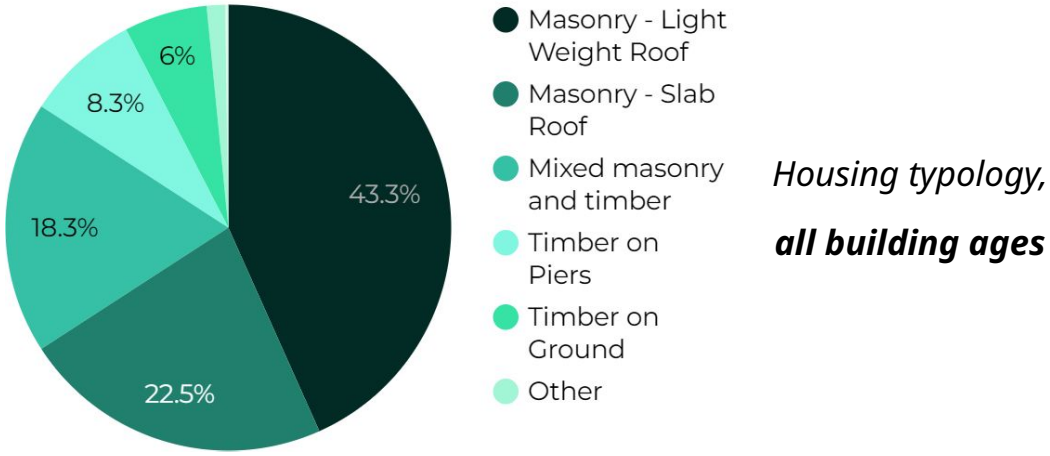
Comparison of findings against the 2017 Building Damage Assessment



Whole building vulnerability,

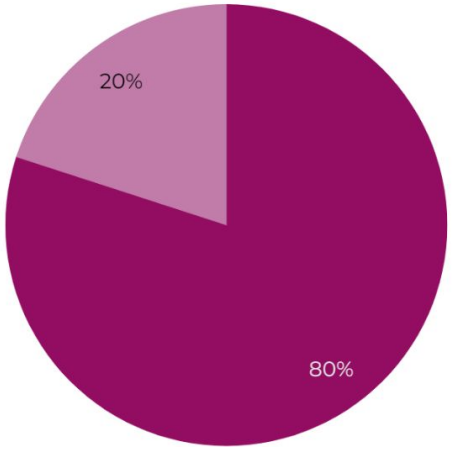
masonry houses with galvanize roofs,

all building ages



Housing typology,

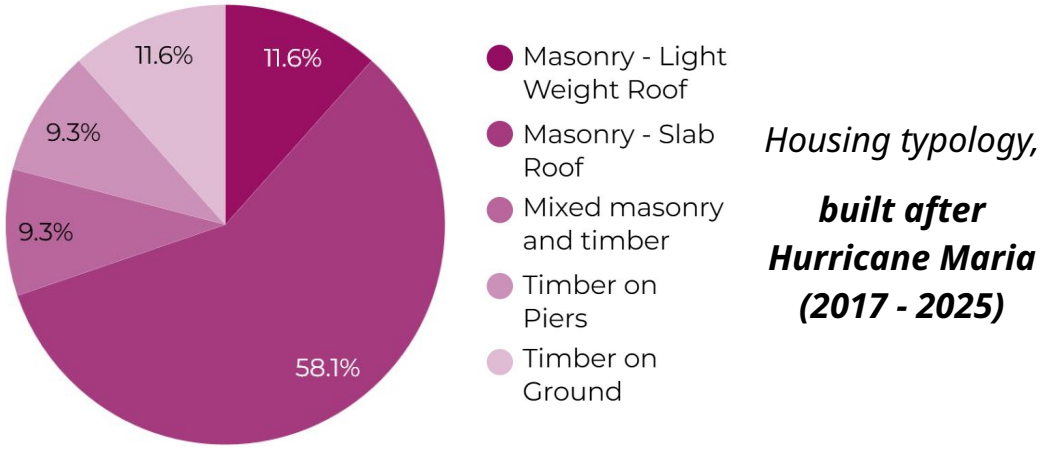
all building ages



Whole building vulnerability,

Masonry houses with galvanize roofs

built after Maria (2017-2025)



Housing typology,

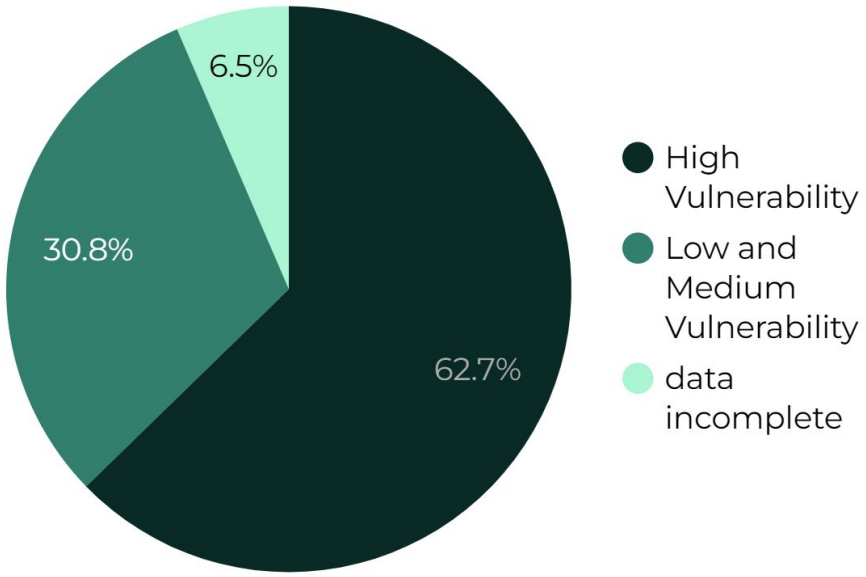
built after Hurricane Maria (2017 - 2025)

Build Change

Key findings

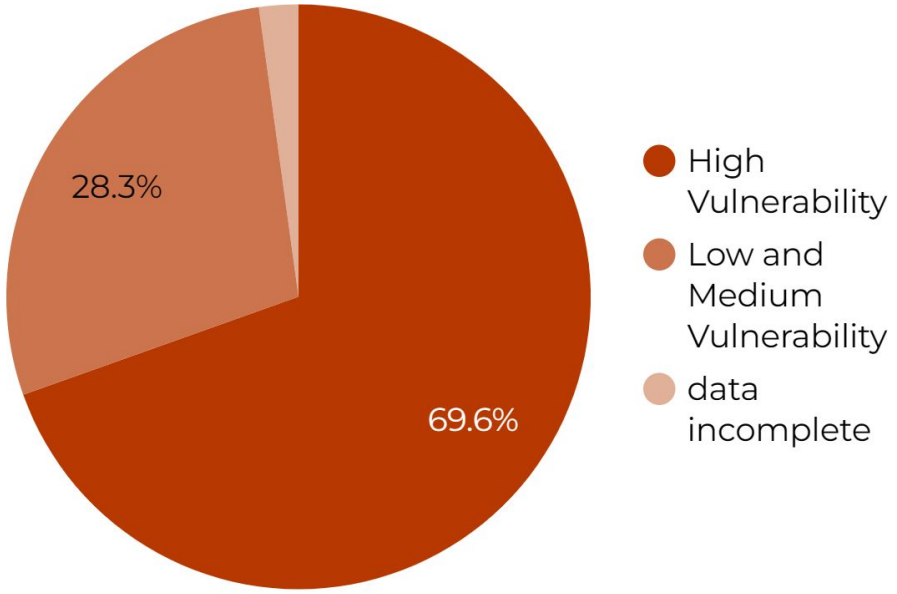
Physical and socioeconomic vulnerability

63% of roofs are highly vulnerable



"Roofs" includes all roof types on all building types. This includes both galvanize and slab roofs of all shapes, sizes and slopes, and masonry, timber or mixed walls.

For households with increased socioeconomic vulnerability, the proportion of houses with roofs that are highly vulnerable increased to 70%.



Key findings

Physical and socioeconomic vulnerability

Overview of the proportion of highly vulnerable houses by building typology:

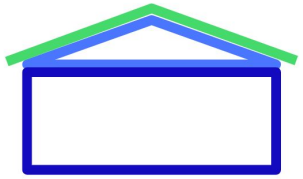
Basic Roof
44% houses highly vulnerable

Advanced Roof
78% houses highly vulnerable

Walls & Foundations
0% houses highly vulnerable

Galvanize Roof Masonry House

Slab Roof Masonry House
0% houses highly vulnerable



Timber House
89% houses highly vulnerable

- **Timber houses are the most vulnerable.** Timber houses, considered as one complete package due to the nature of the retrofits required, are the most vulnerable, with 89% of houses highly vulnerable.
- **Block houses with slab roofs are the least vulnerable.** None of the masonry block houses with reinforced concrete slab roofs were found to be highly vulnerable.
- **For masonry houses with galvanize roofs, approximately half of the roof coverings and three quarters of the roof framing are highly vulnerable.** Roof covering considers the metal sheets and their connection to the purlins or other roof framing. Roof framing considers all timber framing elements and their connection to the ring beam.
- **Block walls are not highly vulnerable.** No houses surveyed had highly vulnerable walls or foundations.

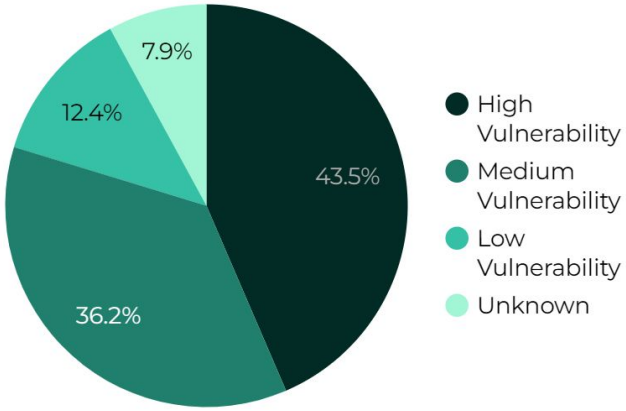
Detailed findings - physical and socioeconomic vulnerability

Masonry houses

Basic Roof

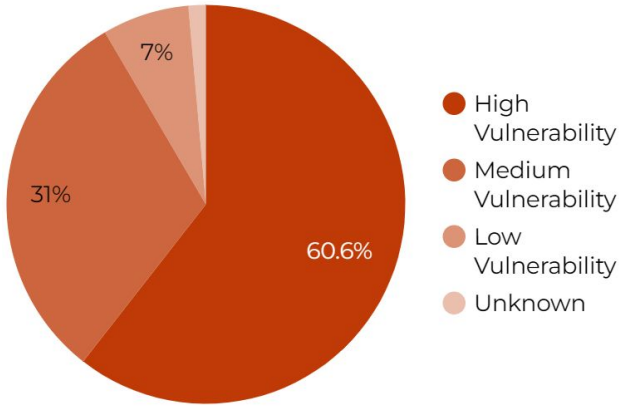
Conclusions:

- 44% of roof coverings and drainage are highly vulnerable.
- For households with increased socioeconomic vulnerability, this increases considerably to 61% highly vulnerable.
- **Significant potential to reduce disaster risk with basic roof retrofits, particularly for the poorest families.**



Basic roof vulnerability,

all masonry with galvanize roof households



Basic roof vulnerability,

all households with masonry and galvanize roof AND ***increased socioeconomic vulnerability***

Build Change

Key findings - physical and socioeconomic vulnerability

Masonry houses

Basic Roof

Key issues:

- Roof covering:
  - Poor condition of covering (galvanize sheets: inadequate thickness, rusted, dented, perforated; shingles: rotten, missing)
  - Inadequate connection of covering to roof framing (inadequate spacing of screws, particularly at eaves and ridges)
- Roof drainage: Inadequate gutters and downpipes, inadequate flashing particularly at roof connections

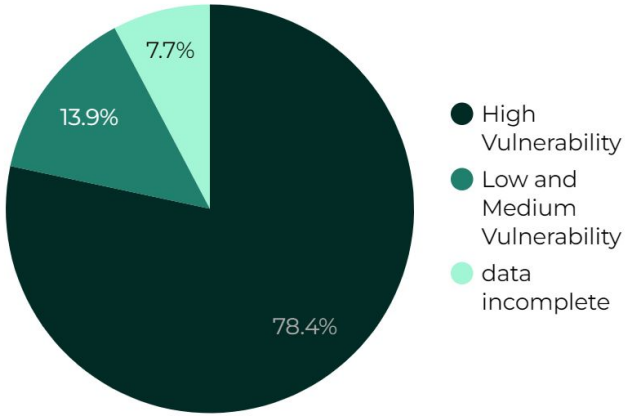
Key findings - physical and socioeconomic vulnerability

Masonry houses

Advanced Roof

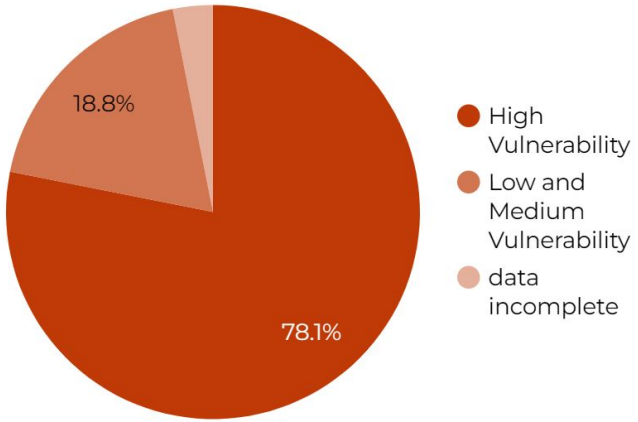
Conclusions:

- 78% of roof structures are highly vulnerable.
- No change for households with increased socioeconomic vulnerability.
- **Advanced roof retrofits are critical to reducing disaster risk.**



Advanced roof vulnerability,

all masonry with galvanize roof households



Advanced roof vulnerability,

all households with masonry and galvanize roof AND ***increased socioeconomic vulnerability***

Build Change

Key findings - physical and socioeconomic vulnerability

Masonry houses

Advanced Roof

Key issues:

- Weak timber structure: Inadequate size and spacing of structural members - rafters, purlins. and trusses.
- Inadequate connections between purlins and rafters or trusses.
- Inadequate connections between roof elements (rafters or trusses) and the ring beams above walls.

Key findings - physical and socioeconomic vulnerability

Masonry houses

Walls and Foundations

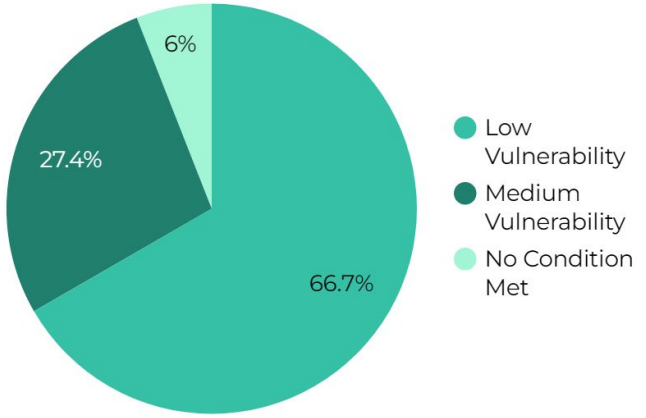
- **Key issues:** missing lintels, minor cracking around openings, absence of tie-columns in specific areas.
- **Conclusion:** Only 16% of masonry walls & foundations are highly vulnerable. **Not a priority retrofit area.**

Key findings - physical and socioeconomic vulnerability

Masonry houses

Slab Roof

- **Key issues:** localized concrete spalling/honeycomb, some exposed reinforcement bars.
- **Conclusion:** Only 12% of slab roofs are highly vulnerable. **Not a priority retrofit area.**

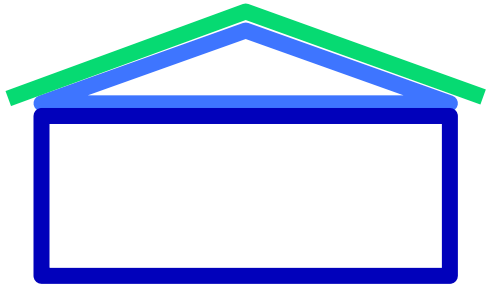


Slab roof vulnerability,

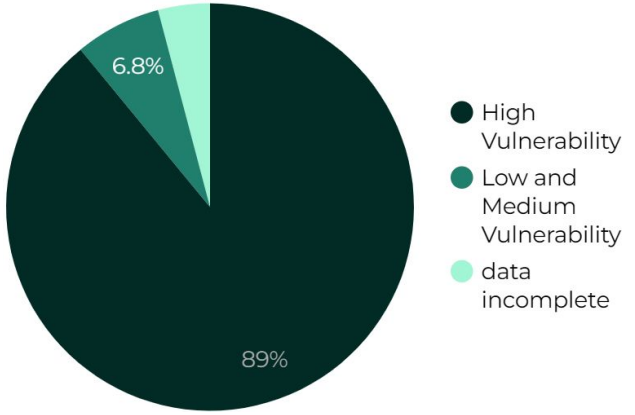
all masonry with slab roof households

Key findings - physical and socioeconomic vulnerability

Timber houses



Timber houses

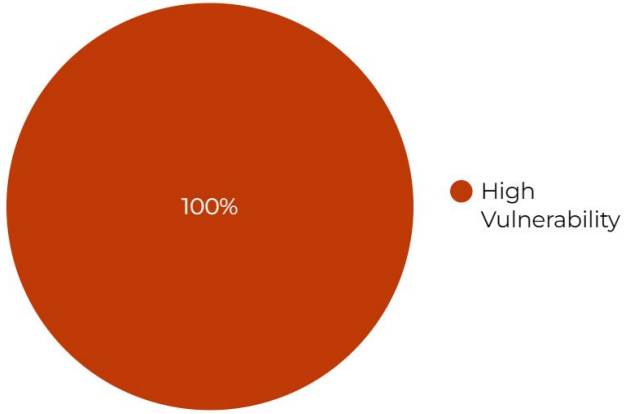


Timber houses vulnerability,

all timber households

Conclusions:

- 89% of timber houses are highly vulnerable.
- For households with increased socioeconomic vulnerability, the number of houses with high physical vulnerability increases to 100%, all houses.
- **Advanced roof retrofits are critical to reducing disaster risk.**

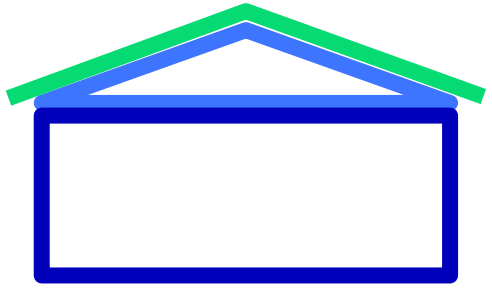


Timber houses vulnerability,

all households with timber houses AND ***increased socioeconomic vulnerability***

Key findings - physical and socioeconomic vulnerability

Timber houses



Timber houses

Key issues:

- **Wall framing:** excessive spacing of studs, absent double studs at wall intersections and ends, lack of double top and sill plates.
- **Wall cladding:** Inadequate thickness, insufficient fixing to framing, excessive deterioration of plywood.
- **Connections:** In particular walls to foundations (insufficient hold downs and shear bolts) and roof to walls.

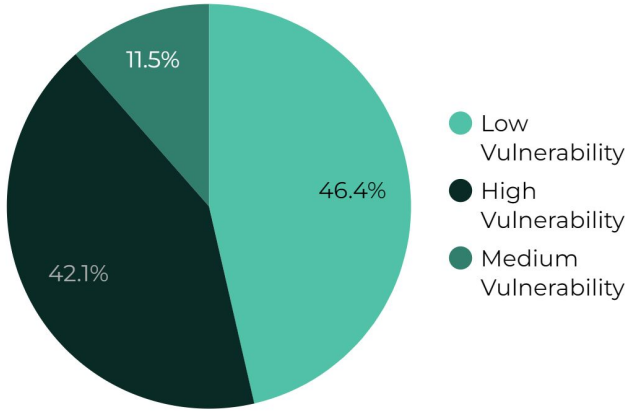
Key findings - physical and socioeconomic vulnerability

Site hazards

Assessed vulnerability

Site vulnerability considered three hazards: sea surge, pluvial/fluvial flooding, and slope instability. Considering all of these hazards, 42% of sites assessed were highly vulnerable. As shown by the breakdown below, this is predominantly due to flood hazard and was largely based on homeowners responses to past floods (32% of homeowners commented they had experienced floods on their site in the past).

- **Sea surge:** 19% of sites assessed highly vulnerable
- **Flood:** 35% of sites assessed highly vulnerable
- **Slope instability:** 2% of sites assessed highly vulnerable

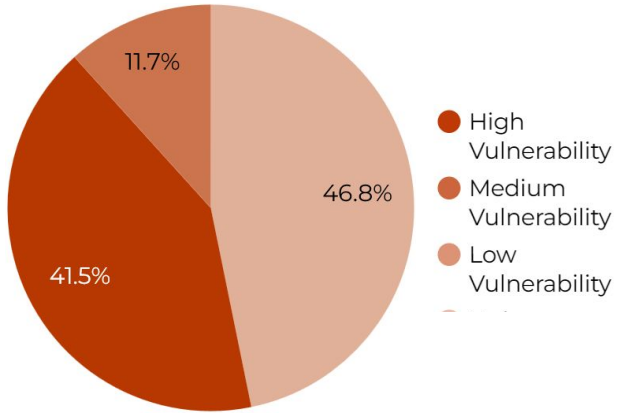


Site hazard vulnerability,

all households

Site hazards and retrofitting

It is not recommend to retrofit houses on highly vulnerable sites. While it may technically be feasible, it is much more costly and often not an efficient use of funds. Instead it is recommended to focus funding on structural interventions in the house with higher benefit:cost ratios.



Site hazard vulnerability

all households with ***increased socioeconomic vulnerability***

Key findings - socioeconomic

Household income, expenditure and savings

Monthly income and expenditure

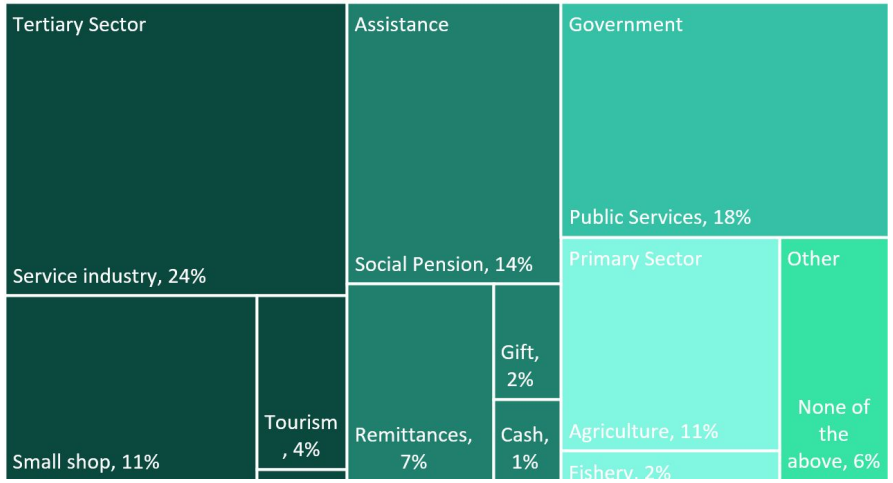
More than half (54%) of households earn less than XCD $1,500 each month.

Most households have more than one source of income. The most common source of household income is service industry (24%), followed by public services (18%) and agriculture (11%).

Annual savings

45% of households do not save. Of the households that do save:

- Less than half (41%) of households save regularly.
- 50% of households save less than XCD $500 per year. Less than 20% of households save more than XCD $1,500 per year.
- 32% reported the savings are for healthcare, another 32% reported emergencies. Only 23% of households reported they are saving for home maintenance and improvement.



Source of household income

Monthly household income and expenditure

Build Change

Key findings - socioeconomic

Insurance

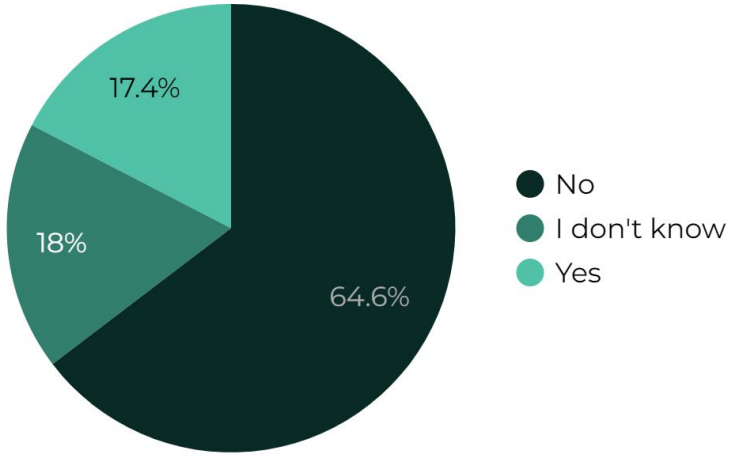
Only 17% of households have insurance

For households with increased socioeconomic vulnerability, only 6% have insurance.

There has not been a significant change in uptake of insurance since 2017

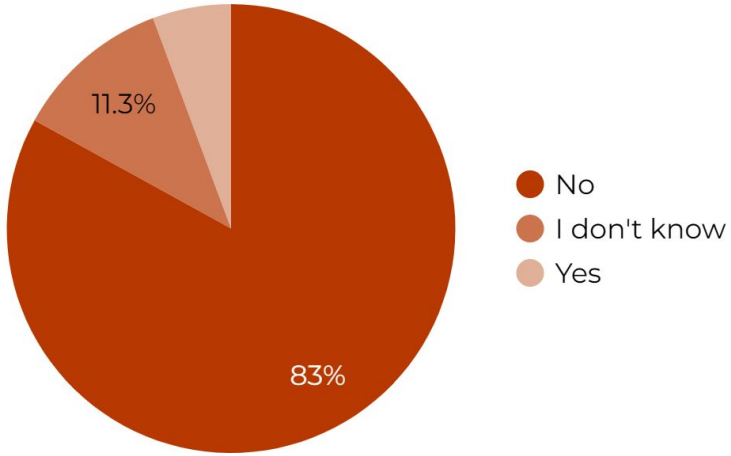
Slightly more households have taken out home insurance since 2017, increasing from 13% to 16%.

Home Insurance	2025	2017	Difference
Yes	16%	13%	+4%
No	66%	48%	+18%
Unknown	18%	39%	-22%



Property insurance status,

all households



Property insurance status,

*Households with **increased socioeconomic vulnerability***

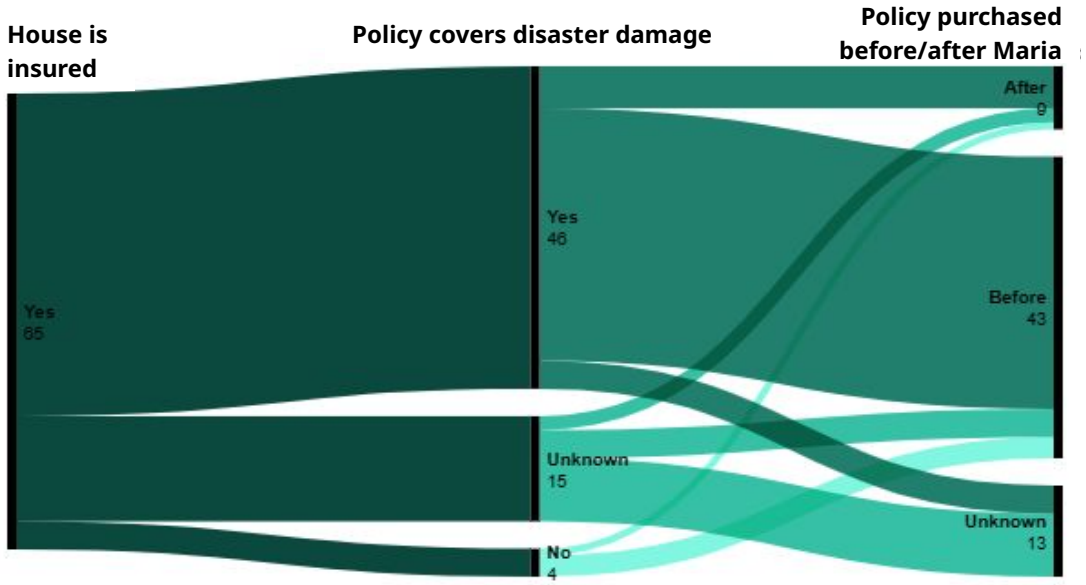
Key findings - socioeconomic

Insurance

Only 17% of households have home insurance

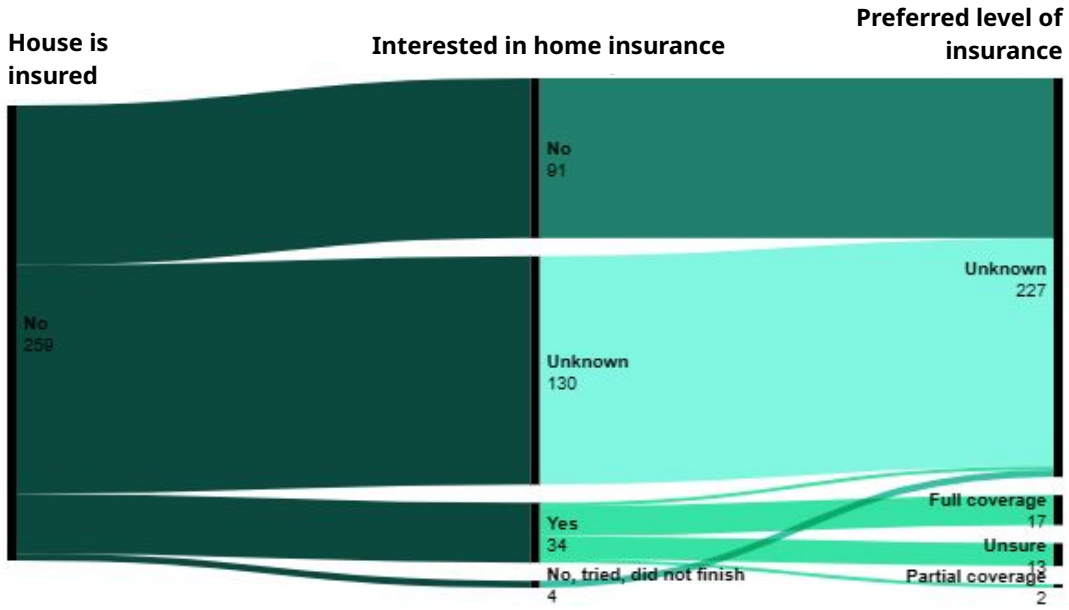
Of the households that have home insurance:

- Only 70% include damages from disasters.
- The majority (66%) had the insurance before Hurricane Maria. Only 14% chose to take on insurance after Maria.



Only 13% of households without insurance are interested in purchasing a policy

When asked why the household did not have home insurance, most did not respond. Those that did commented that it was due to a lack of funds.



Build Change

Key findings - socioeconomic

Household financial capacity for home improvements

Annual maintenance budget

Half of homeowners reported they spend less than XCD $1,000 per year on home maintenance (32% spend less than XCD $500, 20% spend XCD $500-$999).

Willingness to invest

The majority of homeowners were unwilling to answer or reported they did not know how much they could invest in home strengthening.

Of those that did respond, 21% reported they could invest up to XCD $5,000 and 17% could invest up to XCD $20,000. Less than 10% reported willingness to invest over XCD $20,000.

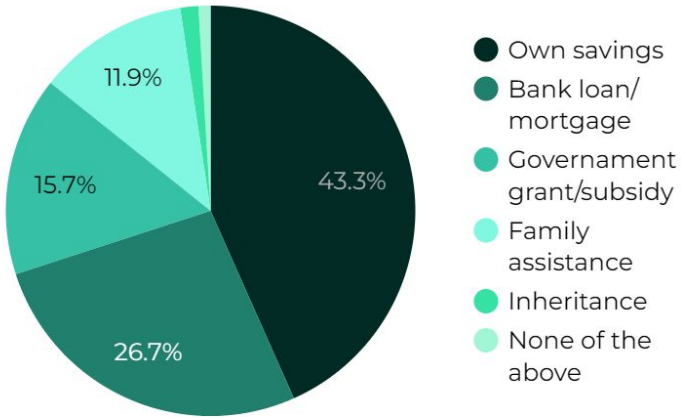
Source of funding for home investments

The large majority of homeowners responded they plan to use their own savings (41%) or family income (9%) for future home improvements. Few reported that they would take out a loan (12%).

Source of funding for home construction

Less than one third (27%) of homeowners reported taking a loan to build their home.

The large majority of homeowners used their own savings (43%), or used family assistance or inheritance funds. 16% of households received government support.



Source of funding for home construction

Key findings - socioeconomic

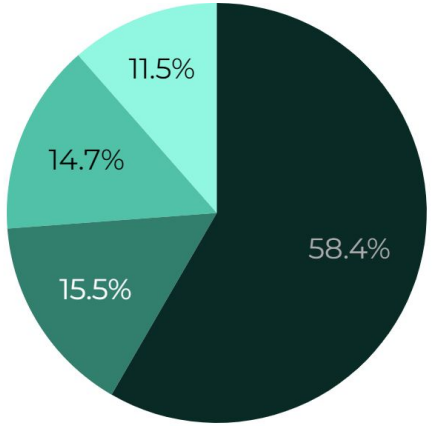
Land tenure

Land ownership status

58% of homeowners reported their land title is available. A further 27% of homeowners reported that the land title exists but is with local authorities or the owner. This shows a slightly increase in evidence of land ownership since the 2017 Build Damage Assessment

Land title status	2017	2025
Land title exists and available	56%	58%
Land title exists, not available	6%	27%
Land title does not exist or unknown	38%	15%

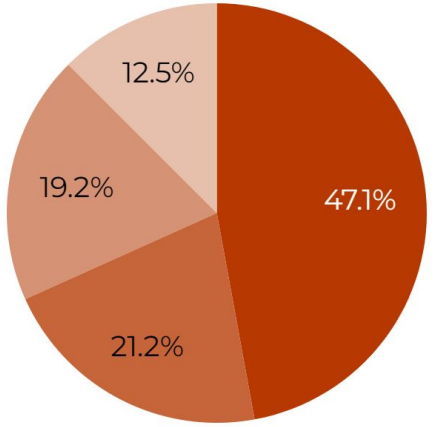
Rates of land ownership are significantly higher for masonry buildings than for timber buildings: approximately two thirds of masonry houses have a land title, whereas only one third of timber houses have a land title.



Land title available
Land title exists but not available - Local authorities might have a copy
Land title doesn't exist
Land title exists but it is with the owner

Land tenure

All households



Land title available
Land title doesn't exist
Land title exists but not available - Local authorities might have a copy
Land title exists but it is with the owner

Land tenure

Households with increased socioeconomic vulnerability

Build Change

Key findings - socioeconomic

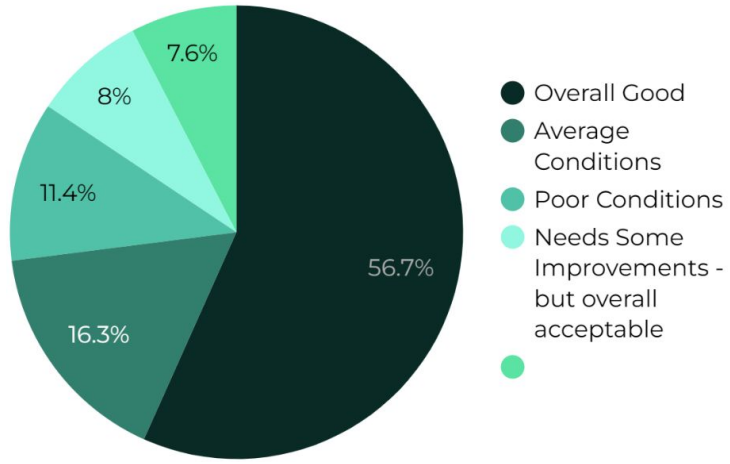
Habitability

Increased socioeconomic vulnerability is strongly correlated with poor habitability

The habitability of over half of households surveyed was rated as good and only 11% was rated as poor. However, for households with increased socioeconomic vulnerability, the number of households rated as good reduced to one third, and the number of households with habitability rated as poor more than doubled.

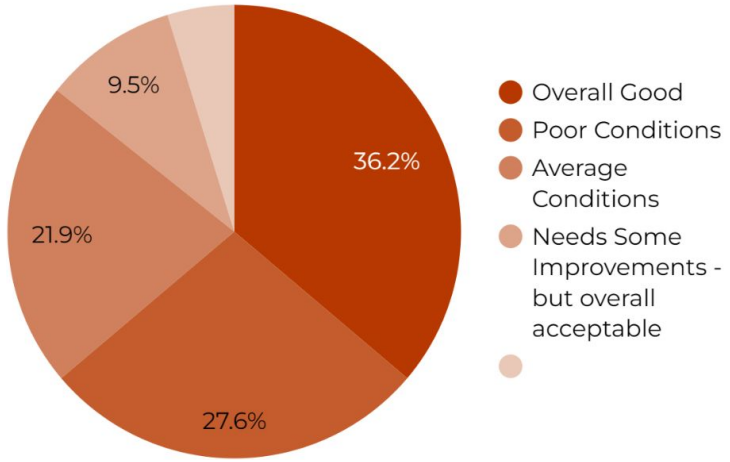
Good habitability was assessed based on the following factors:

- Access to electricity and water
- Access to private and sanitary wash facilities
- No observed issues with solid waste management
- No observed mold
- No evidence of leaks
- No evidence of pests
- Sufficient habitable space/ no overcrowding
- Sufficient natural light and ventilation
- Adequate status of repair and maintenance



Habitability assessment,

all households



Habitability assessment,

households with ***increased socioeconomic vulnerability***

Key findings - socioeconomic

Household preference for home improvements

Reason for past home improvements

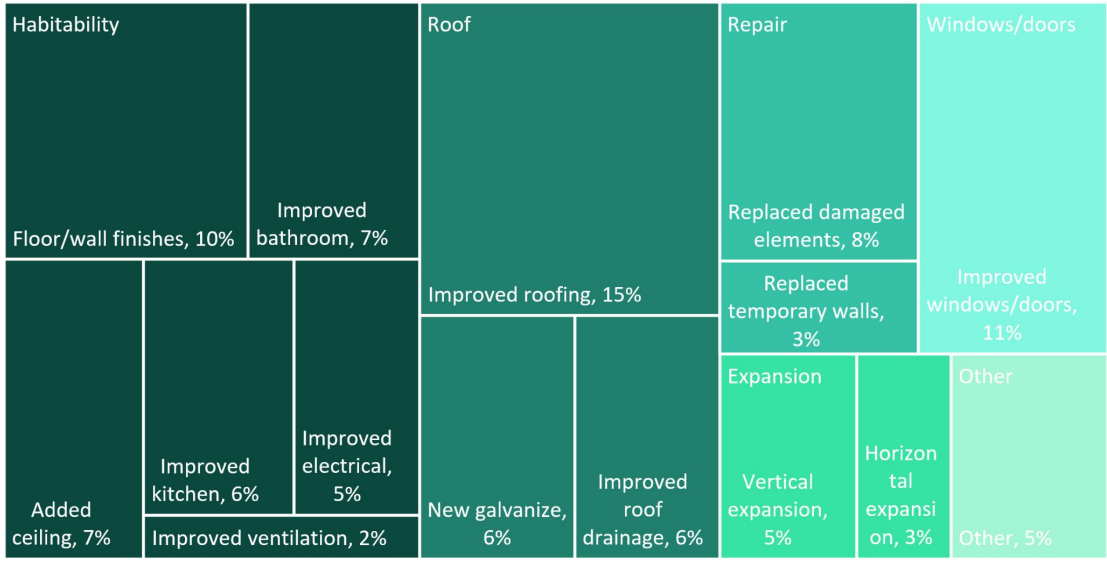
The most popular reason for making improvements to the home was wind or water damage (12%). Poor condition of elements (11%), a desire to improve the house (9%), and a need for more space (4%) were also important reasons.

Breakdown of past home improvements

Habitability improvements were the most common reason for home improvements (38%), followed by roof retrofits (27%). Improvements to windows and doors (11%), repairs (11%), and expansion (8%) were also reported.

Future home improvement plans

Homeowners were asked their plans for future home improvements in the short and long term, however their responses, were less clear. For those that did respond, their priorities did not show a different pattern to what is shown for past improvements.



Scope of past home improvements

Key findings - socioeconomic

Homeowner preferences and perception of vulnerability

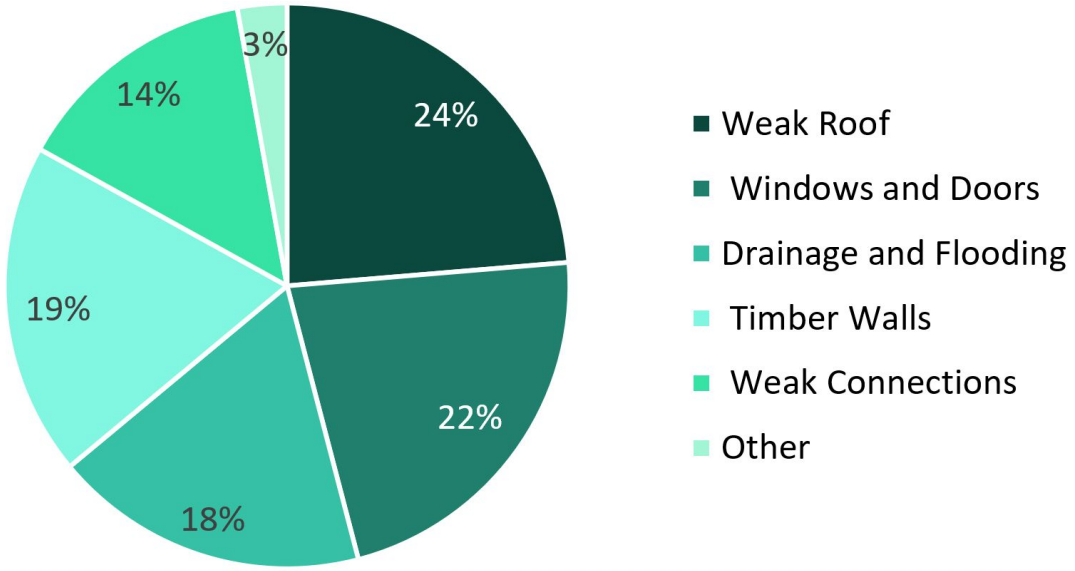
Perceived vulnerabilities

Homeowners' main concerns were weak roofs (24%), closely followed by windows and doors (22%), timber walls (19%), and drainage and flooding. This in line with the actual assessment of vulnerability determined in this survey. The alignment of homeowner perception of vulnerability and actual vulnerability is likely due to the number of extreme hurricanes which have caused damage on the island within living memory.

Material preferences

Masonry vs. timber walls: Of the homeowners who responded, 96% prefer masonry walls over timber walls. Homeowners gave multiple reasons for their preference for masonry walls: masonry lasts longer (66%), is safer (29%) and is cheaper (21%).

Galvanize vs. slab roof: Of the homeowners who responded, 85% prefer a slab roof over a timber roof. Homeowners gave multiple reasons for their preference for slab roofs: slabs are safer (86%), last longer (63%), and better resist the wind (42%).



Vulnerabilities in the house as perceived by the homeowner

RECOMMENDATIONS

- Develop a retrofit program focused on galvanize roofs and timber houses.
- Explore options for funding a retrofit program, including grants, subsidies and affordable loans to households.
- Provide retrofit technical assistance and training to homeowners and builders.