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Resilience and Sustainability in Building Codes in Latin America and the Caribbean

Comparative Regional Analysis and Strengthening opportunities

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EXECUTIVE SUMMARY

Building codes are a determining factor for increasing resilience in infrastructure through disaster and climate change risk management since their existence, quality, legal nature, and level of compliance define the bases on which the built environment and the reliability of services based on physical infrastructure must be developed.

In 2021, the Inter-American Development Bank (IDB), as part of the process of improving its instruments for the analysis of disaster risk and climate change in infrastructure projects, raised the need to carry out an analysis of how resilience and sustainability are included in the building codes of the IDB borrowing countries, to identify the codes that have made the most significant progress in the region, to reference them in the risk analysis processes, as well as to propose regional strengthening recommendations. With this objective, in 2022, the Bank hired the Chilean Construction Institute (IC), which carried out the survey and analysis of earthquakes, strong winds, floods (SVI, in the Spanish acronym) codes and sustainability certifications and ratings in the 26 borrowing countries, as well as interviews with experts and recommendations to move towards resilient construction.

This analysis made it possible to identify that, for example, the region's progress in seismic and wind codes is much more significant than that for floods, which is still a hazard that countries face reactively. Likewise, the region has been taking accelerated steps to incorporate sustainability aspects of building projects, although this is not necessarily reflected in building codes. On the other hand, regarding sustainability aspects, it is identified that issues related to energy savings are more advanced than others, such as the efficient use of water, the quality of the indoor environment, and the identification of climate zonation.

Likewise, this study has identified some opportunities presented by the countries to improve their building codes and regulatory framework in general and increase the resilience and sustainability of infrastructure projects in the region.

As general recommendations, we highlight the following:

- Improve technical capabilities, promote the knowledge and correct application of regulations by professionals in the construction industry to ensure adequate and widespread compliance with codes.
- Encourage the participation of the private sector and academia in developing and updating building codes to have stable mechanisms that guarantee updating with an adequate frequency, in a preventive manner, and improving their implementation process.
- Allocate the necessary human and financial resources to guarantee such updates and conduct hazard studies.
- Develop predictive hazard scenarios based on probabilistic modeling and new data analysis technologies to update building code inputs.
- Promote and encourage associativity for solidarity-based technical collaboration among countries in developing and updating building codes and exchanging knowledge on sustainability criteria and certifications.

In general terms, it is recommended that the capacities of public and private institutions be strengthened in monitoring and compliance strategies with sustainable building codes.

As specific recommendations at the level of the different hazards and for the issue of sustainability, we highlight the following:

- In the case of **earthquakes**, it is recommended to delve into the design aspects of non-structural components, improve information on seismic hazard levels, and develop regulations for structural reinforcement or infrastructure repair after an earthquake.
- For **strong winds**, it is recommended to integrate alternative analysis methods for essential structures exposed to wind forces, as well as evaluate the need to adjust the codes to potential future climate change scenarios in which the frequency and intensity of strong winds associated with storms or other phenomena increase, analyzing, in particular, their impact on non-structural elements such as facades and roofs.
- For **flooding**, it is recommended to include guidelines in the codes to integrate considerations into the design to minimize damage and losses, evaluating exposure to different types of flooding (fluvial, coastal, or urban) with updated spatial information. It is also recommended that the quality, resolution, and periodic updating of maps of the various hazards be improved, as well as training professionals in the incorporation of appropriate and timely measures in the construction designs of buildings according to the level of hazards of the location
- In terms of **sustainability,** it is recommended to strengthen sustainability parameters within the codes, including considering differentiated geographic zonation and energy and water efficiency standards, as well as enhancing regulations for the use of more sustainable construction materials in general in different types of buildings, as well as developing regulatory incentives for sustainable construction projects.

Finally, it is highlighted that sustainability certifications can help countries comply with regulations related to sustainable building codes, such as international agreements on climate change, and it is recommended to promote the development of ratings or certificates adapted to national contexts and under clear and measurable standards.

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INTRODUCTION

In 2017, the Environment, Rural Development and Disaster Risk Management Division (RND), the Climate Change Division (CCS), the Environmental and Social Solutions Unit (ESG) and the Environmental and Social Risk Management Unit (ESR) created the Resilience Practice Community (CPR)[1]. The CPR, in which the technical teams of these Divisions and Units participate, coordinates actions to generate and operationalize policies and instruments that improve the IDB's work in projects that address disaster resilience and sustainability. The CPR constitutes an example of good practice at the level of multi-sector work that involves different sectors and areas of the Bank, recently incorporating the Social Infrastructure Group (GIS) of the Department of Infrastructure and Energy (INE).

The CPR coordinates efforts to ensure that the infrastructure projects financed by the IDB are resilient to disasters and climate change so they can meet their development objectives and improve lives in the region. Disaster and climate change risk assessment activities are mandatory for infrastructure projects financed by the Bank, which is reflected in the Disaster Risk Management Policy OP-704 of 2007 and the Environmental and Social Policy Framework (ESPF) of the IDB, updated in 2021.

In 2021, as part of the review of risk analysis tools in infrastructure projects, the CPR highlighted the need to carry out an analysis of how resilience and sustainability are included in the IDB borrowing countries' building codes to identify those that have made the most significant progress in the region to reference them in the risk analysis processes, as well as to propose regional strengthening recommendations.

To this end, in 2022, the Bank hired the Chilean Construction Institute (IC) to develop a consultancy for (i) the collection and analysis of earthquakes, strong winds, flood codes, and sustainability ratings and certifications in the 26 borrowing countries, (ii) conducting expert interviews and (iii) preparing recommendations to move towards resilient building frameworks. The IC is a private, non-profit corporation created by the main public and private institutions related to the construction sector in Chile. The results of this study are summarized in this publication.

1 Most acronyms used in this document refer to abbreviations in Spanish

1. BACKGROUND

The Latin American and Caribbean (LAC) region is particularly vulnerable to disasters caused by natural hazards. Climate hazards are expected to increase in frequency and intensity under climate change scenarios. Increasing the countries' resilience against such hazards and applying a proactive risk management approach is a priority for the IDB Group, which has been included since 2007 in its Disaster Risk Management Policy (OP-704). On the other hand, there is extensive empirical evidence that supports the effectiveness and efficiency of investments in disaster risk reduction, which shows that for every dollar invested in making infrastructure resilient to disasters, up to four dollars is saved in reconstruction, according to the United Nations Office for Disaster Risk Reduction **(UNDRR)**.

In 2018, the CPR jointly developed the **Disaster and Climate Change Risk Assessment Methodology**, as a reference tool for the design and execution of projects financed by the IDB. Additionally, **the Environmental and Social Policy Framework (ESPF),** Environmental and Social Policy Framework (ESPF), which came into force in 2021, addresses the issue transversally in all its standards, specifically in Performance Standard 4: Community Health and Safety, which includes provisions for emergency preparedness and resilience to natural hazards. In another sense, indicator 3.15 of the Corporate Results Framework establishes as a goal that 100% of the projects of Environmental and Social Impact Categories A or B, and with Disaster Risk and Climate Change Classification High or Moderate financed by the IDB, have at least a simplified qualitative risk analysis (called risk narrative).

The existence, quality, legal nature, and level of compliance of the building codes define the basis on which the built environment must be developed and the reliability of services based on physical infrastructure. It is, therefore, a tool that can contribute to the management of disaster risk and the increase in resilience against various hazards, even considering climate change scenarios

Therefore, an effective way to increase the resilience of infrastructure projects in the region (and of the benefited communities) is to have robust and updated codes incorporating the latest advances in design and construction standards.

This document includes a review of the existing codes for earthquakes, strong winds, and flood hazards in the region's countries, as well as sustainability codes and certifications, identifying strengths that may be used as regional references and weaknesses that represent obstacles to their application. Based on a comparative analysis, actions are proposed to strengthen them, both at the regulatory level and in terms of implementation and compliance.

2. SCOPE AND WORK METHODOLOGY

2.1 Scope

The study carried out by the IC included the survey and comparative analysis of (i) building codes related to earthquakes, strong winds, and floods; (ii) sustainability codes; and (iii) sustainability certificates and ratings for housing buildings and public use for IDB borrowing countries. The goal was to identify their scope and state of development, analyze, categorize, and compare instruments each country has, visualize progress, gaps, and opportunities, and propose actions to improve the instruments to reduce the risk of disasters considering the effect of climate change. Likewise, we sought to identify and disseminate the best instruments and practices in the region.

For the survey, the 26 IDB borrowing member countries were considered: Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Suriname, Trinidad and Tobago, Uruguay and Venezuela. In the case of federated countries such as Argentina, Brazil, Mexico, and Venezuela, the information collected was based on publications from the Federal or Central Government without addressing those of each region, state, or commune.

2.2 Work Methodology

The comparative analysis of building codes and sustainability certifications[2] included a detailed literature review of the countries' information and interviews with local experts, which made it possible to identify needs and opportunities for strengthening.

The literature review was done through direct consultations with the national agencies that issue and update building codes and sustainability certifications.

2 We understand *Sostenibilidad* as any process or dynamic that guarantees the equitable persistence of human and natural systems (IPCC, 2018). It should be clarified that depending on the national or regional context, the term may be referred to as *Sustentabilidad*; in this document, this variation is based on the translation of the Anglo-Saxon term Sustainability beyond its significance in the Spanish language *per se*.

The analysis included a review of the Constitutions of each country since these reflect general rights[3], which are then addressed in specific laws and regulations.

The interview stage made it possible to learn in detail about the codes and certifications, identify relevant actors in their design, implementation, and updating, and learn about the experience of local experts in their use. The expert review identifies aspects such as the status and history of sustainability codes and ratings; binding public and private actors; characteristics of the local construction industry, institutions, and national market, gaps and opportunities; and the context in which they develop. A total of 17 interviews were carried out, and of these, 8 related to Earthquakes, Strong Winds, and Floods codes, limited to 6 countries; and 9 on sustainability, codes, and certification methods, limited to 7 countries.

3 They are considered fundamental laws of a State, with a higher rank than the ordinary laws. They define the regime of rights and freedoms of citizens and delimit the powers and institutions of the political organization (RAE).

The comparative analysis was done based on the existence or absence of requirements or demands, referred to in this document as parameters, defined based on international reference codes. The parameters considered in each type of code are summarized in the following tables and described in detail in Annex I.

Figure 1. Work methodology diagram

Table 1. Parameters analyzed for national constitutions

1. Right to Housing
2. Environmental Protection
3. Protection of the People
4. Protection Against Extreme Natural Events

Table 2. Seismic parameters

1. Seismic Zonation
2. Soil Classification
3. Static Analysis Method
4. Dynamic Analysis Method
5. Other Seismic Analysis Method
6. Seismic Design Philosophy
7. Seismic Hazard Level
8. Structures Risk Category
9. Design Levels or Expected Ductility
10. Materiality and Typology Response Consideration
11. Return Periods
12. Structure Behavior Irregularities
13. Non-Structural Elements
14. Post-Earthquake Reinforcement or Repair

Table 3. Strong wind parameters

1. Minimum Wind Loads
2. Pressure Calculation
3. Wind Zonation
4. Importance Factor
5. Simplified Analysis Method (Envelop method)
6. Directional Analysis Method (Analytical method)
7. Other Wind Analysis Methods

Table 4. Flood parameters

1. Tsunami Mitigation
2. Flood Hazard Maps
3. Storm Mitigation
4. Landslide Mitigation
5. Return Periods Hydrography Hydrology
6. Verification of Dragged Debris Impact Loads
7. Basin Maps

Table 5. Sustainability parameters

Energy	1. Thermal Transmittance Criteria 2. Residential Thermal Transmittance 3. Non-Residential Thermal Transmittance 4. Thermal Transmittance 5. Renovations 6. Hermeticity 7. Solar Control 8. Energy Demand Baseline 9. Heating Provision 10. Cooling Provision 11. Heating Equipment Efficiency 12. Cooling Equipment Efficiency 13. Electronics and Lamps Efficiency 14. Thermal Comfort 15. Lamp Power 16. Residential Non-Renewable Energy Consumption 17. Non-Residential Non-Renewable Energy Consumption 18. ERNC Contribution 19. Total Residential Primary Energy Consumption 20. Total Non-Residential Primary Energy Consumption 21. Home Energy Labeling 22. Carbon Emissions Report 23. Carbon Emissions Baseline 24. Non-Residential Energy Efficiency Parameters
Indoor Environment Quality	1. Natural Ventilation 2. Mechanical Ventilation 3. Mechanical Ventilation Parameters 4. Thermal Bridges 5. Interstitial Surface Condensation 6. Artificial Lighting 7. Natural Lighting 8. Quality Views 9. Acoustic Isolation
Water	1. Outdoor Water Consumption 2. Indoor Water Consumption 3. Gray and Rainwater Reuse 4. Drinking Water Quality
Climate Zones	1. Climate Zonation Definition 2. Climate Zonation Parameters

Table 6. Parameters analyzed for sustainability ratings and certificates

1. Existence of a National Certificate
2. Existence of National Rating
3. Use of international certificates or ratings, whether or not adapted to the national context
4. EDGE-certified projects
5. LEED-certified projects

3. REGIONAL COMPARATIVE

3.1 Regulatory Framework of the Countries in the Region

Understanding a regulatory framework as the set of laws, rules, decrees, or regulations of a mandatory or indicative nature that govern a country through a structure of hierarchical order, this document frames and characterizes the following hierarchical groups, organized through Kelsen's pyramid[4] in Figure 2.

- **Group 1:** The Constitution of the Country that can identify the citizens' rights related to the protection against disasters and climate change, which facilitates the promulgation of Laws and Building codes associated with this matter.
- **Group 2:** Laws, codes, regulations, ordinances, decrees, and mandatory documents.
- **Group 3:** Technical Standards or Technical Reference Documents, mainly those prepared by public or private institutions recognized by the State, whether these standards are mandatory or referential.

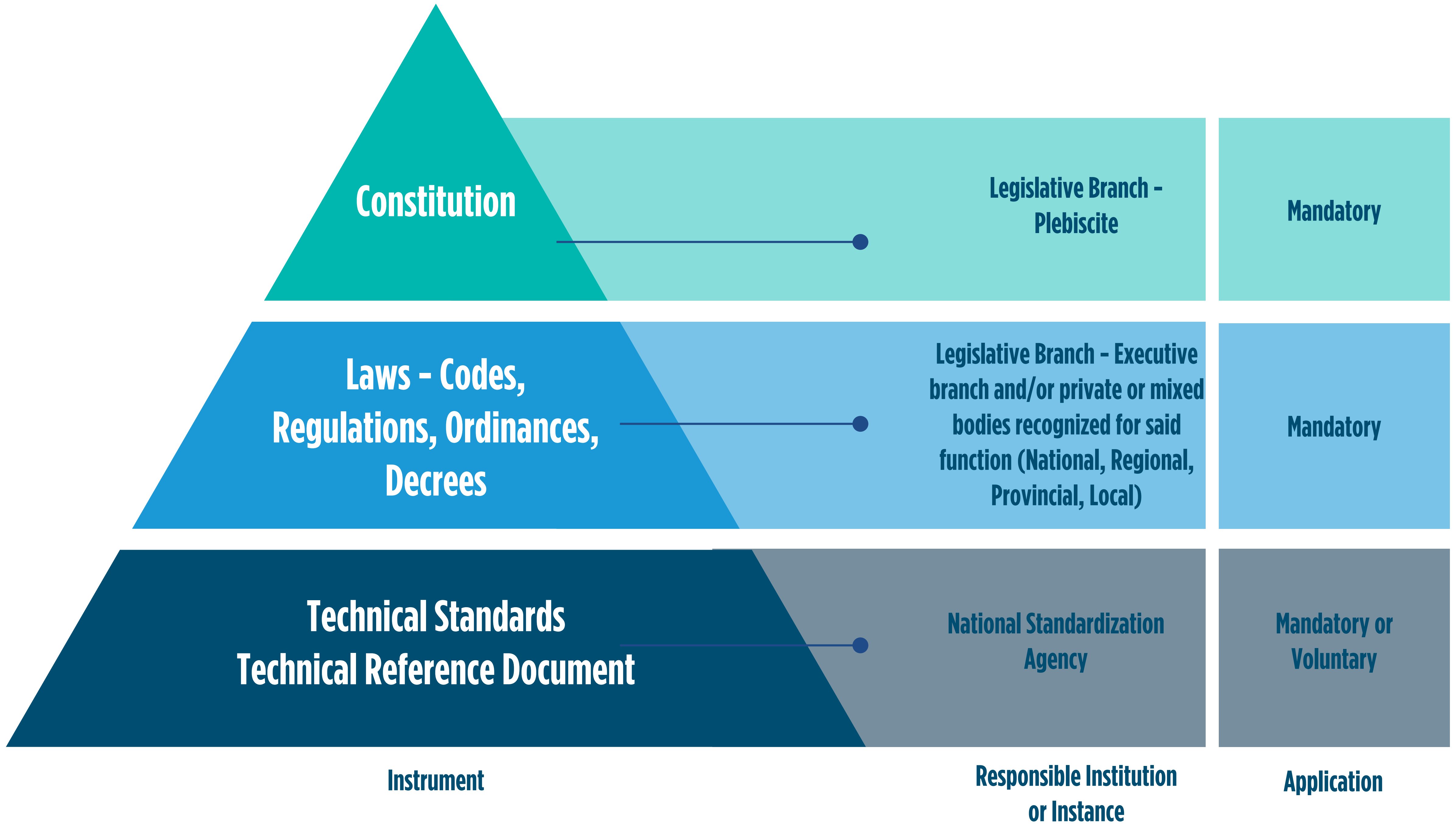


Figure 2. Kelsen's pyramid - regulation

4 A normative pyramid developed by Hans Kelsen establishes a hierarchical system in which each norm receives its value from a higher norm. That means that lower standards cannot contradict higher standards.

3.1.1 Group 1: Constitution

A country's Constitution is an essential document for the organization and functioning of its society. It establishes the rights and duties of citizens from which regulatory instruments, including laws and codes, are derived. In terms of resilience and sustainability, the analysis of the constitutions of each country made it possible to identify references to fundamental rights related to protection against socio-natural disasters (or disasters of natural origin) and/or the assurance of sustainability.

- **Right to Housing:** Enshrines the right to housing and/or its quality.
- **Environmental Protection:** Protects the environment and/or its resources and/or biodiversity.
- **Protection of People:** Sets standards of well-being at work, health, education, and/or of life for people.
- **Protection against extreme natural events:** Preventive or reactive protection measures against natural hazards that could lead to disasters. The reference to the suspension of rights due to states of emergency is omitted when it does not explicitly reference protection against disasters.

Including the rights in the Constitution makes promulgating laws and codes related to these matters possible.

Figure 3 shows the coverage of these rights in the region by country..

Regarding the rights under study, it was observed that the peoples' right to protection is part of all the constitutions surveyed; the environment's right to protection is contemplated in 85% of the countries, the right to housing in 73% of the countries, and in 30% of countries the right to protection against extreme natural events is explicitly highlighted.

Figure 3. Coverage of constitutional rights in the region

3.1.2 Group 2: Laws, Codes and Regulations

This diverse regulatory group is characterized by being mandatory. For this publication, the building codes analyzed are framed here. They may have national, regional, provincial, or local scope, being prepared and approved by an authority defined in the legal framework of the code. In general, the codes establish:

A. Principles, attributions, powers, faculties, responsibilities, rights, sanctions, and other regulations that govern organizations, officials, professionals, and individuals in urban planning, urbanization, and construction actions;

B. regulatory provisions that rule the administrative procedure, urban planning, urbanization, and construction process, and the technical standards of design and construction;

C. the technical characteristics of projects, materials, construction, and urbanization systems per the mandatory requirements established.

For this publication, building codes are those that specifically refer to aspects of resilience and sustainability, as well as a series of related international reference codes. The list of analyzed codes can be found in Annex II and Annex III.

3.1.3 Group 3: Technical Standards

Within the framework of this publication, technical standards are defined as those technical documents of a voluntary and/or referential and/or informative and/or demonstrative nature of national, regional, provincial, or local scope, prepared and published by public or private institutions. These standards establish and define technical guidelines for design and/or construction, technical characteristics of projects, materials, and construction systems related to hazards such as earthquakes, strong winds, floods, or the sustainability of buildings.

Although technical standards are not mandatory - except for those that are incorporated in the codes and regulations or are considered compulsory in contracts - they constitute a baseline technical reference, which facilitates and makes it feasible to prepare and/or complement the codes with technical information being previously prepared and eventually agreed upon by the professional community.

An example of this document is the *Technical Standards* prepared by the National Standardization Organizations[5] (ONN), with powers administratively recognized for this purpose. Although their use is not mandatory, they constitute relevant technical information, usually used as a technical reference. They can also be used as the technical basis for mandatory documents or codes. The Pan American Technical Standards Commission (COPANT, for its Spanish acronym) brings together and enables the ONNs and all IDB borrowing countries are members .

For this publication, the list of technical standards analyzed can be found in Annex II and Annex III[6].

5 Entities dedicated to preparing technical standards at the national level (RAE).

6 The study covered only codes and technical standards publicly accessible through official sources.

3.2 Resilience in Building Codes: Earthquakes, Strong Winds, and Floods

The technical codes and standards of the borrowing countries were analyzed by comparing each of them with the following international standards to address earthquake and strong wind hazards:

- ASCE 7 (2017). "Minimum design loads for buildings and other structures." ASCE 7-16, American Society of Civil Engineers, Reston, VA.: for general loads, seismic loads, strong wind loads, tsunami loads, flood loads, ice loads, rain loads. Load combinations and analysis procedures.
- IBC (2017). "International Building Code." IBC 2018, International Code Council, Country Club Hills, IL. It has specifications similar to those of ASCE SEI 7-16 but incorporates additional specifications for building safety management.
- ASCE 41 (2017), "Seismic Evaluation and Retrofit of Existing Buildings", ASCE 41-17, American Society of Civil Engineers, Reston, VA. Evaluation and retrofit of structures due to earthquakes.

Most of the analyzed countries have derived their regulatory bodies from the United States standards, even applying them as an alternative in cases where there are no developed or updated national standards.

The comparative analysis of the codes between countries was carried out based on the definition of the parameters detailed in Annex I. Each of these parameters is quantified in a binary way. That is, if there is a mention, it is characterized as (1); otherwise, it is (0).

3.2.1 Seismic Hazard

For seismic codes, 14 parameters were defined to evaluate their completeness (See Table 2). Figure 4 shows the values associated with the existence and inclusiveness of these parameters analyzed by country.

For seismic hazard, Figure 4 shows that the countries in the region have a high level of regulatory development, defined according to the number of parameters they meet. This is identified to a greater extent in the countries of the Pacific Rim, where the regulatory requirement is very high due to the high exposure to this natural hazard. It is highlighted that 10 countries have complete codes to address seismic hazards. In contrast, Paraguay and Uruguay, having low exposure to this hazard, do not consider anti-seismic design in their codes.

The development of earthquake codes and standards was derived from catastrophic events, highlighting the importance of minimum construction standards to protect citizens and minimize damage. For example, the seismic code in Chile was formulated after the 1960 earthquake; Colombia's derived after the 1983 Popayan earthquake; and Mexico's formulated its own after the 1985 event. Other high-magnitude seismic events that have generated significant human losses and materials have encouraged updating existing standards, such as the 1999 Colombia earthquake that evidenced the need to include the vertical seismic component in the regulations and the 2016 event in Ecuador that severely damaged the coast. The 2017 earthquake in Mexico led to the creation of the post of director responsible for the construction site (DRO, for its Spanish acronym), which led to detailed supervision of the construction site.

Other countries in the region use international codes as references, such as those published by the American Concrete Institute (ACI) of the United States. A case, in particular, is Belize, which adopted the Caribbean Uniform Building Code (CUBiC) as its building code after achieving its independence and currently does not have a specific building code for the country, only a building regulation that mentions the adoption of any international regulations for the development of projects.

The aggregation of the codes also varies in the region. Colombia, for example, has a single code that brings together several subjects and hazards (NSR-10), while in Chile, the codes are disaggregated by subjects. Regarding applicability, federated countries such as Mexico have advanced regulations. Still, they are centralized in the federal capital, with more buildings and human and economic resources to develop regulations. For municipalities not located in Mexico City, local regulations or the guide of the Federal Electricity Commission must be applied.

A challenge for countries in the region is to produce hazard information that can later be used to generate microzonation studies. Colombia has invested in expanding its national seismological network to have high-quality local hazard data. Other LAC countries can benefit from increasing the technical capabilities of their institutions in charge of generating seismic hazard information, including training specialized professionals who can identify the information and technology gaps their countries face. These institutions can also benefit from exchanges with institutions that have made more significant progress on this issue in the region and abroad.

			Soil Classification	Materiality Consideration	Seismic Design Philosophy	Behavior Irregularities	Seismic Dynamic Analysis Method	Design Levels or Expected Ductility	Seismic Zonation	Seismic Static Analysis Method	Structures Risk Category	Return Periods	Non-Structural Elements	Other Seismic Analysis Method	Post-Earthquake Reinforcement or Repair	Levels Seismic Hazard
			24	24	24	24	24	24	24	23	22	21	18	16	16	14
			92%	92%	92%	92%	92%	92%	92%	88%	85%	81%	69%	62%	62%	54%
Argentina	14	100%	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bolivia	14	100%	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Colombia	14	100%	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Costa Rica	14	100%	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ecuador	14	100%	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Guatemala	14	100%	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Panama	14	100%	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dominican Republic	14	100%	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Trinidad and Tobago	14	100%	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Venezuela	14	100%	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Chile	13	93%	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Mexico	13	93%	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Nicaragua	13	93%	1	1	1	1	1	1	1	1	1	1	1	1	0	1
Brazil	12	86%	1	1	1	1	1	1	1	0	0	1	1	1	1	1
Haiti	12	86%	1	1	1	1	1	1	1	1	1	1	0	1	1	0
Jamaica	12	86%	1	1	1	1	1	1	1	1	1	1	1	0	0	1
Peru	12	86%	1	1	1	1	1	1	1	1	0	0	1	1	1	1
Honduras	11	79%	1	1	1	1	1	1	1	1	1	0	1	0	1	0
Bahamas	10	71%	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Barbados	10	71%	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Belize	10	71%	1	1	1	1	1	1	1	1	1	1	0	0	0	0
El Salvador	10	71%	1	1	1	1	1	1	1	1	1	0	1	0	0	0
Guyana	10	71%	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Surinam	10	71%	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Paraguay	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Uruguay	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 4. Seismic parameters compliance by country

The region can also benefit from updating its earthquake codes, as is the case in Ecuador, which published an update to the Ecuadorian Construction Standard in 2023 to improve the 2015 code. The update of the standards also allows for the inclusion of alternative earthquake methodologies, design, or aspects related to the design of non-structural components, improve information on seismic hazard levels and in the tasks of structural reinforcement or repair after an earthquake, identified in the previous section as missing in the majority of the region.

A case to highlight is El Salvador, which, thanks to technical support and financing from the IDB, has updated its seismic regulations, considering the local hazard with the active participation of the public and private sectors. The regulatory development program with the IDB has led to updating the standards, which has made it possible to have professional teams working on these issues and to have local data on seismic hazard, soil quality, and site amplification effects. Civil organizations (private sector and academia) can support countries and contribute with research on local hazards and the training of professionals with high capacities to comply with regulations and supervise the implementation of codes.

3.2.2 Strong Wind Hazard

Seven parameters were defined to evaluate the quality of codes related to strong winds (See Table 3). Figure 5 shows the values associated with the existence and inclusiveness of these parameters, analyzed by country.

In the case of strong wind hazards, Figure 5 shows that the countries in the region have a high regulatory level defined according to the number of parameters they meet. The region's countries consider basic design parameters for wind loads following appropriate methodologies to estimate wind pressures in structural and non-structural elements in buildings.

Interviews with regional experts showed that the strong wind codes in the LAC region apply traditional approaches and that methods for designing considering wind loads on structures are well established. However, the region needs to improve the scale of strong wind hazard characterization, which is currently very generalized. This could be achieved through greater involvement of local experts in the probabilistic characterization of strong wind hazards (e.g., experts in developing and implementing wind energy projects).

			Minimum Wind Loads	Pressure Calculation	Wind Zonation	Importance Factor	Simplified Analysis Method (Envelopment)	Directional Analysis Method (Analytical)	Other Wind Analysis Methods
			25	26	25	25	25	22	14
			96%	100%	96%	96%	96%	85%	54%
Argentina	7	100%	1	1	1	1	1	1	1
Bolivia	7	100%	1	1	1	1	1	1	1
Brazil	7	100%	1	1	1	1	1	1	1
Costa Rica	7	100%	1	1	1	1	1	1	1
Guatemala	7	100%	1	1	1	1	1	1	1
Haiti	7	100%	1	1	1	1	1	1	1
Honduras	7	100%	1	1	1	1	1	1	1
Nicaragua	7	100%	1	1	1	1	1	1	1
Panama	7	100%	1	1	1	1	1	1	1
Trinidad and Tobago	7	100%	1	1	1	1	1	1	1
Venezuela	7	100%	1	1	1	1	1	1	1
Bahamas	6	86%	1	1	1	1	1	1	0
Barbados	6	86%	1	1	1	1	1	1	0
Belize	6	86%	1	1	1	1	1	1	0
Chile	6	86%	1	1	1	1	1	1	0
Colombia	6	86%	1	1	1	1	0	1	1
Guyana	6	86%	1	1	1	1	1	1	0
Jamaica	6	86%	1	1	1	1	1	1	0
Mexico	6	86%	0	1	1	1	1	1	1
Surinam	6	86%	1	1	1	1	1	1	0
Uruguay	6	86%	1	1	1	1	1	0	1
Ecuador	5	71%	1	1	1	0	1	1	0
El Salvador	5	71%	1	1	0	1	1	1	0
Paraguay	5	71%	1	1	1	1	1	0	0
Peru	5	71%	1	1	1	1	1	0	0
Dominican Republic	5	71%	1	1	1	1	1	0	0

Figure 5. Strong wind parameters compliance by country

3.2.3 Flood Hazard

Seven parameters were defined to evaluate the quality of flood hazard codes (See Table 4). Figure 6 shows the values associated with the existence and inclusiveness of these parameters, analyzed by country.

In the case of the flood hazard, Figure 6 shows that it is the hazard least addressed by the LAC codes. Colombia and Costa Rica stand out as the only countries in the region with complete codes for building design considering the impact of floods. Floods generate many losses and may occur with greater frequency and intensity under climate change scenarios. Therefore, the region can better prepare to face flood events by developing codes that provide guidelines to integrate into the design considerations related to the characteristics of the basins, the exposure of the place, the analysis of sensitivity to flows, and design levels considering potential effects of changes in precipitation regimes.

Interviews with local experts showed that flood hazards are primarily faced in a reactive and non-prescriptive way. The loads associated with floods are little considered in building designs, and the guidelines to prevent damage from floods are limited to defining the distance from bodies of water where construction cannot be done. In cases like Ecuador, municipalities develop mitigation measures once the event has occurred without anticipating the reduction of the impacts of the hazard in the codes. For example, to address the recurring floods in Guayaquil, the municipality has invested millions of dollars in response to emergencies without updating current building codes to reduce long-term losses.

It is worth mentioning that through urban planning, some aspects of this hazard are regulated, such as the definition of flood zones (mainly in the event of river flooding or concentrated urban runoff) and the restrictions on constructing buildings according to the level of hazard or susceptibility to flooding. However, some elements, such as considering design parameters that take into account the effects of pluvial flooding or the existence of events that exceed the zones defined as floodable in urban planning, must be the subject of building codes or technical standards and where a critical deficiency identified in the region.

			Tsunami Mitigation	Landslide Mitigation	Flood Hazard Maps	Storm Mitigation	Return Periods Hydrography Hydrology	Basin Maps	Verification of Dragged Debris Impact Loads
			13	12	11	10	9	9	4
			50%	46%	42%	38%	35%	35%	15%
Colombia	7	100%	1	1	1	1	1	1	1
Costa Rica	7	100%	1	1	1	1	1	1	1
El Salvador	6	86%	1	1	1	1	1	1	0
Dominican Republic	6	86%	1	1	1	1	1	1	0
Chile	5	71%	1	0	1	0	1	1	1
Ecuador	5	71%	1	0	1	0	1	1	1
Belize	4	57%	1	1	1	1	0	0	0
Honduras	4	57%	0	1	1	0	1	1	0
Bahamas	3	43%	1	1	0	1	0	0	0
Guyana	3	43%	1	1	0	1	0	0	0
Nicaragua	3	43%	0	0	1	0	1	1	0
Surinam	3	43%	1	1	0	1	0	0	0
Trinidad and Tobago	3	43%	1	1	0	1	0	0	0
Venezuela	3	43%	0	0	1	0	1	1	0
Guatemala	2	29%	1	1	0	0	0	0	0
Haiti	2	29%	0	1	0	1	0	0	0
Mexico	2	29%	1	0	1	0	0	0	0
Argentina	0	0%	0	0	0	0	0	0	0
Barbados	0	0%	0	0	0	0	0	0	0
Bolivia	0	0%	0	0	0	0	0	0	0
Brazil	0	0%	0	0	0	0	0	0	0
Jamaica	0	0%	0	0	0	0	0	0	0
Panamá	0	0%	0	0	0	0	0	0	0
Paraguay	0	0%	0	0	0	0	0	0	0
Peru	0	0%	0	0	0	0	0	0	0
Uruguay	0	0%	0	0	0	0	0	0	0

Figure 6. Flood parameters compliance by country

3.3 Sustainability and Certification Systems in Building Codes

3.3.1 Sustainability

Sustainability in construction has gained importance in LAC in recent decades, mainly due to the growing awareness of the impact of the construction sector on environmental protection, energy costs, energy dependence, and the need to address challenges related to climate change and sustainable development goals.

Although codes vary from country to country, many have incorporated specific provisions related to sustainability. This study covered the analysis of 76 codes and 126 technical standards, of which 36% established the mandatory application of sustainability parameters in their national contexts. Likewise, it was identified that 7% of codes are associated with international standards, such as CARICOM[7] or the Climate Action Plan to the United Nations Framework Convention on Climate Change (UNFCCC).

When evaluating the codes, it was observed that although many countries have regulations that contemplate sustainability categories, many do not have regulatory instruments that define their application or require their integration into the construction sector.a

For the sustainability analysis, 39 parameters were defined (See Table 5) to evaluate their quality, grouped into four categories[8] (i) Energy, (ii) Indoor Environmental Quality, (iii) Water, and (iv) Climate Zonation. Figure 8 indicates the values associated with the existence and inclusion of these parameters by country.

From the analysis, it was possible to identify that 50% of the countries take into consideration at least some of the sustainability parameters in their codes. The countries with the most significant compliance with the parameters were Argentina, Brazil, Chile, Ecuador, and Peru. Likewise, it is observed that the countries with the lowest development of sustainability issues in their codes are concentrated in Central America and the Caribbean. Considering these countries' vulnerability to the climate crisis and how the lack of regulation can aggravate this situation is crucial.

7 The Caribbean Community (CARICOM) is a group of twenty countries stretching from the Bahamas in the North to Suriname and Guyana in South America. It comprises States that are considered developing countries. Except for Belize in Central America and Guyana and Suriname in South America, all members and associate members are island states.

8 In order to group the parameters, the main categories established in the analyzed codes and international certification systems for green buildings were used as references.

Figure 7. Countries that include sustainability in their codes

			Residential Thermal Transmittance (Energy)	Thermal Transmittance Criteria (Energy)	Artificial Lighting(CAI)	Natural Ventilation (CAI)	Climate Zones Definition (Zonation)	Natural Lighting (CAI)	Climate Zones Parameters (Zonation)	Electronics and Lamps Efficiency (Energy)	Cooling Equipment Efficiency (Energy)	Mechanical Ventilation Parameters (CAI)	Lamp Power (Energy)	Drinking Water Quality (Water)	Indoor Water Consumption (Water)	Heating Equipment Efficiency (Energy)	Home Energy Labeling (Energy)	Solar Control (Energy)	Hermeticity (Energy)	Non-Residential Energy Efficiency Parameters (Energy)
			9	8	8	8	7	7	7	6	6	6	6	5	5	5	5	4	4	4
			35%	31%	31%	31%	27%	27%	27%	23%	23%	23%	23%	19%	19%	19%	19%	15%	15%	15%
Brazil	18	47%	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	0	1
Chile	17	45%	1	1	1	1	1	0	1	0	0	1	1	1	0	0	1	0	1	0
Argentina	15	39%	1	1	1	1	1	1	1	0	0	1	0	1	0	0	1	1	1	0
Ecuador	15	39%	1	1	1	1	1	1	1	0	0	0	1	0	1	0	1	0	1	0
Peru	14	37%	1	1	1	1	1	1	1	0	1	1	0	0	1	1	0	1	0	0
Mexico	12	32%	1	1	1	0	0	0	0	1	1	0	1	1	0	1	1	0	0	1
Panama	11	29%	1	0	0	1	0	0	0	1	1	1	0	0	0	1	0	1	0	1
Uruguay	10	26%	1	1	1	1	1	0	1	1	0	1	0	0	1	0	0	0	0	0
Colombia	8	21%	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	0	1
Bolivia	6	16%	0	0	0	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0
El Salvador	6	16%	1	1	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	0
Costa Rica	4	11%	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0
Nicaragua	4	11%	0	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0
Bahamas	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barbados	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Belize	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Guatemala	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Guyana	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haiti	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Honduras	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jamaica	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paraguay	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dominican Republic	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surinam	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trinidad and Tobago	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Venezuela	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Acoustic Isolation (CAI)	Interstitial Surface Condensation (CAI	Non-Residential Non-Renewable Energy Consumption (Energy)	Residential Non-Renewable Energy Consumption (Energy)	Energy Demand Baseline (Energy)	Thermal Comfort (Energy)	Thermal Bridges (CAI)	Thermal Transmittance Renovations (Energy)	Quality Views (CAI)	Outdoor Water Consumption (Water)	Total Residential Primary Energy Consumption (Energy)	ERNC Contribution (Energy)	Cooling Provision (Energy)	Gray and Rainwater Reuse (Water)	Non-Residential Thermal Transmittance (Energy)	Mechanical Ventilation (CAI)	Total Non-Residential Primary Energy Consumption (Energy)	Carbon Emissions Baseline (Energy)	Heating Provision (Energy)	Carbon Emissions Report (Energy)
	3	3	3	3	3	2	2	2	2	1	1	1	1	1	1	1	0	0	0	0
	12%	12%	12%	12%	12%	8%	8%	8%	8%	4%	4%	4%	4%	4%	4%	4%	0%	0%	0%	0%
Brazil	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Chile	0	1	0	0	1	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0
Argentina	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ecuador	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
Peru	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mexico	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
Panama	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Uruguay	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Colombia	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Bolivia	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costa Rica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nicaragua	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bahamas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barbados	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Guyana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haiti	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Honduras	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jamaica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paraguay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dominican Republic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surinam	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Venezuela	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 8. Sustainability parameters compliance by country

Regarding including sustainability parameters in the countries' building codes, the weighted analysis (Figure 8) shows that the region still presents a low average, reaching just 14%. The countries with the most significant advances in this topic do not exceed more than 50% of incorporation for the parameters considered in this analysis.

In this context, using the same parameterization and weighting scheme as international codes, such as the Spanish code, compliance levels of up to 88% are established in energy and indoor environmental quality parameters, evidencing gaps in the incorporation of said parameters in the building codes of the region with a regional average that does not exceed 11% (Figure 9a and 9b), where Ecuador, Brazil, and Mexico are the countries with the highest compliance with the parameters.

The study observed that Colombia, Ecuador, and Panama are the only countries that define primary energy consumption limits for residential and non-residential buildings. Brazil is the only country that defines total primary energy consumption limits for residential buildings.

The water category (Figure 9c) maintains a regional average of 12%, whereas Colombia stands out with a compliance of 50% in parameters related to the consumption and efficient management of water resources. For the Climate Zonation category (Figure 9d), just a few countries in the region have incorporated it: Argentina, Brazil, and Chile. Ecuador, Peru, Paraguay, and Uruguay have specific and mandatory geographic zoning.

Likewise, it was verified that the prescriptive energy parameters in the codes present, in some cases, particular and not comprehensive solutions at the building level, in contrast to more complex parameters that aim to solve several problems simultaneously. For example, the regulatory requirement for a certain thickness of thermal insulation, compared to the requirement for limited energy consumption that synergistically ensures indoor environmental quality in terms of comfort based on climate zonation.

It is concluded that few countries in the region incorporate sustainability criteria in their technical codes and standards, and those that do include them focus mainly on energy parameters, with slight requirements in other categories, such as indoor environmental quality. In this regard, the study highlights that voluntary instruments have been an important tool in several countries, (e.g. Brazil and Colombia) to promote technological development and increase the quality and well-being of buildings. This is reflected in the number of developed roadmaps, design and construction guides, manuals, and standards, among others, in addition to the great acceptance of international certification instruments.

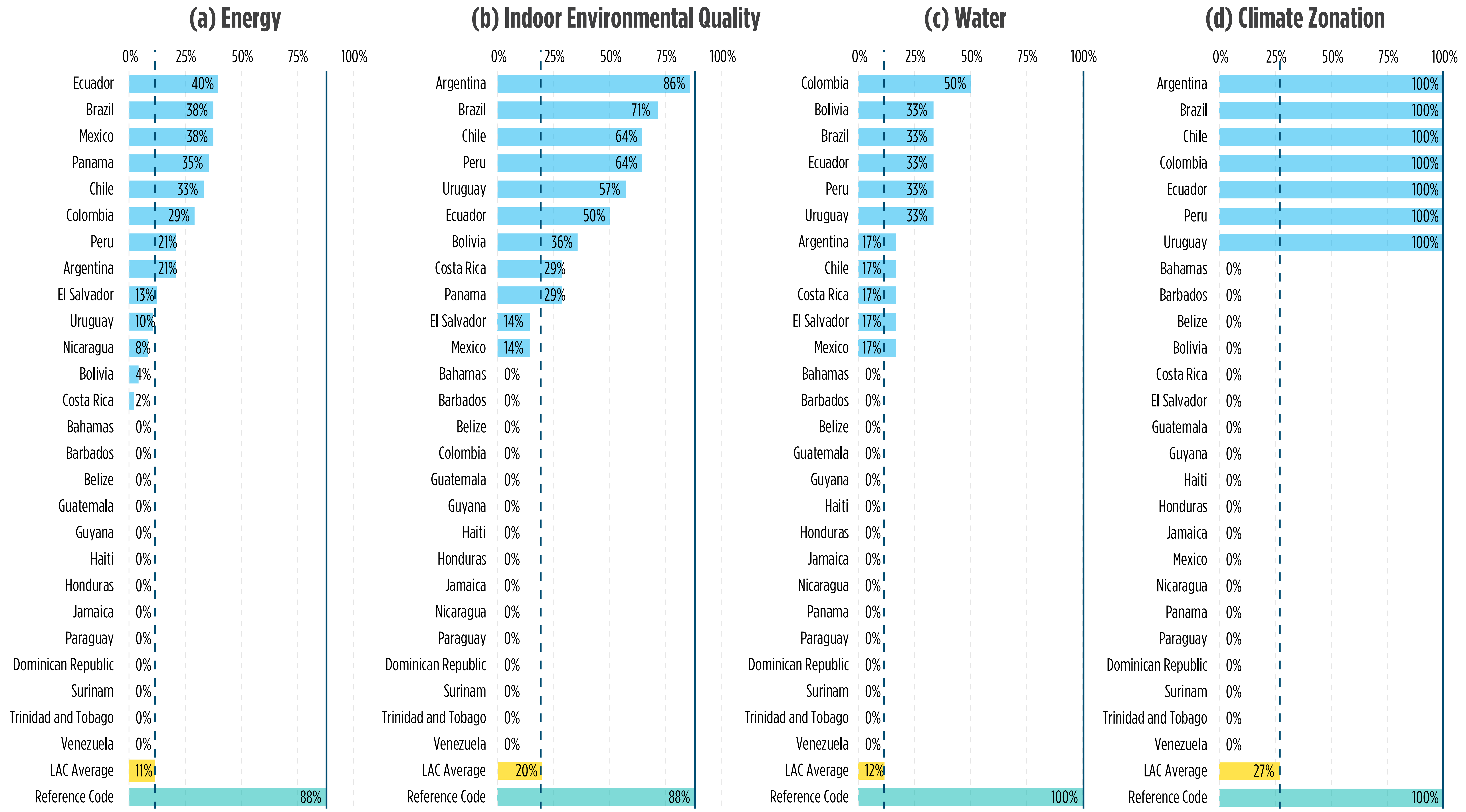


Figure 9. Summary of sustainability parameters compliance by country

3.3.2 Certificates and Ratings

In terms of ratings and certificates[9] for sustainable buildings, 10 certifications were identified and distributed among Brazil (5), Chile (2), Colombia (1), Costa Rica (1), and Guatemala (1); and 13 ratings or certificates distributed in Argentina, Brazil, Chile, Colombia, Mexico, Panama and Uruguay[10].

All of these apply to different types of buildings, public and private. A certificate is considered more respected when an independent third party performs verification tests and grants the certificate. Of these, only Brazil and Chile have independent verification systems. On the other hand, only Argentina, Chile, Colombia, and Mexico have specific energy labeling for the sector.

Regarding the scope of sustainability parameters, it was observed that in addition to energy efficiency and hygrothermal comfort parameters

9 A rating is a badge or label given to a building to indicate its compliance with specific sustainability standards or criteria. On the other hand, a certification results from a formal, independent evaluation and verification process that demonstrates a building's adherence to those standardized sustainability criteria. Certifications are more rigorous and require an independent endorsement.

10 It is highlighted that this corresponds to a non-exhaustive list identified when this document was written, and new ratings or certifications might be developed.

Figure 10. Countries with sustainability ratings and certificates

commonly used in international certifications, others of an environmental nature are incorporated, such as resource conservation, health and well-being, or waste management.

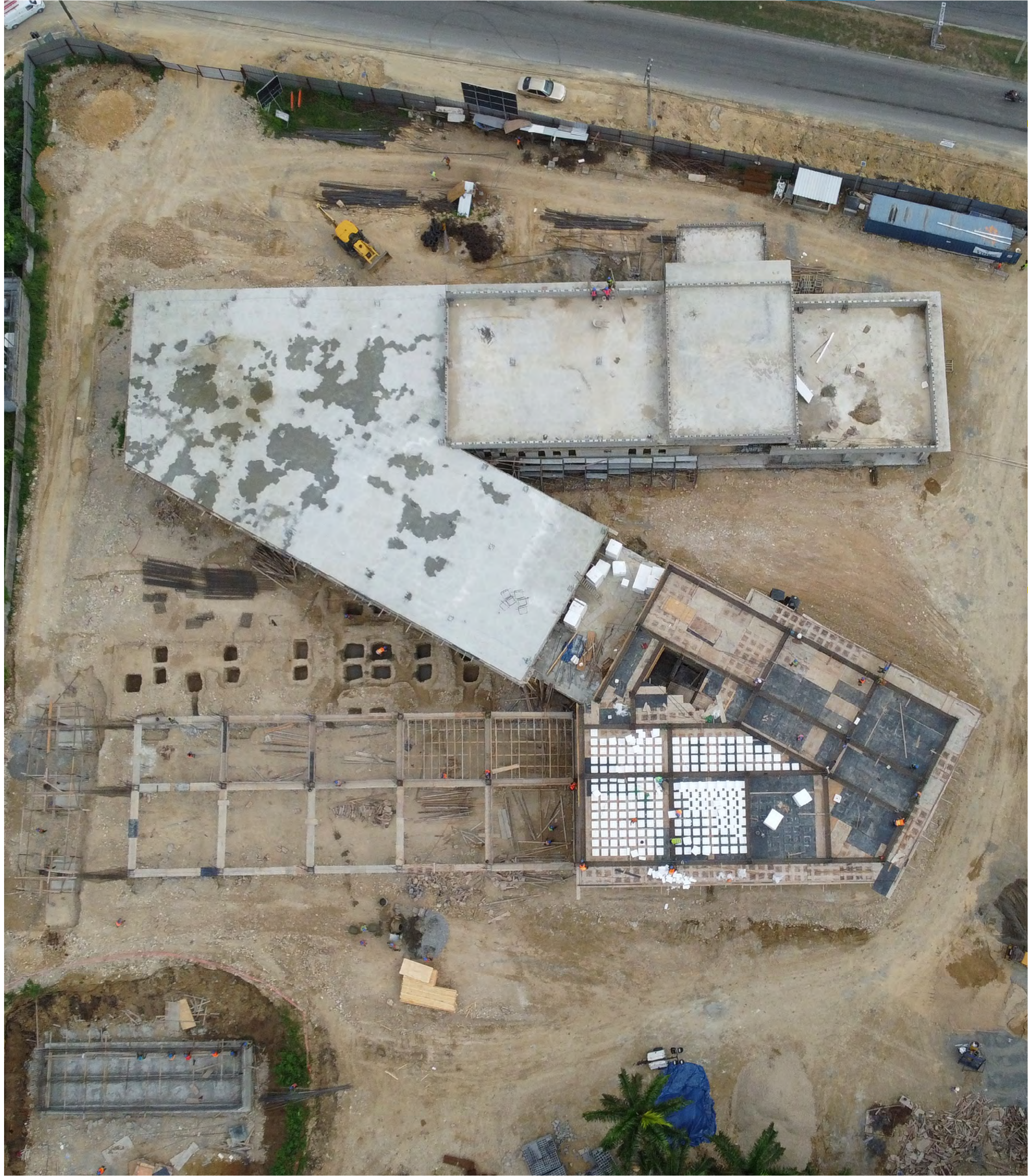
In the area of regulatory incentives, it was observed that countries such as Colombia, Bolivia, El Salvador, and Peru include, in some of their codes, constructive benefits for those buildings that incorporate sustainability parameters or achieve some level of certification under some local or international scheme, whether carried out by the public or private sector. It is highlighted that other multisector regulations could present some incentive, which was not necessarily part of this study.

Although sustainability certifications and ratings tend to be associated with mitigation strategies against climate change, the analysis identified that, of the total number of ratings and certificates identified, 15 include adaptation strategies focused on strengthening resilience in the face of contexts of climate vulnerability and disasters. However, the form of natural hazards compared to sustainability codes presents a marked difference in scope in the region's countries because addressing natural hazards, in most cases, has prevailed over the implications of the construction sector in the face of the impacts of climate change.

This scenario could gradually change, given that many countries currently have climate change laws, and several have established their commitments to reduce emissions in the construction sector through their Nationally Determined Contributions (NDC). However, there is still no carbon baseline established in the regulatory framework, for example, or a clear definition of goals for reducing the carbon footprint of buildings, taking said baseline as a reference.

Studies carried out at the IDB[11], show that at least one certification applies to each LAC country, whether national or international. National certifications are generally better suited to local contexts and priorities, like the NDCs. However, adopting international certifications can guide and promote countries to have more demanding and ambitious standards.

11 Available online in spanish: Edificios verdes: lineamientos para la incorporación y contabilización de medidas de mitigación y adaptación al cambio climático



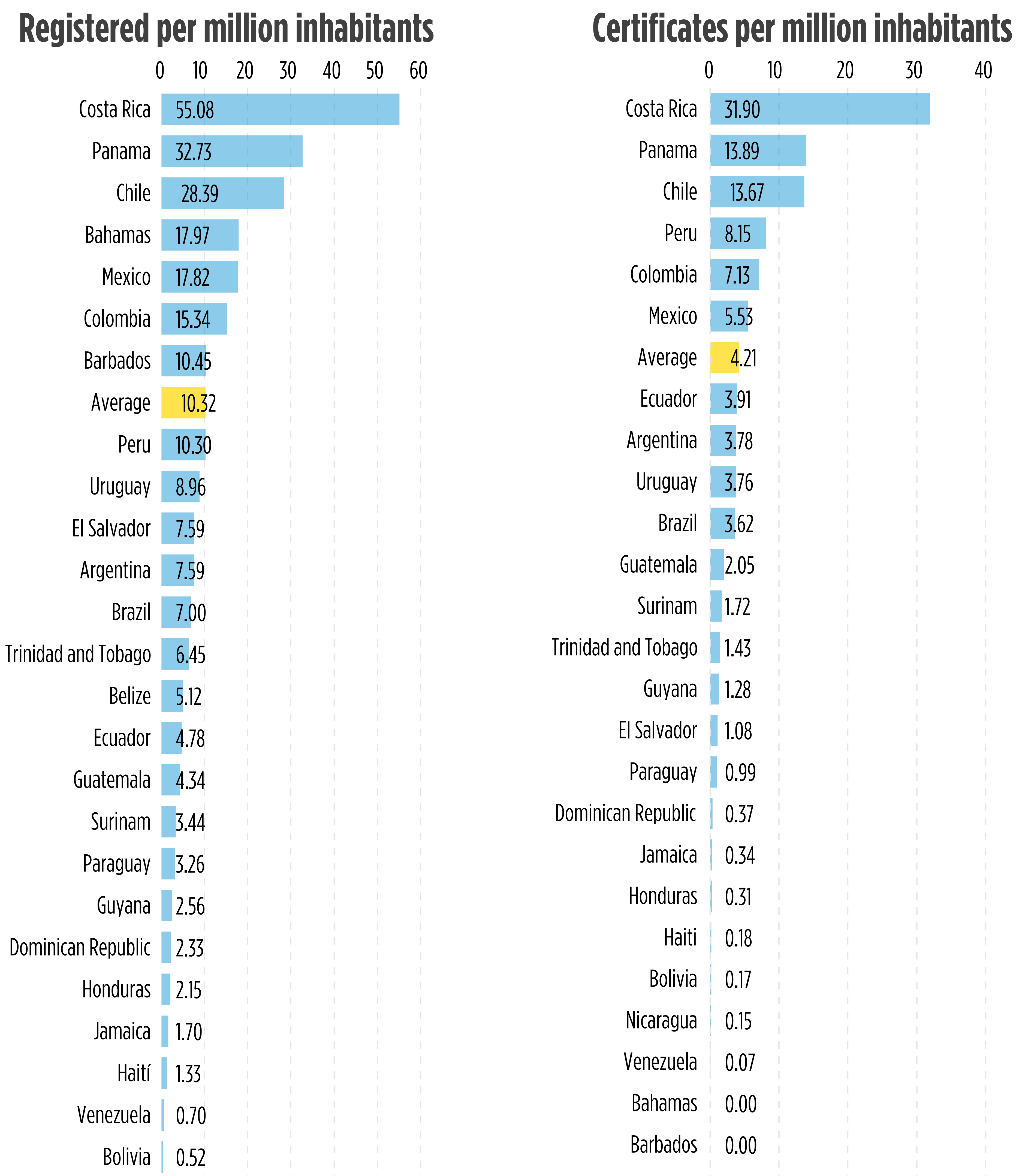


Figure 11. Project registration and international certifications

In this context, and to contrast the countries' demand for international voluntary certifications, the study analyzed projects in LAC that have achieved certifications such as LEED, ARC, EDGE, WELL, Fitwell, SITES, Passivhaus, and HQE. Based on the results, it is concluded that, of the 26 countries, those that have made the most significant progress in the number of certified projects are Costa Rica, Panama, Chile, Peru, Colombia, and Mexico, with values higher than the regional average (Figure 11).

From the analysis of the specific projects registered and certified (Figure 11), a significant difference stands out between the number of registered projects versus the number of projects that have achieved certification. Countries such as Costa Rica, Panama, Chile, Peru, Colombia, and Mexico cover the region's largest number of certified projects. Likewise, it is observed that, in some countries, such as the Bahamas, Barbados, and El Salvador, many projects are registered to achieve a certification level, so the number of certified projects is expected to increase in the coming years.

The difference observed between the number of registered and certified projects is mainly because these are usually registered at the project stage and certified once built, usually within one and three years. In addition, other factors may include halted projects, delayed construction times, structural or technological changes, or difficulties in the certification process.

With a focus on LEED and EDGE, it stands out that, in countries such as Costa Rica, Peru, Ecuador, and Colombia, these ratings have gained relevance in recent years compared to other certifications. LEED has the most certified projects in the region, three times the number of

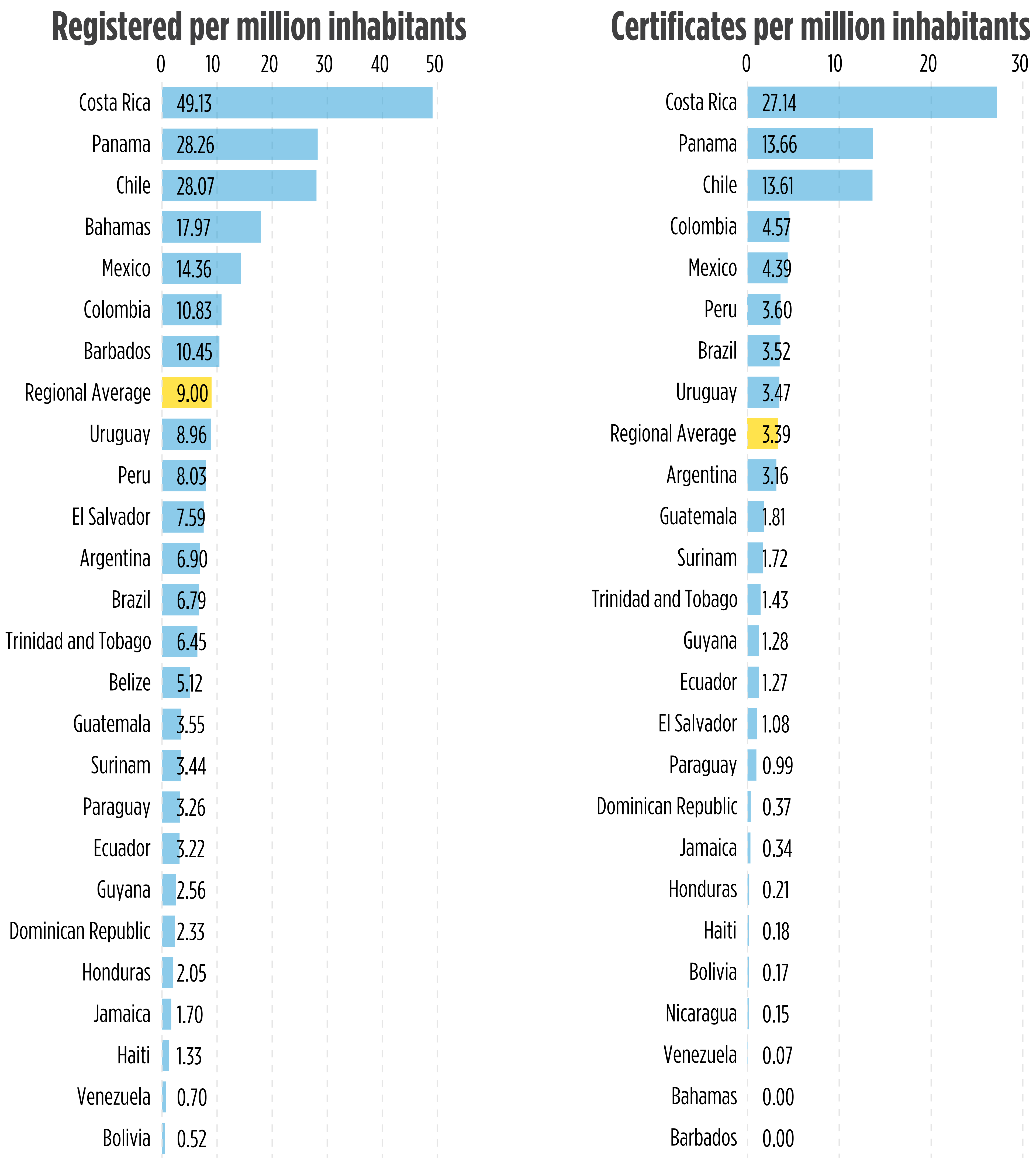


Figure 12. LEED project registration and certifications

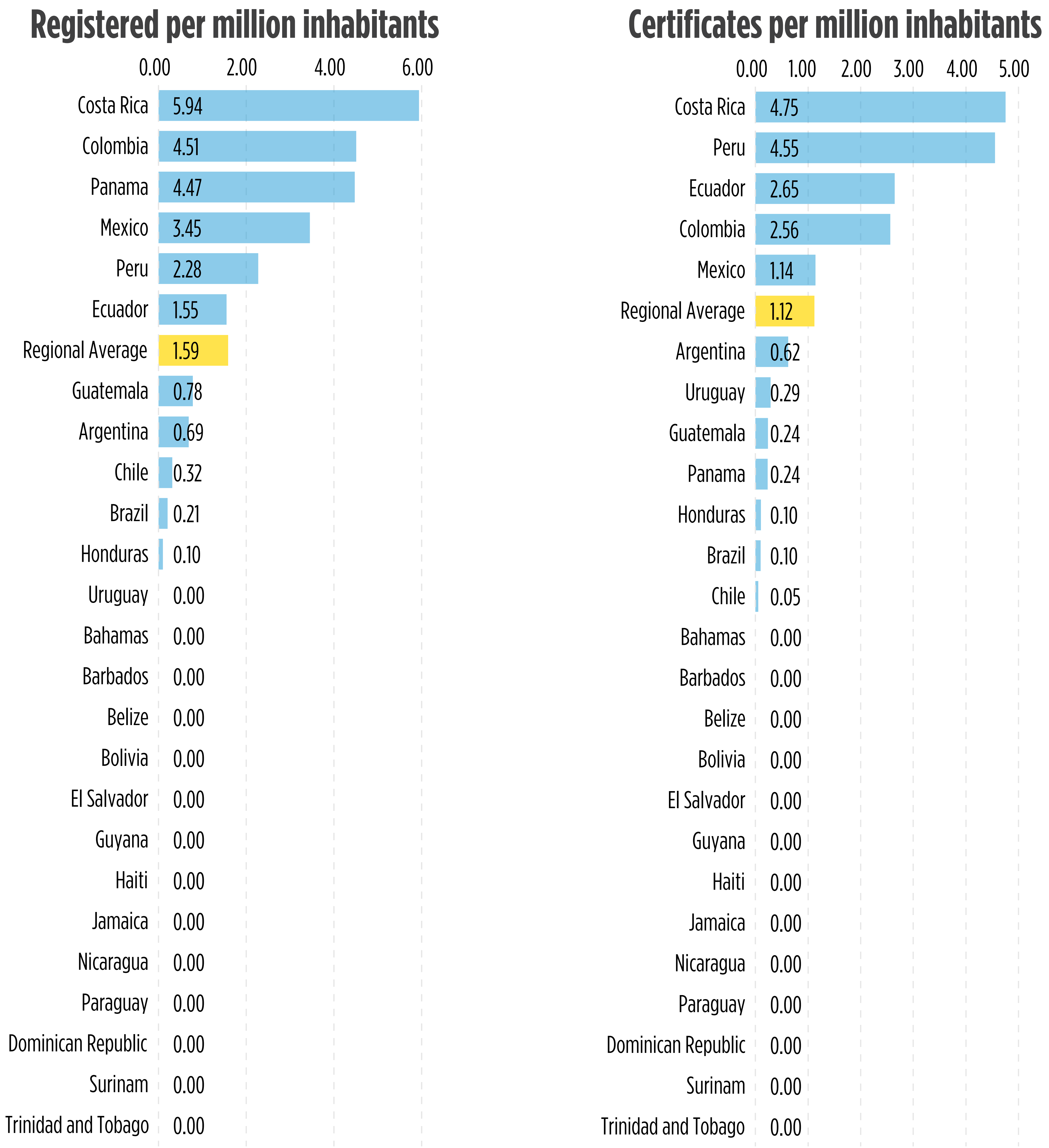


Figure 13. EDGE project registration and certification

projects per million inhabitants certified through EDGEE. Additionally, LEED has projects in all countries in the region. The regional average is 9 certified projects per million inhabitants, with the total average slightly higher than 10 projects per million inhabitants when considering the addition of international certifications. Regarding the number of certifications per million inhabitants, cases such as Costa Rica, Panama, and Chile stand out (See Figure 12 and Figure 13).

Although during the collection of information, it was observed that several countries have very little information regarding sustainability parameters in their codes, the record of certified projects shows that there is a growing interest in promoting the development of green buildings, as in the case of the Bahamas, Barbados, El Salvador, Trinidad and Tobago, and Belize.

3.4 Integrated Analysis of Compliance with Resilience and Sustainability Parameters

Next, an integrated analysis of compliance with the resilience and sustainability parameters in the codes of the surveyed countries is carried out.

The conclusions of this integrated analysis are:

- A certain correlation is observed between the ESWF codes and sustainability, while the top 9 countries in terms of design parameters for hazards in the codes coincide with 7 of the best ranked in terms of sustainability. It can be concluded that these 7 countries have the most complete codes in the different aspects analyzed: Chile, Ecuador, Brazil, Argentina, Mexico, Panama, and Peru. Colombia, Bolivia and Costa Rica follow.
- The strong winds category is the only one in which all countries comply with some parameter, while, in the case of sustainability, a more significant number of countries have not met any parameter.

	Sum of parameters (of a total of 66)		Seismic (14 parameters)	Strong Wind (7 parameters)	Flood (7 parameters	Sustainability (38 parameters)
			298	162	68	140
Chile	41	62%	13	6	5	17
Ecuador	39	59%	14	5	5	15
Brazil	37	56%	12	7	0	18
Argentina	36	55%	14	7	0	15
Colombia	35	53%	14	6	7	8
Mexico	33	50%	13	6	2	12
Costa Rica	32	48%	14	7	7	4
Panama	32	48%	14	7	0	11
Peru	31	47%	12	5	0	14
Bolivia	27	41%	14	7	0	6
El Salvador	27	41%	10	5	6	6
Nicaragua	27	41%	13	7	3	4
Dominican Republic	25	38%	14	5	6	0
Trinidad and Tobago	24	36%	14	7	3	0
Venezuela	24	36%	14	7	3	0
Guatemala	23	35%	14	7	2	0
Honduras	22	33%	11	7	4	0
Haití	21	32%	12	7	2	0
Belize	20	30%	10	6	4	0
Bahamas	19	29%	10	6	3	0
Guyana	19	29%	10	6	3	0
Surinam	19	29%	10	6	3	0
Jamaica	18	27%	12	6	0	0
Barbados	16	24%	10	6	0	0
Uruguay	16	24%	0	6	0	10
Paraguay	5	8%	0	5	0	0

Figure 14. Seismic, strong wind, flood, and sustainability parameters compliance by country

4. STRENGTHENING OPPORTUNITIES

4.1. Resilience in Building Codes

- **Improvement of technical capabilities, promotion of knowledge, and correct application of regulations.**

In the LAC region, gaps were identified in the technical capacity of the professionals who use the codes in their designs and in the institutions that validate and supervise their implementation. This hinders regulatory progress in the countries analyzed and impacts the quality of construction. A resilience approach in building codes must ensure that designer professionals are trained and the institutions in charge of verification are strengthened.

As evidenced in this publication, the region's progress in seismic and strong wind codes is much greater than that for floods, which is still a hazard that countries face reactively. Increasing countries' capabilities in identifying flood hazards and incorporating risk reduction measures into building codes can increase long-term resilience.

- **Incentive for the participation of the private sector and academia in developing and updating building codes.**

The region can benefit from the knowledge of the private and academic sectors, which generate high-quality information and contribute to the code development and updating process. In the case of some countries, such as El Salvador or Ecuador, there is no inter-institutional coordinating entity that promotes the development and updating of standards. On the contrary, in Colombia, the high quality of the codes is due in part to permanent advisory commissions, which guarantee their continuous evolution and can ensure the continuity of the processes even under changes in government.

Encouraging active multi-sector participation structures, such as code advisory commissions, defining the entity in charge of developing the codes, updating the standards with an adequate frequency, and improving their implementation process may be an appropriate mechanism to keep building codes updated.

- **Allocation of human and financial resources for updating processes.**

Regardless of the governance and mechanism for updating the Codes, human and economic resources must be available for developing and updating regulations, including carrying out hazard studies and institutional strengthening to establish standards. This is especially relevant in cases where implementing mandatory codes is proposed since this requires economic, social, and technical impact studies.

- **Development of predictive scenarios based on probabilistic modeling.**

The development of earthquake codes in the LAC region has generally responded to catastrophic events that have generated significant losses. The widespread application of probabilistic hazard modeling methodologies would allow codes to be proactively updated as higher-resolution information becomes available.

Likewise, there is a need for a more significant number of professionals trained in modeling probabilistic scenarios to avoid resistance to incorporating the results of these models into infrastructure design.

- **Promote and encourage associativity for solidarity technical collaboration between countries.**

The region can benefit from exchanging experiences and knowledge between countries, such as the "Permanent Commission of the Seismic Model Code for Latin America and the Caribbean," which currently has representatives from 17 countries. The countries have collaborated on a "Seismic Model Code," which is being used as a reference for updating the seismic codes of Bolivia, Ecuador, El Salvador, Nicaragua, and Peru.

This type of organization and work model could be replicated in other areas, such as sustainability.

Below are some opportunities to strengthen the codes for each hazard evaluated in this study.

4.1.1 Earthquakes

In general, the codes for earthquakes in the region can be complemented in aspects of the design of non-structural components, information on seismic hazard levels, and regulations for structural reinforcement or repair after an earthquake.

Countries such as Chile and Mexico, where the seismic hazard is high, should deepen the analysis of information on different seismic hazard levels.

4.1.2 Strong Winds

The LAC region can strengthen strong wind design codes by integrating alternative analysis methods for critical structures exposed to wind forces.

The region can improve its strong wind codes by increasing the level of participation of local experts in developing higher-resolution hazard maps.

Regarding code updates, it is important to evaluate the need to adjust the codes to potential future climate change scenarios in which the frequency and intensity of winds associated with storms (or other phenomena such as tornadoes) increase, analyzing accordingly and particularly its impact on non-structural elements such as facades and roofs.

4.1.3 Floods

Flood codes have the greatest potential for improvement in the LAC region.

The region can benefit from improvements in the quality and resolution of flood hazard maps and territorial planning instruments, as well as training of professionals in incorporating in the designs appropriate and timely measures according to the level of hazards of the site of construction.

The region can better prepare to face flood events by developing codes that provide guidelines to integrate into the design and considerations to minimize flood damage and losses, studying the characteristics of the basins, and evaluating exposure to different types of flooding (river, coastal, or urban). In addition, design parameters, flows, and water levels must incorporate projections of climate change scenarios considering the potential effects of changes in precipitation regimes.

4.2 Sustainability and Certificate Systems in Building Codes

4.2.1 Sustainability

- **Strengthening sustainability parameters in building codes**

Although the sustainability parameters to be considered in building codes in LAC may vary depending on the geographic location, environmental conditions, and specific socioeconomic needs of the region, they can be incorporated in a gradual and scalable manner into voluntary or mandatory regulatory frameworks of the countries in the region. From the parameters identified within the comparative analysis, there is an opportunity to:

- Incorporate, under official regulations, climate zonation maps. It is understood that each country has climate zones with seasonal variations in temperature, humidity, wind, and solar radiation. Adopting international classifications such as ASHRAE[12] could allow standard sustainability parameters to be adapted to local contexts.
- Increase energy and water efficiency standards, promoting the implementation of technologies and practices that reduce energy and water consumption in buildings, such as using high-quality insulation following climate zonation, efficient lighting systems, low flow devices, stormwater reuse systems, or renewable energy. The codes should be reviewed and updated periodically to reflect technological advances and best practices available and limited to countries.
- None of the analyzed codes incorporates requirements associated with "carbon emissions baseline" or "carbon emissions reporting." Additionally, local certifications and ratings do not consider these aspects within their technical models.

12 The classification system established by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) establishes a climate zone that is used worldwide for the design and evaluation of buildings' energy efficiency. These climate zones are based on historical climate data and help designers consider local climate conditions when planning HVAC systems. They are currently used for LEED and EDGE certifications

- Incorporate measures to adapt to climate change or increase resilience, complementary or under local ratings and certificates.

- **Strengthening multi-sector binding regulations on building codes**
  - Establish regulations that promote the use of more sustainable construction materials, such as wood certified under environmentally and socially responsible processes, recycled products, and materials with low environmental impact. It could also be influenced by regulatory provisions that allow reducing waste.
  - Promote regulations for water conservation in buildings, prioritizing countries or regions with the greatest water shortage.
  - Establish discounts on municipal rates or regulatory incentives for sustainable construction projects.

- **Strengthening public institutional capacities and actors in general**
  - Provide training, outreach campaigns, and educational resources for architects, engineers, builders, national officials, bricklayers, and masons on best practices in sustainable construction and how to apply the new codes.
  - Establish monitoring and compliance systems for sustainable building codes to ensure proper application. It may include regular inspections or the imposition of penalties for non-compliance.
  - Involve the community and stakeholders in the building code development process, which can help identify local priorities and create a sense of ownership regarding sustainability.

Under the comparative approach carried out in this study, it is considered that, for building codes to achieve better sustainability standards, it needs a combination of public institutional strengthening on this topic, creation of voluntary regulations, scalability in existing regulations for the inclusion of new parameters, strong national or regulatory incentives, as well as education and public participation.

4.2.2. Sustainability Certificates and Ratings

The study highlights that sustainability ratings and certificates can provide several significant benefits, especially in countries where building codes are not as robust or comprehensive regarding sustainability. In this sense, in LAC, the use of voluntary certifications such as LEED and EDGE and the number of projects that have acquired these distinctions highlight the countries' potential to develop and adopt their own standards.

Sustainability certifications can help countries comply with regulations related to sustainable building codes, such as international agreements on climate change. In this sense, countries can promote the development of ratings or certificates adapted to national contexts under clear, measurable standards and, if possible, binding on existing building codes and regulatory and planning instruments on climate matters. This will allow public entities, designers, builders, and financiers to identify concrete guidelines for designing and building more sustainable buildings in the long term under national developments.

While a lack of knowledge of sustainable building principles or certification systems limits their adoption, providing and disseminating information on practices and tools can counteract this barrier. To achieve this, educational initiatives are required, ranging from technical training to public awareness, such as promoting training programs, workshops, and accessible educational resources. This can play a crucial role in equipping public institutions, construction professionals, and society at large with the knowledge necessary to make early decisions and encourage the effective implementation of sustainable construction practices.

The trending use of certifications such as EDGE exposes the need to promote the development of dynamic tools with open-access applications to disseminate the best sustainable construction practices in LAC. Several Bank experiences in the region and training programs for managing EDGE demonstrate the versatility of converting a certification standard into a design tool to achieve sustainable construction

Additionally, the significant adoption of energy criteria by applying sustainability ratings and certificates indicates that there may be opportunities to promote the inclusion of other impact parameters through these voluntary mechanisms. These can be related, for example, to climate resilience, social and cultural identity, consumption habits, land ownership, spatial quality, relationship with the urban environment, architectural design, landmarks, incremental construction, availability and continuity of services, connectivity and urban equipment, equity, accessibility, affordability, and financing products.

ANNEX I – GLOSSARY OF COMPARISON PARAMETERS

The definitions[13] of the parameters used to evaluate the codes are detailed below. These definitions are not intended to provide a comprehensive description from an academic point of view but rather to provide a concept that allows the reader to understand each aspect considered in general.

Parameters in Constitutions

Surveying the Constitutions made it possible to identify the following four rights, used as the baseline for the comparative analysis:

1. **Right to Housing:** Grants the right to housing or adequate housing.
2. **Environmental protection:** EEstablishes the obligation of the State and/or people to protect or preserve the environment and nature. It can also give citizens the right to enjoy a healthy environment.
3. **Protection of the people:** Sets well-being standards for work, health, education, and/or protection of peoples' lives.
4. **Protection against extreme natural events:** Preventive or reactive protection against actions or forces of nature that could lead to disasters. The reference to the suspension of rights due to states of emergency is omitted when it does not specify protection against natural disasters.

13 The definitions used do not necessarily correspond to international definitions, and their terminology may vary from country to country.

Seismic Codes Parameters

Seismic Zonation. It is the definition of the seismic hazard within a specific geographical area, usually at the national level, which is commonly associated with basic design acceleration values.

Soil Classification. Soil classification consists of all the regulatory procedures that allow for the determination of the characteristics of the soils in which the structures will be located and that affect the action of earthquakes on said structures through dynamic amplification. Soil characteristics are usually determined with geotechnical studies.

Static Analysis Method. It is a method also known as the Equivalent Static Method. It is applied to determine the seismic stresses on the structural components through a simplified procedure of distributing the lateral forces equivalent to the distribution of the first mode of vibration of a regular structure, both in plan and elevation. Its characteristics limit its use exclusively to regular structures.

Dynamic Analysis Method. The dynamic analysis method, as defined in most standards, refers to the method also known as the Modal Spectral Method. It is based on the determination of the design seismic forces from the resolution of the problem of eigenvalues and eigenvectors. It is associated with determining the seismic acceleration from the resulting combination of the determined vibration modes of a design spectrum structure. Its characteristics allow it to be applied as an analysis method for regular and irregular structures.

Other Seismic Analysis Methods. These are methods other than the Static Analysis Method or the Dynamic Analysis Method, which are included in the design standards. It ranges from simplified to advanced methods, including structure's non-linearity and time-dependent requests, such as recorded or artificially generated accelerograms.

Seismic Design Philosophy. These are the master rules that guide the seismic analysis processes associated with earthquake-resistant design. They are based on the lessons learned from past catastrophic events. They are projected towards the desired behaviors of the structures, obtained through a reflective process of continuous improvement that requires deepening knowledge of both the demand exerted by earthquakes and the capacity granted by the structures' components.

Seismic Hazard Levels These are the different values that the basic design acceleration reaches, determined based on hazard studies and usually represented on seismic zonation maps. They are usually presented as acceleration or fractions of gravity acceleration.

Structures Risk Category It is a classification that indicates the consequences that the considered seismic forces would have on the occupants of a structure if they were exceeded. Therefore, it is a classification based on public policies rather than technical criteria.

Design Levels or Expected Ductility. Seismic-resistant design is based on the concept that structures subjected to exceptional earthquakes can reach certain ductility levels without collapsing. To achieve this ductility, the structural elements must have specific detailing characteristics that allow them to dissipate energy through permanent deformations in a stable manner. The set of measures required by standards to achieve a particular level of ductility is defined through the design levels.

Materiality and Typology Response Consideration. It is a concept that is based on the premise that not all construction materials respond to stresses in the same way. Likewise, not all structural typologies offer the same capacity against the action of earthquakes. For this reason, most standards provide a series of specific design considerations based on materiality and structural typology classification to guarantee a safe design.

Return Periods It is the average time between events of a given characteristic, such as severity or loss. It is determined as the inverse of the average rate of occurrence of events of equal magnitude using instrumental and historical records.

Structure Behavior Irregularities. Irregularities are physical characteristics, usually associated with the configuration and geometry, that can negatively affect the seismic behavior of structures against earthquakes. The standards typically define them by distinguishing between irregularity in plan and irregularity in elevation. Different irregularities usually affect the structures' response to various extents, from local damage to catastrophic collapse.

Non-Structural Elements. Permanent element that is not part of the resistant structure but that is affected by its movements and that interacts with it, such as dividing walls and non-intentionally structural façade elements, windows, false ceilings, window sills, shelves, decorative elements, luminaires, mechanical and electrical equipment, among others.

Post-Earthquake Reinforcement or Repair. These are actions designed to reinforce or repair structures that have been affected to varying degrees by an earthquake but have not reached a degree of damage comparable to collapse. They may include various techniques or strategies but maintain common objectives, both restoring the initial resistance of the building and improving its capacity against stresses that are more significant than those suffered.

Strong Wind Codes Parameters

Minimum Wind Loads. Design standards consider minimum loads to guarantee that once the stresses on structural and non-structural elements are determined, all of them have a minimum resistant capacity to withstand the components of the stresses imposed by the wind.

Cálculo Presiones. The methodology to determine the pressures that act on both the exposed surfaces of the structural and non-structural elements to design these elements properly

Wind Zonation. Establish the hazard level over a specific geographic area, usually at the national level, but also regional or local. The wind hazard is usually specified based on a primary design speed value that will allow for the determination of the pressures acting on structural and non-structural elements.

Importance Factor. It is a factor that assesses the consequences that the collapse or failure of a structure subjected to the action of the wind may have for society. It is determined based on an acceptable probability of exceedance over a specific time window, usually defined based on the structure's design life.

Simplified Analysis Method (envelop). It is a method applied to calculate wind stresses in buildings whose structure and structural elements meet quite limited conditions, such as the following: is closed, is low height, has some regularity, flexibility, and simple diaphragm (among others).

Directional Analysis Method (analytical). It is a method applied to calculate wind stresses in buildings whose structure is classified as regular, with a response that is not susceptible to excessive oscillations produced by the wind.

Other Wind Analysis Methods. They are methods that are applied alternatively to the simplified and directional methods, using wind tunnel tests or some other appropriate fluid. Its scope of application includes structures that cannot be analyzed by the two above-mentioned methods, in other words, singular or complex structures.

Flood Codes Parameters

Tsunami Mitigation These are the design provisions intended to control the adverse effects that occur on buildings under the action of a tsunami. They are broad in nature and range from restrictions on buildable areas to the disposition of elements to contain floods, including the design of evacuation structures.

Flood Hazard Maps. Maps that contain the flood hazard in certain geographic areas at the national, regional, and local levels. They allow urban planning and emergency management, among other actions. They are usually represented by reached flood heights associated with a return period.

Mitigación Tormentas. These are all actions associated with mitigating the effects caused by storms, especially those associated with the intense rainfall and coastal flooding that occurs during the passage of a storm.

Landslide Mitigation. These are all actions associated with mitigating the effects caused by landslides, especially those triggered by intense rainfall and earthquakes.

Hydrological Return Periods. It is the inverse of the probability of exceedance in any year of an event of a given intensity.

Verification of Dragged Debris Impact Loads. Debris impact loads are special loads produced by floods of different types, such as tsunamis, surges, or storms. Floods can carry different components that, when impacting structures, can cause damage more significant than that caused by the flood itself.

Basin Maps. Maps that delimit the hydrological basins of an area of particular interest. They are used to determine the runoff that may affect a specific work, which may be an infrastructure or flood regulation work. Watershed maps can have a national, regional, or local character and are treated as auxiliary documents within the design process.

Sustainability Parameters

Thermal Transmittance Criteria: Definition of calculation methodologies and valuable data for the thermal transmittance of construction elements, such as conductivities and densities of materials, among others.

Residential Thermal Transmittance: Maximum limits for the thermal transmittance of external elements in residential buildings, including opaque and translucent elements, thermal resistances, and maximum glazing percentages by orientation.

Non-Residential Thermal Transmittance: Maximum limits for the thermal transmittance of external elements in non-residential buildings, including opaque and translucent elements, thermal resistances, and maximum glazing percentages by orientation.

Transmitancia Térmica Renovaciones: Maximum limits for the thermal transmittance of external elements in existing buildings, both residential and non-residential, including opaque and translucent elements, thermal resistances, and maximum glazing percentages by orientation.

Hermeticity: Calculation methodologies and maximum limits related to hermeticity, both at the external and product level, such as ratings in component connections, among others.

Solar Control: Requirements for the incorporation of solar protection elements, such as eaves, lattices, curtains, or blinds in the windows of the facades of residential and non-residential buildings, including solar protection strategies via orientation and solutions such as solar filters or sheets of low emissivity incorporated into the windows.

Energy Demand Baseline: Maximum limits for heating or cooling energy demands in residential and non-residential buildings, with a representative baseline of the current construction situation in the country and energy savings goals.

Heating Provision: Conditions in which the incorporation of heating systems in buildings is required.

Cooling Provision: Conditions in which the incorporation of cooling systems in buildings is required.

Heating Equipment Efficiency: Energy efficiency or performance requirements for heating equipment when its use is considered necessary, including energy labeling.

Cooling Equipment Efficiency: Energy efficiency or performance requirements for cooling equipment when its use is considered necessary, including energy labeling.

Electronics and Lamps Efficiency: Energy efficiency requirements or energy labeling (A, A+, A++, etc.) for appliances and lamps in residential and non-residential buildings.

Thermal Comfort: Limits for the maximum percentage of time in thermal discomfort due to cold or heat and minimum percentage of time in thermal comfort due to cold or heat, with different requirements depending on the climate zone.

Lamp Power: Limits for the maximum lighting power, considering the type of building and the type of enclosure.

Residential Non-Renewable Energy Consumption: Maximum limits for the consumption of non-renewable primary energy in residential buildings, covering air conditioning, ventilation, domestic hot water, lighting, and appliances, with a representative base case and energy savings goals.

Non-Residential Non-Renewable Energy Consumption: Maximum limits for the consumption of non-renewable primary energy in non-residential buildings, covering air conditioning, ventilation, domestic hot water, lighting, and appliances, with a representative base case and energy savings goals.

ERNC Contribution: Minimum installation requirements for renewable energy, either as a percentage of the project surface, the end-use energy requirement, or types of final consumption that must be covered, among others.

Total Residential Primary Energy Consumption: Maximum limits for the consumption of non-renewable and renewable primary energy in residential buildings, covering air conditioning, ventilation, domestic hot water, lighting, and appliances, with a representative base case and energy savings goals.

Total Non-Residential Primary Energy Consumption: Maximum limits for the consumption of non-renewable and renewable primary energy in non-residential buildings, covering air conditioning, ventilation, domestic hot water, lighting, and appliances, with a representative base case and energy savings goals

Home Energy Labeling: Energy rating system for residential buildings that grants labels (A+, A, B, C, D, etc.) and energy savings indicators, including data such as energy demands, energy consumption, and percentage of time in thermal discomfort per cold or heat.

Carbon Emissions Report: Requirement to report the carbon footprint in buildings, whether operational or incorporated, including valid and representative calculation methodologies.

Carbon Emissions Baseline: Maximum limits for carbon emissions, whether embodied, operational, or full life cycle, in residential and non-residential buildings, including creating a representative base case and emissions reduction goals.

Non-Residential Energy Efficiency Parameters: Specific energy efficiency requirements for non-residential buildings, considering different types of buildings, such as offices, educational and health establishments.

Natural Ventilation: Calculation methodologies and limits of air renewals, including night ventilation in certain seasons. It includes non-mechanical systems such as ducts and lattices for passive air circulation.

Mechanical Ventilation: Mechanical ventilation systems are required based on climate conditions, thermal zones, air pollution, and type of premises.

Mechanical Ventilation Parameters: Hygienic limits for ventilation or air renewal rates by type of building or use of the premises, including extraction rates and energy efficiency of ventilation equipment.

Thermal Bridges: Requirement to solve thermal bridges, defined according to component connections or limit values of alteration in thermal transmittance, with prescriptive solutions and calculation tools.

Interstitial Surface Condensation: Requirement to solve condensation problems on walls, roofs, and floors, with limit values of surface or interstitial condensation and calculation tools.

Artificial Lighting: To integrate quality parameters in artificial lighting projects, including sufficient lighting according to tasks and limits for quality indicators such as CRI, minimum illuminance, and useful life of lamps.

Natural Lighting: Minimum levels of natural lighting in buildings are required, with prescriptive guidelines to ensure the entry of solar radiation and the definition of indicators for lighting quality.

Quality Views: Requirement for access to outdoor views, with prescriptive guidelines to guarantee said access and definition of quality indicators related to the views.

Acoustic Isolation: To incorporate solutions to reduce exposure to outside noise, with prescriptive guidelines and noise limits or minimum levels of acoustic insulation in decibels (dB), as well as acoustic insulation data and evaluation and calculation methodologies.

Outdoor Water Consumption: Efficiency in using drinking water for irrigation and other outdoor building facilities to save water resources. It includes minimum water savings limits and specific restrictions on drinking water use.

Indoor Water Consumption: Efficiency in using drinking water within buildings to save water resources. It includes minimum water savings limits, restrictions on drinking water use for specific tasks, and maximum discharge and flow limits by type of sanitary fixture or water tap.

Gray and Rainwater Reuse: Design parameters and requirements for gray and rainwater reuse systems, as well as requirements to guarantee the quality of the water reused inside or outside the building.

Drinking Water Quality: Minimum drinking water quality levels and water supply system maintenance are required to guarantee public health and protect the environment. It includes maximum limits of chemicals, microorganisms, and other harmful contaminants for different uses, such as, among others, human consumption, recreational use, direct contact with the skin, and irrigation.

Climate Zonation Definition: Establishes local climate zones based on degrees/day.

Climate Zonation Parameters: Considers the evaluation of specific data in the definition of local climate zones, such as degrees/day, dry bulb temperature, relative humidity, winter-summer thermal oscillation, day/night thermal oscillation, solar radiation, and rainfall.

ANNEX II - CODES ANALYZED REGARDING RESILIENCE

Country	Document Title	Date
Argentina	Ley-L-6062-18-5522	2018
	Decreto-105-19-5578	2019
	Resolución 2-E-2018	2018
	Reglamento Argentino De Cargas Permanentes Y Sobrecargas Mínimas De Diseño Para Edificios Y Otras Estructuras	2005
	Comentarios Al Reglamento Argentino De Cargas Permanentes Y Sobrecargas Mínimas De Diseño Para Edificios Y Otras Estructuras	2005
	Reglamento Argentino De Acción Del Viento Sobre Las Construcciones	2005
	Guía Para El Uso Del Reglamento Argentino De Acción Del Viento Sobre Las Construcciones	2005
	Comentarios Al Reglamento Argentino De Acción Del Viento Sobre Las Construcciones	2005
	Reglamento Argentino Para Construcciones Sismorresistentes - Parte_I-Construcciones En General	2018
	Reglamento Argentino Para Construcciones Sismorresistentes - Comentarios A La Parte_I-Construcciones En General	2018
	Reglamento Argentino Para Construcciones Sismorresistentes - Parte_II-Construcciones De Hormigón Armado	2005
	Reglamento Argentino Para Construcciones Sismorresistentes - Comentarios A La Parte_II-Construcciones De Hormigón Armado	2005
	Reglamento Argentino Para Construcciones Sismorresistentes - Parte_III-Construcciones De Mampostería	2018
	Reglamento Argentino Para Construcciones Sismorresistentes - Parte_Iv-Construcciones De Acero	2005
	Reglamento Argentino Para Construcciones Sismorresistentes - Comentarios A La Parte_Iv-Construcciones De Acero	2005
	Reglamento Argentino Para Construcciones Sismorresistentes - Parte_V-Soldadura De Estructuras De Acero Sismorresistentes	2018
	Reglamento Argentino Para Construcciones Sismorresistentes Parte Vi Puentes De Hormigón Armado	2020

Country	Document Title	Date
Argentina	Comentarios Al Reglamento Argentino Para Construcciones Sismorresistentes Parte Vi Puentes De Hormigón Armado	2020
	Reglamento Argentino De Acción De La Nieve Y Del Hielo Sobre Las Construcciones	2005
	Comentarios Al Reglamento Argentino De Acción De La Nieve Y Del Hielo Sobre Las Construcciones	2005
	Reglamento Argentino De Cargas De Diseño Para Estructuras Durante Su Construcción	2007
	Comentarios Al Reglamento Argentino De Cargas De Diseño Para Estructuras Durante Su Construcción	2007
	Reglamento Argentino De Estructuras De Hormigón	2005
	Comentarios Al Reglamento Argentino De Estructuras De Hormigón	2005
	Reglamento Argentino De Estructuras De Acero Para Edificios	2005
	Comentarios Al Reglamento Argentino De Estructuras De Acero Para Edificios	2005
	Reglamento Argentino De Elementos Estructurales De Tubos De Acero Para Edificios	2005
	Comentarios Al Reglamento Argentino De Elementos Estructurales De Tubos De Acero Para Edificios	2005
	Reglamento Argentino De Elementos Estructurales De Acero De Sección Abierta Conformada En Frio	2009
	Comentarios Al Reglamento Argentino De Elementos Estructurales De Acero De Sección Abierta Conformada En Frio	2009
	Reglamento Argentino Para La Soldadura De Estructuras De Acero	2007
	Recomendación Para Uniones Estructurales Con Bulones De Alta Resistencia	2007
	Comentarios Al Recomendación Para Uniones Estructurales Con Bulones De Alta Resistencia	2007
	Reglamento Argentino De Estructuras De Acero Para Antenas	2018
	Guía Para La Construcción De Estructuras De Acero Para Edificios	2018
	Comentarios A La Guía Para La Construcción De Estructuras De Acero Para Edificios	2018
	Reglamento Argentino De Estructuras Livianas Para Edificios Con Barras De Acero De Sección Circular	2007
	Comentarios Al Reglamento Argentino De Estructuras Livianas Para Edificios Con Barras De Acero De Sección Circular	2007
	Reglamento Argentino De Estudios Geotécnicos	2018
	Comentarios Al Reglamento Argentino De Estudios Geotécnicos	2018
	Reglamento Argentino De Estructuras De Mampostería	2007
	Comentarios Al Reglamento Argentino De Estructuras De Mampostería	2007

Country	Document Title	Date
Argentina	Reglamento Empírico Para Construcciones De Mampostería De Bajo Compromiso Estructural	2007
	Comentarios Al Reglamento Empírico Para Construcciones De Mampostería De Bajo Compromiso Estructural	2007
	Reglamento Argentino De Estructuras De Madera	2016
	Manual De Aplicación De Los Criterios De Diseño Adoptado En El Reglamento Argentino De Estructuras De Madera	2016
	Guía Para El Proyecto De Estructuras De Madera Con Bajo Compromiso Estructural Viviendas De Una Planta	2018
	Reglamento Argentino De Estructuras De Aluminio	2010
	Comentarios Al Reglamento Argentino De Estructuras De Aluminio	2010
	Reglamento Argentino Para La Soldadura De Estructuras En Aluminio	2010
	Comentarios Al Reglamento Argentino De Cargas Permanentes Y Sobrecargas Mínimas De Diseño Para Edificios Y Otras Estructuras	2005
	Guía Para El Uso Del Reglamento Argentino De Acción Del Viento Sobre Las Construcciones	2005
	Comentarios Al Reglamento Argentino De Acción Del Viento Sobre Las Construcciones	2005
	Reglamento Argentino Para Construcciones Sismorresistentes - Comentarios A La Parte_I-Construcciones En General	2018
	Reglamento Argentino Para Construcciones Sismorresistentes - Comentarios A La Parte_II-Construcciones De Hormigón Armado	2005
	Reglamento Argentino Para Construcciones Sismorresistentes - Comentarios A La Parte_Iv-Construcciones De Acero	2005
	Comentarios Al Reglamento Argentino Para Construcciones Sismorresistentes Parte Vi Puentes De Hormigón Armado	2020
	Comentarios Al Reglamento Argentino De Acción De La Nieve Y Del Hielo Sobre Las Construcciones	2005
	Comentarios Al Reglamento Argentino De Cargas De Diseño Para Estructuras Durante Su Construcción	2007
	Comentarios Al Reglamento Argentino De Estructuras De Hormigón	2005
	Comentarios Al Reglamento Argentino De Estructuras De Acero Para Edificios	2005
	Comentarios Al Reglamento Argentino De Elementos Estructurales De Tubos De Acero Para Edificios	2005
	Comentarios Al Reglamento Argentino De Elementos Estructurales De Acero De Sección Abierta Conformada En Frio	2009
	Recomendación Para Uniones Estructurales Con Bulones De Alta Resistencia	2007

Country	Document Title	Date
Argentina	Comentarios Al Recomendación Para Uniones Estructurales Con Bulones De Alta Resistencia	2007
	Guía Para La construcción De Estructuras De Acero Para Edificios	2018
	Comentarios A La Guía Para La construcción De Estructuras De Acero Para Edificios	2018
	Comentarios Al Reglamento Argentino De Estructuras Livianas Para Edificios Con Barras De Acero De Sección Circular	2007
	Comentarios Al Reglamento Argentino De Estudios Geotécnicos	2018
	Comentarios Al Reglamento Argentino De Estructuras De Mampostería	2007
	Comentarios Al Reglamento Empírico Para Construcciones De Mampostería De Bajo Compromiso Estructural	2007
	Manual De Aplicación De Los Criterios De Diseño Adoptado En El Reglamento Argentino De Estructuras De Madera	2016
	Guía Para El Proyecto De Estructuras De Madera Con Bajo Compromiso Estructural Viviendas De Una Planta	2018
	Comentarios Al Reglamento Argentino De Estructuras De Aluminio	2010
	Manual De Prevención Sísmica	2017
	Riesgos De Desastres En Argentina	2009
Bahamas	Ley De Regularización De Construcción	
	Minimum Design Loads For Buildings And Other Structures	1988
	Bahamas Building Code	2003
	Mainstreaming Disaster Risk Management Strategies In Development Instruments (I)	2017
	Prevention Of Floods Act	1951
	Town And Country Planning Act	1968
	Planning And Development Act	2019
	Planning And Development (General Development) Order	2021
	Caribbean Uniform Building Code	1985
	Wind Loads For Structural Design – Technical Report	2013
	National Building Code	1981

Country	Document Title	Date
Barbados	Mainstreaming Disaster Risk Management Strategies In Development Instruments (Ii)	2019
BeliZe	Ley De Construcción De La Ciudad De Belice	2000
	Ley De Construcción De La Ciudad De Belice (Enmienda)	2017
	Caribbean Uniform Building Code	1985
	Annex 08 Issues Of Flood Mitigation And Drainage	2011
	Belize National Flood Hazard Mapping Methodology and Validation Report	2016
	Mainstreaming Disaster Risk Management Strategies In Development Instruments (I)	2017
Bolivia	Ley N° 031. Ley Marco De Autonomías Y Descentralización “Andrés Ibáñez”	2010
	Decreto Supremo N° 29894	2009
	Ley N° 482 Ley De Gobiernos Autónomos Municipales	2014
	Decreto Supremo Nº 23489	1993
	Guía Boliviana De Construcción De Edificaciones	2015
	Guía Nacional. 17 Normas Bolivianas. Accesibilidad De Las Personas Con Discapacidad Al Medio Físico.	2015
	Guía Técnica Para El Ordenamiento De Áreas Urbanas	2014
	Guía Boliviana De Fiscalización De Obras	2016
	Guía Técnica Para La Delimitación De Areas Urbanas	2017
	Guía De Supervisión De Obras	2016
	Guía Para La Formulación Y Presentación De Proyectos De Vivienda Social	2020
	Guía Boliviana De Diseno Sísmico	2018
	Guía Boliviana De Diseno Sísmico	2020
	Guía Boliviana Para Diseno Y Presentación De Proyectos	2017
	Guía Boliviana De Mantenimiento De Edificaciones	2017
	Guia Nacional De Cadastro Urbano	2022
	Manual De Construcción De Viviendas Sociales	2020
	Norma Boliviana De Diseño Sísmico	2006

Country	Document Title	Date
Bolivia	Hormigón Estructural-Parte 1 Especificación	2017
	Hormigón Estructural-Parte 2 Comentarios	2017
	Aparatos De Elevación - Requisitos Generales Para El Mantenimiento De Ascensores	2009
	Hormigón Armado	1987
	Estructuras De Acero - Parte 1: Especificaciones	2019
	Acciones Sobre Las Estructuras - Acción Del Viento – Parte 1: Especificaciones	2022
	Acciones Sobre Las Estructuras - Acción Del Viento – Parte 2: Comentarios	2022
	Acciones Sobre Las Estructuras: Gravitacionales, Reológicas Y Empujes De Suelo - Parte 1: Especificaciones	2019
	Acciones Sobre Las Estructuras Gravitacionales, Reológicas Y Empujes De Suelo. - Parte 2: Comentarios	2019
	Guía Para La formulación Y Presentación De Proyectos De Vivienda Social	2020
	Guía Boliviana De Diseno Sísmico	2018
	Manual De Construcción De Viviendas Sociales	2020
	Norma Boliviana De Diseño Sísmico	2006
	Hormigón Estructural-Parte 2 Comentarios	2017
	Acciones Sobre Las Estructuras - Acción Del Viento – Parte 2: Comentarios	2022
Brazil	Lei Nº 10.257 Institui O Estatuto Da Cidade	2001
	Lei N° 11.124 Dispõe Sobre O Sistema Nacional De Habitação De Interesse Social	2005
	Projeto-De-Pontes-De-Concreto-Armado-E-De-Concreto-Protendido	2003
	Carga Móvel Rodoviária E De Pedestres Em Pontes, Viadutos, Passarelas E Outras Estruturas	2013
	Projeto De Estruturas De Concreto -Procedimento	2004
	Projeto De Estruturas De Concreto -Procedimento	2014
	Ações E Segurança Nas Estruturas - Procedimento	2004
	Forcas Devidas Ao Vento Em Edificações. Errata 2_2013	1988
	Projeto De Estruturas De Aço E De Estruturas Mistas De Aço E Concreto De Edifícios	2008
	Projeto De Estruturas Resistentes A Sismos-Procedimento	2006
Brazil	Projeto E Execução De Fundações	1996
	Cargas Para O Cálculo De Estruturas De Edificações - Procedimento	2019
	Concreto Para Fins Estruturais - Classificação Pela Massa Específica, Por Grupos De Resistência E Consistência Concrete For Estrutural Use - Density, Strength And Consistence Classification	2015
	Projeto E Execução De Estruturas De Concreto Pré-Moldado	2017
	Elaboração De Projetos De Edificações – Arquitetura	1995
	Execução De Estruturas De Concreto - Procedimento	2004
	Projeto De Estruturas De Madeira	1997
	Edificações Habitacionais - Desempenho. Parte 2_Requisitos Para Os Sistemas Estruturais	2013
	Edificações Habitacionais – Desempenho – Parte 1: Requisitos Gerais	2021
	Edificações Habitacionais – Desempenho – Parte 3: Requisitos Para Os Sistemas De Pisos	2021
	Edificações Habitacionais – Desempenho – Parte 4: Requisitos Para Os Sistemas De Vedações Verticais Internas E Externas – Svvie	2021
	Edificações Habitacionais – Desempenho – Parte 5: Requisitos Para Os Sistemas De Coberturas	2021
	Edificações Habitacionais – Desempenho – Parte 6: Requisitos Para Os Sistemas Hidrossanitários	2021
	Alvenaria Estrutural – Blocos De Concreto Parte 1	2011
	Alvenaria Estrutural – Blocos De Concreto Parte 2	2011
	Alvenaria Estrutural – Blocos Cerâmicos	2011
	Projeto De Estruturas Resistentes A Sismos - Procedimento	2006
	Dimensionamiento De Estructuras De Aco Constituidas Por Perfis Formados A Frio	2010
	Proyecto De Estructuras De Concreto En Stuacion De Incendio	2012
	Guia_Da_Norma_de_Desempenho_2013	2013
Chile	Ordenanza General De Urbanismo Y Construcción	2022

Country	Document Title	Date
Chile	Ley General De Urbanismo Y Construcciones	2017
	Fija Disposiciones Para Casos De Sismos O Catástrofes	1965
	Reglamento Que Fija Los Requisitos De Diseño Y Cálculo Para El Hormigón Armado.	2011
	Diseño Sísmico De Edificios	2011
	Reglamento Del Registro Nacional De Revisores De Proyectos De Cálculo Estructural	2002
	Diseño Estructural - Cargas Permanentes Y Cargas De Uso	2009
	Construcción - Estructuras De Acero - Parte 1: Requisitos Para El Cálculo De Estructuras De Acero Para Edificios	2016
	Requisitos De Diseño Y Cálculo, Hormigón Armado	2008
	Diseño Estructural	1905
	Diseño Estructural -Cargas De Viento	2010
	Diseño Sísmico De Edificios	2009
	Diseño Sísmico De Estructuras E Instalaciones Industriales	2003
	Análisis Y Diseño De Edificios Con Aislación Sísmica	2013
	Diseño Estructural - Disposiciones Generales De Combinaciones De Carga	1905
	Diseño Sísmico De Edificios Con Sistemas Pasivos De Disipación De Energía - Requisitos Y Métodos De Ensayo	2017
	Diseño Sísmico De Componentes Y Sistemas No Estructurales	2015
	Intervención De Construcciones Patrimoniales De Tierra Cruda - Requisitos Del Proyecto Estructural	2013
	Estructuras En Construcciones Patrimoniales Y Edificaciones Existentes - Requisitos Del Proyecto Estructural	2020
	Madera - Construcciones En Madera - Cálculo	2014
	Albañilería Armada -Requisitos De Diseño Y Cálculo	1905
	Albañilería Confinada - Requisitos De Diseño Y Cálculo	1905
	Requisitos Para Edificaciones Estratégicas Y De Servicio Comunitario	2015
	Diseño Estructural - Edificaciones En Áreas De Riesgo De Inundación Por Tsunami O Seiche	2015
Chile	Arquitectura Y Construcción - Muros Cortina - Parte 4: Método De Ensayo Estático Para La Evaluación De Muros Cortina Exteriores O Interiores Sometidos A Deformaciones De Entrepiso Inducidas Por Sismos Y Otras Cargas	2020
	Requisitos Mínimos De Diseño, Instalación Y Operación Para Ascensores Electromecánicos Frente A Sismos (Visualización Gratuita Disponible En Www.Minvu.Cl)	2014
	Diseño Estructural - Edificaciones En Áreas De Riesgo De Inundación Por Tsunami O Seiche	2015
Colombia	Reglamento Colombiano De Construcción Sismo Resistente	2010
	Reglamento Técnico Del Sector De Agua Potable Y Saneamiento Básico	
	Estudio Zonas De Afectación De Acuerdo A Reporte Final De Áreas Afectadas Por Inundación 2010-2011	-
	Atlas De Viento Y Energía Eólica De Colombia	-
Costa Rica	Lineamientos Técnicos Para El Cálculo Y La Aplicación De Las Fuerzas De Viento En El Diseño Y Construcción De Edificaciones En Costa Rica	-
	Código Sísmico De Costa Rica	2010
	Suplemento Al Código Sísmico De Costa Rica (Cscr2010) (Rev.2014). Especificaciones Para Diseño Y Construcción De Sistemas De Estructuras Tipo Mixto Con Losa Plana Mlp	2021
	Aec. (2003). Código Modelo De Construcción Para Cargas De Viento.	-
	Recomendaciones Para La construcción Y La Reducción De Desastres	-
Ecuador	Norma Ecuatoriana De La Construcción - NEC Cargas Sísmicas/Diseño Sismo Resistente	-
	Cargas Sísmicas/Diseño Sismo Resistente	-
	2014 NEC Cargas No Sísmicas	1905
	Portal Geográfico	-
El Salvador	Ley De Protección Civil, Prevención Y Mitigación De Desastres	2005
	Plan Municipal De Ordenamiento Territorial De La Ciudad De San Salvador	2015
	Ordenanza Reguladora De Construcciones Y Otras Obras Particulares	1988
	Ordenanza Del Control Del Desarrollo Urbano Y De La Construcción En El Municipio De San Salvador	1989
	Norma Técnica Para Diseño Por Sismo Y Sus Comentarios	1997

Country	Document Title	Date
El Salvador	Norma Técnica Para Diseño Por Viento Y Sus Comentarios	1997
	Análisis De Riesgo Por Inundación En Cuencas Prioritarias Y Perfil De Riesgo Por Inundaciones	2014
	Gestión De Riesgos Urbanos Inundaciones Urbanas En El Salvador	2007
	Sistema Nacional De Protección Civil, Prevención Y Mitigación De Desastres	2012
Guatemala	Guía De Aplicación Plan De Ordenamiento Territorial	2009
	Plan De Ordenamiento Territorial	2014
	Demandas Estructurales Y Condiciones De Sitio	2018
	Diseño De Edificaciones De Acero	2018
	Diseño De Edificaciones De Concreto Reforzado Con Muros De Ductilidad Baja	2018
	Diseño De Concreto Reforzado	2018
	Diseño De Mampostería Reforzada	2018
	Diseño Estructural De Edificaciones	2018
	Estudios Geotécnicos	2018
	Evaluación Y Rehabilitación De Obras Existentes	2018
	Generalidades, Administración De Las Normas Y Supervisión Técnica	2018
	Plan Nacional De Gestión De Riesgo De Desastres Guatemala 2018-2022	2018
	Town And Country Planning Act	1998
	Caribbean Uniform Building Code	1985
	Código De Practica Para Construcciones	2005
	Mainstreaming Disaster Risk Management Strategies In Development Instruments (Ii)	2019
	Development Of Disaster Risk Indicators and Flod Risk Evaluation	2012
Haiti	Leyes Y Reglamentos Urbanísticos	2013
	Código Nacional De Construcción De Haití	2012
	International Building Code	2009
	Minimum Design Loads For Buildings And Other Structures	2005

Country	Document Title	Date
Haiti	Eurocódigo 8: Disposiciones Para El Proyecto De Estructuras Sismorresistentes	1998
	National Building Code Of Canada	2005
	Caribbean Uniform Building Code	1985
	Flood Resistant Design And Construction	2005
	Guía De Reforzamiento Sísmico Y Paraciclónico De Edificios	2012
	Microzonificación Símica De La Aglomeración De Puerto Príncipe	2014
	Plan Nacional De Gestión De Riesgo De Desastres Haití 2019-2030	2019
Honduras	Ley De Ordenamiento Territorial Y Su Reglamento General	2003
	Borrador Del Reglamento De La Ley General De Aguas	2019
	Ordenanza De Zonificación Y Urbanización Del Plan Maestro De Desarrollo Urbano San Pedro Sula	2004
	Reglamento Especial Para La Protección Y Mantenimiento De Obras Contra Inundaciones (Diario Oficial)	2021
	Código Hondureño De Construcción	2010
	Manual Para El Diseño, Instalación, Operación Y Mantenimiento De Sistemas Comunitarios De Alerta Temprana Ante Inundaciones	2010
	Recomendaciones Técnicas Para La Elaboración De Mapas De Amenazas Por Inundaciones	2008
Jamaica	Lands Development And Utilization Act	1966
	The Building Act	2018
	International Building Code	2018
	Minimum Design Loads For Buildings And Other Structures	2016
	Caribbean Uniform Building Code	1985
	Flood Resistant Design And Construction	2014
	Borrador Del Código De Construcción Jamaicano	2021
	Mainstreaming Disaster Risk Management Strategies In Development Instruments (I)	2017
Mexico	Manual De Obras Civiles (Moc-Cfe2015) Para El Resto De La Republica Mexicana	1905
	Norma Para La Rehabilitación Sísmica De Edificios De Concreto Dañados Por El Sismo Del 19.Sep.2017 (Distrito Federal)	2017

Country	Document Title	Date
Mexico	Normas Técnicas Complementarias Para Diseño Y Construcción De Cimentaciones	2017
	Nom-006-Segob-2015	2017
	Industria De La Construcción - Diseño Por Viento De Edificaciones Y Otras Construcciones - Parte 1: Requisitos	2021
	Industria De La Construcción - Diseño Por Viento De Edificaciones Y Otras Construcciones - Parte 2: Métodos De Ensayo En Túnel De Viento	2021
Nicaragua	Norma, Pauta Y Criterios Para El Ordenamiento Territorial	2002
	Reglamento Nacional De Construcción	2007
	Norma Sismorresistente Para La Ciudad De Managua	2021
	Norma Mínima De Diseño Y Construcción De Concreto Estructural	2017
	Norma Mínima De Diseño Y Construcción De Acero	2017
	Norma Mínima De Diseño Y Construcción De Mampostería	2017
	Política Centroamericana De Gestión Integral De Riesgo De Desastre (Pcgir)	2017
	Recomendaciones Técnicas Para La Elaboración De Mapas De Amenazas Por Inundaciones Fluviales	2005
Panama	Ley No. 6	2006
	Reglamento Estructural De Panamá	2015
	Reglamento Estructural De Panamá	2023
	Guía Municipal De Gestion De Riesgo De Desastres En Panamá	2016
	Política Centroamericana De Gestión Integral De Riesgo De Desastre (Pcgir)	2017
Paraguay	Ley Nº 3966 - Orgánica Municipal.	-
	Ord-1990-26104-Reglamento-General-De-La-Construccion	-
	Ley Nº 3966 / Orgánica Municipal.	2010
	Ord-2017-128_Establece_Norma__Regula_Construccion_Sostenible_En_La_Ciudad_De_Asu._Insentivos	2017
	Ordenanza Municipal N° 26.104/90. Que Establece El Reglamento General De Construcción.	1990
	Construcción Sostenible. Sitio Y Arquitectura. Requisitos Generales	2014

Country	Document Title	Date
Paraguay	Construcción Sostenible. Recursos Materiales. Requisitos Generales	2015
	Ctn 17: Construcción, 98 Archivos	-
	Ctn 34: Geotecnia, 12 Archivos	-
	Ctn 48: Ensayos No Destructivos	-
	Acción Del Viento En Las Construcciones	-
	Ctn 30: Estructuras, 9 Archivo	-
	Ctn 08: Maderas, 30 Resultados	-
	Ctn 12: Soldaduras, 3 Resultados	-
	Construcción Sostenible. Sitio Y Arquitectura. Requisitos Generales	2014
	Construcción Sostenible. Recursos Materiales. Requisitos Generales	2015
Peru	Reglamento Nacional De Edificaciones	-
	Lineamientos Para El Diseño De Edificaciones Para Evacuación Vertical Frente A Tsunamis	2021
	Madera	2020
	Cargas	-
	Diseño Sismorresistente	2020
	Aislamiento Sísmico	2020
	Suelos Y Cimentaciones	1905
	Concreto Armado	1905
	Albañilería	1905
	Diseño Y Construcción Con Tierra Reforzada	1905
	Estructuras Metálicas	1905
	Bambú	1905
Dominican Republic	Plan Regional De Ordenamiento Y Desarrollo Territorial	2021
	Urbanización, Ornato Público Y Construcciones	1944
	Gestión De Riesgos	2002

Country	Document Title	Date
Dominican Republic	Reglamento Para El Análisis Y Diseño Sísmico De Estructuras	2011
	Reglamento Para Estudios Geotécnicos En Edificaciones	2011
	Reglamento Para Diseño Y Construcción De Estructuras En Hormigón Armado	2012
	Reglamento Para Diseño Y Construcción De Estructuras En Madera Estructural	2009
	Reglamento Para Diseño, Fabricación Y Montaje De Estructuras De Acero	2007
	Reglamento Para Diseño Y Construcción De Edificios En Mampostería Estructural	2007
	Recomendaciones Provisionales Para El Análisis Por Viento De Estructuras	1980
	Reglamento Técnico Para Diseño De Obras E Instalaciones Hidro-Sanitario Del Inapa	2018
	Documento De Consulta Plan Nacional De Ordenamiento Territorial 2030 (Borrador)	2015
	Mainstreaming Disaster Risk Management Strategies In Development Instruments (I)	2017
	Manual De Evaluación Sísmica Y De Huracanes De Edificios Existentes De Hormigón Para La República Dominicana	2002
Surinam	Ley No. 30	1956
	Ley No. 96	1972
	Caribbean Uniform Building Code	1985
	Mainstreaming Disaster Risk Management Strategies in Development Instruments (Ii)	2019
Trinidad and Tobago	Town And Country Planning Act	2014
	Caribbean Uniform Building Code	1985
	Minimum Design Loads for Buildings and Other Structures	2010
	International Building Code	2012
	Código Modelo De Construcción Para Cargas De Viento	2003
	Código Modelo De Construcción Para Sismos	2003
	Guía Para El Diseño Y Construcción De Edificios Pequeños	2006
	Mainstreaming Disaster Risk Management Strategies In Development Instruments (Ii)	2019
	Guide To Developers and Applicants For Planning Permission	1988

Country	Document Title	Date
Uruguay	Compilación De Leyes, Ordenanzas, Decretos Y Resoluciones Relacionadas Con La Construcción De Edificios. Volumen 2	1957
	Proyectos De Construcción De Edificaciones - Desarrollo Del Proyecto De Arquitectura - Proceso Y Documentación.	2013
	Redacción De Proyectos De Estructuras De Hormigón Armado.	1990
	Símbolos Y Notaciones Matemáticas.	1945
	Ensayo De Estructuras De Hormigón Armado.	1946
	Cargas A Utilizar En El Proyecto De Edificios.	1991
	Acción Del Viento Sobre Construcciones.	1984
	Hormigón. Clasificación Por La Resistencia Característica.	1997
	Diseño De Estructuras De Hormigón Y Hormigón Armado. Notaciones, Símbolos Generales.	2001
	Proyecto Y Ejecución De Estructuras De Hormigón En Masa O Armado.	2005
	Barras De Acero Con Nervaduras Longitudinales Retorcidas En Frío Para Hormigón Armado.	1961
	Barras De Acero De Sección Cuadrada Con Aristas Redondeadas, Laminadas En Caliente Y Torsionadas En Frío, Para Hormigón Armado.	1995
	Perfiles Abiertos De Chapa De Acero Galvanizado, Conformados En Frío, Para Uso En Estructuras Portantes De Edificios A Construirse Con El Sistema Steel Framing - Parte 1: Requisitos Generales	2021
	Perfiles Abiertos De Chapa De Acero Galvanizado, Conformados En Frío, Para Uso En Estructuras Portantes De Edificios A Construirse Con El Sistema Steel Framing - Parte 2: Perfil U. Medidas Y Características Geométricas	2021
	Perfiles Abiertos De Chapa De Acero Galvanizado, Conformados En Frío, Para Uso En Estructuras Portantes De Edificios A Construirse Con El Sistema Steel Framing - Parte 3: Perfil C. Medidas Y Características Geométricas	2021
	Perfiles Abiertos De Chapa De Acero Galvanizado, Conformados En Frío, Para Uso En Estructuras Portantes De Edificios A Construirse Con El Sistema Steel Framing - Parte 4: Perfil G (Galera). Medidas Y Características Geométricas	2021
	Perfiles Abiertos De Chapa De Acero Galvanizado, Conformados En Frío, Para Uso En Estructuras Portantes De Edificios A Construirse Con El Sistema Steel Framing - Parte 5: Perfil Omega. Medidas Y Características Geométricas	2021
	Estructuras De Madera - Madera Laminada Encolada - Requisitos De Fabricación	2019

Country	Document Title	Date
Uruguay	Estructuras De Madera – Madera Laminada Encolada – Requisitos	2020
	Seguridad Y Resiliencia - Sistemas De Gestión De Continuidad Del Negocio - Requisitos	2019
	Barras Y Alambres De Acero Para Hormigón Armado. Ensayo De Tracción.	1995
	Madera Aserrada De Uso Estructural - Clasificación Visual - Madera De Pino Taeda Y Pino Ellioti (Pinus Taeda Y Pinus Elliottii)	2018
	Madera Aserrada De Uso Estructural - Clasificación Visual - Madera De Eucalipto (Eucalyptus Grandis)	2018
	Madera Aserrada De Uso Estructural - Método Para La Determinación De Las Dimensiones Y Tolerancias	2018
	Contenido De Humedad En La Madera. Determinación Por El Método De Secado En Estufa.	2007
	Contenido De Humedad De La Madera. Parte 2: Estimación Por El Método De Resistencia Eléctrica.	2007
	Contenido De Humedad De La Madera. Parte 3: Estimación Por El Método Capacitivo.	2007
	Glosario General De Maderas.	2008
Venezuela	Ordenanza Sobre Arquitectura, Urbanismo Y Construcciones En General - Nov. 1998	1998
	Estructuras De Acero Para Edificaciones. Método De Los Estados Limites	1999
	Proyecto Y Construcción De Obras En Concreto Estructural	2006
	Edificaciones Sismorresistentes Parte 1; Requisitos	2001
	Construcciones Sismorresistentes Parte 1; Requisitos	2019
	Construcciones Sismorresistentes Parte 2; Comentarios	2001
	Criterios Y Acciones Mínimas Para El Proyecto De Edificaciones	1988
	Acciones Del Viento Sobre Las Construcciones	1989
	Diseño Sismorresistente De Instalaciones Industriales	2000
	Diseño Sismorresistente De Tanques Metálicos	2000
	Especificación Técnica Sobre Requerimientos Antisísmicos	1984
	Diseño Antisísmico Para Recipientes Verticales, Chimeneas Y Torres	-
	Especificaciones Técnicas Generales De Subestaciones. Consideraciones Antisísmicas	-
	Código De Practicas Normalizadas Para La Fabricación Y Construcción De Estructuras De Acero	1982

Country	Document Title	Date
Venezuela	Diseño Sismorresistente De Recipientes Y Envases	2000
	Diseño Sismorresistente De Estructuras En Aguas Lacustres Y Someras	2000
	Sector Construcción. Mediciones Y Codificación De Partidas Para Estudio, Proyectos Y Construcción. Parte Ir-A Edificaciones	1993
	Sector Construcción. Mediciones Y Codificación De Partidas Para Estudios, Proyectos Y Construcción. Parte 2. Suplemento De La Norma Covenin-Mindur 2000/Ii.A-92	2000
	Terminología De Las normas Covenin-Mindur De Edificaciones	1998
	Proyecto, Construcción Y Adaptación De Edificaciones De Uso Público Accesibles A Personas Con Impedimentos Físicos	1991
	Entorno Urbano Y Edificaciones Publico Accesibilidad Para Las Personas	2004
	Impermeabilización De Edificaciones	1998
	Perfil De Riesgo De Desastres Para Venezuela	2015

ANNEX III - CODES ANALYZED REGARDING SUSTAINABILITY

Country	Document Title
Argentina	Ley Nro. 27.520 - Presupuestos Mínimos De Adaptación Y Mitigación Al Cambio Climático Global
	Ley Nro. 27.424 - Régimen De Fomento A La Generación Distribuida De Energía Renovable Integrada A La Red Eléctrica Pub
	Estándares Mínimos de Calidad para Viviendas de Interés Social
	Etiquetado de viviendas
	Actualización de la meta de emisiones netas de Argentina al 2030
	Vivienda y construcción sostenible
Bahamas	The Bahamas National Energy Policy 2013 2033
	The Bahamas Building Codes 3rd Edition
	CARICOM Regional Energy Efficiency Building Code
	Intended Nationally Determined Contribution (INDC) under the United Nations Framework Convention on Climate Change (UNFCCC)
Barbados	The Barbados National Building Code
	CARICOM Regional Energy Efficiency Building Code
	Barbados Nacional Energy Policy (BENP)
	Plan Implementación BENP
	Barbados 2021 Update of the first Nationally Determined Contribution
	Programa de Eficiencia Energética Residencial
	Demostración de edificios de energía inteligente para el proyecto de Barbados

Country	Document Title
Belize	Belice Building Act Chapter 131
	CARICOM Regional Energy Efficiency Building Code
	BELIZE Updated Nationally Determined Contribution
Bolivia	Ley Nro 1.333 – Ley de Medio Ambiente
	DS Nro 29.466 – Programa Nacional de Eficiencia Energética
	Ley Nro 300 - Ley Marco De La Madre Tierra Y Desarrollo Integral Para Vivir Bien
	Guia Boliviana de Construcción de Edificaciones
	Normas Técnicas de Vivienda
	Certificación ISO 50001 para la gestión energética
	Contribución Nacionalmente Determinada (CND) del Estado Plurinacional de Bolivia
	Programa Nacional de Eficiencia Energética
	Plan Estratégico Institucional 2011-2015
	Programa de proyectos de Eficiencia Energética
	Cámara de la Construcción de Santa Cruz
Brazil	Mapa de clima
	Resolución del Consejo Nacional del Medio Ambiente (CONAMA) nº 307
	Nationally Determined Contribution
	PORTARIA Nº 326
	Municipal urban codes
	Aspectos da construção sustentável no Brasil e Promoção de Políticas Públicas
	materiales de bajo carbono y energía
	Procel-Edifica
Chile	D.F.L. Nro 458 / Ley N°21.450 Ley General de Urbanismo y Construcciones
	D.T.O. N°47 Ordenanza General de Urbanismo y Construcciones
	Ley Nro 21.305 Ley Eficiencia Energética

Country	Document Title
Chile	Ley Nro 21.455 Ley Marco de Cambio Climático
	Ley Nro 20.920 Ley de Responsabilidad Extendida del Productor
	Aislación térmica - Requisitos de rotulación de materiales aislantes (Visualización gratuita disponible en www.minvu.cl)
	Doble vidriado hermético - Parte 3: Ensayo de hermeticidad (Visualización gratuita disponible en www.minvu.cl)
	Doble vidriado hermético - Parte 4: Método de envejecimiento acelerado (Visualización gratuita disponible en www.minvu.cl)
	Prestaciones higrotérmicas de los productos y materiales para edificios - Determinación de las propiedades de transmisión de vapor de agua (Visualización gratuita disponible en www.minvu.cl)
	Comportamiento térmico de puertas y ventanas - Determinación de la transmitancia térmica por el método de la cámara térmica - Parte 1: Puertas y ventanas (Visualización gratuita disponible en www.minvu.cl)
	Puentes térmicos en construcción de edificios - Flujos de calor y temperaturas superficiales - Cálculos detallados (Visualización gratuita disponible en www.minvu.cl)
	Comportamiento térmico de ventanas, puertas y contraventanas - Cálculo de transmitancia térmica - Parte 1: Generalidades (Visualización gratuita disponible en www.minvu.cl)
	Aislación térmica - Determinación de la permeabilidad del aire en edificios - Método de presurización por medio del ventilador (Visualización gratuita disponible en www.minvu.cl)
	Puertas y ventanas - Permeabilidad al aire - Clasificación (Visualización gratuita disponible en www.minvu.cl)
	Puertas y ventanas - Permeabilidad al aire - Método de ensayo (Visualización gratuita disponible en www.minvu.cl)
	Ventilación - Calidad aceptable de aire interior - Requisitos (Visualización gratuita disponible en www.minvu.cl)
	Ventilación - Calidad de aire interior aceptable en edificios residenciales de baja altura - Requisitos (Visualización gratuita disponible en www.minvu.cl)
	Doble vidriado hermético - Parte 1: Características de diseño y construcción (Visualización gratuita disponible en www.minvu.cl)
	Doble vidriado hermético - Parte 2: Ensayo de condensación (Visualización gratuita disponible en www.minvu.cl)
	Certificación CEV
	Gestión de residuos – Consideraciones para la gestión de residuos en obras de demolición y auditorías previas a obras de demolición
	Aislación térmica - Poliestireno expandido - Requisitos
	Aislación térmica - Lana mineral - Requisitos

Country	Document Title
Chile	Aislación térmica - Cálculo de coeficientes volumétricos globales de pérdidas térmicas
	Aislación térmica - Cálculo de temperaturas en elementos de construcción
	Comportamiento higrotérmico de elementos y componentes de construcción - Temperatura superficial interior para evitar la humedad superficial crítica y la condensación intersticial - Métodos de cálculo (Visualización gratuita disponible en www.minvu.cl)
	Acondicionamiento térmico - Aislación térmica - Determinación de la ocurrencia de condensaciones intersticiales
	Aislación térmica - Espuma rígida de poliuretano - Parte 1: Requisitos de los sistemas antes de la aplicación in situ
	Aislación térmica - Espuma rígida de poliuretano - Parte 2: Requisitos del producto aplicado in situ
	Aislación térmica - Materiales, productos y sistemas - Terminología
	Desempeño higrotérmico de los materiales y productos para la construcción - Determinación de las propiedades de absorción higroscópica
	Aislación térmica - Transferencia de masa - Magnitudes y definiciones
	Propiedades térmicas prácticas de materiales y elementos de construcción
	Sostenibilidad en la construcción - Indicadores de Sostenibilidad - Parte 1: Marco para el desarrollo de indicadores para edificios
	Sostenibilidad en la construcción - Indicadores de Sostenibilidad - Parte 2: Marco de referencia para el desarrollo de indicadores para obras de ingeniería civil
	Sostenibilidad en la construcción - Marco para los métodos de evaluación del desempeño ambiental de las obras de construcción - Parte 1: Edificios
	Directrices para la determinación de la calidad ambiental interna en edificios de uso comercial
	Comportamiento térmico de puertas y ventanas - Determinación de la transmitancia térmica por el método de la cámara térmica - Parte 2: Ventanas de techumbres y otras ventanas sobresalientes (Visualización gratuita disponible en www.minvu.cl)
	Prestaciones térmicas de los edificios - Coeficientes de transferencia de calor por transmisión y ventilación - Método de cálculo
	Comportamiento térmico de edificios - Transmisión de calor por el terreno - Métodos de cálculo
	Comportamiento térmico de ventanas, puertas y persianas - Cálculo de la transmitancia térmica - Parte 2: Método numérico para marcos
	Diseño ambiental de edificios - Eficiencia energética - Terminología

Country	Document Title
Chile	Ventilación - Calidad de aire interior aceptable en edificios residenciales - Requisitos
	Puentes térmicos en la edificación - Transmitancia térmica lineal - Métodos simplificados y valores por defecto
	Sostenibilidad en la construcción - Principios generales
	Sostenibilidad en la construcción - Vocabulario
	Sostenibilidad en edificios y obras de ingeniería civil - Reglas básicas para declaraciones ambientales de productos y servicios de construcción
	Desempeño energético de los edificios - Evaluación general EPB - Parte 1: Marco de trabajo general y procedimientos
	Desempeño energético de los edificios - Evaluación general de EPB - Parte 2: Explicación y justificación de ISO 52000-1
	Desempeño energético de los edificios - Indicadores, requisitos, clasificaciones y certificaciones - Parte 1: Aspectos generales y aplicación del desempeño energético global
	Desempeño energético de las edificaciones — Condiciones climáticas externas - Parte 1: Conversión de datos climáticos para cálculos de energía
	Desempeño energético de edificios - Demanda de energía para calefacción y enfriamiento, temperaturas interiores y cargas de calor sensible y latente - Parte 1: Procedimientos de cálculos
	Desempeño energético de los edificios - Cargas térmicas sensibles y latentes y temperaturas internas - Parte 1: Procedimientos de cálculo genéricos
	Desempeño energético de edificios - Indicadores de requerimientos parciales de EPB relacionados con balance térmico de energía y características de los elementos - Parte 1: Resumen de opciones
	Eficiencia energética de los edificios - Métodos para expresar la eficiencia energética y para la certificación energética de los edificios
	Vidrio en la construcción - Determinación de la transmitancia térmica (valor U) - Método de cálculo
	Reutilización de aguas - Selección de sistemas de reutilización de aguas lluvias y aguas grises
	Productos eficientes en el uso de agua (PEUA) - Clasificación y etiquetado
	Techos verdes - Terminología, clasificación y requisitos
	Desempeño energético de los edificios - Calidad del ambiente interior - Parte 1: Parámetros de entrada del ambiente interior para el diseño y evaluación del desempeño energético de los edificios
	Desempeño energético de los edificios - Procedimientos generales de evaluación del desempeño energético - Parte 2: Guía para el uso de parámetros del aporte ambiental interior para el diseño y evaluación del desempeño energético de los edificios

Country	Document Title
Chile	Diseño del ambiente de los edificios comerciales e institucionales - Calidad del aire interior - Métodos de expresión de la calidad del aire interior para la ocupación humana
	Diseño del ambiente de los edificios - Ambiente interior - Principios generales
	Aislación térmica - Magnitudes físicas y definiciones
	Aislación térmica - Determinación de resistencia térmica en estado estacionario y propiedades relacionadas - Aparato de placa caliente de guarda (Visualización gratuita disponible en www.minvu.cl)
	Aislación térmica - Determinación de propiedades de transmisión térmica en estado estacionario y propiedades relacionadas - Cámara térmica calibrada y de guarda (Visualización gratuita disponible en www.minvu.cl)
	Acondicionamiento ambiental - Materiales de construcción - Determinación de la permeabilidad al vapor de agua
	Componentes y elementos para edificación - Resistencia térmica y transmitancia térmica - Métodos de cálculo
	Acondicionamiento ambiental - Ventilación natural - Requisitos generales
	Prestaciones térmicas de los productos y componentes para edificación – Características térmicas dinámicas - Métodos de cálculo
	Ciudades y comunidades sostenibles - Vocabulario
	Desarrollo sostenible en las comunidades - Sistema de gestión para el desarrollo sostenible - Requisitos con orientación para su uso
	Arquitectura y construcción – Zonificación climática y térmica para el diseño de edificaciones
	Aislación térmica - Barreras hidrófugas para cubiertas, muros exteriores y pisos ventilados - Clasificación y métodos de ensayo
	Plan Nacional de Eficiencia Energética 2022 -2026
	Estrategia Climática de Largo Plazo
	Contribución Determinada a Nivel Nacional (NDC) de Chile
	Programa Casa Solar
	Programa Ponle energía a tu escuela
	Proyectos de Mejoramiento de la Vivienda, del Programa de Protección del Patrimonio Familiar (PPPF)
	Certificación CVS

Country	Document Title
Colombia	Decreto de Ley 3571 - Ministerio de Vivienda Ciudad y Territorio
	Decreto 1285 de 2015 título 7
	Resolución 0549
	Guía de Construcción sostenible para el ahorro de agua y energía en edificaciones
	Mapa de clasificación climática
Costa Rica	Ley Nro 7447
	INTE C170: 2020 Requisitos para Edificaciones Sostenibles en el Trópico (RESET)
	Programa Energías Renovables y Eficiencia Energética en Centroamérica (4E)
Ecuador	Ley Orgánica de Eficiencia Energética
	Plan Nacional de Eficiencia Energética
	Estrategia Nacional de Cambio Climático
	Norma NEC Eficiencia Energética en la Edificación Residencial
El Salvador	Decreto Nro 233 Ley del Medio Ambiente
	Decreto Nro 527 Ley de Gestión Integral de Residuos y Fomento al Reciclaje
	Reglamento a la ley de Urbanismo y Construcción en lo relativo a parcelaciones y urbanizaciones habitacionales
	Programa Energías Renovables y Eficiencia Energética en Centroamérica (4E)
Guatemala	Plan Nacional de Eficiencia Energética
	Decreto N° 7 Ley Marco para regular la reducción de la vulnerabilidad, la adaptación obligatoria ante los efectos del cambio climático y la mitigación de GEI
	RG-1 Plan Regulador, Reglamento de construcción de la ciudad de Guatemala
	Anteproyecto Ley Eficiencia Energética
	Certificación CASA

Country	Document Title
Guayana	Guyana Energy Agency Act 1997,
	Guyana Energy Agency (Amendment) Act 2004,
	National Climate Change Policy and Action Plan
	Guyana NDC
	CARICOM Regional Energy Efficiency Building Code
	Guyana Energy Agency
Haiti	Plan de acción climática a la Convención Marco de Naciones Unidas sobre Cambio Climático (CMNUCC)
	CARICOM Regional Energy Efficiency Building Code
Honduras	Decreto 112-2007
	Decreto PCM 010-2012
	Código Hondureño de Construcción
	Manual de Eficiencia Energética en la Construcción de Edificaciones para Honduras
	Programa Energías Renovables y Eficiencia Energética en Centroamérica (4E)
Jamaica	Conservación nacional de la energía y política de Eficiencia 2010-2030. Asegurando el futuro energético de Jamaica
	CARICOM Regional Energy Efficiency Building Code
	Plan de acción climática a la Convención Marco de Naciones Unidas sobre Cambio Climático (CMNUCC)
Mexico	Ley General de Cambio Climático
	Estrategia Nacional de Cambio Climático
	Ley General de Economía Circular
	Contribución Determinada a nivel Nacional
Nicaragua	Ley de Eficiencia Energética
	Norma técnica obligatoria nicaragüense. Eficiencia Energética
	Fondo nacional de Eficiencia Energética FONDEFER
	Programa Nacional de Eficiencia Energética PRONAEE

Country	Document Title
Panama	Ley UREE (Uso Racional y Eficiente de la Energía)
	PEN 2015-2050 se introduce la Política Energética para el Uso racional y Eficiente de la Energía
	Eficiencia Energética en Acondicionadores de Aire
	Guía de Construcción Sostenible de Panamá
	CDN1 Actualizada República de Panamá
Paraguay	Ley de Eficiencia Energética
	DECRETO PARA ESTABLECER LA POLÍTICA NACIONAL DE MITIGACIÓN Y ADAPTACIÓN AL CAMBIO CLIMÁTICO Y DE CREACIÓN DEL SISTEMA NACIONAL DE RESPUESTA AL CAMBIO CLIMÁTICO
	Certificación de Construcción sustentable “Hacia ciudades más sostenibles: Una certificación de Construcción Sostenible para Paraguay”
Peru	Ley Marco sobre Cambio Climático
	Plan Nacional de Adaptación
	Código técnico de construcción Sustentable
	Norma EM 110 Confort térmico y lumínico
	Zonificación climática Perú
	Bono Verde
Dominican Republic	Vice Ministerio de Ahorro y Eficiencia Energética
	Anteproyecto ley EE
	NDC
	CARICOM Regional Energy Efficiency Building Code
Surinam	Plan de acción climática a la Convención Marco de Naciones Unidas sobre Cambio Climático (CMNUCC)
	Nationally Determined Contribution Suriname
	CARICOM Regional Energy Efficiency Building Code
Trinidad and Tobago	CARICOM Regional Energy Efficiency Building Code
	Draft National Standard for Public Comment – Trinidad and Tobago Energy Efficiency Building Code

Country	Document Title
Uruguay	Ley de uso eficiente de la energía
	Estándares de requisito y desempeño para la vivienda de interés social
	Aislamiento térmico de edificios. Zonificación climática.
	Primera Contribución Determinada a nivel Nacional al Acuerdo de París
	Años Meteorológicos típicos
	Evaluación de desempeño energético de viviendas. Edición para viviendas (EDEE v1.0).
	HTERM 3.0
Venezuela	Ley de Uso Racional y Eficiente de la Energía
	Actualización NDC Venezuela
	PROGRAMA BEA

Social Infrastructure

Resilience and SUSTAINABILITY IN BUILDING CODES in Latin America and the Caribbean

Comparative regional analysis and strengthening opportunities

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