

EXECUTIVE SUMMARY

COUNCIL OF ARCHITECTURE AND URBANISM OF BRAZIL (CAU/BR)
NATIONAL COUNCIL FOR SCIENTIFIC AND TECHNOLOGICAL DEVELOPMENT (CNPQ)

[RESILIENT HOUSE]

Design Strategies for Promoting Resilience in Social Housing through Post-Occupancy Evaluation Methods

RESILIENCE



RESIST · ADAPT · TRANSFORM

EVALUATION



MATRIX · RESILIENCE RULER

ADAPTABILITY



LONG-TERM FIT

CO-PRODUCTION



ATHIS · WORKSHOPS

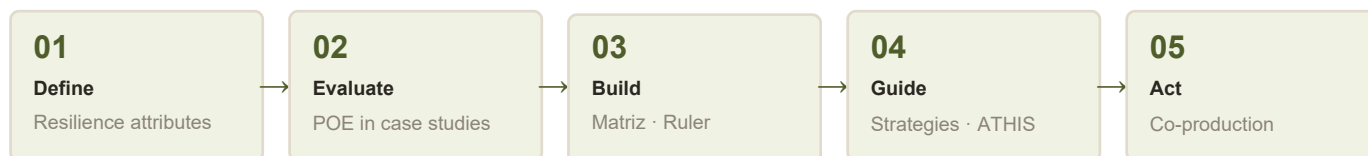
OVERVIEW

[Resilient House] investigates how Brazilian social housing can adapt to social, environmental, and physical challenges over time. Grounded in the concept of resilience in the built environment, the research explores housing performance, adaptability, and long-term quality in social housing. The project has developed resilience indicators, assessment methods, and design strategies to support housing upgrades and interventions, particularly in single-family social housing. By connecting Post-Occupancy Evaluation, housing performance, and Technical Assistance for Social Housing (ATHIS), it promotes more resilient, sustainable, and adaptable homes while supporting evidence-based housing improvements.

OBJECTIVES

- 01 Develop and apply the Resilient House Evaluation Matrix for social housing.
- 02 Measure resilience and adaptability through the Resilience Ruler instrument.
- 03 Assess energy-efficiency refurbishment of social housing.
- 04 Evidence the impacts of low adaptability on residents.

METHODOLOGY — PROCESS



RESEARCH TEAM

01 Coordination Profa. Dra. Simone B. Villa	01 Post-doc Dra. Karen C. R. Bortoli	08 Master's (MSc) Architecture, Urbanism and Design (FAUeD)	12 Scientific Initiation Architecture, Urbanism and Design (FAUeD)
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THE RESEARCH GAP

Despite growing interest in housing resilience, there is a lack of practical assessment methods and design guidelines to support resilience-oriented interventions in Brazilian social housing. Existing approaches rarely translate Post-Occupancy Evaluation findings into accessible strategies for residents and housing professionals, particularly in single-family social housing. To address this gap, the research translates evaluation findings into actionable resilience strategies for housing improvements.

KEY FACTS

FUNDING

Council of Architecture and Urbanism of Brazil (CAU/BR)

NATURE

Innovation Stimulus Project (R&D)

PARTNERS

UFU · CAU/BR · CNPQ

ETHICS

CEP / UFU - CAAE: 56151522.3.0000.5152

FIELD

Shopping Park and Pequis - Uberlândia/MG

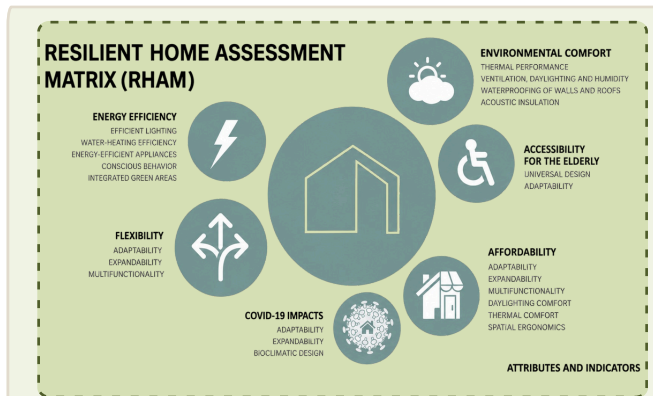
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THE PRODUCTS



Evaluation Matrix

INSTRUMENTS · RESILIENCE

The Evaluation Matrix defines a set of attributes and quality indicators for assessing housing resilience, covering aspects such as environmental comfort, energy efficiency, adaptability, accessibility, and affordability.

IMPACT: URBAN CLIMATE										
ATTRIBUTE: RESILIENCE BASED ON THERMAL COMFORT										
Indicators	Sub-indicators	Evaluation items	Assessed aspects	Comment/description	1 Not Resilient	2 Low Resilience	3 Moderate Resilience	4 Resilient	5 Highly Resilient	Reference
Bioclimatic building	Building systems considering the interaction with natural radiation and ventilation	Thermal properties and constructive components	Heat absorption by external walls (average)	Determines heat absorption by the incident heat in relation to wall area and thermal mass. Evaluation based on the weighted average obtained by combining the materials and dimensions of their respective surfaces. Walls measured in square meters - resilience.	Out of range	$\alpha \leq 0.6 - U \leq 3.7$ or $2.0 \leq U \leq 2.5$	$\alpha \leq 0.6 - U \leq 3.7$ or $2.0 \leq U \leq 1.5$	$\alpha \leq 0.6 - U \leq 1$ or $2.0 \leq U \leq 1$	$\alpha \leq 0.6 - U \leq 1$ or $2.0 \leq U \leq 0.5$	EEIUS (2022); ABNT - NBR 15575-4 (2021)
			Heat absorption by roofs (average)	Determines heat absorption in relation to roof area and thermal mass. Evaluation based on the weighted average obtained by combining the materials and dimensions of their respective surfaces. Roofs measured in square meters - resilience.	Out of range	$\alpha \leq 0.6 - U \leq 3.7$ or $2.0 \leq U \leq 2.5$	$\alpha \leq 0.6 - U \leq 3.7$ or $2.0 \leq U \leq 1.5$	$\alpha \leq 0.6 - U \leq 1$ or $2.0 \leq U \leq 1$	$\alpha \leq 0.6 - U \leq 1$ or $2.0 \leq U \leq 0.5$	EEIUS (2022); ABNT - NBR 15575-4 (2021)
			Heat transmission through external walls (average)	Determines heat transmission absorbed in relation to the thickness and density of the system. Evaluation based on the weighted average obtained by combining the materials and dimensions of their respective surfaces. Walls measured in square meters - resilience.	Out of range	$\alpha \leq 0.6 - U \leq 3.7$ or $2.0 \leq U \leq 2.5$	$\alpha \leq 0.6 - U \leq 3.7$ or $2.0 \leq U \leq 1.5$	$\alpha \leq 0.6 - U \leq 1$ or $2.0 \leq U \leq 1$	$\alpha \leq 0.6 - U \leq 1$ or $2.0 \leq U \leq 0.5$	EEIUS (2022); ABNT - NBR 15575-4 (2021)
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RESILIENCE SCALE (RATING LEGEND)										
NOT RESILIENT 1 - 3.99		LOW RESILIENCE 2 - 2.99		MODERATE RESILIENCE 3 - 3.99		RESILIENT 4 - 4.99		HIGHLY RESILIENT 5		

Resilience Ruler

INSTRUMENTS · RESILIENCE

The Resilience Ruler provides a scoring system that measures and grades the resilience and energy-efficiency performance of social housing refurbishment projects, to support a structured evaluation of retrofit strategies and help improve housing quality and long-term resilience.



Resilient House Web

WEB PLATFORM

A public platform sharing resilience attributes, instruments and practical guidance for residents and service providers.



SCAN TO OPEN

MAIN RESULTS

The project delivered the Evaluation Matrix and Resilience Ruler, a framework for assessing and grading housing resilience and energy-efficiency performance, together with the Casa Resiliente Platform, which provides guidance, assessment tools, and practical recommendations for residents and service providers. The methodology was applied and validated through social housing case studies, generating technical guidance, scientific publications, and evidence to support resilient housing policies and refurbishment strategies.

KEY PUBLICATIONS

Buildings	Villa et al. · Buildings 2025
Resilient House Evaluation Matrix: Attributes and Quality Indicators for Social Housing	Develops a resilience assessment matrix with attributes and indicators for social housing.
Buildings & Cities	Villa et al. · Buildings & Cities 2022
Lack of adaptability in Brazilian social housing: impacts on residents	Examines adaptability deficiencies in Brazilian social housing and resident impacts.
IJSDP	Oliveira & Villa · IJSDP 2023
Resilience Ruler for Energy Efficiency: An Evaluation of Social Housing Refurbishment	Develops and applies the Resilience Ruler (RR) to assess energy-efficiency resilience in Brazilian social housing refurbishment projects.
UIA 2023	Villa et al. · UIA 2023
Resilience Ruler in Social Housing: A Case Study in the City of Uberlândia/Brazil	Applies the Resilience Ruler (RR) to evaluate resilience and energy performance in social housing in Uberlândia, identifying key vulnerabilities and opportunities for refurbishment.

TECHNICAL INFORMATION

APPROACH	POE + Action Research + co-production
INSTRUMENTS	Evaluation Matrix · Resilience Ruler
PLATAFORM	www.casaresiliente.com
ACTIONS	Evaluating, Guiding, Acting and Preventing

CONTRIBUTIONS

- Social** — Housing that adapts to residents' changing needs.
- Policy** — Resilience indicators to guide norms & programmes.
- Capacity** — Refurbishment guidance reducing long-term costs.

SUSTAINABLE DEVELOPMENT GOALS



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