

BUILDING REGULATION FOR RESILIENCE

A Global Assessment of Building Codes

CURRENT STATUS AND EVOLVING NEEDS TO PROMOTE
RESILIENT, GREEN AND INCLUSIVE BUILDINGS



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Foreword

Society rightly expects buildings to provide safe, comfortable, and healthy spaces for people to live and work. At the same time, the built environment must adapt to changing demographics, accelerating urbanization, and growing impacts of disasters and climate hazards.

This transformation is fueling a surge in new construction, particularly in regions such as Africa, Asia, and Latin America where populations are expanding rapidly. Elsewhere, the risk lies in managing and maintaining aging infrastructure. There is a growing global imperative to improve the sustainability of buildings, and ensure they are universally accessible to meet the needs of people of all ages and abilities.

In the next few decades, as cities grow and populations age, these challenges will only intensify. Thus, investment in modernizing building codes and enforcement mechanisms is urgent. Otherwise, the world risks locking in a costly and unsustainable cycle of reacting to shocks and stresses rather than preventing them through proactive, high-quality construction.

Building codes and effective code compliance mechanisms are among the most powerful tools to improve the safety and resilience of the built environment. They help reduce disaster risks that are increasing in frequency and severity, including storms, extreme heat, flooding, and wildfires. In addition, having effective codes in place can drive sound design and construction practices across the entire building lifecycle, reducing the risk of collapse, ensuring the safety of existing buildings, and guiding safe structural modifications. Even in countries where non-engineered or vernacular construction is common, simplified building code provisions for small-scale structures can still drive safer construction practices.

This publication —developed in collaboration with the Inter-American Development Bank (IDB) and made possible with support from the Global Facility for Disaster Reduction and Recovery (GFDRR) and the government of Japan, through the Japan-World Bank Program for Mainstreaming Disaster Risk Management in Developing Countries—assesses building codes and compliance environments across selected countries from around the world.

It offers practical case studies showing how countries are progressing on this journey and recommendations to help enhance building codes and the wider regulatory and enabling environment for code compliance. Strengthening these systems is critical to protecting people, economies, and the quality of the built environment for generations to come.

We hope this publication serves as a valuable resource for policymakers, practitioners, and development partners working to build a safer, greener and more inclusive future.

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Acronyms and Abbreviations

AAL	Average Annual Loss
AALR	Average Annual Loss Ratio
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
BIM	Building Information Modeling
BRCA	Building Regulatory Capacity Assessment
BRR	Building Regulation for Resilience
BREEAM	Building Research Establishment Environmental Assessment Methodology
CBD	Central Business District
CEN	Comité Européen de Normalisation (European Committee for Standardization)
CP	Collapse Prevention
CSC	Concrete Sustainability Council
CTN	Complementary Technical Norm
CUBiC	Caribbean Uniform Building Code
DRM	Disaster Risk Management
EAC	East African Community
EAP	East Asia & Pacific
ECA	Europe & Central Asia
EDGE	Excellence in Design for Greater Efficiencies
EFTA	European Free Trade Association
EUI	Energy Use Intensity
EPBD	Energy Performance of Buildings Directive
EU	European Union
FEMA	Federal Emergency Management Agency
FRP	Fiber-Reinforced Polymer



GEM	Global Earthquake Model
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	Green House Gas
GPS	Global Positioning System
HEPA	High-efficiency Particulate Air
HVAC	Heating, Ventilation and Air Conditioning
IAEE	International Association for Earthquake Engineering
IBC	International Building Code
ICC	International Code Council
ICT	Information and Communication Technology
IECC	International Energy Conservation Code
ISO	International Organization for Standardization
JRC	Joint Research Centre
LAC	Latin America & Caribbean
LCA	Life-cycle Assessment
LS	Life Safety
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
MENA	Middle East & North Africa
MEP	Mechanical, Electrical and Plumbing services
MMC	Modern Methods of Construction
NBC	Nepal Building Code
NDC	National Determined Contribution
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
NSCP	National Structural Code of the Philippines
OECD	Organisation for Economic Co-operation and Development
OECS	Organisation of Eastern Caribbean States
PBSD	Performance-based Seismic Design
PGA	Peak Ground Acceleration
PSHA	Probabilistic Seismic Hazard Analysis
PV	Photovoltaic
RC	Reinforced Concrete



SA	South Asia
SSA	Sub-Saharan Africa
SABS	South African Bureau of Standards
SHM	Seismic Hazard Model
SNIP	Stroitelnye Normy i Pravila (Russian Construction Codes and Regulations)
SRI	Solar Reflectance Index
TMS	The Masonry Society
UBC	Uniform Building Code
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
URM	Unreinforced masonry
WC	Water Closet (e.g., toilet)
WHO	World Health Organization
WUI	Wildland-Urban Interface
WWR	Window-to-Wall Ratio



Executive Summary

Executive Summary

The quality of the built environment is fundamental to the functioning, health, and sustainability of societies and economies. Rapid population growth and urbanization are expected to increase the proportion of people living in cities to nearly 70 percent by 2050. This means that a significant portion of global building stock that will exist in 2050 is yet to be constructed (UN, 2019). Much of this growth will occur in African, Asian, and Latin American cities, presenting both opportunities and challenges. Enhanced building codes and compliance mechanisms are essential tools to address the impacts of natural disasters, urbanization, and the need for accessible buildings. Modern building codes, finely tuned to local contexts, can create vibrant and resilient urban landscapes that stand the test of time.

Additionally, the increasing frequency and severity of tropical cyclones, floods, extreme heat and other climate-related events, demand comprehensive design provisions in building codes to mitigate damage and ensure habitability. Improved building codes can reduce risks for new construction and play a crucial role in ensuring the safety and adaptive reuse of existing structures. This approach enhances the resilience of the built environment and ensures that cities are safe, healthy, and sustainable for future generations.

PURPOSE AND SCOPE OF THE ASSESSMENT

This report has two main objectives:

- » **Provide a snapshot of the status of building codes in selected countries globally** to identify potential areas for improvement in code provisions and the wider code implementation environment.
- » **Formulate recommendations on how to enhance building codes** to improve the structural safety and resilience, sustainability and universal accessibility of buildings given the increasing impacts of natural hazards and climate risk.

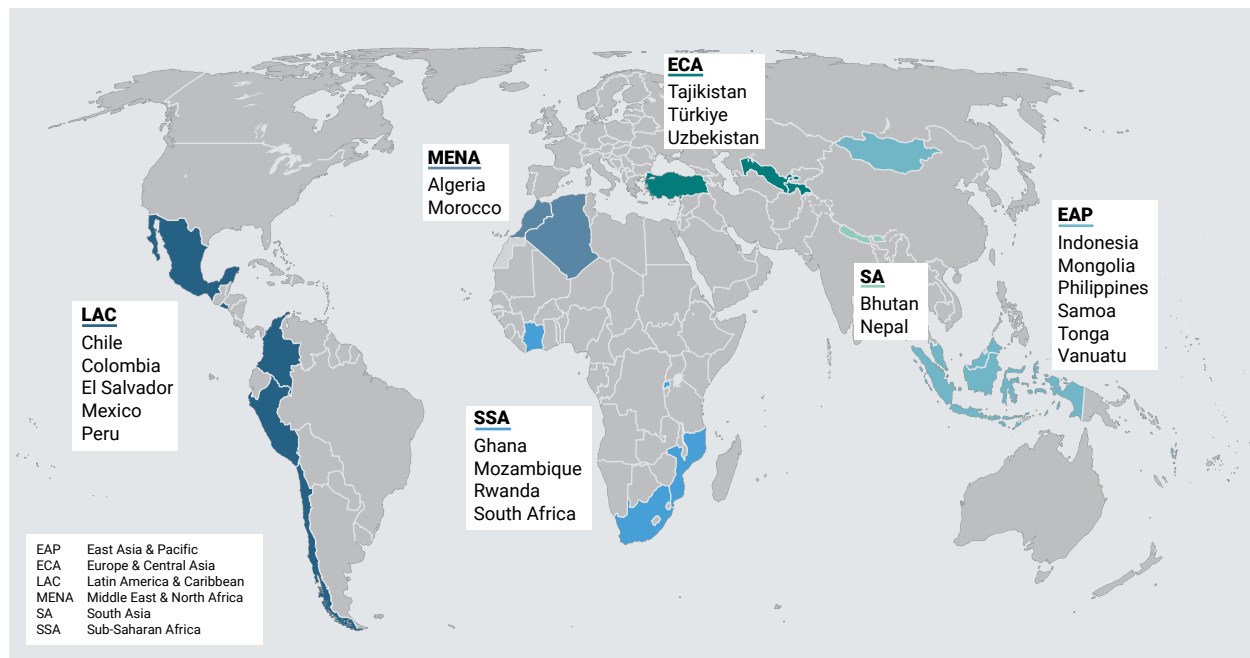
This report assesses the technical content of building codes for selected countries and related code implementation mechanisms. It considers three priority areas: structural safety and resilience, green buildings, and universal accessibility. It aims to support a wide range of actors involved in building regulatory policy and code development, including policy makers, government agencies at national and local level, technical professionals, academics, and development partners.

The assessment is limited to provisions related to buildings and does not cover other types of construction such as energy, water, communications or transport infrastructure. Although selected building control regulations and related processes were assessed, the study did not cover planning regulations. This report builds upon the work of previous regional studies on the status of building codes carried out in [Sub-Saharan Africa](#) (World Bank, 2023c), [Latin America and the Caribbean](#) (IDB, 2023), and [Pacific Island countries](#) (PRIF, 2021), as well as the flagship report: [Building Regulation for Resilience: Managing Risks for Safer Cities](#) (World Bank, 2016).

METHODOLOGY

This review examined the content, organization, and accessibility of building codes and related control mechanisms in 22 countries across six geographic regions. Countries were prioritized based on expected losses from seismic and cyclonic wind events, regional distribution, and status of their building code. See Map E.1.



Map E.1 // The 22 countries selected for review of building codes and implementation mechanisms

The assessment framework covered three main topic areas: structural safety and resilience, green building, and universal accessibility. Each main topic area had evaluation statements for selected subtopics based on contents covered in global building codes and expert opinion to check for coverage by topic area. In addition, the study assessed regulatory jurisdictions, regulatory structure, types of buildings covered, and accessibility of regulations. Data were collected using standardized forms completed by local technical experts, in combination with desktop review. The country data were then validated by a team of global specialists and structured into a database for analysis and visualization. This assessment provided a high-level evaluation of the contents and implementation environments of building codes across the selected countries. It is important to note that the assessment did not evaluate the quality and comprehensiveness of the code provisions in detail.

KEY FINDINGS

Based on the study findings, some broad areas for improvement were identified:

- » **Code Development Processes:** Government agencies leading code development often lack clearly defined processes, roles and responsibilities, and underestimate the resources needed, leading to a lengthy code development process. The triggers for initiating code updates are often not specified.
- » **Code Tailoring for Country Context:** Codes can be better tailored to local contexts, considering factors like development patterns, hazards, climatic conditions, and construction practices. Simplified provisions for small-scale buildings are often not in place.
- » **Completeness and Consistency of Code Provisions:** Some codes contain incomplete procedures, inconsistent references, and incompatible provisions across different topic areas. Effective compliance is challenging when code provisions contain inconsistencies and contradictions, or when a code is not aligned with its associated regulations and standards.

- » **Provisions for Existing Buildings:** Limited provisions are contained in the codes to address the safety, resilience, and accessibility of existing buildings in most countries, including provisions for vulnerability assessment, rehabilitation, and retrofit.
- » **Seismic and Wind Design Provisions:** Some countries have out-of-date and/or incomplete seismic and wind design provisions. For instance, some lack up-to-date hazard design criteria and comprehensive design and detailing requirements for structural and nonstructural elements to limit damage and protect building occupants. Few countries incorporate approaches for the design of buildings to minimize disruption during and after disaster events, through setting more stringent prescriptive requirements or targeting higher performance objectives with performance-based design methods.
- » **Climate Change Adaptation:** Codes in the study countries rarely address climate-related hazards like extreme heat, flooding, and wildfires.
- » **Green Building and Universal Accessibility Requirements:** Adoption of green building provisions, particularly for energy efficiency and low-carbon design, is insufficient. Many provisions related to green buildings and universal accessibility are voluntary and a more intensive effort is needed to transition to more mandatory requirements.
- » **Access to Building Regulations:** Many countries lack free, online access to all building code documents in official languages, hindering effective implementation.
- » **Code Implementation:** Building control can benefit from more efficient and transparent processes as well as targeting resources toward higher-importance buildings to better support compliance. Capacity building in both public and private sectors is needed.

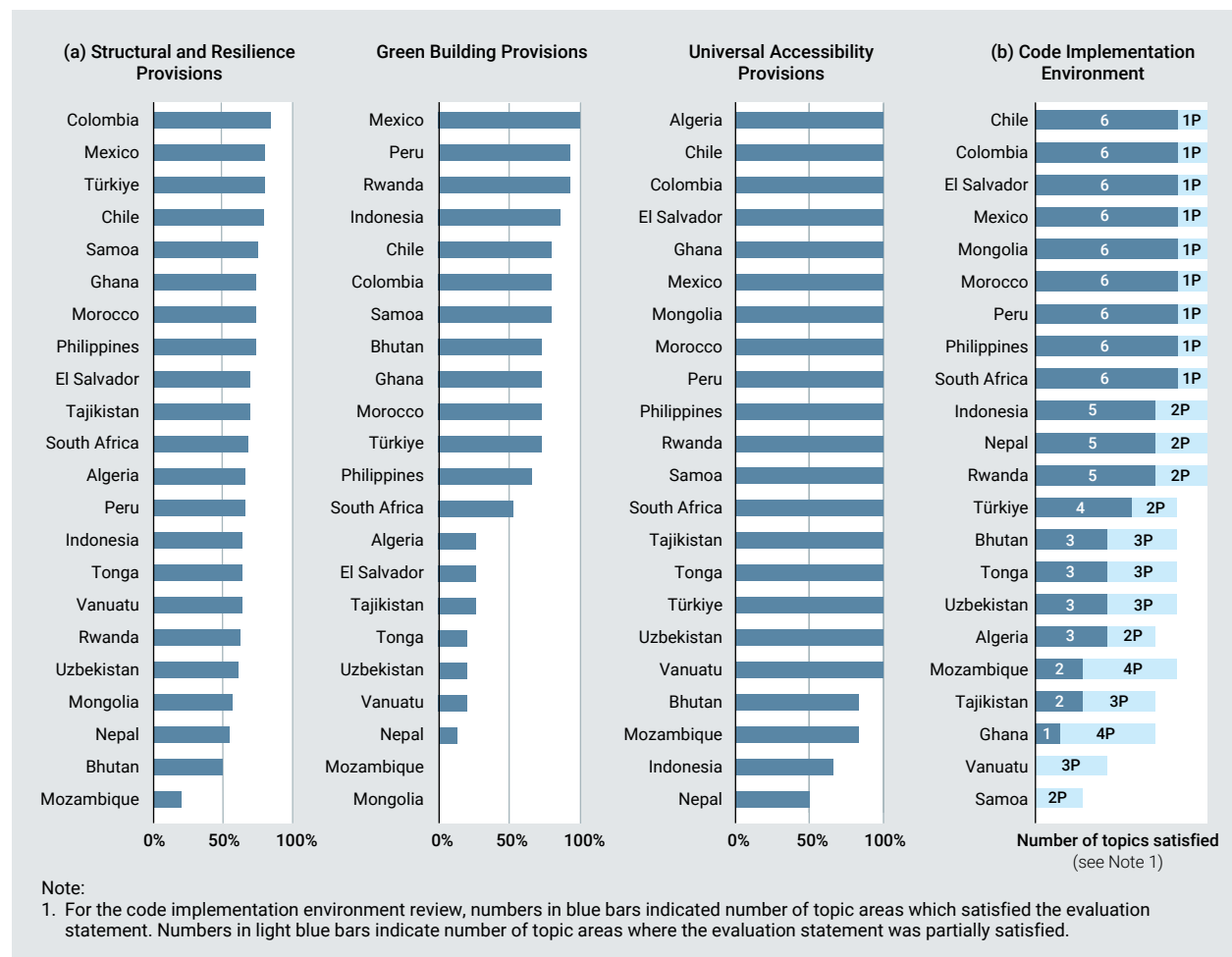
The assessment provides insights into which areas to prioritize in further code development and where additional investment in aspects of the code implementation environment could improve code compliance in the study countries. Some countries have advanced the development of their building codes in the three main areas assessed and already have in place most of the key elements needed for a robust code implementation environment like Chile, Colombia, and Mexico. Other countries, such as Ghana or Samoa, have made progress in code development but more investment is needed to refine code provisions and build capacity and complementary mechanisms for effective code implementation. Finally, countries such as Mozambique have less comprehensive and up-to-date building regulatory environments overall—in terms of building code coverage of key topics and code implementation environment. The remaining countries are at an intermediate level of maturity (codes and implementation environment).

See Figure E.S.1 for a high-level summary of results by country and Figure E.S.2 for key results by topic area for selected high priority topics. Refer to the Country Profiles in Annex A for more detailed findings for each of the 22 study countries.

A glossary of key terms is provided in Annex E.



Figure E.S.1 // (a) Summary of code coverage for structural and resilience provisions, green building provisions and universal accessibility provisions; and (b) Code implementation environment evaluation



Based on the assessment of code contents, Figure E.S.2 below lists priority areas for code improvements linked to the percentage of countries which covered them. The assessment did not evaluate the comprehensiveness or quality of the provisions in detail, so countries with some coverage can also often benefit from code improvements in the topic areas.

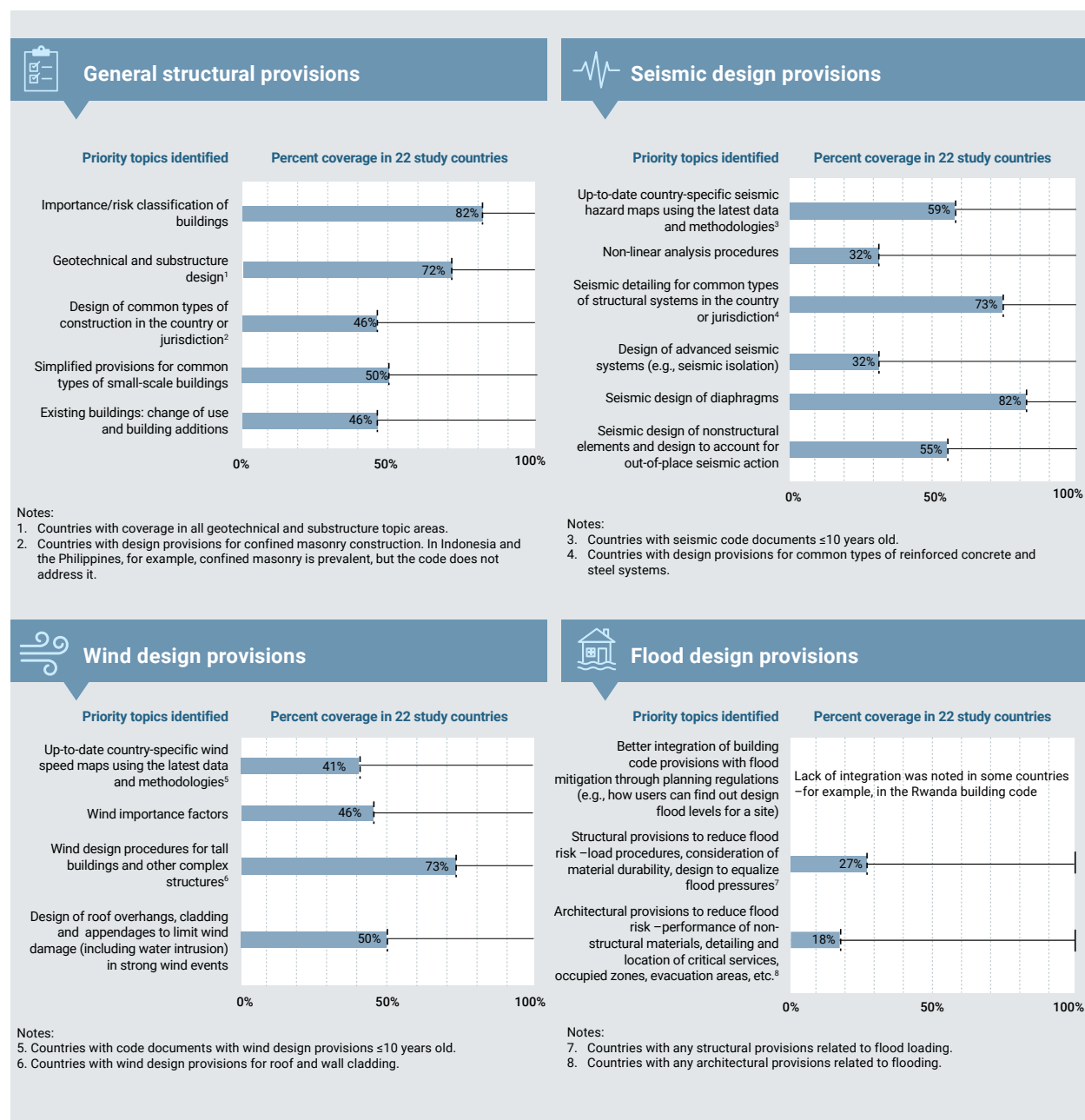
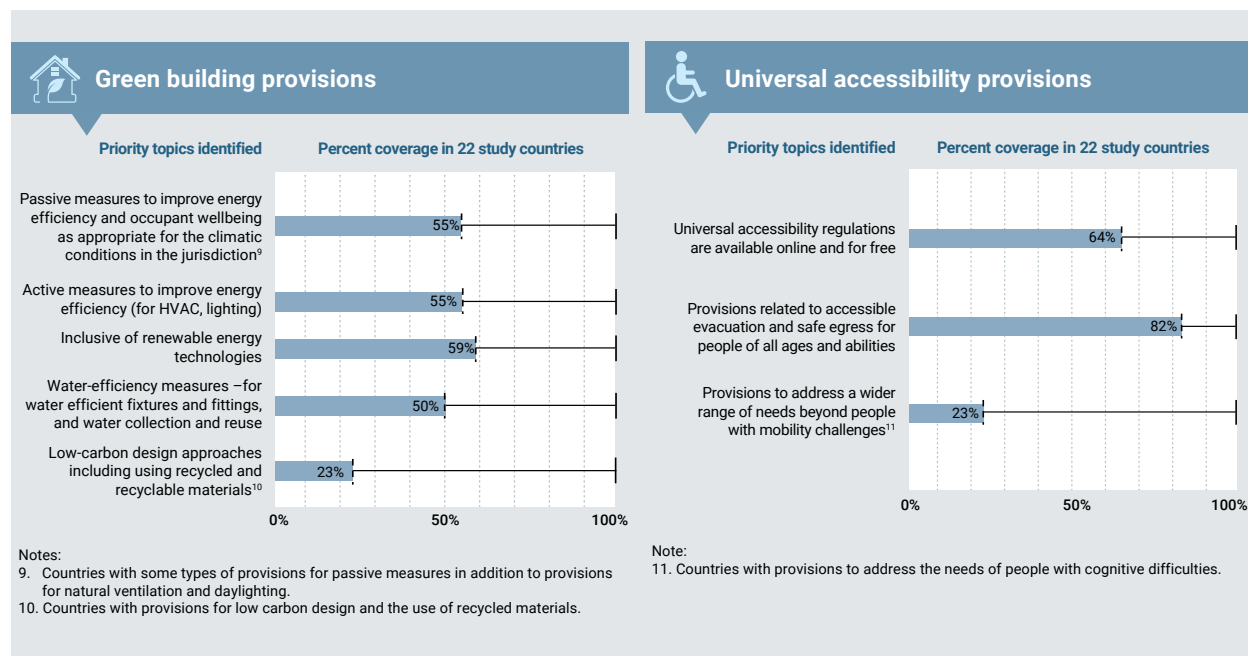
Figure E.S.2 // Priority topic areas for building code development based on the findings in the study countries

Figure E.S.2 // Priority topic areas for building code development based on the findings in the study countries (cont.)

KEY RECOMMENDATIONS

Based on the findings of the study, the following key recommendations have been identified. Although the study was high-level, the recommendations can be useful as a starting point ahead of more detailed analysis to inform prioritized actions for specific countries.

Topic 1 Recommendations: Building Code Development

R1.1 Set clear processes for code development with defined roles and responsibilities, stakeholders, activities, data requirements, and timelines, supported by adequate resources.

Developing building codes is an intensive exercise which requires clearly defined processes, roles, responsibilities, and resource allocation, with wide stakeholder participation and a rigorous validation process. Those leading code development should consider setting the criteria that trigger code updates and whether sharing resources and knowledge through regional code development activities would be beneficial.



For further information:

Chapter 2, Section 2.2.3 & Table 2.2



Key Stakeholders:

National government and/or local government, bodies leading code development

R1.2 Ensure that building codes are well-tailored to the country context.

Building codes need to be well-tailored to the local context, including local development patterns, hazards, climatic conditions, social and cultural factors, common construction practices, and construction sector capacity. Adapting model codes or another country's code to a new country or jurisdiction can be more efficient than developing new codes from scratch, but it still requires substantial effort. For example, country-specific design criteria for hazards are generally needed, and modifications to the code may be needed to align with local capacity and common construction practices.



For further information:

Chapter 2, Section 2.2.2 & Table 2.2



Key Stakeholders:

Bodies leading code development, disaster risk management (DRM) agencies, code development technical committees, wider code development stakeholders

R1.3 Ensure that building code provisions are complete and consistent.

During code development, it must be verified that compliance procedures for design and construction are complete, and code documents have consistent and compatible provisions, including when other codes and/or international standards are referenced.

**For further information:**

Chapter 2 & Table 2.2

**Key Stakeholders:**

Code development technical committees, standards development organizations

R1.4 Harmonize code provisions across different topic areas.

Code provisions are typically developed by expert specialists in a siloed manner, whereas a multidisciplinary approach would better balance risks and benefits and achieve harmonization of provisions across topic areas. For example, fire risk must be considered when introducing green building measures.

**For further information:**

Chapter 2, Table 2.2, Chapter 4, Section 4.2.5

**Key Stakeholders:**

Code development technical committees, wider code development stakeholders

Topic 2 Recommendations: Code Provisions for Small-Scale Buildings

R2.1 Include simplified provisions for common types of small-scale buildings.

Including simplified provisions, communicated in a straightforward manner for common types of small-scale buildings, can increase code compliance and promote safe construction. This approach better tailors the provisions to local capacity and the types of buildings commonly constructed by communities, often without input from design and construction professionals.

**For further information:**

Chapter 4, Sections 4.1.2.7 & 4.2.1, Chapter 6, Section 6.3.2

**Key Stakeholders:**

Bodies leading code development, code development technical committees, wider code development stakeholders, community- and self-builders, insurance industry

R2.2 Incorporate code provisions for vernacular construction that are adapted for local hazards.

Including code provisions for local vernacular construction types that are adapted for local hazards has the benefit of promoting safe construction practices for local materials and techniques.

**For further information:**

Chapter 4, Section 4.1.2.4 & Chapter 5, Section 5.3.2

**Key Stakeholders:**

See R 2.1, also DRM agencies

Topic 3 Recommendations: Code Provisions for Existing Buildings

R3.1 Include code requirements for modifications and/or change of use of existing buildings.

Building codes predominantly address the design and construction of new buildings. However, to address risks to existing buildings and provide clear guidance on adaptive re-use of buildings to improve sustainability, code provisions should also cover existing buildings.

**For further information:**

Chapter 4, Sections 4.1.2.6 & 4.2.4, Chapter 5, Section 5.1.3, Chapter 9, Section 9.2.4, Chapter 10, Section 10.2.1

**Key Stakeholders:**

Bodies leading code development, code development technical committees, wider code development stakeholders, DRM agencies

R3.2 Include code provisions for building assessment, rehabilitation and retrofit.

Incorporating existing building provisions allows for the proactive assessment and retrofitting of buildings. This can improve safety and reduce damage from disaster events, protecting lives and leading to faster recovery times.

Topic 4 Recommendations: Code Provisions for Seismic Design

R4.1 Review and periodically update country-specific seismic hazard maps.

Countries can benefit from improving the quality and resolution of seismic hazard maps in the building codes, to more accurately reflect the best available information, using up-to-date methodologies to inform building design criteria.



For further information:

Chapter 5, Sections 5.1.1 & 5.3.1



Key Stakeholders:

Bodies leading code development, code development technical committees, wider code development stakeholders, DRM agencies

R4.2 Improve critical elements of seismic design code requirements, such as geotechnical provisions, ductile detailing provisions, and diaphragm design provisions.

Geotechnical and foundation design provisions are particularly critical in seismic regions, to ensure that foundations can withstand seismic actions. Diaphragms are a critical component to effectively transfer lateral loads to the buildings' main lateral system. Ductile detailing provisions for structural elements are essential to ensure they can absorb and dissipate earthquake-induced energy through deformations—as opposed to failing in an undesirable, brittle manner, which may lead to partial or total building collapse.



For further information:

Chapter 4, Section 4.1.2.3, Chapter 5, Section 5.1.3



Key Stakeholders:

See R 4.1

R4.3 Improve code provisions for the design of nonstructural components to protect occupants and limit service disruption after major earthquakes.

To enhance the seismic performance of nonstructural components, codes can limit building lateral displacements and include design/detailing requirements for verifying seismic safety of nonstructural elements and their connections. Preventing damage to nonstructural components will reduce harm to occupants and assets within buildings and ensure that services can be restored more quickly after an earthquake.



For further information:

Chapter 5, Section 5.1.3



Key Stakeholders:

See R 4.1

R4.4 Consider the inclusion of seismic design provisions to limit damage and service disruption after an earthquake, especially for selected types of higher importance/critical buildings.

Recent earthquakes have shown that buildings designed for Life Safety performance may be uneconomical to repair. It can be desirable to include code provisions intended to achieve enhanced performance, including functional recovery objectives, and as a result limit damage in the structural and nonstructural building systems through more stringent prescriptive requirements, performance-based design approaches and nonlinear seismic analysis procedures, and/or application of advanced seismic systems (such as base isolation devices and dampers).



For further information:

Chapter 2, Box 2.5, Chapter 4, Section 4.2.2, Chapter 5, Section 5.1.3



Key Stakeholders:

See R 4.1

Topic 5 Recommendations: Code Provisions for Wind Design

R5.1 Review and periodically update country-specific wind design maps.

Codes in some countries can benefit from including up-to-date wind design maps, developed using a probabilistic methodology, to ensure the safety of occupants and limit damage and disruption caused by strong wind events.



For further information:

Chapter 6, Section 6.1 & 6.3.1



Key Stakeholders:

Bodies leading code development, code development technical committees, wider code development stakeholders, DRM agencies

R5.2 Improve wind design provisions for roofs, cladding, and other non-structural components to increase the resilience of buildings to strong wind events.

Provisions related to the design of roof overhangs, roof cladding, wall cladding and other appendages to resist wind loading can reduce damage to building components from wind loads—leading to faster recovery times after strong wind events.



For further information:

Chapter 6, Sections 6.1, 6.2 & 6.3.2



Key Stakeholders:

See R 5.1

R5.3 Depending on the in-country capacity, consider the inclusion of performance-based design approaches in the code provisions for wind design of tall buildings and other complex structures.

Codes can prescribe special design and analysis procedures to capture dynamic behavior under wind loading to ensure the safety of tall buildings and other complex structures, including performance-based design approaches.



For further information:

Chapter 2, Box 2.5, Chapter 4, Section 4.2.2, Chapter 6, Sections 6.1 & 6.3.3



Key Stakeholders:

See R 5.1

Topic 6 Recommendations: Code Provisions to Address Climate Hazards

R6.1 Incorporate green building measures to mitigate the impacts of extreme heat.

Codes should consider including provisions to reduce the risks of extreme heat for building occupants such as for natural ventilation, green and/or 'cool' roofs, and external solar shading. Codes can also combine green building measures with other strategies related to the wider site such as requirements for external planting to provide shade and specifications for the solar reflectivity of site hardscaping.



For further information:

Chapter 9, Sections 9.1.2 & 9.3.1



Key Stakeholders:

Bodies leading code development, planning authorities, code development technical committees, wider code development stakeholders, DRM agencies

R6.2 Incorporate provisions to mitigate the impacts of flooding.

Flood risks are predominantly managed through planning regulations that prohibit construction on flood-prone sites and help determine appropriate locations to construct buildings. As flood risk is increasing due to the impacts of climate change and pressure on land for development, there is a need for building codes to address flooding, with provisions to limit building damage and disruption and designate safe areas for evacuation if a building is flooded.



For further information:

Chapter 7, Sections 7.1, 7.2 & 7.3



Key Stakeholders:

See R 6.1

R6.3 Incorporate provisions for buildings and their surrounding sites to reduce the risk of wildfires.

Although the study did not evaluate building code provisions to reduce the risk of wildfires (still very rarely included in building codes), wildfires are becoming a growing problem due to the impacts of climate change. Measures to reduce the risk of wildfire include using fire-resistant materials, detailing to prevent ignition from wind-blown embers, and site-related measures such as controlling flammable vegetation.



For further information:

Chapter 8, Section 8.1



Key Stakeholders:

Bodies leading code development, planning and land management authorities, code development technical committees, wider code development stakeholders, DRM agencies

Topic 7 Recommendations: Green Building and Universal Accessibility Provisions

R7.1 Increase the adoption of green building provisions related to energy efficiency.

Code provisions to improve energy efficiency are needed to make building operations more affordable and support global sustainability goals. At present, these provisions are often voluntary, or mandatory only for certain types of buildings. Also see R 7.4.



For further information:

Chapter 9, Sections 9.1, 9.2, & 9.3.2



Key Stakeholders:

National and/or local government, bodies leading code development, code development technical committees, wider code development stakeholders

R7.2 Increase the adoption of green building provisions related to water efficiency, collection, and reuse.

Water efficiency measures are often relatively easy to implement and can help to address the problem of water scarcity, which is increasingly common due to the impacts of climate change.

R7.3 Incorporate provisions for low-carbon design.

The building sector accounts for 37 percent of total greenhouse gas (GHG) emissions worldwide, with around one quarter of those emissions associated with embodied carbon (GlobalABC, 2024). Building codes can promote low-carbon design through additional requirements related to the use of lower-carbon materials, consideration of life-cycle approaches (for example, recycling and recyclable materials), and expanding existing building provisions to enable adaptive reuse of existing buildings.

**For further information:**

Chapter 9, Sections 9.1, 9.2, & 9.3.2

**Key Stakeholders:**

See R7.1

R7.4 Introduce mandatory provisions to advance green buildings and universal accessibility where appropriate.

Green building provisions and universal accessibility provisions are often voluntary. Countries can support the transition to stricter requirements for buildings by mandating green building and universal accessibility requirements for public buildings, while supporting market-driven mechanisms such as green building certification systems and financial incentives for privately-owned buildings. In addition, these provisions should be expanded to address retrofits to existing buildings.

**For further information:**

Chapter 9, Chapter 10

**Key Stakeholders:**

See R7.1

Topic 8 Recommendations: Building Code Implementation

R8.1 Ensure that efficient and transparent building control processes are in place, with streamlined processes and information available online.

Transparent and streamlined building control processes are needed to facilitate compliance. More efficient processes, including digitized systems, can also reduce the time and resources needed within building control.

**For further information:**

Chapter 11

**Key Stakeholders:**

National and/or local government, bodies leading building regulations development, building control departments, design and construction professionals, professional organizations, insurance industry

R8.2 Target building control resources toward buildings of higher importance.

Optimized processes with requirements linked to a categorization based on project risk level and/or importance of the building can ensure that building control requirements are proportionate, and less onerous for typical buildings. Benefits include a more effective use of resources for building control and reduced barriers for compliance.

R8.3 Leverage the engagement of the private sector paired with mechanisms to monitor the performance of the private sector.

If building control resources are limited, countries can consider supplementing building control capacity with private-sector participation. To ensure quality control and avoid conflicts of interest, mechanisms are required to ensure the use of qualified personnel and systems to monitor the performance of private-sector engagement.

R8.4 Where appropriate, consider incentives for compliance.

If resources are available, it can be useful to introduce incentives to facilitate investment in the safety, resilience, sustainability and universal accessibility of buildings, for both existing and new private buildings. Incentives can be financial such as grants, subsidies, tax breaks, government-backed low-interest loans, or take the form of expedited or relaxed building control processes, or recognition, promoted through certification or awards.

R8.5 Invest in capacity building to support code compliance.

Continuous investment in capacity building is essential to support code compliance. Capacity building can take the form of guidance and training for public- and private-sector stakeholders, including formal routes to professional licensing and/or certification. In addition, public communication campaigns and community engagement can raise awareness of the benefits of code compliance and gather valuable feedback on how best to implement building codes in practice.





1. Introduction

1. Introduction

The built environment is under pressure as disasters and extreme events become increasingly frequent. To limit damage and disruption from recurring events, buildings must be more resilient to both sudden-onset and chronic hazards and risks, while also meeting minimum standards for structural safety, accessibility, and comfort (Harle et al., 2024; Al-Humaiqani and Al-Ghamdi, 2022). The devastating earthquakes in Türkiye and Syria in February 2023 served as a reminder of the scale of destruction inflicted by disasters on the built environment and communities. The earthquakes resulted in the deaths of 56,683 people in Türkiye and Syria, affected an area of 350,000 km² (similar to the size of Germany), and led to the destruction or severe damage of more than 300,000 buildings, according to UN estimates (DEC, 2024). Although chronic hazards, such as frequent and more intensive heat or water scarcity, receive less attention than less frequent disaster events such as earthquakes or severe flooding, their ongoing impacts can be of a similar magnitude or even exceed the most severe disaster losses. For example, the World Health Organization (WHO) estimates that heat-related mortality in the WHO European region has increased by 30 percent over the past 20 years, with more than 175,000 heat-related deaths occurring in the region every year on average (WHO, 2024).

Investing in a more resilient and sustainable built environment as urbanization is increasing is one of the most effective ways to mitigate and adapt to climate change. Climate change impacts are a major driver of risk to the built environment, with storms and other strong wind events, floods, and heat waves occurring with increasing frequency and severity. At the same time, the construction sector was estimated to generate 37 percent of all greenhouse gas emissions in 2021 (GlobalABC, 2024), with the sector expected to grow on average at six percent per year over the 2023–2037 period (Oxford Economics, 2023).

It is also increasingly recognized that people of all ages and abilities should be able to fully participate in society and access essential services. For example, the World Health Organization's Global report on health equity for persons with disabilities (WHO, 2022), estimated that 16 percent of the world's population, around 1.3 billion people, live with some form of disability. Due to global trends such as aging populations, and the impacts of disasters and climate change, the number of persons with disabilities is expected to increase (World Bank, 2022). Therefore, there is a strong need to integrate the principles of universal accessibility or 'barrier free' design into the built environment.

Effective building regulations are essential to address the multifaceted challenges posed by climate change, frequent disasters, and the growing societal expectation for buildings to be accessible to users of all ages and abilities. These regulations ensure that buildings are not only safe and sustainable but also resilient and inclusive. As a critical component of building regulatory frameworks, building codes establish a comprehensive set of requirements for the design and construction of buildings. Promulgated by local or national governments, these codes provide a structured approach to ensure that all construction activities meet specific safety, sustainability, and accessibility standards. Building codes often refer to or incorporate other standards, such as material design standards, testing standards, and other topic-specific guidelines. By doing so, they make these standards legal requirements that must be adhered to in all design and construction work within the building code's jurisdiction. They not only protect lives but also prevent economic disruption and property damage (World Bank, 2023c).

1.1 BENEFITS OF BUILDING CODES

Context-appropriate building codes and code compliance mechanisms can be a cost-effective way to reduce risk and improve resilience. A comprehensive cost-benefit study in the USA showed that every US dollar invested in adopting and implementing model building codes such as the ICC International Building Code¹ would avoid US\$ 11 in losses, and every dollar invested in further code improvements for building resilience would avoid an additional US\$ 4 in losses (Multi-Hazard Mitigation Council, 2019). A follow-up study by the US Federal Emergency Management Agency (FEMA) found that the proportion of building stock in the country that was constructed in accordance with post-2000 model hazard-resistant ICC codes would realize an estimated US\$ 1.6 billion in avoided average annual losses (AAL). Given a projection in which 70 percent of US buildings are constructed in compliance with model building codes (for example, I-Codes),² the avoided AAL is estimated to total US\$ 132 billion by 2040 (FEMA, 2020b).

Building codes, when effectively implemented and enforced, are an essential tool for promoting public safety, as well as providing comfortable, sustainable and accessible spaces for communities. A well-regulated building sector can protect the public from unsafe buildings, poor construction practices and environmental risks by setting minimum standards of practice. Many societies, particularly in urban areas, have moved away from self- or community-built construction (also referred to as ‘non-engineered’ or ‘vernacular’), which relied on local traditions and construction practices, to buildings designed and constructed with the input of professional engineers or architects. At the same time, there is a global trend, particularly in urban and suburban areas, toward application of modern construction technologies such as reinforced concrete, which require imported or manufactured materials, advanced design and construction skills, and specialized equipment. As a result, building owners—and their occupants—can be unfamiliar with key aspects of safety and construction quality (WHE and EERI, 2008). In that context, building code adoption and effective implementation can help ensure that minimum design and construction standards are met and support more informed choices about design tradeoffs, reflecting society’s priorities for safety, health, and comfort (World Bank, 2023c).

Building codes and compliance mechanisms that are clear, up-to-date, transparent and well-tailored to the country context and local capacity can support economic growth and increase investor confidence. They do so by improving the safety and reliability of buildings while reducing the likelihood of errors in design and execution of building development projects by private-sector professionals and building control authorities, while also minimizing unnecessary delays, disputes, and uncertainty (World Bank, 2024a). They also set consistent and verifiable minimum standards for building performance for private-sector investors and insurers looking to protect their investments and generate returns.

Building codes can also support wider societal efforts to advance broader agendas for safer, more sustainable, and more inclusive urban development. For example, universal accessibility requirements are incorporated in building codes to ensure that people of all ages and abilities can use buildings, especially facilities that house essential public services (Terashima and Clark, 2021). Requirements for improved ventilation and indoor air quality can improve productivity and reduce airborne disease transmission (Saeedi et al., 2023).

Building codes offer a mechanism for setting requirements for all new construction and alterations of the buildings they cover, providing a powerful tool to operationalize national or local priorities for the life of a building. This is particularly important in developing economies where extensive construction is anticipated in the next few decades. Buildings constructed today are likely to last generations, so buildings that do not align with long-term

¹ The codes considered in this study were post-2000 model building codes developed by the International Code Council (ICC); a US based non-profit organization. These International Codes (I-Codes) are a coordinated set of 15 building safety codes, including the International Building Code (IBC) (ICC, 2024b).

² The I-Codes are a set of model USA building codes which include the International Building Code (IBC) and others. Refer to <https://codes.iccsafe.org/i-codes/>.



priorities may become burdensome to government and building owners, may require expensive retrofitting or fail to protect residents from increasing risks.

1.2 RISK TO THE BUILT ENVIRONMENT IS INCREASING

Disaster losses are intensifying as a result of climate change impacts and increased risk linked to rapid urban development and population growth in regions exposed to hazards. In 2023 alone, 86,473 deaths were reported as a direct consequence of disasters globally, alongside economic losses estimated at US\$ 202.7 billion (CRED, 2023). One study found that the number of major disasters increased by 175 percent from 2000 to 2019 compared to the previous 20-year period (1980–1999); this corresponded to an increase in economic losses of 182 percent. Over the same periods, climate-related disasters increased by 183 percent, predominantly storms and floods (CRED and UNDRR, 2021). The true scale of disaster losses is likely to be underestimated, due to persistent challenges in obtaining reliable disaster data. Data gaps for disaster losses are prevalent in lower-income countries, and for slower onset events like drought, epidemics and extreme temperature events (Jones et al., 2022). Urban development patterns are influencing the level of risk. Between 1985 and 2022, for example, 76,400 km² of land that was transformed through urbanization faced estimated inundation depths of at least 0.5 meters during severe flooding (Rentschler et al., 2022).

In this evolving risk landscape, effective building regulations must consider a wider range and variety of hazards and risks, alongside the increasingly complex interactions among them. Most current building codes focus on provisions for building safety and stability under gravity, wind and earthquake loads, where building damage is deemed acceptable for more infrequent, extreme events, provided that the damage does not cause loss of life or injury. There is a need to expand building codes to address other hazards such as floods, wildfires, and extreme temperatures, to which buildings are being exposed with increasing severity and frequency around the world. For example, in response to increasing losses from wildfires, Australia developed and adopted a building design standard³ to reduce the risk of damage and losses from bushfire. The standard includes building design provisions to prevent fire ignition from embers, radiant heat, and direct contact with flames from wildfires. In addition, design criteria in building codes must consider predictions of future trends related to the magnitude and frequency of hazard events due to climate change and other human-induced impacts. For example, Canada is in the process of updating its National Building Code to account for future climate change effects on wind patterns, precipitation, severe weather events, and temperature changes (Government of Canada, 2024).

A shift is needed from current code approaches that address individual hazards separately to a more coordinated set of code provisions that consider the design tradeoffs for buildings subjected to multiple hazards over their design life. Buildings are often exposed to multiple and evolving hazards, which need to be considered—despite the increased design complexity demanded—not least because design solutions for one hazard might inadvertently increase vulnerability to another. For example, buildings that use timber structural systems can be more sustainable and perform better in earthquakes but may be more vulnerable to strong winds and flooding (de Ruiter, 2021). Another key example is the need to better address fire safety considerations in provisions and requirements for using green building technologies (Meacham and McNamee, 2020). Thus, codes should aim to address performance requirements holistically to optimize safety and improve resilience to hazards in combination with sustainability, as these goals are interdependent.

1.3 OVERVIEW OF BUILDING REGULATORY FRAMEWORKS

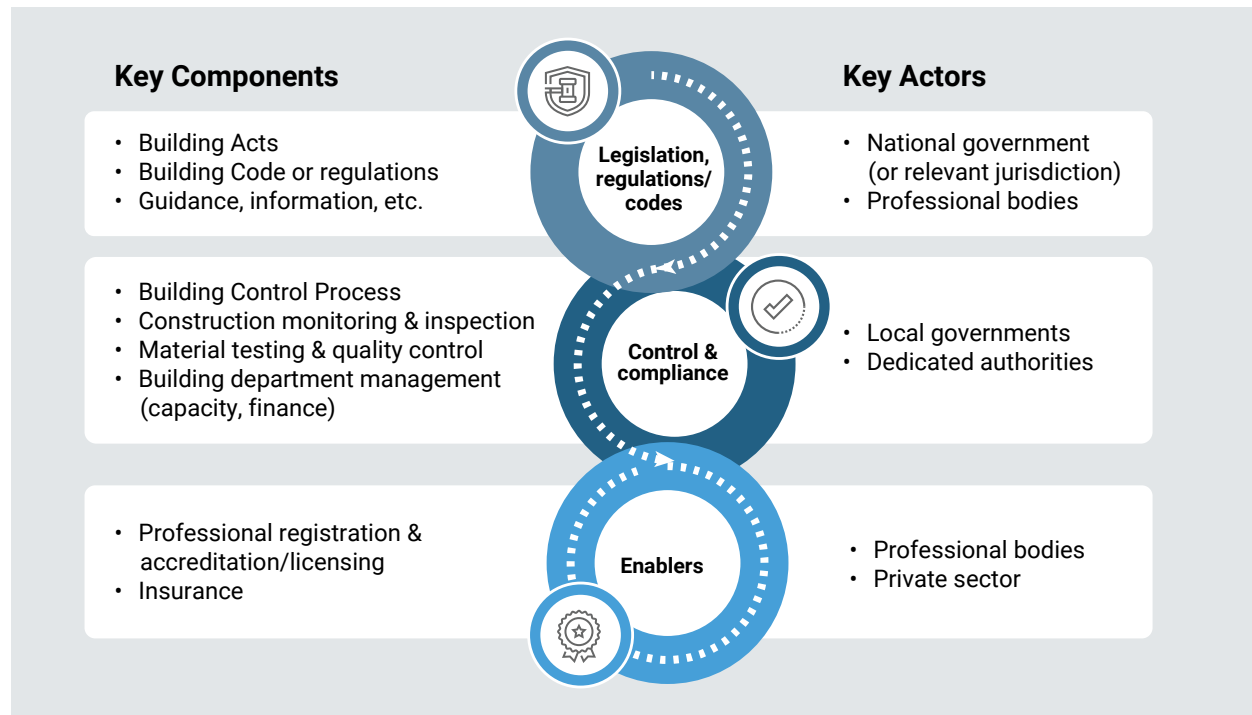
A building regulatory framework is the set of laws, regulatory documents, compliance mechanisms, education and training requirements, product testing and certification, professional qualifications, and licensing schemes

³ Australian Standard 3959-2018: Construction of buildings in bushfire-prone areas (Standards Australia, 2018).



that support a safe and sustainable built environment (see Figure 1.1. below). It is composed of three core components: (i) **legislation and building regulations** that comprise a building regulatory system, including legislative acts that reference the planning regulations, building design codes and construction standards, and building control regulations; (ii) **control and compliance mechanisms and capacity** such as building control processes, including construction quality assurance; and (iii) **the wider enabling environment** to support implementation of building regulations, including professional licensing and insurance mechanisms (World Bank, 2023c).

Figure 1.1 // Key components and actors in the building regulatory framework



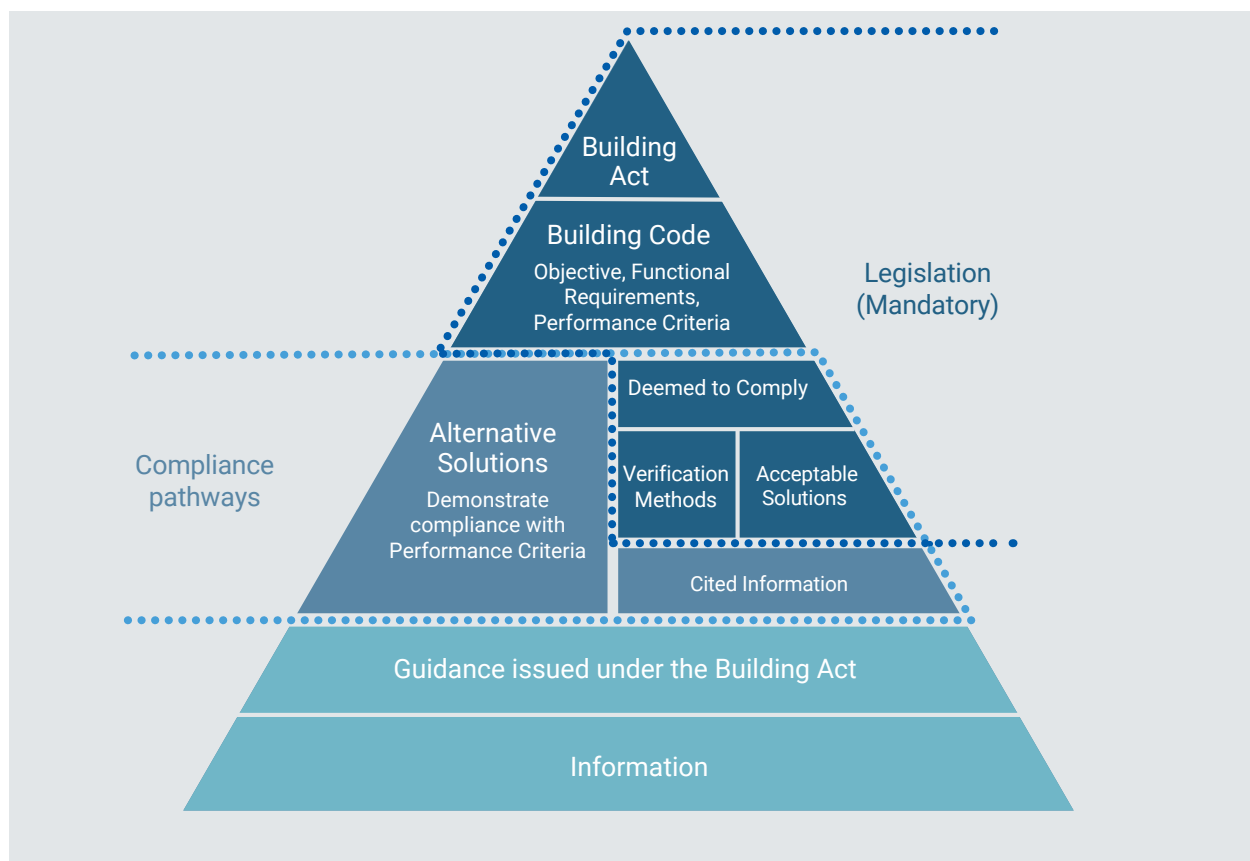
Regulatory instruments in this framework fall into five main categories:

- 1 **Building acts:** the overarching laws passed by a legislative body (such as a national or state government) that establish the legal framework for building design, construction and safety and mandate the creation and enforcement of building codes.
- 2 **Building policies:** refers to a set of overarching principles, guidelines, and regulations established by local, regional, or national governments to govern the planning, design, construction, and maintenance of buildings. Building policies, while not legally binding like acts, provide guidance and direction for implementing building codes. They can set targets, priorities, and incentives to encourage compliance with the codes.
- 3 **Planning regulations and related land use and development plans:** these prescribe where development is permitted, and for which types of buildings and occupancies. These regulations can include considerations such as either prohibiting development at higher-risk sites or requiring site mitigations as a condition of development.
- 4 **Building codes (also referred to as building design and construction regulations):** these set minimum requirements related to building performance, covering such areas as structural safety, fire safety, heating, cooling, ventilation, indoor air quality, plumbing, sanitary facilities, lighting, green building (including energy and water efficiency), and universal accessibility requirements.

- ⑤ **Building control regulations:** requirements and processes for obtaining design approvals, occupancy permits, as well as for performing site inspections. They also define the roles and responsibilities of building control authorities, design and construction sector professionals, as well as penalties and incentives for compliance and dispute resolution mechanisms (World Bank, 2023c).

For example, the structure of New Zealand's building regulatory framework is described here and illustrated in Figure 1.2 below. All building work in New Zealand must comply with specific requirements outlined in legislation and regulations, ensuring proper execution, qualified personnel, and consumer protection. The building regulatory system promotes quality decision-making through the Building Act 2004, which governs the industry, and the Building Code, which sets minimum performance standards.⁴ The code is supplemented by additional regulations that detail specific controls, such as prescribed forms and definitions. This regulatory framework works in tandem with other legislation, including the Resource Management Act, laws for qualified plumbing, gas, and electrical work, the Fire and Emergency New Zealand Act 2017, and council bylaws.

Figure 1.2 // A sample building regulatory structure, based on the New Zealand building regulatory framework



Source: Government of New Zealand, 2024.

The exact structure and organization of building regulations may vary but having clarity on the legislation that formally adopts the mandatory provisions in the building code and building control regulations is essential.

⁴ To meet the minimum standards, New Zealand's code allows users to implement prescriptive provisions or performance-based approaches—or both—and also allows the use of 'alternative solutions'. These can be proposed by the user and are acceptable as long as they comply with required performance criteria set out by the code. Refer to Box 2.5 in Chapter 2 for more detail on prescriptive and performance-based provisions.

1.4 BUILDING CODES

A building code (also referred to as building regulations in some jurisdictions) is a set of legally adopted minimum performance requirements for building design and construction. It is part of a broader building regulatory framework, as described in Section 1.3.

Building codes can be structured in different ways. For example, comprehensive provisions for building design and construction (for example, architectural, structural, mechanical, electrical and plumbing (MEP), fire safety, accessibility, energy efficiency, and so forth) can be contained in a single document; alternatively, a building code can comprise a coordinated set of documents. These regulations often refer to or incorporate other standards, such as material standards that provide technical specifications, or guidelines that are recognized as best practices. Building codes typically contain design and construction provisions in the following areas (World Bank, 2023c; NIST, 2024):

- » **Architectural design provisions:** Interior and exterior environment, occupancy types, provisions for egress;
- » **Structural design and construction provisions:** Applicable loads, design of structures constructed using different materials;
- » **Geotechnical engineering provisions:** Site investigations, soil parameters for foundation design;
- » **Fire safety provisions:**⁵ Fire prevention, resistance to fire/fire spread, fire suppression, occupant safety, refuge and egress, and fire service access;
- » **Water, sanitation and hygiene provisions:** Plumbing, including water supply and wastewater, hand washing and toilet facilities;
- » **Indoor air quality and comfort provisions:** Lighting, heating, cooling and ventilation;
- » **Green building provisions:** Energy- and water-efficiency provisions, low-carbon design; and
- » **Universal accessibility provisions:** to allow use of the building by people of all ages and abilities.

In some cases, building regulation documents may combine design and construction provisions with planning/development and other building control requirements. However, while critically important, a detailed assessment of planning and building control regulations is not the focus of this report. High-level implementation considerations related to the development of building codes are explored in Chapter 2, Section 2.2.

Although building design and construction provisions typically apply to new buildings, code provisions related to existing buildings are also important. For example, codes or regulations may include requirements for building additions, change of use, or safe building demolition. To ensure the ongoing safety and performance of existing buildings, codes can benefit from having technical provisions for building assessment, rehabilitation and/or retrofit. Other code provisions for existing buildings can include special requirements for alterations to buildings with cultural heritage value.

Building codes often refer to other technical documents (called reference standards) that contain specific design and construction provisions, material-specific design, products testing and certification, or information on other topics. Although there is no precisely agreed definition of how reference standards are distinguished from codes, some distinctions are presented in Table 1.1 below.

⁵ In some cases, certain types of design provisions, such as fire-safety provisions, may be covered in a separate fire code or other form of regulation.

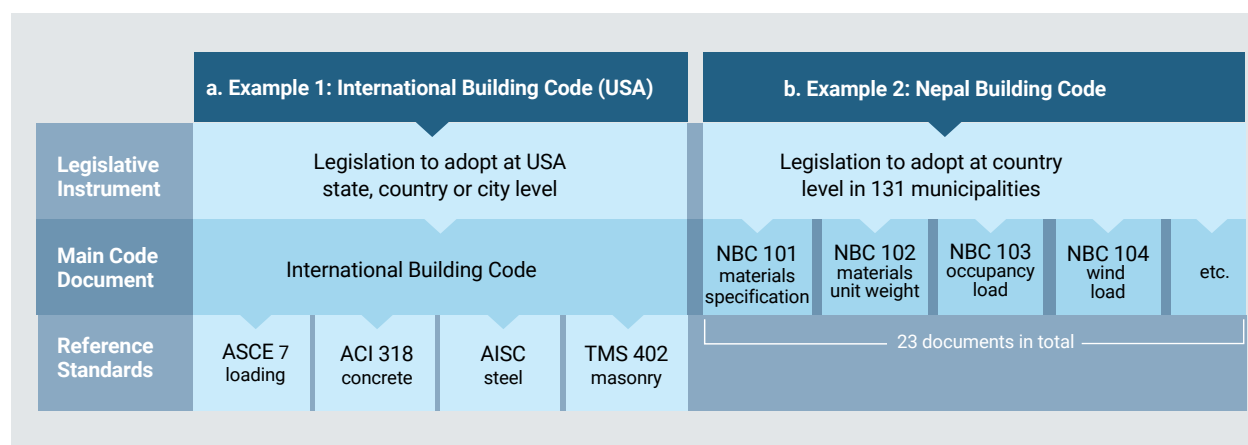


Table 1.1 // Distinctions between codes and reference standards

Topic	Codes	Reference standards
Legal status	Codes are explicitly adopted through mandating legislation and promulgated by governments and include mandatory provisions for design and construction.	Standards only have legal status when incorporated into codes and/or regulations but can also have status as voluntary standards and be generally recognized as part of “good practice”.
Oversight of Development	The code development process is typically led by governments although a wide range of stakeholders are involved, including technical and industry experts.	Standards can be developed by the public or private sector with support from professional organizations and with a suitable representation of stakeholders. This process can be led by—and the final standard approved and published by—a Standards Developing Organization.
Scope	Codes typically cover a broader scope of topics and issues.	Standards typically cover a specific topic or a more limited range of issues.

Code documents and how they relate to reference standards can be organized in different ways, as illustrated in Figure 1.3 below.

Figure 1.3 // Examples of different options for the organization of code documents: (a) International Building Code (IBC), developed in the USA where a main code document refers to various reference standards and (b) Nepal Building Code where all provisions are included in the code documents.



Globally, most building codes are set at a national level, but there are some exceptions for selected countries with federal systems of government or where cities or other types of local jurisdictions have their own code requirements. In these cases, states or other territorial units have the power to set the building codes. These include India, and Nigeria, or the USA for example. Other countries, such as Indonesia, formerly gave each city or regency (district) the authority to set its building code,⁶ but have now moved to regulations and building control requirements set at national level. Even within a national system, in some cases cities have the authority to mandate additional building code requirements tailored to their specific needs and priorities.

Codes can be developed through a variety of approaches, but such approaches should be adapted to meet country-specific requirements. Some countries develop the entirety of their code using in-country expertise and

⁶ In practice, the Indonesian design standards were developed at national level, but different cities and/or regencies formerly had the authority to decide whether their local jurisdictions would comply with the most up-to-date standards.

through various levels of consultation with stakeholders. Others use model codes (such as the I-Codes)⁷ as an initial starting point but then adapt these to address local requirements or practices. Although model codes can accelerate adopting and implementing a code, significant effort is required to tailor them to the specific needs of the country and/or local jurisdictions to allow for effective implementation.

This report focuses primarily on building regulations that contain design and construction provisions; these are henceforth typically referred to as building codes.

⁷ <https://codes.iccsafe.org/codes/i-codes>





2. Considerations for Building Code Development

2. Considerations for Building Code Development

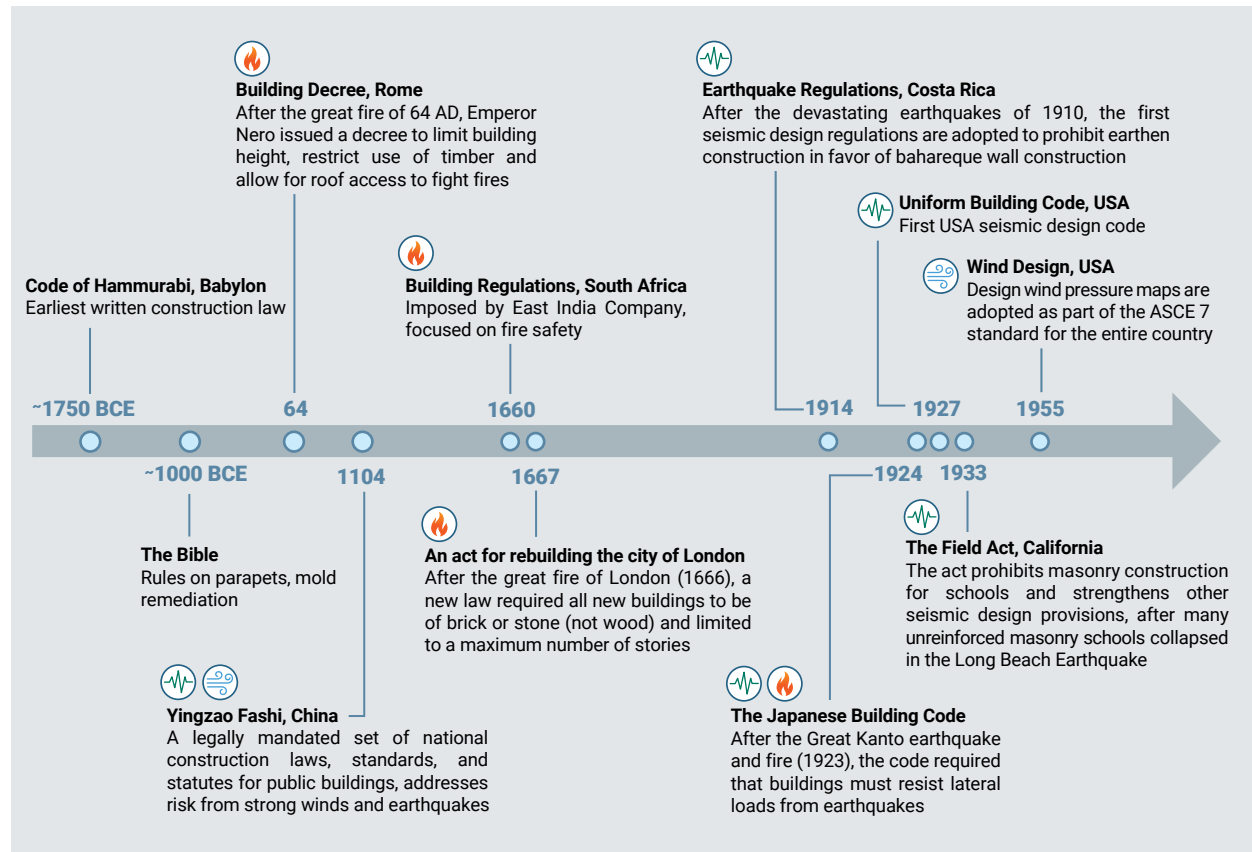
Developing comprehensive building codes lays the groundwork for a built environment that is safe, resilient, and sustainable. As urbanization accelerates and the impacts of climate change become more pronounced, the need for robust and adaptive building codes is increasingly urgent. Effective codes are central to the design and construction of buildings that can withstand natural disasters, reduce environmental impact, and provide safe and accessible spaces for all. This chapter delves into the intricate process of building code development, exploring the challenges faced, the types of innovative solutions that can be implemented, and the lessons learned from various countries around the world.

2.1 TRANSITION TO COMPREHENSIVE BUILDING REGULATIONS

Before formal building regulatory frameworks were widely adopted, most common types of buildings followed vernacular or traditional forms. Vernacular construction used local materials and construction techniques developed over time, and the designs were influenced by locally available materials, cultural practices, geography and environmental conditions. In some cases, vernacular building types were also well adapted to local hazards, most likely through an empirical process where construction methods for buildings that performed better prevailed. For example, traditional Vietnamese buildings in the low-lying river deltas have customarily been elevated on stilts to adapt to frequent flooding, while lightweight plant-based wall panels in these buildings can be removed to reduce damage in strong wind events (Ngo, 2010).

Increasing urbanization, combined with the impacts on societies of disasters such as fires, earthquakes and strong wind events, motivated efforts to enact and strengthen building regulations. For example, after the great fire in ancient Rome in 64 AD, building regulations, including fire safety-related building requirements, were imposed by Emperor Nero (ICC, 2021a). See Figure 2.1 for other early examples of building regulation development.

The development of modern building codes began in the early 1900s, and from then on, their adoption has gained pace in many cities and countries. Early 20th century building codes often focused on setting minimum standards to protect building occupants, and primarily included provisions related to public safety: structural stability, public health and sanitation, and fire-safety requirements. Over time, codes have become more detailed and comprehensive, benefiting from progress in building engineering knowledge, including performance-based design approaches and lessons learned from past disasters. Many codes now also include provisions for energy efficiency, other green building measures, and universal accessibility.

Figure 2.1 // Timeline of selected early building codes

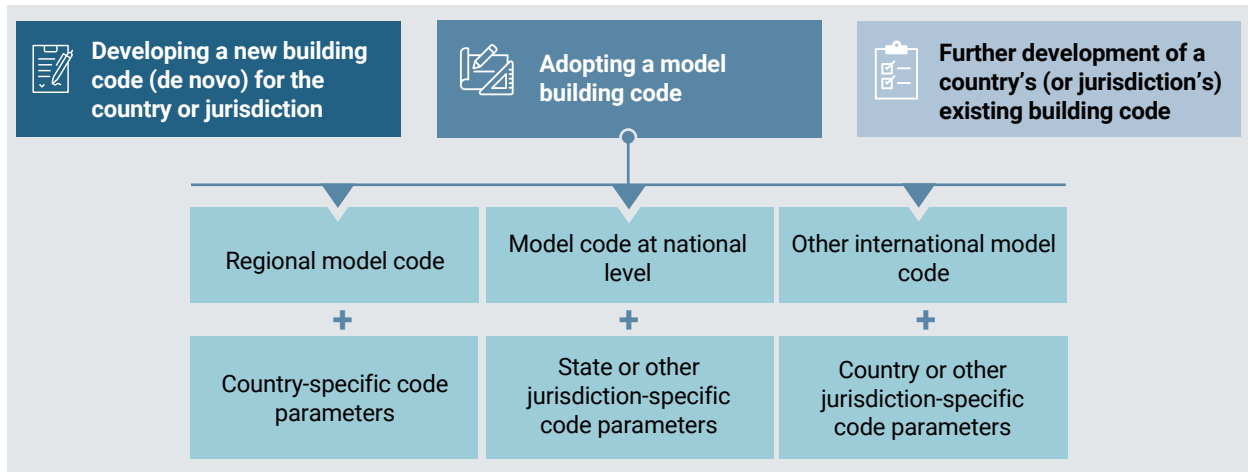
Source: Developed by authors based on referenced materials: The Bible, Deuteronomy 22:8 and Leviticus, 14; ICC, 2021a; Ma and Li, 2023; Laubscher, 2011; Barben and Solonsky, 2017; Reitherman, 2012; Vaughan and Turner, 2013.

2.2 BUILDING CODE DEVELOPMENT

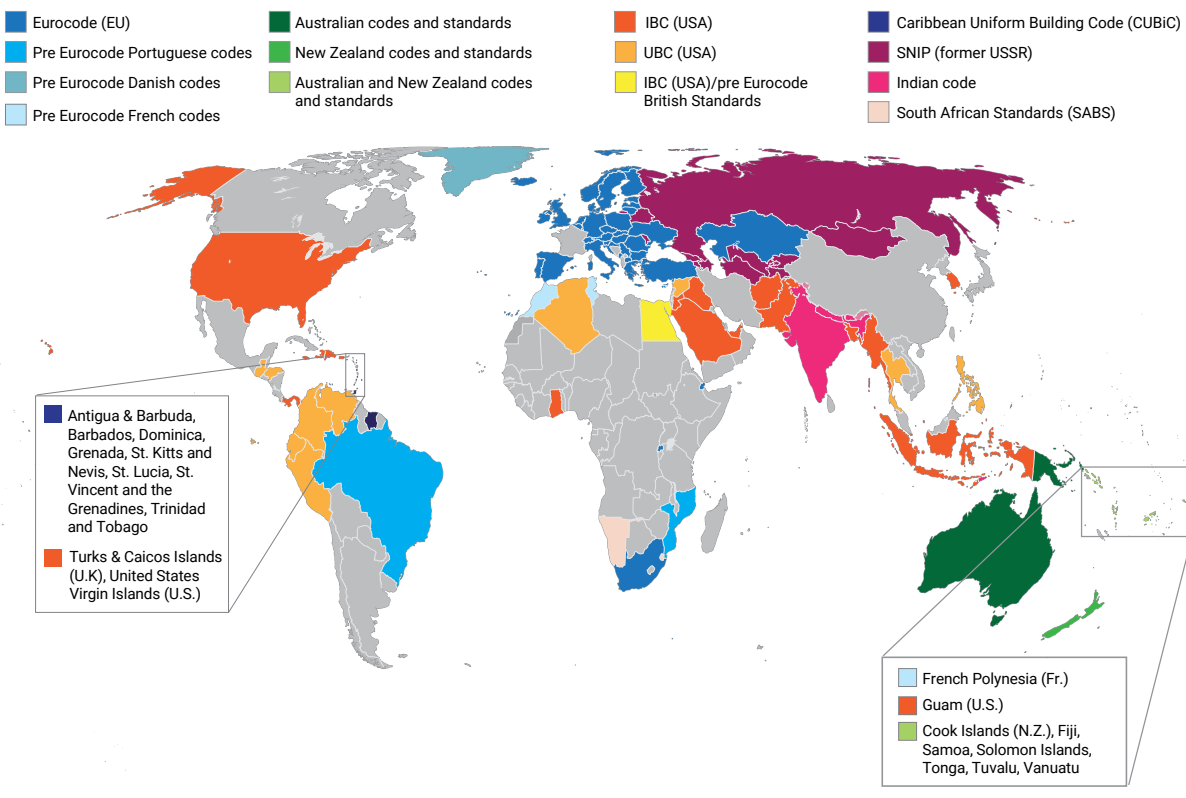
This section provides an overview of various approaches to developing and organizing building codes. It explores the steps involved in the code development process and highlights key considerations that influence the effectiveness and adaptability of building codes. By understanding these approaches and considerations, stakeholders can better navigate the complexities of building code development to ensure safety, resilience, sustainability and accessibility of the built environment.

2.2.1 Approaches for building code development

An important initial consideration in the code development process is to determine the overall approach and basis for the code provisions. This decision is highly dependent on the current stage of code development in a country or jurisdiction. Countries at different stages of maturity in their building codes require distinct approaches: emerging markets may focus on establishing basic code frameworks, countries with more mature building codes may focus on updating and enhancing existing provisions – for example, by incorporating performance-based design requirements. The most common approaches include: (i) development of a new code from scratch (*de novo*); (ii) adoption of a model building code or another country's code with modifications to tailor it to the jurisdiction's context; (iii) further development (maintenance) of an existing code that is already in place to ensure that it reflects the latest research and current safety and performance requirements; or (iv) a combination of the above. Refer to Figure 2.2 for a summary of these approaches. Any changes to the code need to be coordinated and harmonized with wider legislative acts and regulations in the code jurisdiction.

Figure 2.2 // Common code development approaches**Box 2.1 // Influence of international and model building codes around the world**

A review of global building code influences as part of this study revealed that 109 countries have adopted either model codes and standards or have been strongly influenced by codes from other countries. Refer to Annex C for a table of the country code influence data.

Figure B2.1 // Map of countries that have adopted model codes or standards or were influenced by international codes

Sources: World Bank, 2023c; PRIF, 2023; ICC, 2024a; JRC, 2024b; Paz, 1994; IISEE, 2024; GEM, 2022.

The approach to code development depends on the structure of the current regulatory framework, scope of amendments needed, the maturity level of the existing code, and the time and resources available. Each approach has associated benefits and challenges. For example, the effort associated with initial development of a new code entirely from scratch (plus subsequent updates on a regular basis) is more time-consuming, technically demanding and resource-intensive than adoption of a model code or another international code. Developing a new code from scratch provides the opportunity to shape the code specifically for the country's needs and context but can have the disadvantage of less alignment with wider international codes and standards – particularly where countries wish to import and export construction products and technologies.

2.2.2 Adopting model building codes and standards

Model building codes can provide a jurisdiction with a starting point based on knowledge and practices accumulated by regional or international experts over many years. By using a model code, and modifying it to fit local or national needs, jurisdictions can save time and effort, as the original code developers have established a foundation for the provisions in key topic areas. This efficiency can extend beyond the codes themselves, as associated educational and implementation resources may also exist, or can be swiftly developed to support adopters. Typically, model codes are regularly updated, presenting opportunities to capture new technologies, practices and lessons learned from prior disaster events. A few examples of model codes and standards are discussed in Box 2.2 below. Box 2.1 above also shows the influence of model codes and other international codes on selected countries around the world.

Box 2.2 // Examples of model codes and standards

ICC Model Codes

The International Codes ('I-Codes') are a set of model codes for new and existing buildings developed in the USA by the International Code Council (ICC), a not-for-profit, non-governmental organization.

ICC has facilitated the development of 15 model codes, such as The International Energy Conservation Code (IECC), and the International Green Construction Code (IgCC).

I-Codes have been adopted by most states or other local jurisdictions in the USA and by many other countries around the world (ICC, n.d.).

The I-Codes are updated every three years through a bottom-up process, where a range of interested stakeholders such as industry representatives, design professionals and the wider public can propose code amendments. These amendments are reviewed by ICC specialist committees of stakeholder experts and discussed in open public hearings. Code amendments are voted on by public hearing participants and ICC-appointed governmental representatives before being finalized and adopted (ICC, n.d.).

Eurocodes

The Eurocodes are a set of design and construction standards for new and existing buildings and other types of civil infrastructure (EC, n.d.).

Development of the Eurocodes began in 1975 as part of a broader push to introduce common regulations within the European Economic Community, and the first Eurocodes were published in 1984 (EC, n.d.).

Since then, these codes have been adopted by 31 EU/European Free Trade Association (EFTA) countries and the United Kingdom.

They have also been adopted or are in the process of adoption in 22 non-EU/EFTA countries (EC, n.d.).

Updates to the Eurocode are proposed at National level by technical subcommittees and coordinated and finalized by the Comité Européen de Normalisation (CEN), with major updates typically taking place on a five-year cycle (EC, n.d.).

OECS/CUBiC code

The Caribbean Uniform Building Code (CUBiC), was first developed in 1985 by a team of regional experts, government representatives of each Member State, universities, and other design and construction sector stakeholders in the Caribbean (Caribbean Community Secretariat, 1985).

Subsequently, the Organization of Eastern Caribbean States (OECS)⁸ introduced a model building code based on CUBiC and other selected national codes from Caribbean countries to form a basis for updated national codes in each Member State, with the latest version published in 2016 (Wason, 2001; OECS, n.d.; OECS, 2016).

This allows the Code to be easily amended and approved by the Minister without the requirement of parliamentary approval.

The energy efficiency code for the region (CARICOM Regional Energy Efficiency Building Code) (ICC, 2018) is based on the International Energy Conservation Code (IECC) developed by ICC.

⁸ It has seven full member states: Antigua and Barbuda, Dominica, Grenada, Montserrat, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines. (It also has four associate member states).



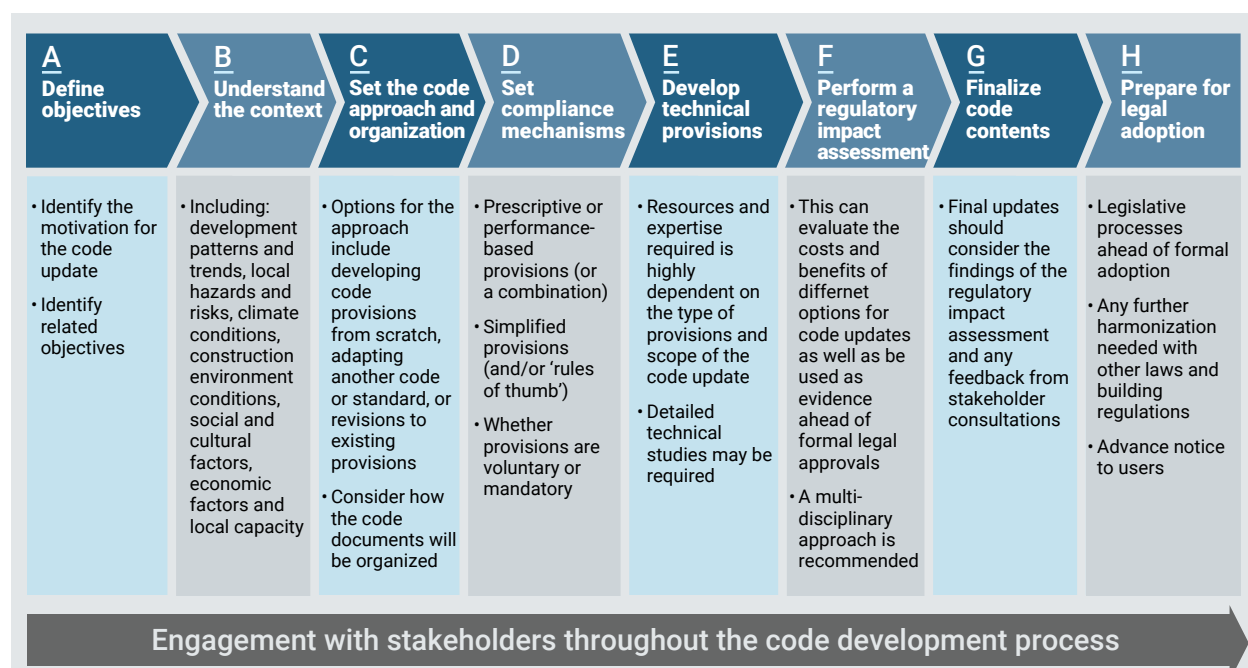
When model codes are adopted by a country, significant effort is required to tailor the code to the country's or jurisdiction's context, including the development of country-specific code parameters. When adopting a model code, it is necessary to consider design requirements for all relevant construction types, effects of prevalent local hazards, topography and soil conditions, and climatic conditions in a specific country or jurisdiction. Assessing the local design and construction capacities and practices of the country is critical to identify appropriate code provisions and the adjustments required. The model code may also be too complex for straightforward implementation in the country or jurisdiction. Another element to consider is that reference standards are relevant to the construction materials available in that country. Countries with many years of code development that already have a comprehensive and consistently enforced code often chose to develop and update it on a regular basis rather than adopt an internationally developed model code.

Overall, countries must balance the need for stringent standards to ensure safety with the costs of compliance and related capacity needs. For example, in countries with resource and capacity constraints, an incremental approach to building code requirements can be effective. This involves setting minimum safety standards that are achievable and gradually increasing stringency as capacity improves.

2.2.3 Code development process

Code development is an intensive and complex process; taking a strategic approach and allocating adequate time and resources is essential. This section gives a high-level overview of key steps in the code development process (see Figure 2.3 and Box 2.4 for an example of code conceptualization in Zanzibar as a first step in the code development process). Key aspects of the process include clear definition of the motivation and related objectives for creating or updating the code, understanding the context for the country or jurisdiction, setting the overall approach, compliance mechanisms, and organization of code documents. Development of the code provisions is often led by technical specialists but should also use input from wider stakeholders to take account of social and economic factors. In some cases, code development has been a top-down process with limited stakeholder engagement; this can result in lack of buy-in, reduced compliance, and unintended negative effects on communities and the economy.

Figure 2.3 // Overview of the code development process



A regulatory economic impact assessment can be a useful mechanism to formally document the costs and benefits of proposed code modifications or updates. In addition to informing the finalization of code provisions, the results of the regulatory impact assessment can also be used as evidence during the legislative processes ahead of formal adoption. Lastly, cross-cutting issues are described, including the code update cycle, resources and time required, and setting clear roles and responsibilities for code development.

Box 2.4 // Code conceptualization in Zanzibar

In 2023, the World Bank provided Technical Assistance to the Government of Zanzibar, to lay the groundwork for developing a new building code. Activities included establishing consensus on the approach to development of the building code, identifying responsible government agencies and their roles and responsibilities, and providing technical support to the oversight committee for code development. The project identified that the new code needed to be tailored to the country's monsoon climate and exposure of the built environment to the dominant hazards, including flooding, fire, strong wind events, and earthquakes. In addition, the code needed to consider the cultural heritage of historic "Stone Town", a UNESCO World Heritage site. Key lessons from the conceptualization process—beyond the fundamental need to understand the local context—were the importance of taking an inclusive approach with relevant stakeholders, knowledge sharing with other countries on their experience, and the centrality of capacity building, especially at the beginning of the code implementation stage, for both the private and public sectors.



Photo credit: Vita Sanderson

Table 2.2 below provides more detail on activities and consideration for each step of the code development process.

Table 2.2 // Key steps and related considerations for the code development process

Steps	Activities and key considerations
A. Define objectives	The motivation for the new or updated code is identified and the related objectives that need to be met are set.
B. Understand the context	For a code to be effective, it must be well-tailored for the country or jurisdiction's context, hence it is critical to understand the characteristics of the country/region/jurisdiction early in the code development process (World Bank, 2023c; World Bank, 2024a). Areas include: » Development patterns and trends: for example, the level of informal development, and demographic and urbanization trends in the country; » Local hazards and risks: an understanding of primary hazards and risks governs the types of code provisions needed to ensure public safety; » Local climatic conditions: these will inform the types of green building provisions needed; » Construction environment characteristics: for example, code provisions should address local materials and common construction types; » Social and cultural factors: for example, how social and cultural practices influence design, perception of risks, and the needs of vulnerable groups, if incremental construction is common; » Economic factors: for example, if code provisions could hamper innovation or affect market conditions. Other common issues occur when codes prioritize imported materials or enforce rigid requirements that drive up housing costs; » Effort to comply: The requirements for compliance should correspond to the capabilities of expected users and the building control authorities overseeing design and construction. A step-by-step approach, starting with the most important requirements and expanding as capacity increases, can ensure more sustainable implementation, particularly in lower-capacity settings; » Harmonization with wider provisions and regulations: Codes should be developed or updated such that they remain compatible with other code provisions and fit into the wider building regulatory framework, including related compliance mechanisms; and » Insurance and liability mechanisms: Codes should take into account what is already in place in the jurisdiction and related legal requirements. For example, housing may need to meet certain minimum code requirements for the homeowner to obtain building insurance. Designers and builders may also be required to hold insurance to practice.
C. Set the code approach and organization	Depending on the status of the current code and scope for code development, different approaches to code development can be taken, such as adopting a model code, incremental updates to an existing code or developing a new code from scratch (do novo). See Section 2.2.1 and in Figure 2.2. Issues to consider related to organization of code documents include structure of the code and language(s) to be used, how easy it is for users to access the various required documents, and ensuring coordination and compatibility of provisions across code documents and related reference standards.
D. Determine compliance methods	Depending on the capacity and skills of the design and construction sector and building control authorities, different types of acceptable methods to demonstrate code compliance may be appropriate; typically: » Prescriptive design and construction provisions for engineered buildings where the user needs to follow a set of prescribed step-by-step provisions. Refer to Box 2.5; » Performance-based design requirements where the user needs to demonstrate that the design meets a minimum level of performance, and methods to achieve this are more flexible. Refer to Box 2.5; and » Simplified ('rules of thumb') provisions for simple, non-engineered buildings with smaller footprints. In some cases, for example in green building provisions, some provisions may be voluntary to comply with rather than mandatory.
E. Develop the technical provisions	The process and resources required for drafting of the code provisions will be largely contingent on the specific setting of the country or jurisdiction. The outputs and decisions made in Steps B, C and D will also be considered when developing the code provisions. For example, to develop design criteria and green building provisions, studies may be required to provide an updated characterization of the level of hazard, and climatic conditions. Technical provisions across codes and standards need to be aligned.



Table 2.2 // Key steps and related considerations for the code development process (cont.)

Steps	Activities and key considerations
F. Perform a regulatory impact assessment	To evaluate options for code provisions, it is best practice for a multidisciplinary group of experts with input from wider stakeholders to carry out a Regulatory Impact Assessment. This assessment typically: (i) defines the problem and sets the objectives for the updated code; (ii) gathers data on the contextual characteristics of the country or jurisdiction; (iii) assesses the costs, risks and benefits of each code development option against a baseline, including the impacts on diverse societal groups, different geographical contexts (for example, low-income groups, rural versus urban), and market conditions; and (iv) evaluates related compliance processes, and distributional effects (Arlani, 1988). The results of the Regulatory Impact Assessment are used by government decision-makers and other stakeholders as part of the formal process ahead of code finalization and approval. Overall, a balance must be found between the stringency and type of code requirements (voluntary or mandatory) and factors such as cost, compliance burden, and technical feasibility.
G. Finalize code contents	Based on the outputs of the regulatory impact assessment and input from decision-makers and other key stakeholders, the code will be developed or updated and final revisions to the code will be carried out based on the selected method for developing the technical provisions ahead of the approval process.
H. Prepare for implementation	In addition to the technical and legislative processes for formal approval, other activities in this phase may include: » Harmonization with other laws and building regulations, including other code documents, and building control regulations for compliance; » Advance notification to users of the date when the code will come into force; » Ensuring that the updated code documents are accessible and affordable to users, for example, translation into commonly used languages, access to the code and reference standards online or in printed form at a reasonable cost; » Plans and required resources for capacity building to improve code compliance (for example, establishment/expansion/funding of enforcement entities, coordination with professional bodies, supplementary guidance, trainings, and so forth).

Box 2.5 // Prescriptive versus performance-based design approaches

It is common for building codes to have design provisions that follow a prescriptive approach. Prescriptive design sets minimum criteria and procedures that buildings need to comply with in the design and construction stages. Prescriptive approaches can also include advanced engineering procedures that, if followed, allow for compliance with an implicit performance objective. For example, a prescriptive provision could specify the spacing and type of nails in a timber stud wall assembly required to resist a certain level of shear loading. The prescriptive approach has the advantage of setting a clear procedure to demonstrate compliance which is relatively straightforward to implement.

An alternative approach is performance-based design (PBD). Here, the focus is on achieving specific performance goals for a building, rather than following a set of predefined rules or methods. In PBD, designers have the flexibility to use innovative and creative solutions to meet or exceed the desired outcomes, such as safety, durability, and energy efficiency. The acceptance of the design approach is determined by the regulatory authority (in cases where the building or approach are particularly complex, the authority may rely on third parties or peer reviewers). For example, in seismic design, the concept behind PBD is to set performance objectives for a building, corresponding to an acceptable level of damage due to an earthquake with predefined seismic hazard level (ASCE, 2023c). Unlike a prescriptive design approach, where the building performance criteria are implicitly set by the code developers, PBD objectives are usually established with the active engagement of building owners and other stakeholders who would ultimately be affected by any financial losses and interrupted functionality of the building (FEMA, 2000).



The following cross-cutting issues are essential aspects of the code development process:

- » **The cycle for code updates:** criteria and/or a set cycle for when the code is updated can be set in the building regulatory legislation. Triggers for code updates can include lessons learned from disasters, the need to address changing levels of hazard and risk, or imperatives to reduce greenhouse gas emissions (alongside continual innovation in the design and construction sector);
- » **Clearly assigned roles and responsibilities for code development:** these are typically set by the government, including assignment of ministries that will lead the process and their roles in supporting other government entities and technical steering committees;
- » **Time and resources required:** Allowing adequate time and resources for technical studies and other expert inputs, stakeholder consultation, feedback—and subsequent revisions— and the legal adoption process;⁹
- » **Stakeholder engagement:** The process should be transparent, clarify the potential risks and benefits of proposed code development options, and cultivate ownership of regulatory changes (Croley, 2008). Relevant stakeholders can range from government policymakers, building control officials, urban planners, design and construction industry professionals, professional bodies, building owners, insurers, research institutions, environmental groups, economists, social scientists, and local communities (Nwadike et al., 2020); and
- » **Diverse expertise in code development.** Code development is often led by technical experts from academia, alongside public- or private-sector professionals with expertise in a variety of disciplines related to the built environment under the direction of government or quasi-governmental entities. In addition, input is needed from regulatory impact specialists, economists, market analysts, and sociologists—as well as community stakeholders—to understand the socioeconomic impacts of the proposed building code provisions. Although it can be more challenging to engage a wider range of stakeholders, this can help ensure that the code aligns better with societal expectations, reduces the risk of regulatory capture by special interests, and can help address the needs of vulnerable groups (Tanner et al., 2020).

⁹ For example, in the USA, where 15 codes are updated during each cycle, the model code revisions take three years to complete and publish. Individually, jurisdictions sometimes opt to enact updates over a six-year, rather than three-year cycle (ICC, 2021a).





3. Methodology for the Country Assessments

3. Methodology for the Country Assessments

This chapter presents the key objectives of this global assessment and the methodology underpinning it.

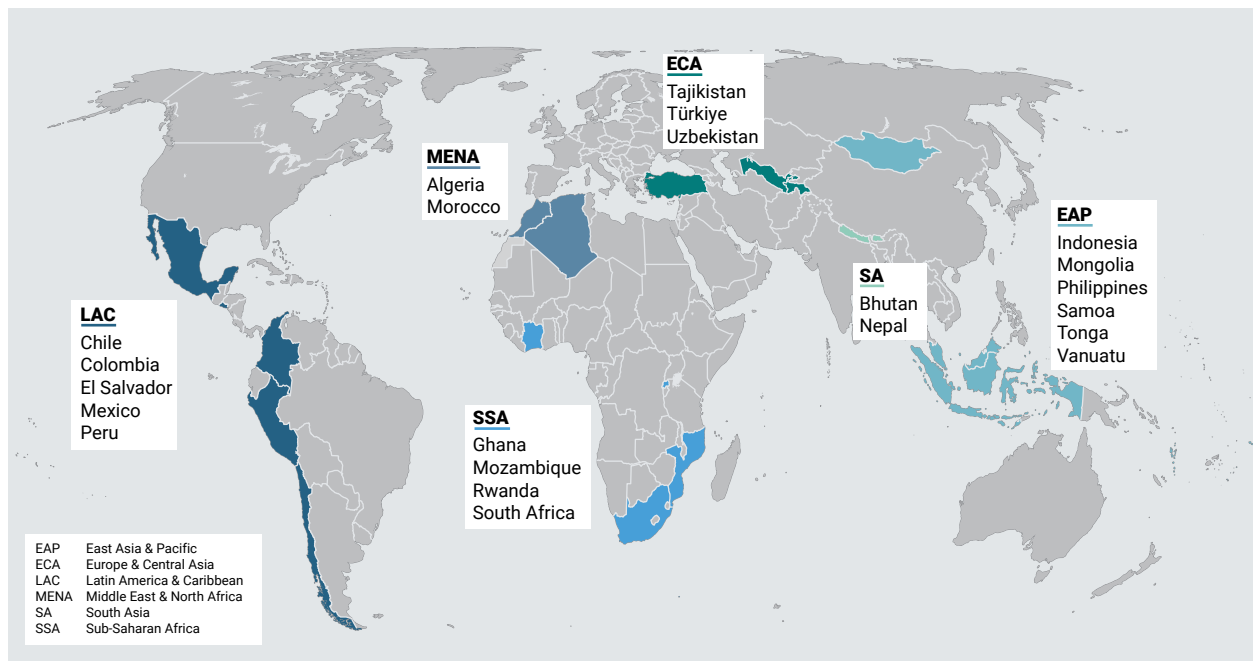
3.1 KEY OBJECTIVES

The primary aim of the review was to understand the content, organization, and accessibility of building codes and related building control mechanisms for selected countries across six different geographic regions. The assessment of building codes focused on design and construction provisions related to structural safety and resilience, green building, and universal accessibility. In addition, the review assessed, at a high level, the comprehensiveness, clarity and accessibility of building control regulations and the broader enabling environment.

3.2 COUNTRY SELECTION

Countries were selected for this study based on the level of expected losses from seismic and cyclonic wind events, regional distribution, and building code status. A total of 22 countries were chosen from the following six regions: East Asia & Pacific (EAP), Europe & Central Asia (ECA), Latin America & Caribbean (LAC), Middle East & North Africa (MENA), South Asia (SA) and Sub-Saharan Africa (SSA).¹⁰ Refer to Map 3.1 below.

Map 3.1 // The 22 countries selected for review of building codes and implementation mechanisms



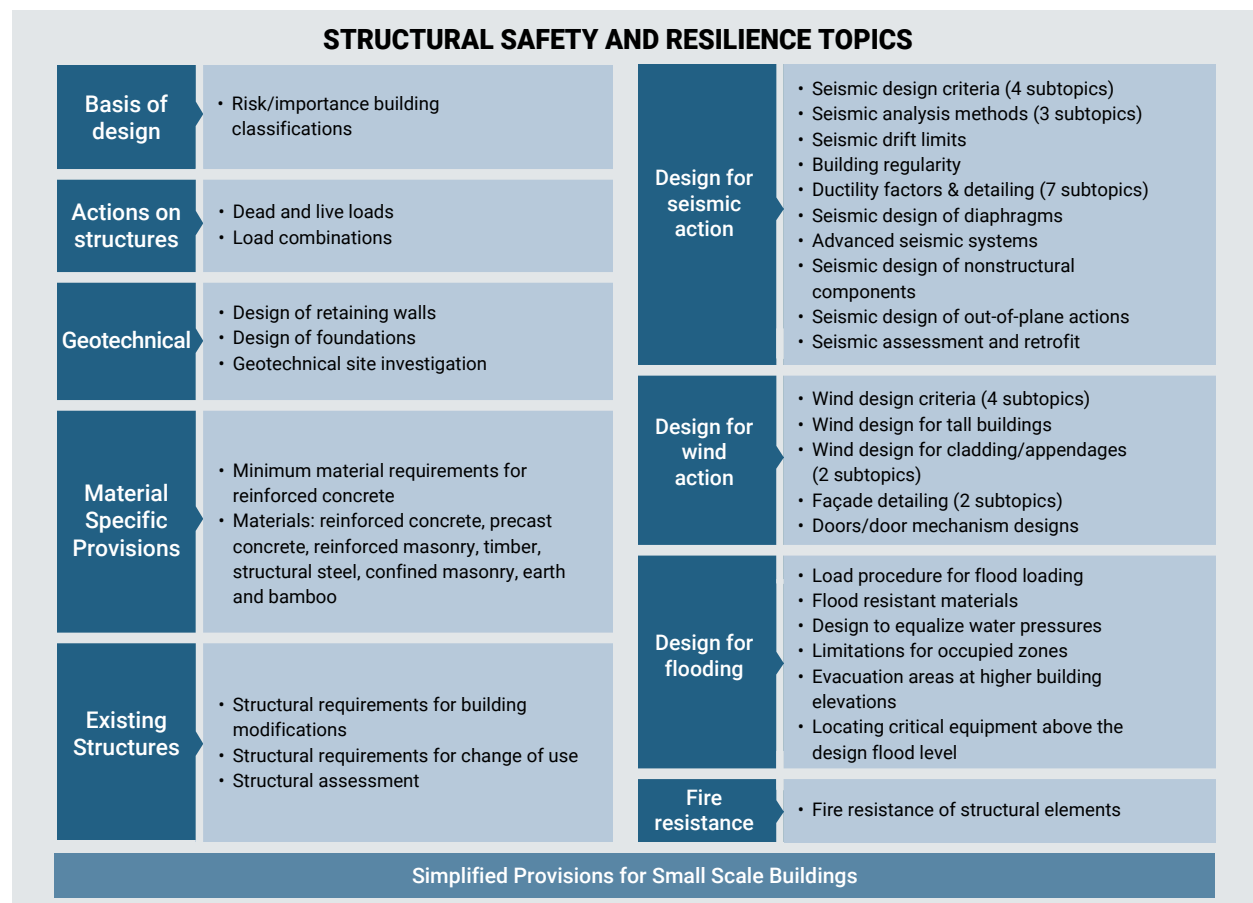
¹⁰ Countries are assigned to regions in accordance with the World Bank convention. <https://datatopics.worldbank.org/sdcatlas/archive/2017/the-world-by-region.html>.

Initially, countries were selected on the basis of global seismic and cyclonic wind risk rankings. The final selection also considered regional representation and building code status. First, 50 countries were selected based on: (i) the highest expected ratio of average annual losses for seismic events to the total estimated replacement cost for the country's building assets (AALR) based on the seismic risk assessment from the Global Earthquake Model (Johnson et al., 2023); and (ii) the highest expected ratio of average annual losses for cyclone events to total estimated replacement cost for the country's building assets (AALR), based on the Global Assessment Report on Disaster Risk Reduction Study (UNDRR, 2016).¹¹ The final selection of 22 countries ensured proportional representation within the six targeted regions, excluding countries without a legally adopted building code.¹²

3.3 FRAMEWORK FOR ASSESSING THE BUILDING CODES AND REGULATIONS

The assessment of the building code contents focused on provisions under the following main topic areas: (i) structural safety and resilience, (ii) green building; and (iii) universal accessibility. Under each main topic, code provisions assessed were identified for different subtopics presented in Figure 3.1. These topics and subtopics, as well as evaluation statements related to each subtopic, were prioritized and formulated based on a comparative analysis of global building codes and expert opinions. They were also informed by a set of Building Code Checklists for structural resilience, green buildings, and universal accessibility developed by the World Bank/GFDRR (World Bank, 2024b; World Bank, 2023a; World Bank, 2025).

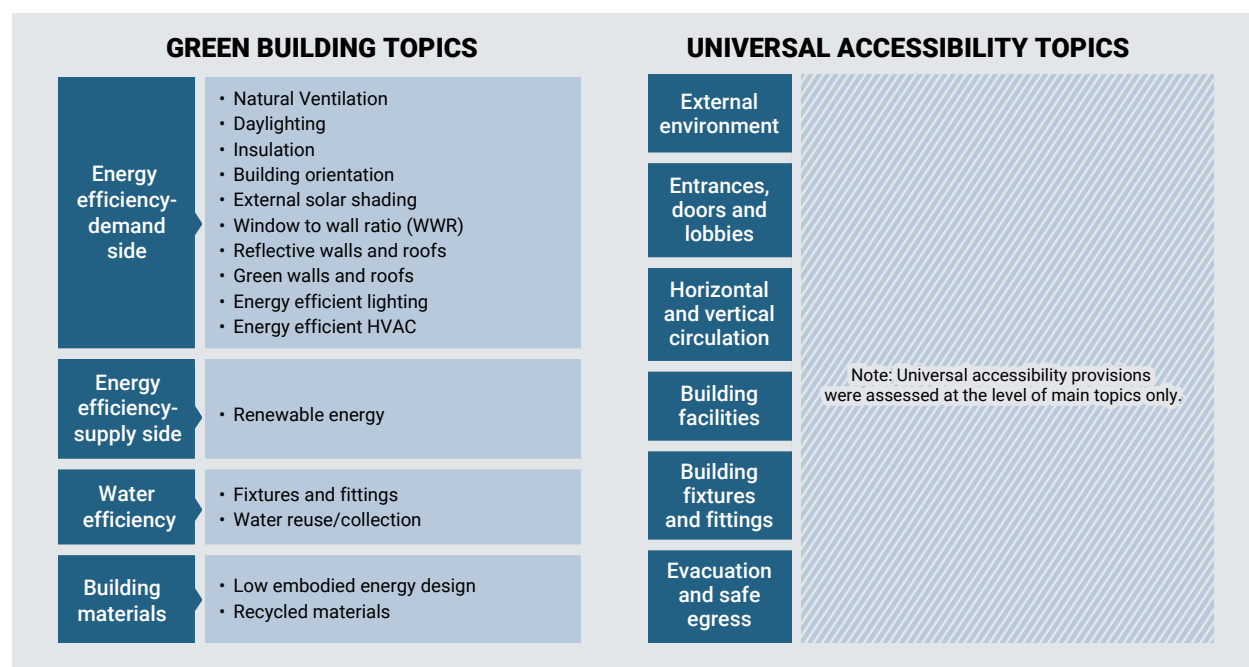
Figure 3.1 // Main topic areas and subtopics for the building code review: (i) structural safety and resilience; (ii) green building; and (iii) universal accessibility



¹¹ Of these, approximately 70 percent were selected based on their seismic risk ranking, while the remaining 30 percent were selected based on the cyclone risk ranking.

¹² In some cases, countries were also excluded if an extensive building code update was anticipated in the short term.

Figure 3.1 // Main topic areas and subtopics for the building code review: (i) structural safety and resilience; (ii) green building; and (iii) universal accessibility (cont.)

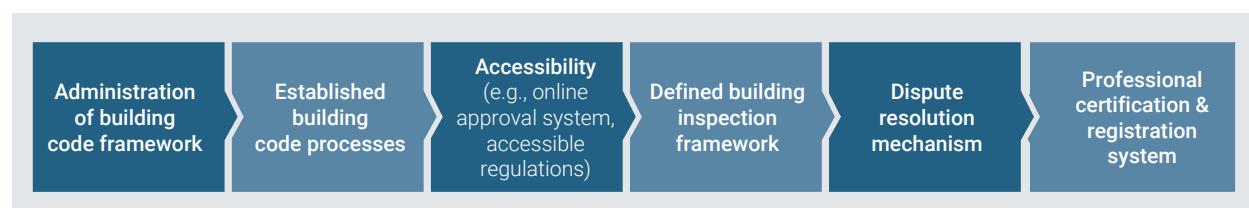


In addition to the high-level assessment of the technical contents of the codes, this study also examined the following aspects: **(i) regulatory jurisdictions** – at what level regulations are set (national or state/territorial or city level); **(ii) regulatory structure** – how the regulations are organized; **(iii) types of buildings the codes apply to**; and **(iv) accessibility of documents** – whether the regulations are easily accessible (for example, free of charge and available online). For green buildings and universal accessibility provisions, the assessment determined whether compliance with provisions was **mandatory** or **voluntary**.

3.4 FRAMEWORK FOR ASSESSING THE CODE IMPLEMENTATION ENVIRONMENT

The review of building control regulations and other aspects of the wider enabling environment to support effective code implementation (also called the “enabling environment”) focused on six main topics. Refer to Figure 3.2. It also examined **regulatory jurisdictions**, **regulatory structure** and the **accessibility of documents** for building code implementation regulations (adhering to the same format) as for the review of building code contents.

Figure 3.2 // Main topic areas for the building control regulations and enabling environment review



3.5 STATEMENTS FOR THE ASSESSMENT OF CODE CONTENTS AND CODE IMPLEMENTATION TOPIC AREAS

The assessment approach was designed to produce a high-level evaluation of code contents and code implementation factors for the selected topics in a consistent manner across the study countries. For each topic and the related subtopics, one or more statements were developed to determine whether relevant provisions in a building code met the chosen threshold. The number of statements varied across the main topic areas: 60 related to structural safety and resilience, 15 to green buildings, and six to universal accessibility (all statements are given in Annex D). Possible answers for each statement were: ‘Yes’, when a statement was clearly supported by the relevant content of the code; ‘No’, when it was not; or ‘U’, when the country expert was unable to verify the statement based on their understanding of the code provisions.¹³ For the code implementation environment topics, ‘P’ was also used if the country’s code implementation processes and environment partially satisfied the statement. The assessment sought to determine whether or not the codes and regulations contained basic provisions in each topic area, rather than evaluating quality and comprehensiveness of the codes in detail, which was beyond the scope of this study.

3.6 DATA COLLECTION AND PROCESSING

Data for these 22 countries were collected using standardized forms with the statements discussed in Section 3.5. Technical experts, referred to as “country experts” in the report, who were familiar with the country’s local building code and its design and construction practices, provided data for the standardized forms. The data were collected over six months (April to October 2024) and were then validated by the study team, comprising technical specialists familiar with global building codes for structural resilience, green buildings, and universal accessibility. The final data for each country were then used for data analysis and visualization purposes, in preparation of this report.

¹³ In some cases, code provisions referred to a section in the regulation document that was omitted, or other inconsistencies or lack of clarity in provisions existed.





4. Structural Safety and Resilience

4. Structural Safety and Resilience

A key function of building codes is to set minimum standards for the structural safety of buildings to protect the public. There is a broad expectation by the public that buildings will be safe. Unfortunately, because of poor design and construction practices, building failures, including collapses, do occur, even under normal loading. This can be a persistent problem in developing countries where rapid urbanization and lack of affordable housing can lead to risky and less well-regulated development practices. For example, in Lagos, Nigeria, between 2000 and 2021, there were 167 reported cases of spontaneous building collapse (Okunlola, 2022). In other cases, including in developing countries, the predominant factor contributing to building failures is how aging structures are managed and maintained. For example, one study in the USA recorded 225 building failures between 1989 and 2000, many of which were caused by lack of maintenance and/or modifications to existing buildings without proper structural checks or regulatory oversight (Wardhana and Hadipriono, 2003).

Beyond achieving minimum safety, there is a growing awareness of the benefits of improving the physical resilience of buildings. There are new and expanded ways that building codes can encourage improvements to the physical resilience of the built environment and the resilience of communities in the face of climate change and increased disaster risk. The concept of resilience relates to the ability of a system to absorb, accommodate, or recover from the effects of shocks and stresses with limited disruption to its essential functions (adapted from UNDRR, 2025). Building measures to improve resilience can include designing for more ambitious building performance objectives and the design of systems that ensure continuity of essential services like communications, water supply and power.

This chapter presents the findings related to general structural safety and resilience, followed by a discussion of priority areas for the further development of code provisions to promote these goals. These include broader objectives beyond structural safety including limiting disruption during and after shocks and stresses (see Section 4.2.3). Assessment of structural safety and resilience provisions related to specific hazards is covered separately in Chapter 5 (seismic), Chapter 6 (wind), and Chapter 7 (flooding).¹⁴ Comprehensive risk reduction and resilience improvements require consideration of multiple hazards and risks. Considerations for harmonizing code provisions to achieve this are discussed in Section 4.2.5.

4.1 ASSESSMENT OF STRUCTURAL DESIGN PROVISIONS

This study looks at diverse aspects of structural design and construction codes, starting with regulatory structure, organization and accessibility of code documents (Section 4.1.1), followed by code provisions for structural safety (Section 4.1.2).

4.1.1 Regulatory structure, organization, and accessibility of structural design codes

For the review of regulatory structure, organization, code updates and accessibility of documents, the findings are summarized below:

¹⁴ Chapter 8 covers considerations for wildfire design provisions in building codes. This study did not present data for the 22 countries for these provisions as they were very limited.



- » **Regulatory jurisdictions:** Across the 22 countries, this study found that all codes related to structural safety and resilience were set at national level, except for Mexico which has a federal system. In Mexico, the 31 states and the federal district of Mexico City set their own building codes.
- » **Organization of code documents:** In six countries (in Bhutan, Colombia, Ghana, Samoa, Tonga, and Vanuatu), there was one main building code document for most design provisions¹⁵. The remaining 16 countries had the provisions contained in a set of separate documents.
- » **Code update cycle:** In many of the countries assessed, there is a need to update codes, as they were last updated over a decade ago. Peru and Rwanda had structural design code documents published within the past five years. Ghana and the Philippines had code documents which had all been published in the past 10 years. The remaining 17 countries, except for Mozambique, had some regulations that were older than 10 years (though no older than 40 years).¹⁶ Mozambique's regulations are based on old Portuguese codes dating from 1961 to 1968.
- » **Accessibility of documents:** If codes are not available online and are not free of charge, users cannot easily access them. Of 22 countries, only nine made all code documents available online and free of charge.¹⁷ In Mongolia and Tajikistan, none were available online or free of charge. In Rwanda, Samoa, South Africa, Tonga, Türkiye, and Vanuatu, the codes were available online, but some required a fee. In Bhutan, Chile, El Salvador, and Morocco, some code documents were available online and free of charge, some were available online for a fee, and others were neither available online nor free of charge.

Box 4.1 // Evolution of Chile's building code

Chile has been a leader in building code development in the Latin American region. Located in a region of high seismicity, Chile was the first country to incorporate seismic design provisions into their code in 1935, with more comprehensive provisions in place by the 1970s (GEM, n.d.). Over the past century, Chile's seismic design provisions have continued to evolve, with updates often incorporating lessons learned from major earthquakes. For example, following the Maule earthquake in 2010, the 2011 update included improved definition of soil types, and updated seismic hazard maps for design. In 2015, a new standard for the design of nonstructural components and systems was also introduced after widespread non-structural damage observed in previous earthquake events.



Santiago, Chile. Photo credit: diegograndi | iStock

¹⁵ For some of these countries, green building and universal accessibility provisions were contained in separate documents.

¹⁶ This was assessed based on the earliest year of publication for the regulations in use for each country.

¹⁷ In Algeria, Colombia, Ghana, Indonesia, Mexico, Mozambique, Nepal, Peru and Uzbekistan.

Overall, based on the assessment findings, efforts are needed in many countries to update out-of-date structural design codes as well as improve access to code documents for users. This highlights the need for countries to periodically update codes, particularly for design criteria related to natural hazards and climatic conditions, where knowledge is continuously evolving. In addition, to support effective implementation, countries can benefit from improving user access to code documents, ideally by making them freely available online.

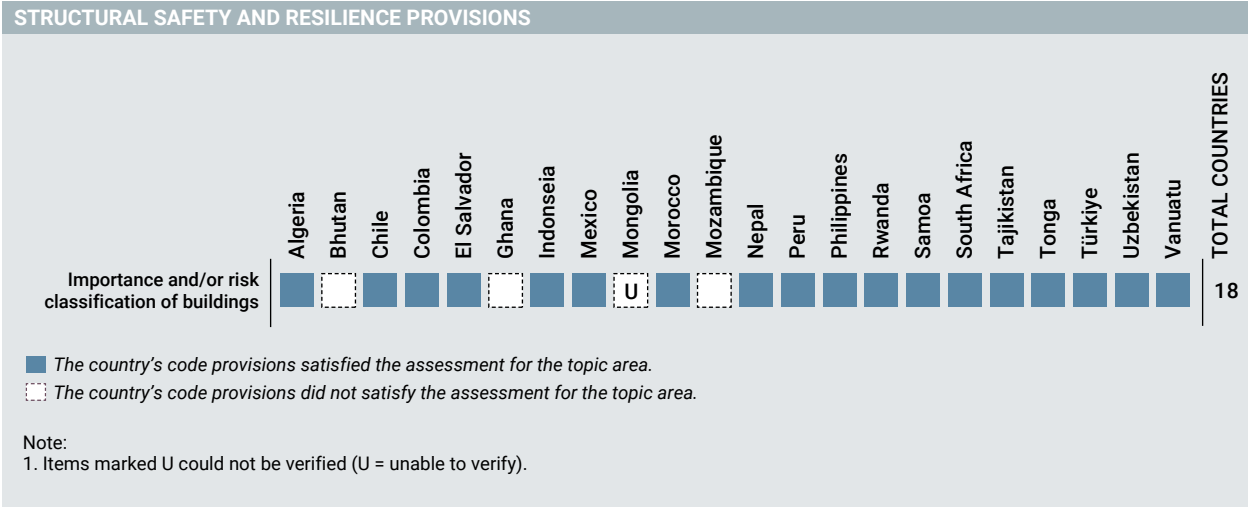
4.1.2 General structural design provisions

This section presents selected findings of the technical evaluation of general structural design provisions, covering: (i) basis of design; (ii) actions on structures (general provisions); (iii) geotechnical/foundation design; (iv) material-specific design; (v) fire resistance of structural elements; (vi) existing buildings; and (vii) simplified provisions for common types of small-scale buildings. Technical provisions related to these topics were assessed to understand content and level of code provisions from various countries. The overall findings are presented in Figure 4.10.

4.1.2.1 Basis of design

The basis of design within building codes establishes general principles and requirements. These can include acceptable methods to demonstrate code compliance, target design life (expressed in years), requirements for durability of materials and structures, key definitions, specification of units of measurement (for example, metric or imperial), and the importance/risk classification of buildings (World Bank, 2024b). This study focused on whether the code included a generalized framework to classify the importance and/or risk level of buildings for structural design purposes, particularly related to hazards such as seismic and wind events. The importance/risk level is typically assigned depending on the building usage category, occupancy level and/or possible hazardous contents. This requirement was prioritized as it can be used to link the criticality of a building or the function it serves to design provisions, where code provisions apply more rigorous requirements for buildings of higher importance. See Figure 4.1 for the findings of the assessment.

Figure 4.1 // Assessment results for importance and/or risk classification of buildings



A majority of countries (18 out of 22) included provisions related to the importance/risk classification of buildings in their building codes. Ghana and Bhutan did have importance factors related to seismic design, but not for wind design. Mozambique did not have importance factors for seismic or wind design.¹⁸ These countries would

¹⁸ The assessment was unable to determine if Mongolia's code contained an importance/risk classification for buildings.



benefit from more stringent provisions for higher importance buildings¹⁹ and a consistent approach across different hazards.

4.1.2.2 Actions on structures

Actions on structures are defined as the types of loading that should be considered for building design. These include dead load, live load, earth/soil loading parameters, wind load, seismic load, flood load, snow and/or rain loads, and accidental loads. The following items were assessed in this context: (i) whether the code included minimum dead load assumptions (for example, the inherent weight in a building from structural elements, architectural finishes, and so forth) and live load assumptions (movable loads such as people, furniture, and so forth); and (ii) whether the code prescribed load combinations for considering simultaneous effect of applicable loads, for example, dead and live loads, wind loads, seismic loads, and so forth.

All 22 countries contained provisions for dead and live loads as well as load combinations. This finding was not unexpected as this is a basic element of building codes. Findings for provisions related to seismic, wind, and flood loads are presented in more detail in Chapters 5, 6, and 7 respectively.

4.1.2.3 Geotechnical engineering considerations and design of substructure

Geotechnical provisions relate to the engineering behavior of earth materials and related parameters for structures in contact with soil/earth. Key topics assessed in this study were related to the code provisions for geotechnical site investigations, foundation design, and retaining wall design, as outlined in Table 4.1.

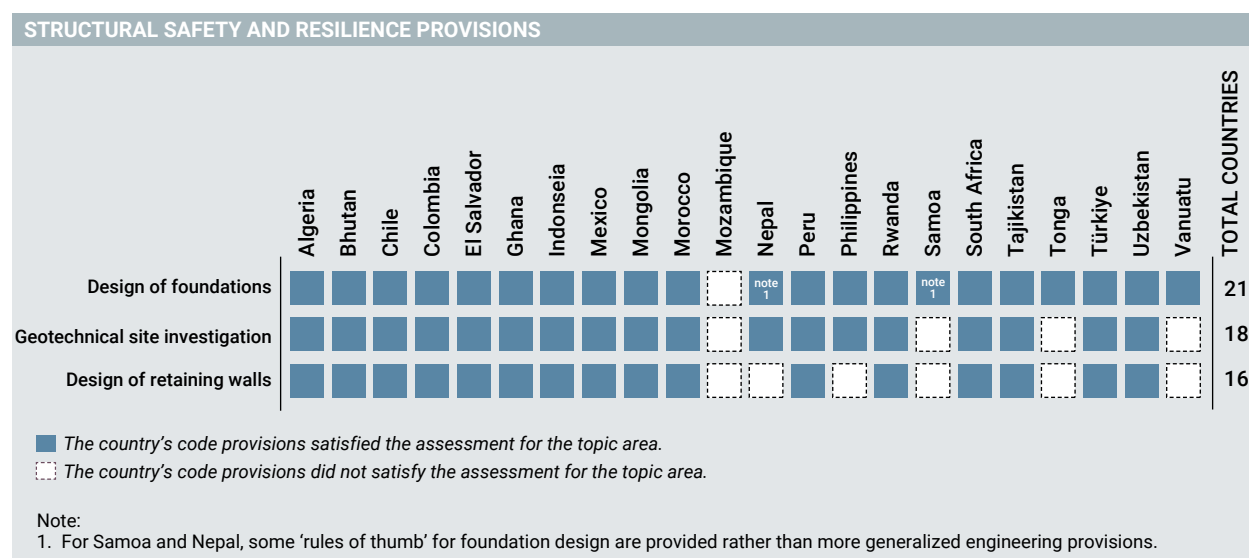
Table 4.1 // Topic areas for geotechnical and substructure design provisions

Topic Area	Description
Geotechnical site investigations	Site investigations are needed to understand the geology, soil properties, and site hazards, as well as to specify parameters for foundation design in most projects. In some cases, soil testing results can be used to establish the soil type, which may be required for seismic design (in the context of site response factors for seismic hazard criteria).
Design of foundations	Adequate foundations are an essential building component, irrespective of a building's size, importance, and exposure to various hazards. Foundation types include shallow foundations, such as raft (mat) foundations and strip footings, or deep foundations such as piles. Foundations are commonly constructed using cast-in-place reinforced concrete, and/or brick or stone masonry, as is often the case for vernacular buildings.
Design of retaining walls	Retaining walls resist soil pressure (and water pressure, depending on the level of the water table). They are important for buildings located on sloped ground, buildings with basements, and in some cases, are used on the wider building site. Design provisions for retaining walls include checks related to their stability to sliding and overturning, as well as strength under the combined effects of gravity and lateral loads.

Most countries had some provisions related to geotechnical site investigations, and design of foundations and retaining walls, except for Mozambique, where no geotechnical provisions were included (Figure 4.2). Gaps also existed for the Pacific Island countries of Samoa, Tonga and Vanuatu, which did not include any provisions for site investigation or retaining wall design. In addition, no retaining wall design provisions were included in the building codes for the Philippines and Nepal. In Samoa and Nepal, the only foundation design provisions were “rules of thumb” for small-scale buildings.

¹⁹ For example, buildings with higher-level occupancy levels, buildings that provide essential services or are essential to post-disaster recovery, and buildings associated with hazardous contents.



Figure 4.2 // Assessment results for geotechnical and substructure design topics in the building code

4.1.2.4 Material-specific structural design provisions

Material-specific structural design provisions include requirements related to minimum material properties and the structural design of buildings constructed using specific materials (for example, reinforced concrete, steel, masonry), as explained in Table 4.2.

Table 4.2 // Topic areas for material-specific structural design provisions

Topic Area	Description
Minimum material requirements for reinforced concrete	Reinforced concrete is the prevalent construction material for new buildings in urban areas worldwide. Minimum requirements related to the quality of concrete and steel materials need to be included in structural design codes and implemented in the construction of reinforced concrete buildings to ensure their safety and durability. These requirements include minimum compressive strengths for concrete and minimum strength and ductility for steel reinforcing bars.
Design of reinforced concrete buildings	Reinforced concrete combines the compressive strength of concrete with the tensile resistance of steel reinforcement. Common reinforced concrete structural systems for buildings are beam-column frames (often with masonry infill walls) and reinforced concrete shear walls (extending continuously from the foundations to the roof), usually constructed in combination with frames. Floor structures in these buildings are usually in the form of reinforced concrete slabs.
Design of precast concrete buildings	Precast concrete buildings are common in some parts of the world, such as Eastern Europe and Central Asia. These buildings are often constructed using wall panels and floor slabs that are prefabricated offsite and subsequently transported to the construction site and erected in the final position. The fabrication and erection of precast concrete systems requires advanced skills and equipment.
Design of unreinforced masonry buildings	Unreinforced masonry (URM) buildings are commonly used for housing in many countries. The structural system of masonry buildings comprises loadbearing masonry walls, made using clay bricks or blocks, hollow concrete blocks, or stone. Mortar type and composition range from lime to cement-based mortars. Reinforcement is not provided in the walls. Unreinforced masonry buildings are vulnerable to earthquakes.
Design of reinforced masonry buildings	Reinforced masonry buildings have masonry walls reinforced with horizontal and vertical steel bars, usually embedded in grouted hollow concrete or clay blocks.

Table 4.2 // Topic areas for material-specific structural design provisions (cont.)

Topic Area	Description
Design of confined masonry buildings	Confined masonry buildings have masonry walls enclosed by horizontal and vertical reinforced concrete confining elements. Walls are constructed first, and reinforced concrete tie-columns and tie-beams are cast later.
Design of steel buildings	Steel buildings consist of structural steel beams and columns in frame structures. It is a common practice to provide diagonal elements, known as braces, in the frames. Examples of seismically detailed braced frame systems include concentric braced frames and eccentric braced frames. Other types of seismically resistant steel structures include moment-resisting frames.
Design of earthen buildings	Earthen structures are used as dwellings in many low- and middle-income countries. These buildings have walls constructed using unreinforced rammed earth, adobe or stabilized mud blocks, or cob technologies. Unreinforced earthen structures are vulnerable to earthquake effects. In some cases, it is possible to provide internal reinforcement in the walls or apply mesh externally to enhance the structural integrity of these buildings. Earthen buildings are also vulnerable to floods and storms as their materials can absorb moisture and are vulnerable to erosion.
Design of timber buildings	Timber is a locally available material in many countries and often used in the construction of dwellings. Timber buildings may be in the form of a post-and-beam system, or a wood stud wall system. Timber structures are lightweight and inherently more resilient to earthquake effects, provided that they have sufficient resistance to lateral forces and the connections between structural components are adequate. They can be vulnerable to insect attacks and moisture if not properly protected and maintained.
Design of bamboo buildings	In some countries, bamboo is a locally available material and is often used in the construction of vernacular dwellings (Kaminski et al., 2016), as well as in engineered buildings in some Latin American countries. Because bamboo structures are lightweight, they are inherently more resilient to earthquake effects, provided that the connections between structural components are adequate. They can be vulnerable to insect attacks and moisture if not properly protected and maintained.

This study found that building code coverage is more comprehensive for ‘engineered’ materials such as reinforced concrete and structural steel, and that only a few countries included provisions for materials such as earth and bamboo associated with vernacular construction. Design provisions for different structural materials in building codes should consider materials that are commonly used in local construction practices. All 22 countries have design provisions related to reinforced concrete and structural steel buildings, prevalent construction materials used in urban areas around the world; however, design provisions related to URM, confined masonry, bamboo and earthen construction are addressed in fewer than half the study countries. Design provisions for timber and reinforced masonry structures are covered by most countries. In some countries, such as Algeria and Chile, URM is prohibited by the code as it is vulnerable to earthquakes—thus, URM design provisions are excluded (see Figure 4.3).

The study findings demonstrate that gaps exist in the coverage of vernacular construction types, such as earthen construction and unreinforced masonry construction. For example, in Algeria and Mozambique, earthen construction is estimated to be used for 17 percent and 29 percent of the building stock respectively, but no provisions for it are contained in the country’s codes.²⁰

When provisions for vernacular construction types are included in the codes, careful consideration is needed to adapt them for local hazard conditions. For example, Peru has developed and adopted a design code for earthen construction that includes methods and detailing to resist seismic loads (Neumann et al., 2006). It is also recommended that countries in seismic regions include provisions for more seismically resistant masonry construction technologies, such as reinforced masonry, confined masonry, and/or specifications to enhance existing vernacular masonry buildings to improve seismic resistance. It is not uncommon for countries to prohibit unreinforced masonry (URM) in their codes, as is the case in Algeria and Chile. As these countries are in regions of moderate to

²⁰ Data for the prevalence of construction types is based on the GEM Exposure Model (Yepes-Estrada et al., 2023).



high seismicity, the use of URM is discouraged in favor of higher-performing masonry systems and/or vernacular types with enhancements such as timber or cast-in-place reinforced concrete ring-beams and through-stones (bond-stones).

Figure 4.3 // Assessment results for structural design provisions for different materials and technologies

STRUCTURAL SAFETY AND RESILIENCE PROVISIONS																							
	Algeria	Bhutan	Chile	Colombia	El Salvador	Ghana	Indonesia	Mexico	Mongolia	Morocco	Mozambique	Nepal	Peru	Philippines	Rwanda	Samoa	South Africa	Tajikistan	Tonga	Türkiye	Uzbekistan	Vanuatu	TOTAL COUNTRIES
Reinforced concrete design																							22
Structural steel design																							22
Timber design																							19
Reinforced masonry design (may include hollow block masonry)												note 4											18
Precast concrete design																							17
Unreinforced masonry design (e.g., brick, stone, and/or hollow block)	note 1		note 1		U			note 2															13
Confined masonry design																							10
Earth structure design (e.g., adobe, soil stabilized block, rammed earth)																							10
Bamboo design																							6

The country's code provisions satisfied the assessment for the topic area.

The country's code provisions did not satisfy the assessment for the topic area.

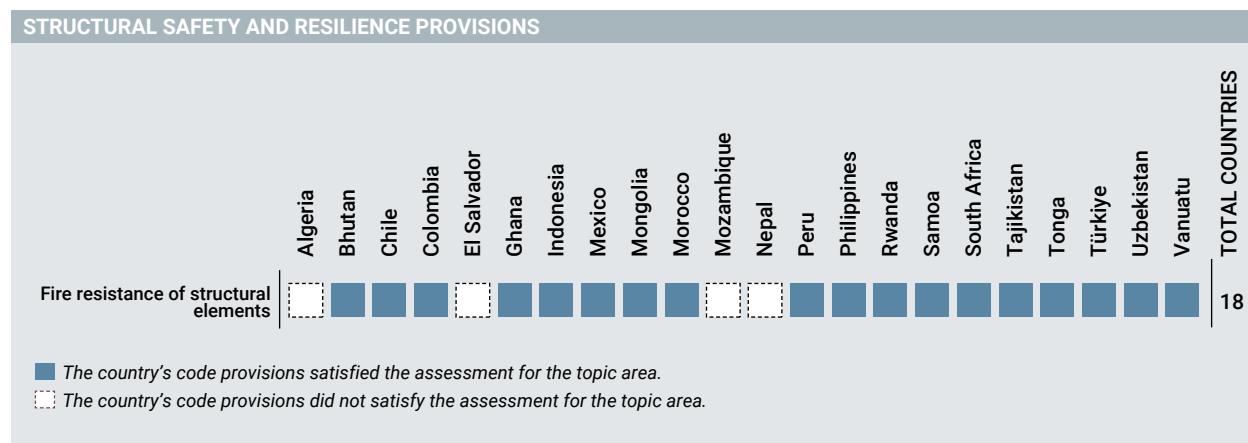
Notes:

1. In Algeria and Chile, unreinforced masonry construction is prohibited, as it is vulnerable to earthquakes.
2. For Mexico, unreinforced masonry is only allowed for certain limited applications, such as foundations for small-scale buildings.
3. Items marked U could not be verified (U=Unable to verify).
4. For Nepal, 'rules of thumb' for reinforced masonry design are provided rather than more generalized engineering provisions.

4.1.2.5 Fire resistance of structural elements

All countries, except for Algeria, El Salvador, Mozambique and Nepal, had some provisions related to the fire resistance of structural elements.²¹ This study did not focus in detail on building code provisions related to fire safety. However, as part of the assessment of structural safety provisions, it was considered important to assess whether codes included provisions related to the fire resistance of structural elements. These requirements typically prescribe a minimum duration (number of hours) for a structural element or assembly to withstand a certain level of exposure to fire while maintaining load-bearing capacity and structural integrity. Refer to Figure 4.4.

²¹ This assessment looked at building codes, standards and wider building regulations such as Building Acts and building control regulations, mostly set at national level. In some cases, fire-safety requirements can be set by different agencies, including at local level.

Figure 4.4 // Assessment results for provisions for fire resistance of structural elements

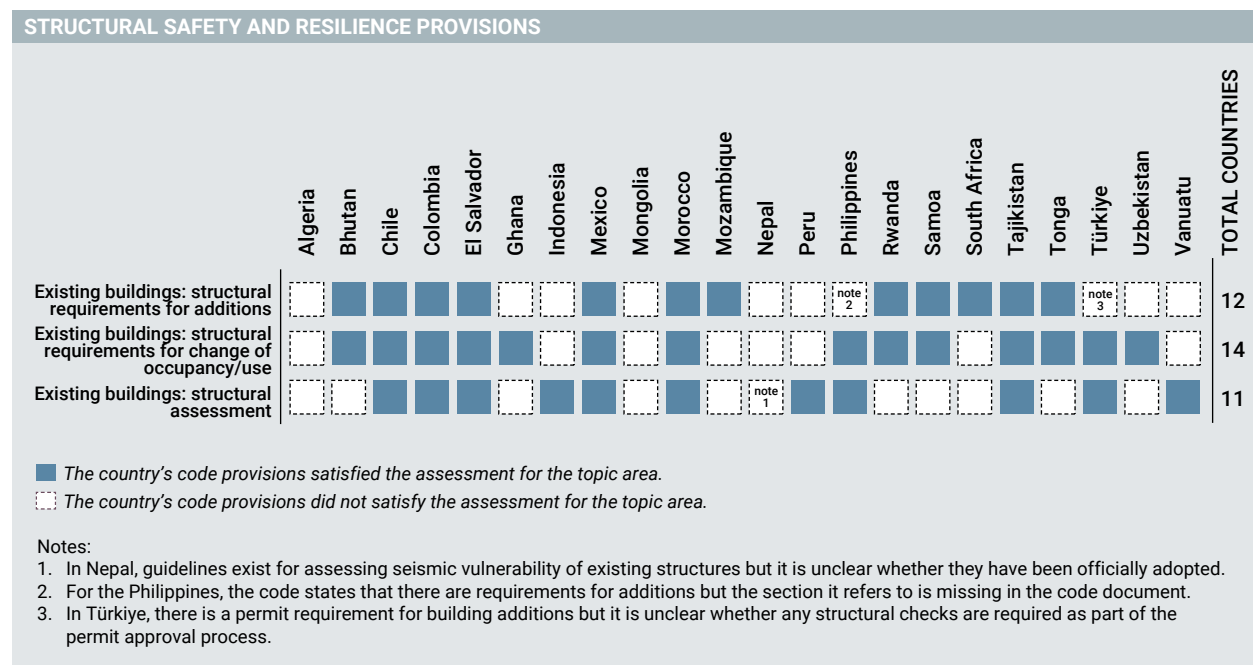
4.1.2.6 Provisions related to existing buildings

It is important for building codes to address modifications to existing buildings and include requirements to assess their condition to ensure structural safety. For existing buildings, codes can include provisions related to building condition assessment and structural requirements for buildings undergoing a change of usage (for example, converting an office to a residential building), horizontal or vertical building expansions (for example, adding floors), or other forms of structural modification. In some cases, building rehabilitation may be required if a building's condition has deteriorated over time. Insufficient regulation related to modifications to existing buildings can have serious consequences for structural safety. The 2017 Puebla earthquake in Mexico predominantly impacted the country's capital, Mexico City. One of the earthquake's biggest tragedies was the collapse of the Enrique Rebsamen School, where 19 children and seven adults were killed. Subsequent investigations confirmed that two additional floors had been added prior to the earthquake without performing proper structural safety checks and the required structural strengthening in accordance with the Mexico City code (Reuters, 2017).

Figure 4.5 // Rescue efforts after the collapse of the Enrique Rebsamen School, Mexico City in the 2017 Puebla earthquake.

Photo credit: Xinhua | Alamy

Code provisions related to structural assessment and modifications to existing buildings were less well covered in the study countries than provisions for new buildings. Refer to Figure 4.6. For example, six countries—Chile, Colombia, El Salvador, Mexico, Morocco, and Tajikistan—have some provisions in all three existing building topic areas assessed. Countries often develop these types of provisions in response to disaster events that damage comparatively vulnerable existing buildings and demonstrate the need for assessment, rehabilitation and retrofitting. Refer to the discussion on seismic assessment and retrofitting of existing buildings in Chapter 5, Section 5.3.3.

Figure 4.6 // Assessment results for code provisions related to the modification and structural assessment of existing buildings

4.1.2.7 Simplified design provisions for common types of small-scale buildings

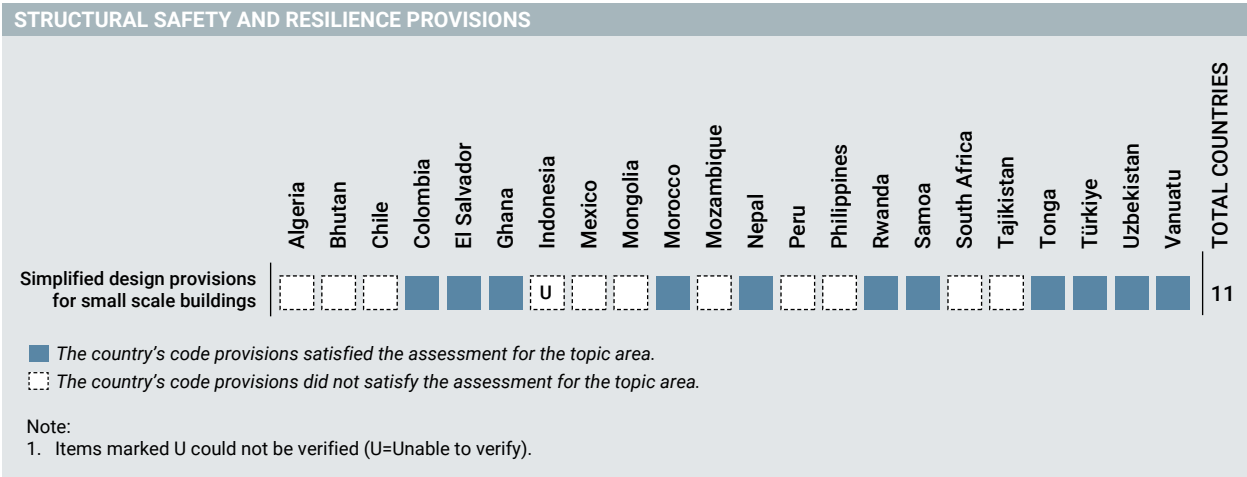
Simplified provisions for common types of small-scale buildings can be particularly beneficial in countries where smaller residential and commercial buildings are often constructed without the input of building design and construction professionals. These provisions may be contained in the building code or presented as guidelines containing “rules of thumb” and prescriptive provisions that apply only to small-scale buildings. These types of provisions are more accessible and less complex to follow, facilitating a streamlined building control process, and resulting in safe, code-compliant, and cost-effective construction. Conversely, some countries simply exempt small-scale buildings²² from following the building code requirements. This is not a recommended practice as small-scale buildings often represent the highest proportion of building stock in low- to middle-income countries, leading to significant informal development and related risks. **Of the 22 countries assessed in this study, 11 had some simplified design provisions for small-scale buildings, typically low-rise dwellings with a limited footprint, in their building code.** See Figure 4.7.

Some countries have formally adopted guidelines to address the design and construction of small-scale buildings. For example, guidelines that address the design and construction of small-scale, mostly vernacular buildings (for example, NBC 203 for masonry or NBC 204 for earthen construction) (DUDBC, 1994a, b; DUDBC, 2015a, b), were adopted as official code documents in Nepal. Other countries, such as Bhutan, have guidelines for vernacular building typologies that are not referenced in the building code but were issued by government agencies (EARRD, 2020; SATREPS, 2023). Alternatively, Peru has a design standard for earthen structures: RNE E.080 (SENCICO, 2020), that is mostly used for the construction of small scale buildings; however, it does not explicitly contain specific provisions for small-scale buildings.

²² For example, buildings below a certain footprint area or number of stories.

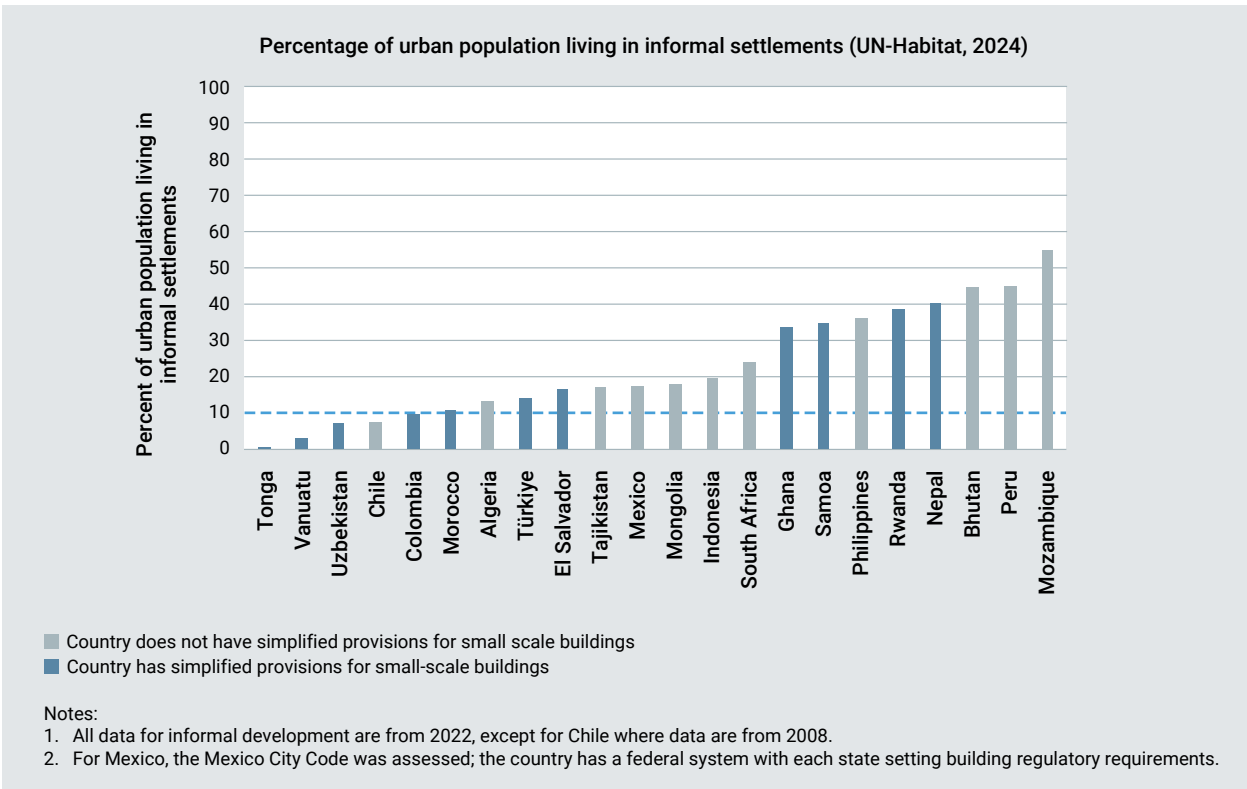


Figure 4.7 // Assessment results for simplified design provisions for small-scale buildings



Informal development is a significant issue in many countries, where a substantial portion of the building stock has been designed and constructed not in accordance with building code or building control requirements. Refer to Figure 4.8 showing the estimated percentage of the urban population living in informal settlements and highlighting the countries in this study with simplified design and construction provisions for small-scale buildings. It can be observed that in 10 countries with significant levels of informal development (greater than 10 percent of the building stock), the building codes lack these simplified provisions. These countries could benefit from incorporating simplified code provisions to facilitate higher levels of compliance and potentially reduce informality in the construction sector in conjunction with compliance support mechanisms liking training.

Figure 4.8 // Percentage of urban population living in informal settlements in the 22 countries considered in this study, identifying those with simplified design and construction provisions for small-scale buildings



Improved building codes linked to effective building control measures can help improve compliance and reduce informal development, but the issue is complex. The prevalence of informal development in some countries may be influenced by factors such as a lack of affordable housing, rapid urbanization without sufficient infrastructure development (transport, water, sewage, power), pressure on land for development, and lack of access to good quality construction materials.

Figure 4.9 // Informal construction on the slopes of the Atlas Mountains, Morocco



Photo credit: Salvador-Aznar | iStock

4.1.3 Summary of findings: general structural design provisions

Although provisions for structural design are a fundamental aspect of buildings codes, some gaps remain in the codes of the countries assessed in this study. The overall findings of the assessment for general structural provisions are presented in Figure 4.10, ranking countries by the total number of topic areas that satisfied the assessment statements. Some topic areas are context-specific and depend on the country's construction environment and common practices. For example, certain construction materials, such as timber, bamboo, earth and confined masonry, may be used less frequently in some countries and regions. In other words, countries cannot be regarded as having less comprehensive codes if they lack provisions covering materials that are not commonly used. Even when accounting for differences in local construction practices, however, Colombia, Mexico, and Türkiye emerge as the countries covering the most topic areas for general structural provisions. In other countries, the main gaps relate to risk/importance classification for buildings, geotechnical provisions, fire resistance of structural elements, and existing building provisions. Some countries, such as Chile, Mexico, Peru, and Tajikistan, have comprehensive structural design provisions, but they could benefit from the addition of simplified design rules for small-scale buildings.

Figure 4.10 // Summary of assessment of general structural design provisions for the 22 countries

STRUCTURAL SAFETY AND RESILIENCE PROVISIONS																					
COUNTRY	Basis of design	Actions on structures		Geotechnical/substructure design			Material specific designs provisions									Fire resistance	Provisions for existing buildings			Simplified design provisions	
	Importance/risk classification	Dead and live loading	Load combinations	Geotechnical site investigation	Design of foundations	Design of retaining walls	Minimum material requirements for reinforced concrete	Reinforced concrete design	Precast concrete design	Reinforced masonry design	Unreinforced masonry design	Timber design	Structural steel design	Confined masonry design	Earth structure design	Bamboo design	Fire resistance of structural elements	Structural requirements for additions	Structural requirements for change of occupancy/use	Structural assessment	Provisions for small-scale buildings
Colombia																					
Mexico											note 5										
Türkiye																		note 7			
El Salvador											U										
Morocco																					
Peru																					
Tajikistan																					
Uzbekistan																					
Rwanda																					
Chile											note 3										
Ghana																					
Philippines																		note 8			
South Africa																					
Nepal					note 2			note 10												note 4	
Samoa					note 2																
Tonga																					
Algeria											note 3										
Bhutan																					
Indonesia																					U
Mongolia	U																				
Vanuatu																					
Mozambique																					
Total Countries	18	22	22	18	21	16	22	22	18	18	13	19	22	10	10	6	18	12	14	11	11

■ The country's code provisions satisfied the assessment for the topic area.

□ The country's code provisions did not satisfy the assessment for the topic area.

Notes:

1. Items marked U could not be verified (U=Unable to verify).

2. For Samoa and Nepal, some 'rules of thumb' for foundation design are provided rather than more generalized engineering provisions.

3. For Algeria and Chile, unreinforced masonry construction is prohibited in seismic regions.

4. In Nepal, guidelines exist for assessing seismic vulnerability of existing structures but it is unclear whether they have been officially adopted.

5. For Mexico, unreinforced masonry construction is only permitted for limited applications such as foundations for small-scale buildings.

6. Structural design and construction provisions in the study countries cover all types of buildings unless otherwise noted.

7. In Türkiye, there is a permit requirement for building additions but it is unclear if any structural checks are required as part of the permit approval process.

8. For the Philippines, the code states that there are requirements for additions but the section it refers to is missing from the code document.

9. For Samoa, buildings constructed with traditional materials are exempt.

10. For Nepal, 'rules of thumb' for reinforced masonry design are provided rather than more generalized engineering provisions.

4.2 PRIORITIES FOR FURTHER DEVELOPMENT OF PROVISIONS TO ENHANCE STRUCTURAL SAFETY AND RESILIENCE

This section discusses priority topics for future code development related to structural safety and resilience, that may be applicable to the countries included in the study as well as other countries. The priority topic areas presented in this section were identified based on the review of the assessment results presented in Section 4.1, further supplemented by desktop review.

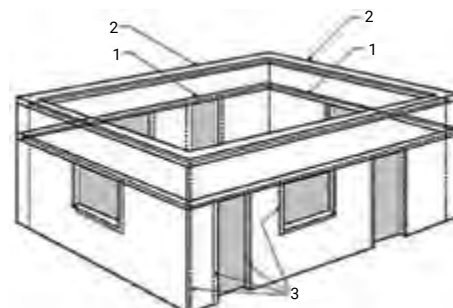
4.2.1 Simplified provisions for common types of small-scale buildings

To increase code compliance and ensure that building codes address the prevalence of non-engineered and/or vernacular construction in many countries, code provisions and complementary guidelines for common types of small-scale buildings can be beneficial. To develop these simplified provisions and guidelines, common types of construction for small-scale buildings, their inherent resilience to disaster risks, and any adaptations to the typologies needed for safety or resilience should be considered. More specific simplified provisions related to seismic and wind design are discussed in Chapters 5 and 6.

Box 4.2 // Simplified guidelines for non-engineered low-rise buildings in India

The Indian Standards have adopted simplified, prescriptive guidelines for non-engineered and vernacular construction. India was one of the first countries to publish dedicated design standards in the form of prescriptive guidelines for small-scale, low-rise vernacular construction, including IS 13827 for earthen construction (Bureau of Indian Standards, 1993a) and IS 13828 for masonry construction (Bureau of Indian Standards, 1993b). In 2011, it was estimated that vernacular masonry was used in the construction of approximately 60 percent of all housing units in India (NBO, 2011), 30 percent of which are exposed to high seismic hazard (Jain, 2016). Much of the content of these Indian standards was drawn from widely used guidelines, originally published by the International Association for Earthquake Engineering (IAEE) in 1980 (reprinted by NICEE, 2004), and an updated edition published by UNESCO (Arya et al., 2014).

Figure B4.2 // Seismic design provisions for non-engineered masonry buildings



- 1: RC lintel band
- 2: RC roof band (for pitched roofs and under flexible roof and floor)
- 3: Vertical reinforcing bar

Source: UNESCO, 2014.

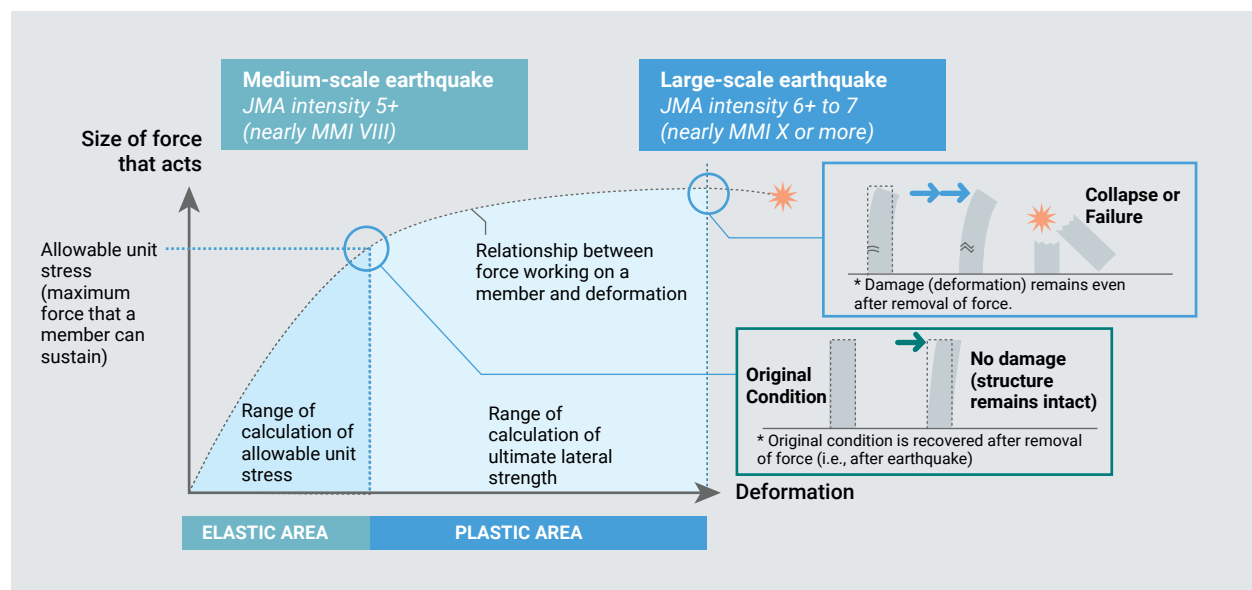
4.2.2 Enhanced building performance objectives to improve resilience

Although Life Safety remains the minimum performance requirement, building codes can include provisions for certain buildings that target higher performance objectives aimed at limiting disruption and expediting recovery after extreme events. Current building design approaches in many countries do not limit repairable or irreparable damage to the structures and other building components and systems in rare events such as hurricanes or major earthquakes. However, a higher margin of safety may be prescribed for buildings linked to their level of criticality and/or occupancy by specifying Importance Factors for wind, snow, and earthquake loading that increase the design loads for the main structure. Note that these types of provisions do not address damage

control beyond Life Safety performance in nonstructural components such as cladding, nonstructural walls, or building utilities, although their damage could severely impact building functionality following a disaster event. Loss of building function can interrupt essential services and hinder rapid recovery. For example, the nonstructural damage to masonry infill walls in many high-rise reinforced concrete buildings in Türkiye from the 2023 earthquakes led to their evacuation, protracted displacement of people from their homes, and eventual demolition of many damaged buildings (Binici et al., 2023).

Some building codes have design requirements to check building performance for different levels of design earthquake as well target higher levels of performance beyond Life Safety to minimize building damage in earthquakes. For example, since 1981, the building code of Japan stipulates that buildings must be designed for two performance objectives: (1) collapse prevention in a rare, large-scale earthquake (expected once in several hundred years) as well as (2) damage-free (or operational) performance in a more frequent, moderate-level earthquake (expected once in a few decades) (World Bank, 2017). See Figure 4.11. For most buildings except very small buildings, the code requires designers to conduct a nonlinear pushover analysis in addition to a linear elastic analysis. Nonlinear pushover analysis is used to simulate and validate the performance in terms of understanding the location and sequence of nonlinear (plastic) hinges in the structure and its final collapse mechanism (Narafu, 2017). The code is supplemented by government-issued guidelines for higher-importance buildings such as hospitals and schools that specify stricter performance requirements, including requirements to limit damage in non-structural components such as ceilings and infill walls. By adhering to these procedures, buildings are designed to remain undamaged or have minor damage from medium-scale earthquakes, and to protect life and only sustain moderate damage in large-scale earthquakes. The improved performance of Japanese code-compliant buildings was demonstrated in earthquakes after the major building code updates in 1981, including 1995 Hanshin Awaji Earthquake, 2011 Great East Japan Earthquakes, and the 2016 Kumamoto earthquake (World Bank, 2017).

Figure 4.11 // Seismic design approach for buildings adopted in Japan since the 1981 Building Standard Law



Source: World Bank, 2017 (based on version in Japanese from website of Japan's Ministry of Land, Infrastructure, Transport and Tourism (MLIT)).

Other emerging approaches to reduce damage, service disruption, and population displacement include “functional recovery” in the USA, “low-damage design” in New Zealand, or “recovery-based design” in some other parts of the world. The concept of functional recovery aims to reduce the time to recovery of function for a building in proportion to its importance to the local community (NIST, 2015). Increasingly, performance-based design approaches are being used for critical buildings to demonstrate higher, “beyond code” performance, mostly in

high-income countries (see Box 4.3). Some countries are mandating the use of advanced technologies such as seismic isolation to prevent damage and service disruption in key buildings such as hospitals. For countries that may not be prepared to introduce performance-based design provisions, an important step toward enhancing the seismic performance of buildings beyond Life Safety is the introduction of more comprehensive, and possibly more stringent, prescriptive strength and displacement requirements for the structural and nonstructural components in building codes to reduce the likelihood of damage and improve post-disaster building functionality.

Box 4.3 // Christchurch, New Zealand's long-term recovery challenges

While the 2010 to 2011 Canterbury earthquake sequence resulted in relatively few deaths, the earthquakes caused widespread disruption of transport, electricity, sewage and water infrastructure (Miles et al., 2014). A significant portion of buildings in the Central Business District (CBD) of Christchurch were cordoned off for months, and in some cases, years. Approximately 60 percent of buildings in the CBD were eventually demolished, following prolonged periods of building closure, even though only 19 percent of them were tagged as unsafe and unlikely to be repairable (“red”) in rapid damage assessments (Gonzalez et al., 2022).



Cordoned-off buildings in Christchurch, New Zealand. Photo credit: Kokkai Ng | iStock

The reasons for demolishing buildings that had potentially repairable damage were principally financial and social, without considering the technical feasibility of repair and retrofitting. The main factors were related to high insurance penetration, while uncertainties related to government rezoning of the CBD created disincentives for building owners to keep and rehabilitate buildings (Miles et al., 2014). Economic impacts from the earthquake sequence are estimated to be NZ\$ 40 billion (approx. US\$ 25 billion) (Gonzalez et al., 2021), and approximately one-fifth of the Christchurch population permanently left the city (Internet Geography, n.d.). The staggering economic and social losses from earthquakes that have relatively low fatalities have led New Zealand to develop guidance on how engineers and developers can bring a “Low Damage Design” approach to seismic design. Though this guidance has not yet been incorporated into the regulations, the country is preparing the groundwork by sharing knowledge and engaging with wider stakeholders such as the insurance industry to raise awareness of the benefits of targeting higher performance goals (Engineering New Zealand, 2021).

4.2.3 Introducing provisions to support reliable building utilities

Hazard events, including severe weather, are causing more frequent and prolonged power outages and water shortages, which disrupt building operations. Hurricane Maria, which hit Puerto Rico in 2017, left 1.5 million customers of the central power grid without electricity, some of them for almost a year (EfSI, n.d.; Grid Deployment Office, 2024). In 2024, Typhoon Yagi left 830,000 households on the Chinese island of Hainan without power (Fisher, 2024). The aging power grid infrastructure, along with the pressures of urban growth, are leading to more frequent outages, particularly in Central Asia and South Africa (Pollitt, 2023). Water supply disruption is also increasingly common. Flooding and other natural hazards can damage water infrastructure or contaminate centralized water supply. Changing precipitation patterns are leading to an increased risk of drought in some places. One study indicates that as of 2022, about half of the global population had experienced at least temporary severe water scarcity

(Cohen, 2024). The loss of power or water, whether the result of a storm or an earthquake, can have significant impacts on building occupants and a building's ability to maintain function. Power outages in hospitals and other health care facilities can have life-threatening impacts on patients who rely upon medical devices like ventilators. These outages can lead to dangerously high temperatures in homes and buildings that normally rely on air conditioning. Loss of water supply can also interfere with service provision at hospitals and other essential facilities, create significant sanitation issues in residential and other buildings, and impact the ability to fight fires.

Building codes can enhance the resilience of communities by incorporating provisions for backup power and water supply in building design. While many countries are making efforts to reduce the risk of power and water outages through improvements to their centralized infrastructure systems, measures to make power and water supply more reliable, at the individual building level or building complex level, to support passive survivability, are also increasingly being integrated into building codes and standards. Some building regulations include requirements for backup power supply for emergency power needs, including for some health-care facilities, facilities housing critical infrastructure, and high-rise residential buildings. In Europe, the EN 50171 (Central Safety Power Supply Systems) standard includes provisions for independent energy supply to essential safety equipment (British Standards Institute, 2022). While rarely compulsory for all buildings, many countries also have green building standards, as well as incentivizing policies to integrate solar photovoltaic (PV) systems in buildings. These can support energy consumption goals but can also enhance passive survivability in power outages as these systems can continue to supply power when the grid is down, especially if coupled with onsite energy storage systems.^{23, 24} Some green building codes include measures to reduce water consumption in buildings that indirectly support resilience to water shortages and drought. Typical provisions cover greywater reuse, water-efficient fixtures and fittings, and the use of drought-resistant landscaping.²⁵ Rainwater capture can also be used to create a backup water supply in the event of a water supply outage.²⁶ For further discussion of green building measures to reduce disruption of water and power supplies, see Chapter 9, Section 9.3.

4.2.4 Expanded provisions for the assessment, modification, rehabilitation and retrofit of existing buildings

There is an urgent need for more comprehensive building regulations related to the assessment and modifications to existing buildings, including incentives for rehabilitation and retrofit. As seen from the study results, coverage of provisions related to existing buildings is inadequate in many countries. Expanded regulatory frameworks should clearly specify how and when periodic assessments are to be carried out and ensure that any additions or changes in use are completed safely and in compliance with standards (World Bank, 2023c). As mentioned earlier, many building failures are linked to a lack of maintenance, or modifications undertaken without proper structural design checks or scrutiny from building control. Rehabilitation and retrofits to improve safety and limit disruption from hazards and risks will have net benefits, especially for higher importance buildings such as schools, health-care facilities and emergency response facilities.²⁷ Better building code provisions and requirements for existing buildings are crucial to achieving these goals.

Established approaches for promoting the rehabilitation and retrofit of existing buildings include government investment for critical public buildings combined with incentives for upgrading private buildings. Governments have stricter regulatory oversight for public-owned buildings such as health facilities, schools, and emergency response facilities. Thus, they can prioritize investment in the rehabilitation and retrofit of critical public buildings

²³ Improperly implemented PV and energy storage systems increase building fire risk (Salmeron-Manzano et al. 2024).

²⁴ The findings of this study presented in Section 9.1 indicate that of the 22 evaluated countries 12 included some provisions for onsite, renewable power generation.

²⁵ The study findings also indicate that 12 out of 22 countries included some provisions for water-efficient fixtures and fittings.

²⁶ Study findings indicate that 13 out of 22 countries included some provisions for water collection or reuse, including (for example, condensate recovery, rainwater harvesting, reuse of treated water for potable and non-potable uses).

²⁷ Refer to Chapter 5, Section 5.3 for further information related to special considerations for seismic assessment and retrofit provisions.



and require more stringent checks during design and construction of the upgrades. For privately-owned buildings, rehabilitation and retrofits can be costly and are often more difficult to mandate. Some countries, such as New Zealand, mandate the assessment and retrofitting of unreinforced masonry buildings, which are highly vulnerable to earthquakes, but require compliance to 34 percent of the level of what would be required per the current code (Murphy, 2020). Other ways to encourage investment in maintaining and improving privately-owned existing buildings are complementary incentives such as tax breaks, matching funds, low-interest government-backed loans or preferential conditions for permits. For example, in Berkeley, California, USA, the city allows homeowners to reduce their transfer tax liability when buying a property by up to 33 percent if they seismically retrofit the property and construction is completed within 12 months (City of Berkeley, 2025).

Formalization of existing buildings that were not originally built to comply with building codes requires more flexible regulatory approaches. Addressing the complexities of mitigating the risks related to informal development is beyond the scope of this report. It should be noted though that building regulations in countries where informal development is prevalent need to be responsive to a variety of factors: (i) the realities of incremental development where people's resources are limited; (ii) the need for continuous feedback from stakeholders, including vulnerable groups, to ensure regulation is effective and equitable; and (iii) acceptance that a flexible regulatory approach is required for regularization of informal buildings (Payne and Majale, 2004). See Box 4.4 for an example of a regulatory approach to slum upgrading.

Box 4.4 // Improvements to informal housing settlements in Indonesia

In coordination with Indonesia's National Slum Upgrading Program, Indonesia's National Affordable Housing Program provided grants to homeowners for critical improvements to their existing homes. This followed a decree from the Minister of Regional Settlements and Infrastructure (403/KPTS/M/2002) on Technical Guidance for Construction of Simple Healthy Houses to improve housing quality, including structural integrity and health standards related to space, light and ventilation. The improvements were homeowner-led. Support and quality assurance were provided through hands-on training for homeowners, training programs on construction quality for local governments and beneficiaries, and the use of checklists, photo documentation and third-party verification of outputs. Of the nearly one million households that received funds, over 75 percent met the minimum standards for the works as set by the project (World Bank, n.d.).



Informal housing in Indonesia. Photo credit: Sony Herdiana | iStock

In addition to improving structural safety and resilience, building retrofits are a key part of efforts to move toward more sustainable construction practices. To further efforts to reduce construction waste and greenhouse gas emissions, societies need to rapidly move toward lower-carbon practices including adaptive reuse of existing building stock in preference to new construction (World Bank, 2023a). Similar retrofits are needed to improve the energy efficiency of existing buildings. Refer to Chapter 9 for more detailed discussion of low-carbon and energy-efficient design provision approaches.

4.2.5 Enhanced coordination and harmonization of code provisions across topic areas and hazards

As buildings increasingly face various types of hazards throughout their design life, the failure of building codes to address these hazards in an integrated way can lead to siloed design approaches that increase risk. In disaster risk management, it is important to consider risk to buildings from a range of hazards for two key reasons. First, hazards can be compounding, creating increased risk when occurring simultaneously or sequentially, or when one triggers another. For example, a study of the Wayanad District in Kerala, India, which is highly susceptible to landslides, attributed an increase in deadly landslides in the district to monsoons with one-day rainfall totals that had increased by 10 percent due to climate change (Tandon et al., 2024). Second, approaches to addressing risks from individual hazards may introduce trade-offs. Measures to reduce the vulnerability of buildings to one hazard may inadvertently increase vulnerability to another. For example, a common approach for mitigating flood risk is to elevate buildings; however, this approach can increase the seismic vulnerability of a house if not implemented with seismic design considerations in mind. **Beyond the established code approach to account for load combinations in the design loading combinations, this study did not identify any instructive examples of integrated, multi-hazard considerations in the codes for the 22 study counties.**

The complex and interactive nature of different topics and associated performance objectives in building design needs to be addressed by enhanced integration and harmonization of code provisions. Building codes cover many design topics, including hazard-specific design, but they most often address them independently, with separate provisions for each topic area. It is typically the responsibility of the architect and/or engineer²⁸ to assess each area and determine what governs the design. More holistic design approaches are not yet well-integrated into building codes. Emerging areas include research to better understand multihazard risk, including cascading and interactive hazards (Stalhandske et al., 2024). Efforts are also focused on a better comparison of risk across hazards with differing return periods and safety indices to allow decision-makers and building designers to more easily determine planning and implementation priorities (Silva et al., 2022; Arup, 2024; Sevieri, 2020; Bruneau et al. 2017). For example, the California Building Code (CBC) (California Building Standards Commission, 2022), has anchorage requirements for foundations for both ground shaking and flood forces, while the International Existing Building Code (IEBC) (ICC, 2021b) contains guidance on the retrofit of existing buildings exposed to multiple hazards. Fire safety related to green building measures is another key area where better consideration of the risks and benefits of different design solutions is essential. See Box 4.5 below.

Box 4.5 // Trade-offs in code provisions: fire safety and green building



*Grenfell Tower following the 2017 fire.
Photo credit: Alex Donohue | iStock*

There is growing evidence that green building practices can have unintended consequences in terms of increased fire hazard and risks. A study by Meacham et al. (2012) identified 22 potential sources of increased fire hazard or risk associated with green building measures. Tragic events such as the 2017 Grenfell Tower fire in London, UK due to combustible exterior cladding installed as part of a renovation to improve energy efficiency have raised the profile of these risks. Areas of concern include photo-voltaic systems, green façade systems, high-rise mass timber construction, energy storage systems, and use of recycled construction materials. Greater efforts are needed to better integrate fire-safety requirements into green building regulations, including setting clear fire-safety performance requirements for green materials, technologies and features (Meacham and McNamee, 2020). These examples highlight the need to move away from a siloed approach to building regulation and design to allow building owners and designers to better harmonize risk and performance goals for projects.

²⁸ For more complex projects, a multidisciplinary design team is often employed, and design issues are resolved by the team through close coordination.





5. Seismic Design

5. Seismic Design

Earthquake ground shaking and other seismic hazards (for example, surface fault rupture, landslides, soil liquefaction) can damage or destroy buildings, resulting in significant human and economic losses and long recovery times. Seismic design provisions in building codes aim to limit damage and prevent the collapse of buildings and infrastructure during earthquakes, while protecting lives and limiting injury among the affected population. Although the focus of seismic design codes is on structural building components (usually constructed using reinforced concrete, steel, masonry, or timber), lessons learned from past earthquakes have shown that the seismic design of nonstructural components must also be considered. For example, in the February 2010 Chile earthquake, most commercial, residential, office, and industrial buildings suffered limited structural damage. However, widespread nonstructural damage—observed across all types of buildings—significantly disrupted and delayed recovery (Miranda et al., 2012). Some strategies addressed in building codes can protect buildings and their contents from damage and minimize disruption of building function after a major earthquake. These include provisions to limit interstory drifts, provisions to ensure enhanced strength and ductility of the structural elements, and the use of advanced systems, such as seismic isolation. These strategies are of particular importance for buildings that must maintain functionality after an earthquake, such as hospitals or emergency response facilities. This chapter presents the findings of the assessment related to seismic design provisions and discusses priority areas for further code development in this topic area.

5.1 ASSESSMENT OF SEISMIC DESIGN PROVISIONS

Statements related to the code provisions in 21 key topic areas related to seismic design were evaluated for the 22 study countries. The overall findings are presented in Figure 5.13. The following subsections explore key findings in greater depth, focusing on: (i) seismic design criteria; (ii) seismic analysis methods; and (iii) seismic design and detailing provisions, including provisions for existing buildings.²⁹

5.1.1 Seismic design criteria

Seismic design criteria in building codes establish the seismic hazard parameters for the site of a proposed building and the procedures to develop seismic design loads for specific building types. The four topics related to seismic design criteria are described in Table 5.1, followed by the most relevant findings.

Codes in most of the countries examined include basic provisions related to developing seismic design criteria, but a few lack fundamental elements such as a complete procedure to determine seismic loads or country-specific seismic hazard maps. It is important for a building code to include basic seismic design criteria, such as a procedure to determine seismic loading, including the effects of site soil conditions and that considers the importance and/or criticality of the building type. All 22 countries include provisions to develop seismic design criteria which satisfied the statements in all topic areas except for Bhutan and Mozambique. However, Ghana does not have complete provisions in this topic area as its building code includes only a procedure for reinforced concrete buildings. Bhutan and Mozambique do not have country-specific seismic hazard design criteria.

All countries, except Mozambique include seismic importance factors that are used to increase the seismic design loading for structures of higher importance, such as hospitals and schools. Refer to Figure 5.1.

²⁹ For further reading on concepts related to seismic design, FEMA P-749: Earthquake Resistance Design Concepts (FEMA, 2020a) is a good primer for nonspecialists.



Table 5.1 // Topic areas for seismic design criteria

Topic Area	Description
Procedure to develop seismic design criteria	Building codes for countries located in seismic regions need to include a procedure to determine basic design parameters for seismic design, for example, a procedure that specifies the level of seismic hazard for a building site and/or a procedure to determine the design seismic forces for a building. Seismic hazard denotes earthquake ground shaking of specified severity for a given site, ³⁰ usually expressed in terms of accelerations, and is used as input for seismic design. For example, many codes have simplified seismic design procedures to develop the lateral seismic loads that are applied to a structure at each floor level.
Consideration of soil effects in seismic design criteria	The type of soil at a given building site influences the expected intensity of earthquake shaking. For example, it is well established that softer soil types (for example, sandy soils common in the vicinity of river-banks) may cause more intense shaking of taller buildings than stiff soils.
Country-specific seismic hazard design criteria	Seismic hazard denotes the anticipated level of earthquake ground shaking of specified severity for a given building site; this is used as input for seismic design and is usually presented in the form of a seismic hazard map for a country.
Seismic importance factors	Seismic importance factor accounts for risk to human life, health and welfare associated with potential building damage. Buildings may have different importance for a society during and after an earthquake, depending on their type/usage or potentially hazardous contents. The importance factor is typically used to increase the seismic design loads and provide a greater margin of safety for buildings of higher importance.

Figure 5.1 // Assessment results for code provisions related to seismic design criteria topic areas

SEISMIC PROVISIONS																							
	Algeria	Bhutan	Chile	Colombia	El Salvador	Ghana	Indonesia	Mexico	Mongolia	Morocco	Mozambique	Nepal	Peru	Philippines	Rwanda	Samoa	South Africa	Tajikistan	Tonga	Türkiye	Uzbekistan	Vanuatu	TOTAL COUNTRIES
Procedure to develop seismic design criteria	■	■	■	■	■	note 1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	22
Consideration of soil effects in seismic design criteria	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	22
Country-specific seismic hazard criteria	■	□	■	■	■	■	■	■	■	■	note 2	■	■	■	■	■	■	■	■	■	■	■	20
Seismic importance factors	■	■	■	■	■	■	■	■	■	■	□	■	■	■	■	■	■	■	■	■	■	■	21
■ The country's code provisions satisfied the assessment for the topic area. □ The country's code provisions did not satisfy the assessment for the topic area. Notes: 1. In Ghana, only some elements of a procedure to determine seismic load criteria are provided as current provisions address only reinforced concrete structures. 2. For Mozambique, country specific seismic hazard design criteria exist for a nationally adopted school construction guideline only.																							

³⁰ In more technical terms, this can be expressed as a certain level of Peak Ground Acceleration (or Spectral Acceleration, if the structure's response is considered) corresponding to a design earthquake that is expected to be exceeded over a specified time period (referred to as the return period).

It is important to update seismic hazard maps on a regular basis, based on the latest knowledge on past earthquakes and potential sources and mechanisms of future earthquakes. For example, updated seismic hazard maps were incorporated into the Indonesian seismic code SNI 1726 (BSN, 2019) in 2002, 2012 and 2019 with another updated map currently in development. Refer to Box 5.1 below for a more detailed discussion on the different approaches to seismic hazard assessment (probabilistic versus deterministic) that can be taken when setting seismic design criteria for codes.

Box 5.1 // Deterministic versus probabilistic seismic hazard estimation

Seismic hazard denotes a possibility of destructive earthquake effects occurring at a specific location (Bommer, 2002). Seismic hazard is usually quantified in terms of engineering parameters such as ground accelerations, which are used for seismic design purposes and presented in the form of seismic hazard maps. According to the current state of practice, seismic hazard is estimated based on either a deterministic or a probabilistic approach (Abrahamson, 2000). The deterministic approach for seismic hazard estimation is based on an individual earthquake scenario, which considers an earthquake of specific magnitude, distance from the site, and probability of occurrence (also referred to as the return period). An alternative approach for seismic hazard estimation, known as the Probabilistic Seismic Hazard Analysis (PSHA), uses a probabilistic time-based approach to model potential earthquake events, considering magnitudes, distances from the site, and return periods across the different regions over a specified timeframe.

In many countries a transition from deterministic to probabilistic seismic hazard estimation has taken place over the past 20 to 30 years, owing to seismological and geotechnical studies which have advanced our knowledge of the frequency and magnitude of earthquakes along known or recently identified faults, the effects of local soil conditions on the intensity of ground shaking, and so forth. For example, seismic hazard maps in the USA have evolved from the original, deterministic seismic zone maps, to maps which identified PGA values and corresponding ground velocities for specific zones within the country (1984–1994), and finally to current maps which provide spectral accelerations based on the PSHA (1997 to the present) (FEMA, 2021b). Seismic hazard is usually expressed as a Peak Ground Acceleration (PGA), or, if taking the response of the structure into account, a Peak Spectral Acceleration.

5.1.2 Seismic analysis methods

Codes should include a range of seismic analysis procedures, from simplified equivalent static procedures for low-rise and/or regular buildings, to those that capture more complex dynamic and nonlinear structural behavior. Both equivalent static and dynamic analysis procedures assume elastic structural behavior and may be appropriate for the seismic design of new buildings. However, nonlinear seismic analysis procedures, such as nonlinear static (pushover) analysis, are often used for the seismic assessment of existing buildings because they enable a better understanding of their seismic behavior and failure mechanisms. The key topics for seismic analysis methods considered in this study are described in Table 5.2, followed by the most relevant findings.

Table 5.2 // Topic areas for seismic analysis methods

Topic Area	Description
Equivalent static analysis	Simplified static analysis (also known as equivalent static analysis) simulates earthquake effects in the form of static seismic forces applied at the floor levels of a numerical model of a building. This type of analysis is elastic (in other words, inelastic behavior is not modeled explicitly) and is used in combination with global ductility factors.
Dynamic analysis	Dynamic analysis procedures, such as response spectrum analysis, are more advanced, as they consider possible vibration shapes of the structure, and the seismic forces are determined based on seismic hazard parameters which are presented in the form of an acceleration response spectrum. In some cases, nonlinear response history analysis ³¹ is conducted to simulate the response of the building under specific earthquake ground motions while taking into account the effects of structural damage.
Nonlinear static (pushover) analysis	Nonlinear static (pushover) analysis is performed by applying gradually increasing lateral displacements to a numerical model of the structure until the target performance has been attained. Inelastic behavior (for example, damage) is explicitly modeled.

Some of the countries in this study could benefit from introducing nonlinear analysis procedures into their codes. All countries, except Tajikistan and Uzbekistan, included simplified seismic analysis procedures (for example, equivalent static analysis) in their codes, and only two countries (Mozambique and South Africa) did not include linear dynamic analysis procedures (response spectrum analysis) in their codes. However, only seven countries (Algeria, Chile, Colombia, Mexico, Morocco, Rwanda, and Türkiye) included the nonlinear static (pushover) analysis procedure in their codes. Because nonlinear static analysis procedure has been commonly used for the seismic assessment of existing buildings, this is consistent with the findings (see Figure 5.12) that only seven out of 22 countries included provisions related to the seismic assessment and retrofit of existing buildings. It should be noted that seismic design codes in many countries are moving toward incorporating performance-based seismic design approaches (as described in Chapter 2, Box 2.5), which require nonlinear seismic analysis procedures (see Figure 5.2).

Figure 5.2 // Assessment results for code provisions related to seismic analysis procedures

SEISMIC PROVISIONS

	Algeria	Bhutan	Chile	Colombia	El Salvador	Ghana	Indonesia	Mexico	Mongolia	Morocco	Mozambique	Nepal	Peru	Philippines	Rwanda	Samoa	South Africa	Tajikistan	Tonga	Türkiye	Uzbekistan	Vanuatu	TOTAL COUNTRIES
Simplified analysis procedures																							20
Dynamic analysis procedures																							20
Non-linear static analysis procedures (pushover)												U											7

The country's code provisions satisfied the assessment for the topic area.

The country's code provisions did not satisfy the assessment for the topic area.

Note:

1. Items marked U could not be verified (U=Unable to verify).

³¹ Also referred to as time history analysis.



5.1.3 Seismic design and detailing provisions

This section describes relevant seismic design and detailing provisions, including building regularity requirements, ductility factors, and related detailing requirements for ductile seismic performance, interstory drift limits, design of advanced seismic systems, design of nonstructural components, design for out-of-plane seismic actions, and specific provisions for the seismic assessment and retrofit of existing buildings. The key topic areas considered in this study are described in Table 5.3, followed by the most relevant findings.

Table 5.3 // Topic areas for seismic design and detailing provisions

Topic Area	Description
Regularity requirements for seismic design	Regular buildings are characterized by a symmetrical floor plan, with similar floor heights, floor plan dimensions and configuration (Allen et al., 2024a). Research studies and experience from past earthquakes have shown that regular buildings perform better than buildings with irregular-shaped plans, or those with significant changes in mass, stiffness, or plan dimensions at different floor levels (in other words, vertical irregularities).
Seismic ductility factors	Ductility is the ability of a structure or a structural element to deform beyond the elastic range and avoid sudden, brittle failures (Allen et al., 2024b). The extent of expected damage in structural elements will largely depend on the assumed ductility, which is usually expressed in terms of a ductility factor (also known as force modification factor or behavior factor). Global ductility factors are often used in codes to approximate the overall ductility of a building based on the design and detailing of its lateral force resisting system (for example shear wall or moment frame) in combination with simplified, linear elastic analysis methods (that is, equivalent static).
Ductile detailing of structural systems	Ductile detailing of structural elements in a building depends on several factors, including the type of structural system (for example, frame or wall), main construction material (for example, reinforced concrete, steel, masonry, or timber), and the expected ductility level (FEMA, 2022a). Also see “seismic ductility factors” (above). The importance of ductile detailing was recognized in early design codes in some countries and more widely recognized by the 1970s. Ductile detailing provisions have continued to evolve over time, incorporating performance-based design approaches to enhance the seismic resilience of buildings.
Lateral interstory displacements (drifts)	Seismic design provisions in most countries set limits on the maximum acceptable lateral displacements (drifts) caused by expected earthquake ground motions. These drift limits are intended to control structural and nonstructural damage due to potentially excessive lateral swaying of buildings in an earthquake.
Seismic design of diaphragms	Diaphragms are the floors and roofs of buildings, which need to have sufficient strength to remain undamaged under design lateral loads and to be properly connected to structural walls and columns to allow for building stability and safety. Diaphragms or their connections to the vertical structure (for example, frames or walls) that are not adequately designed for the applied loads may experience failure leading to partial or total building collapse, as reported in past earthquakes (FEMA, 2022a).
Seismic design of advanced systems	Advanced systems for enhancing the seismic resilience of buildings include seismic (base) isolation and supplemental damping devices (Allen et al., 2024c). Seismic isolation is based on the concept of increasing flexibility at a specific location within a building (usually at the base—hence the term base isolation), by means of custom-made devices. This has the effect of concentrating displacements caused by earthquake ground shaking within the device’s isolation zone, while reducing displacements and accelerations in the structure above. Supplemental damping devices (also known as dampers) act like shock absorbers, reducing earthquake effects on the structure via increased damping. Examples include buckling restrained braces or viscous dampers.
Seismic design of nonstructural components	Nonstructural components in a building include elements such as exterior cladding (façade), doors and windows, partition walls, building contents (furniture), mechanical and electrical equipment, and so forth (FEMA, 2012). Nonstructural components are affected by earthquake ground shaking, and their failure may cause injuries or even fatalities and can disrupt building function. Design provisions need to include engineering calculations to determine loads and checks related to the nonstructural elements and their connections, and/or accommodate building displacements (for example, for façades).

Table 5.3 // Topic areas for seismic design and detailing provisions (cont.)

Topic Area	Description
Seismic design for out-of-plane seismic action	Earthquake ground shaking induces internal forces in vertical structural elements (for example walls) that are perpendicular to their plane (in other words, out-of-plane) (Charleson, 2022) and need to be considered in design.
Seismic assessment and retrofit of existing buildings	Seismic assessment of existing buildings aims to identify buildings at high risk of damage or collapse in future earthquakes, while seismic retrofitting involves the strengthening of existing structural and nonstructural elements in vulnerable buildings, ensuring that retrofitted buildings can withstand future earthquakes without risk to life or injury of occupants.

It is important for building codes to include provisions related to the seismic design of buildings with irregularities to reduce the chance of severe building damage or collapse in earthquakes. Buildings with irregularities in plan or elevation (also respectively known as horizontal and vertical irregularities) are more prone to damage and even collapse. For example, an irregular layout of walls and stairwells at a floor level may cause torsional effects, which may lead to damage unless they are adequately accounted for in the design. Soft story irregularity is a common vertical irregularity, characterized by an open ground floor (without any walls) in a reinforced concrete frame building, and this often causes severe building damage or collapse, as observed in past earthquakes (see Figure 5.3). **Most of the 22 countries—all except Mozambique—had provisions related to horizontal and vertical building irregularities.**

According to current seismic design philosophy, buildings are designed such that their structural elements (for example, beams, columns, walls) perform in a ductile manner and experience limited damage in a design-level earthquake. Building codes specify global ductility factors for different types of seismically designed structural systems to approximate the combined damping, ductility and overstrength of those systems in an earthquake. **All 22 countries—except Mozambique—had provisions related to ductility factors in their codes.**

Seismic design codes need to include comprehensive ductile detailing provisions that allow structures to dissipate energy during earthquake ground shaking while protecting the life safety of occupants. Achieving life safety performance means that although there may be significant damage to structural and nonstructural building elements, the building is nevertheless designed to avoid a sudden failure of structural elements or total building collapse that could injure or kill building occupants or those in the vicinity of the building. Specific detailing provisions depend on the structural system and material. For example, ductile detailing for a reinforced concrete moment frame structure is related to the spacing and size of transverse reinforcement (stirrups, ties) in columns, beams, and beam-column joints, as well as adequate anchorage of such reinforcement (for example, 135-degree hooks). Special attention is needed during the execution of these detailing requirements within the column end zones at each floor level, where structural damage can be concentrated in frame buildings. buildings. Inadequate detailing may result in damage or sudden failure in severe earthquakes (see Figure 5.5). Figure 5.4 presents countries that included ductile detailing provisions for different types of structural systems considered in this study.

Figure 5.3 // Example of a reinforced concrete frame building with a soft story irregularity in the bottom two floors in Türkiye



Photo credit: S. Brzev

Figure 5.4 // Assessment results for ductile seismic detailing code provisions for different structural systems

SEISMIC PROVISIONS																				
	Algeria	Bhutan	Chile	Colombia	El Salvador	Ghana	Indonesia	Mexico	Mongolia	Morocco	Mozambique	Nepal	Peru	Philippines	Rwanda	Samoa	South Africa	Tajikistan	Tonga	Türkiye
Ductile detailing of concrete moment frames	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Ductile detailing of steel braced frame systems	■	■	■	■	■	■	■	■	■	■	■	■	■	■	U	■	■	■	■	■
Ductile detailing of steel moment resisting frames	■	■	■	■	■	■	■	■	■	■	■	■	■	■	U	■	■	■	■	■
Ductile detailing of RC shear wall systems	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Ductile detailing of timber systems	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Ductile detailing of confined masonry systems	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	TOTAL COUNTRIES																			
	18																			
	18																			
	17																			
	16																			
	12																			
	9																			

■ The country's code provisions satisfied the assessment for the topic area.
 □ The country's code provisions did not satisfy the assessment for the topic area.

Note:

1. Items marked U could not be verified (U=Unable to verify).

Figure 5.5 // The collapse of this reinforced concrete building in Kathmandu, Nepal during the 2015 Gorkha earthquake can be attributed to substandard quality of concrete construction, and a lack of ductile detailing of transverse reinforcement in reinforced concrete columns

Photo credit: S. Brzev

Seismic design and detailing provisions in some countries from this study are very limited, such as for Bhutan, Mongolia, Mozambique, Rwanda, and Tajikistan. In these countries (except for Mozambique) current code documents have been published in the past ten years, but gaps remain in their ductile detailing provisions. Most countries included detailing provisions for reinforced concrete moment frame structures in their codes, except for

Mongolia, Mozambique, Rwanda, and Tajikistan. Ductile detailing requirements are also available for some of the masonry systems such as confined masonry, a common system in Latin America, Asia, and other regions. Of the ten countries with general structural design provisions for confined masonry systems (see Chapter 4, Figure 4.3), all except Tajikistan include ductile detailing provisions for confined masonry in their codes. These provisions are mostly related to the size and spacing of transverse reinforcement in the reinforced concrete confining elements, which are critical for enhancing the seismic performance of these structures. The understanding of ductile detailing is evolving with the latest advances in research and learnings from past earthquakes, and it is vital that such knowledge is reflected in building codes through regular updates. For example, many failures in steel moment resisting frame buildings were observed in California during the 1994 Northridge earthquake, which led to updated detailing and inspection requirements to prevent brittle failures in welded steel connections.

In an earthquake, lateral displacements (or drifts) due to seismic forces need to be restricted to provide structural stability and to control damage in brittle nonstructural components such as partition and masonry infill walls. Recent earthquakes, for example, the February 2023 Türkiye earthquake sequence, have revealed excessive damage to nonstructural elements in buildings due to flexible reinforced concrete frame structures. **All countries—except Mozambique—included interstory drift limits for buildings during a design-level earthquake.**

Provisions for the seismic design of diaphragms (that is, floor or roof structures) are an essential component of comprehensive seismic design codes. These typically include procedures for calculating force transfer within diaphragms and design checks related to the strength of diaphragms and their connections for different floor systems (for example, reinforced concrete slabs, precast floors, timber-framed floors). The codes for some countries, such as Indonesia, Peru, Philippines and Vanuatu, include relatively complete design provisions for diaphragms. For example, Indonesia's building code classifies diaphragms into rigid and flexible depending on how they transfer load to the walls. It also provides procedures to determine design forces for diaphragm components and includes anchorage requirements. Other countries, such as El Salvador and Ghana, include general concepts and requirements related to diaphragm stiffness and force transfer but do not include explicit procedures to determine seismic design forces and verify their strength. No seismic design provisions for diaphragms were identified for Bhutan, Mozambique, Nepal and Rwanda. Refer to Figure 5.6. **Most countries in this study could benefit from the addition of more comprehensive procedures for diaphragm design because in their absence, critical seismic requirements may be overlooked in design and lead to partial or total building collapse (see Figure 5.7).**

Figure 5.6 // Assessment results for provisions related to the seismic design of diaphragms

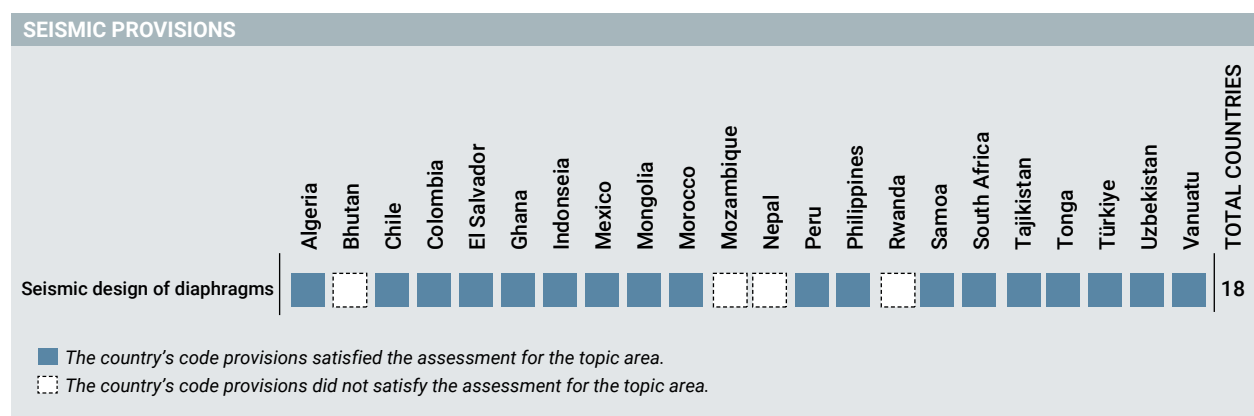


Figure 5.7 // (a) Building collapse in the 2008 Wenchuan, China earthquake due to a lack of connection between the floor, diagram (hollow core precast concrete slabs) and walls, (b) diagram illustrating the failure mechanism

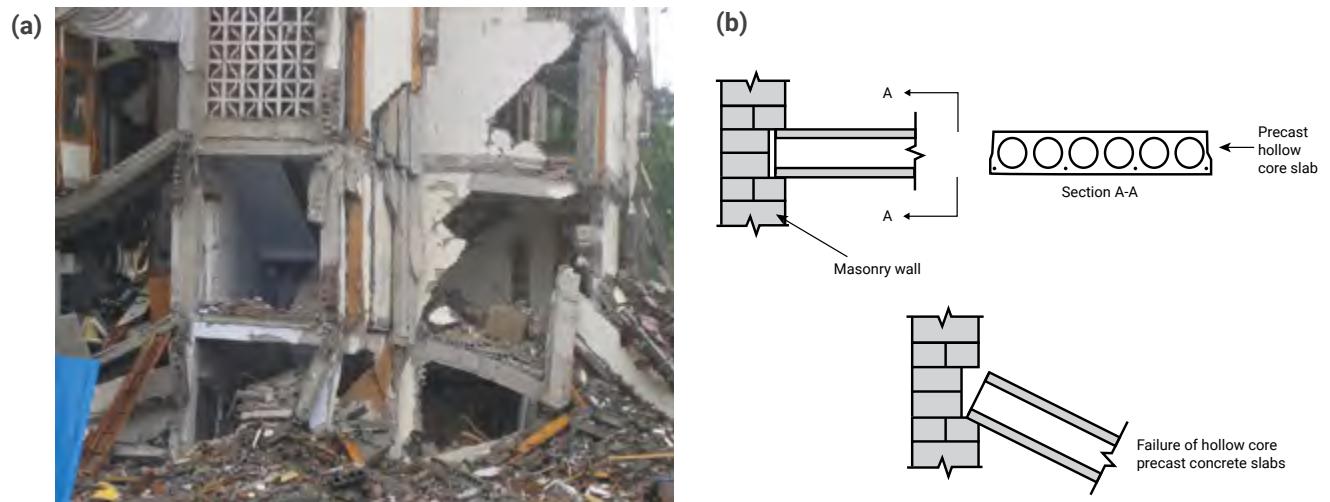


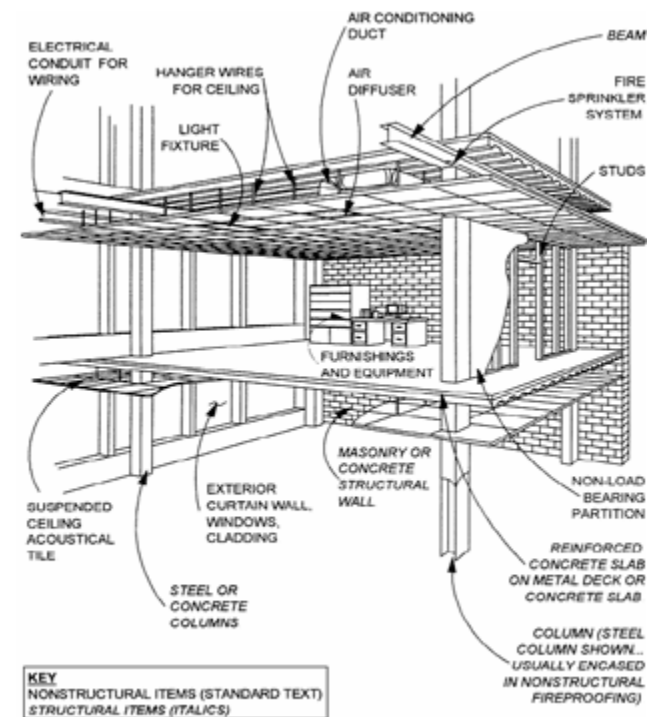
Photo credit: R. Laberenne

Source: Serbian Association for Earthquake Engineering

Although most countries in this study have some seismic design provisions for nonstructural components, these provisions often fail to cover all important types of nonstructural components.

See Figure 5.8. Ideally, codes should cover common types of nonstructural components such as façades/building envelope; building appendages; nonstructural/infill walls; and/or mechanical, electrical, plumbing (MEP) equipment, and, in some cases, furniture and other contents. Design includes engineering calculations to determine seismic loads for nonstructural elements, as well as design checks on their structural integrity, and that of their connections and anchorage. Nonstructural exterior masonry walls are often constructed as architectural elements without adequate integrity with intersecting walls and anchorage to adjacent floors/roof (Figure 5.10 and 5.11). Unfortunately, building codes often neglect important provisions related to the interaction between masonry infill walls and the main reinforced concrete frame structure. When masonry infill walls are not isolated from the main structure, they can attract seismic inertial forces, which can lead to unpredictable behavior and damage to the reinforced concrete structure (WHE, 2006). For example, the Supplementary Technical Standard for Earthquake Design for Mexico City addresses this by requiring cladding and other architectural elements to be designed to accommodate movement of the structure during a design-level earthquake (CDMX, 2023). Bhutan, Mozambique, and Rwanda have no provisions related to seismic design of nonstructural components. Refer to Figure 5.9.

Figure 5.8 // Structural and nonstructural components in a building (FEMA, 1994)



Source: FEMA.

Figure 5.9 // Assessment results for seismic design provisions related to nonstructural components and out-of-plane earthquake actions

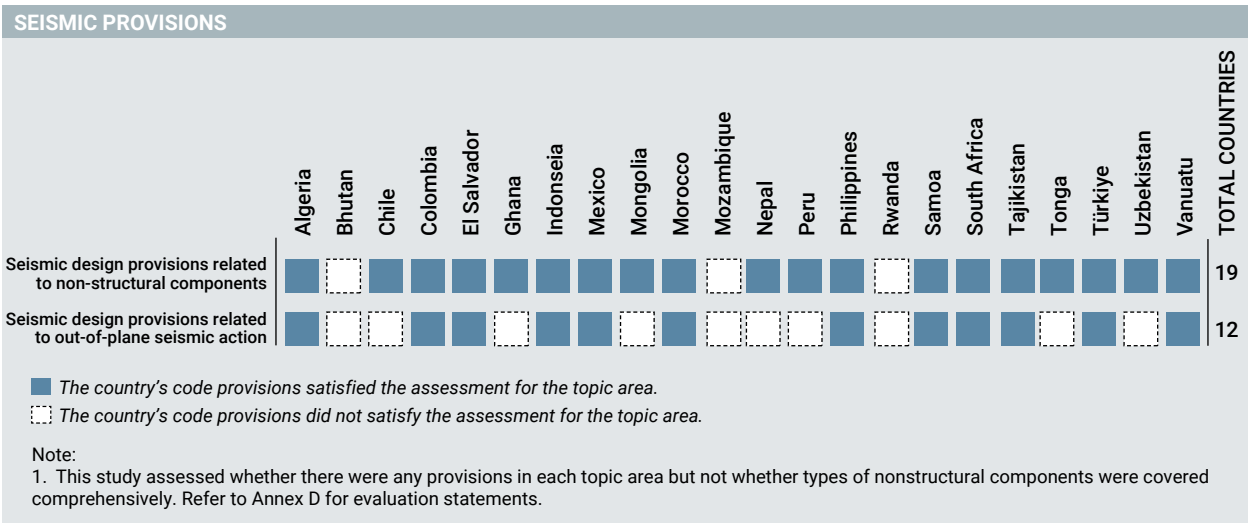


Figure 5.10 // Nonstructural URM exterior walls experienced damage or collapse in mid- and high-rise RC buildings due to the February 2023 Türkiye earthquake sequence, which can be attributed to inadequate connections between the intersecting walls and their anchorage to floor system



Photo credit: S. Brzev

Figure 5.11 // Collapse of exterior walls in an older URM building in Türkiye due to out-of-plane seismic actions in the February 2023 earthquake sequence



Photo credit: S. Brzev

Many codes lack provisions to address the vulnerability of structural and nonstructural elements to out-of-plane seismic effects. Past earthquakes have revealed that exterior walls in older URM buildings frequently experience collapse due to out-of-plane seismic effects (see Figure 5.11). This assessment shows that the majority of seismic design codes contain provisions related to the design of structural and nonstructural elements for in-plane seismic effects; however, only 12 countries include provisions related to the design for out-of-plane seismic effects (refer to Figure 5.9). The key design provisions are related to procedures for the calculation of out-of-plane seismic loading, as well as the verification of the out-of-plane strength of nonstructural elements and their connections to supporting structural elements.

Only seven countries (Algeria, Chile, Colombia, Indonesia, Mexico, Peru, and Türkiye) included seismic design provisions for advanced systems in their codes. It is important to include provisions related to the seismic design of buildings equipped with advanced systems (such as base isolation devices and dampers) in building codes, because these systems are effective in protecting important facilities such as hospitals that need to remain operational after an earthquake (NZSEE, 2019). Refer to Box 5.2 for an example of the performance of seismically isolated hospitals in Türkiye.

Box 5.2 // Seismic resilience of hospitals in Türkiye

In 2013, Türkiye's Ministry of Health issued a regulation mandating the use of seismic isolation for all new hospitals with more than 100 beds located in high seismic zones (Erdik et al., 2015). Seismic isolation technology employs devices that decouple a building from its foundations, allowing for relatively large horizontal movements within the devices, and significantly reduced seismic displacements and accelerations in the building above the zone of isolation. This is particularly important for hospitals that contain sensitive and expensive medical equipment and whose continued operation immediately after an earthquake is essential for response and recovery. Since 2013, numerous new base isolated hospitals have been built in Türkiye, including five hospitals located in the region affected by the February 2023 earthquakes, which caused close to 60,000 deaths in Türkiye and Syria. Four of the five hospitals performed to targeted "Immediate Occupancy" levels, which allowed for continuous delivery of essential services and faster recovery. Ground motion sensors indicated that several of these hospitals withstood ground motions that were more than twice their design levels, highlighting the resilience of seismically isolated buildings (Qu et al., 2023).



Seismically Isolated Elbistan State Hospital in Türkiye (Qu, 2023)

Only seven countries in this study (Chile, Colombia, Mexico, Morocco, Peru, Tajikistan, and Türkiye) have provisions in their building codes related to the seismic assessment and retrofit of existing buildings, highlighting a significant gap in most of the countries assessed. Many existing buildings in seismic regions have either not been designed for seismic effects at all or have been designed according to outdated codes and may be vulnerable to earthquake effects. Provisions related to the seismic assessment and retrofitting of existing buildings inform major renovations, as well as retrofitting and post-earthquake reconstruction processes. They also aim to ensure that existing buildings comply with improved safety standards but generally do not require the same performance standards as those applied to new buildings.

5.2 SUMMARY OF FINDINGS: SEISMIC DESIGN PROVISIONS

The assessment shows that the countries examined are at various stages in the development of their seismic design codes. For context, all countries selected have significant levels of seismic risk, either throughout their national territory or in specific regions within a country. Countries with comparatively higher levels of seismic risk³² include El Salvador, Nepal, the Philippines, Peru, Tajikistan, Tonga and Vanuatu. Countries with significant, but relatively lower seismic risk include Mozambique, Mongolia, South Africa and Ghana (Johnson et al., 2023). Figure 5.13 summarizes the findings for all the topic areas assessed and ranks countries by the total number of topic areas that satisfied the assessment statements. Some items may be context-specific—in some countries, for example, confined masonry or timber construction would not be common practice. In some cases, countries may not contain provisions for more advanced procedures or systems of analysis (as these countries may generally lack the capacity and/or resources to carry out design of advanced systems). Mozambique has the least comprehensive seismic code provisions³³ although it spans part of the East African rift zone and has seismic hazard levels ranging from low to moderate (Johnson et al., 2023). Bhutan, Mongolia, Nepal, Rwanda, Tajikistan, and Uzbekistan could be considered to be in the earlier stages of developing their seismic codes. By contrast, the seismic codes of Chile, Colombia, Mexico, and Türkiye are the most comprehensive, with some provisions in all topic areas assessed. In the remaining countries, the main gaps are related to provisions for seismic assessment and retrofit of existing buildings and the related analysis procedures (such as nonlinear static analysis), the design of advanced systems such as seismic isolation, design of nonstructural elements, and for out-of-plane seismic actions.

Figure 5.12 // School in Defne, Hatay, Türkiye, which experienced minor damage after the February 2023 Türkiye-Syria earthquake sequence



Photo credit: EEFIT

³² In terms of expected average annual seismic losses (scaled by the estimated costs of building assets) or AALR.

³³ Mozambique's code is based on 1960s Portuguese codes and does not contain a seismic hazard map for the country or provisions in many critical areas. The country has adopted a guideline for school construction which contains a country-specific seismic hazard map for Mozambique.

Figure 5.13 // Summary of assessment of seismic design provisions for the 22 countries

SEISMIC PROVISIONS																					
COUNTRY	Procedure to develop seismic design criteria	Country-specific seismic hazard criteria	Consideration of soil effects in seismic design criteria	Seismic importance factors	Simplified analysis procedures	Dynamic analysis procedures	Non-linear static analysis procedures (pushover)	Seismic design - ductility requirements and factors	Seismic design - drift limits	Seismic design - requirements for building regularity	Ductile detailing of concrete moment frames	Ductile detailing of RC shear wall systems	Ductile detailing of steel moment resisting frames	Ductile detailing of steel braced frame systems	Ductile detailing of confined masonry systems	Ductile detailing of timber systems	Seismic design of diaphragms	Provisions for advanced systems	Seismic design provisions related to non-structural components	Seismic design provisions related to out-of-plane seismic action	Provisions for seismic assessment and retrofit of existing buildings
Colombia																					
Mexico																					
Türkiye																					
Algeria																					
Chile																					
Morocco																					
Peru																					
Indonesia																					
El Salvador																					
Philippines																					
Samoa																					
Vanuatu																					
Ghana	note 3																				
Tonga																					
South Africa																					
Nepal																					
Uzbekistan																					
Tajikistan																					
Mongolia																					
Bhutan																					
Rwanda																					
Mozambique	note 5																				
TOTAL COUNTRIES	22	20	22	21	20	20	7	21	21	21	18	16	17	18	9	12	18	7	19	12	7

■ The country's code provisions satisfied the assessment for the topic area.

□ The country's code provisions did not satisfy the assessment for the topic area.

Notes:

- Provisions apply to all new buildings, unless otherwise noted.
- Items marked U could not be verified (U=Unable to verify).
- In Ghana, only some elements of a procedure to determine seismic load criteria are provided as current provisions only address reinforced concrete structures.
- For Indonesia, the code addresses seismic retrofitting with FRP but does not cover seismic assessment and retrofit in general.
- For Mozambique, country specific seismic, hazard design criteria exists for a nationally adopted school construction guideline only.
- For Uzbekistan, there is a requirement to strengthen existing buildings, but no detailed assessment and retrofit code exists.
- For El Salvador, there are some requirements for assessment, but no specific provisions for seismic assessment and retrofit are in place.
- For Nepal, detailed guidelines for seismic assessment and retrofit exist, but it is unclear if they have been officially adopted.



5.3 PRIORITIES FOR FURTHER DEVELOPMENT OF SEISMIC DESIGN PROVISIONS

This section discusses priority topics for the future development of seismic provisions that may be applicable to the countries included in the assessment as well as other countries. These priority topic areas emerged through review of the assessment results presented in Section 5.1, further supplemented by desktop review.

5.3.1 Improving seismic hazard maps in building codes

Many countries have made great progress in updating seismic hazard maps in building codes, but some maps still reflect an incomplete understanding of the seismic hazard based on the quality of data and methodologies that underpin them. It was beyond the scope of this study to evaluate the quality of seismic hazard maps in the codes. In terms of updates, eight countries had updated their seismic design criteria within the past five years, and five countries within the past ten (see Table 5.4 below). The year of latest update does not necessarily reflect quality; for example, although Uzbekistan updated its seismic code in 2019, the zoning map still follows older methodologies (SNIP codes dating back to the Soviet Union). Common shortcomings in out-of-date seismic hazard maps are: (i) maps generated from limited historical earthquake catalogs, or limited knowledge of underlying geology, fault tectonics and/or soil type characteristics;³⁴ (ii) maps based on seismic hazard assessment models using out-of-date methodologies; and (iii) limited resolution of maps that do not account for regional or local variations in ground motion, geology and soil. Up-to-date seismic hazard maps are based on current methodologies for probabilistic seismic hazard assessment (see Box 5.1). Seismic hazard maps in a building code must also accommodate the level of seismic risk people are willing to accept, balanced against the costs of design to a certain level.³⁵ Reliance on inadequate seismic hazard maps can result in the overestimation or underestimation of seismic hazard in specific areas, leading to buildings with structural systems that may be over- or under-designed.

Table 5.4 // Age of code documents containing country-specific seismic hazard maps, by date of publication

Countries	Publication date of code seismic hazard maps
Algeria, Indonesia, Mexico, Mongolia, Nepal, Peru, Rwanda, Uzbekistan	In the last 5 years
Ghana, the Philippines, South Africa, Tajikistan, Türkiye	In the last 10 years
Chile, Colombia, El Salvador, Morocco, Samoa, Tonga, Vanuatu	Older than 10 years

Note: Bhutan and Mozambique did not have country-specific seismic hazard maps in their codes.

Periodically updating seismic hazard maps in building codes, based on the best available scientific data and modeling techniques, is an important step toward improving the seismic performance of buildings. As earthquake engineering is a relatively new field, many advances in the development of seismic hazard maps have been made over the past 50 years. These include better coverage and recording of earthquake ground motions with seismographic networks, improved fault mapping and modeling, and improved understanding of how earthquake motions are attenuated (based on earthquake magnitude, fault mechanism, distance to the site and soil conditions). Probabilistic Seismic Hazard Analysis (PSHA) is generally accepted as the preferred methodology to generate country-specific seismic hazard maps for seismic design in building codes. PSHA better quantifies uncertainty by using a time-based probabilistic approach, which considers all the earthquakes that can occur in the future probabilistically for each location in the region assessed within a specific timeframe. To do this, PSHA uses available data on past earthquake activity and information about the geology, tectonics and soil properties to predict

³⁴ These data can inform the return period selected for the seismic hazard map. For example, in regions where the seismicity is dominated by infrequent, high-magnitude events, design criteria linked to a return period of 2,475 years may be more appropriate.

³⁵ In this respect, a probabilistic seismic hazard assessment (PSHA) for a country conducted purely by technical experts cannot automatically be converted into a seismic hazard map for code design, without consideration of levels of acceptable risk.



the frequency of occurrence of earthquake events of different magnitudes and the level of hazard at specific sites. When countries lack the resources to collect seismic and geological data to develop bespoke Seismic Hazard Models (SHMs) from scratch, another option is to build upon open-source regional or global SHMs. Open-source global SHMs were developed by the Global Earthquake Model Foundation (Johnson et al., 2023) and the European Facilities for Earthquake Hazard and Risk (EFEHR, 2021), albeit these models are not sufficiently granular to form the basis of country- or region-specific code seismic hazard maps without further development. Several comprehensive regional models, developed through international projects and initiatives, are also available, including for Europe (Danciu et al., 2024), the Middle East (Şeşetyan et al., 2018), and Central Asia (World Bank, 2023b). Seismic hazard maps in some of the study countries, such as Indonesia, Mexico and the Philippines, have been updated on a regular basis. Countries can also consider making seismic hazard data accessible online and allowing higher resolution data to be easily retrieved using the GPS coordinates of the building site.

5.3.2 Addressing the seismic safety of small-scale vernacular and other non-engineered buildings

A significant source of seismic risk in many countries is related to the seismic vulnerability of "non-engineered" buildings built outside the formal building regulatory system. These include vernacular, self-built buildings, often constructed in rural and peri-urban areas using indigenous or traditional materials like unreinforced stone or brick masonry, timber, earth and bamboo. These types of construction are not commonly addressed in building codes, as highlighted in Chapter 4, Section 4.1.2.4. Non-engineered buildings also include low-rise to mid-rise buildings built from construction materials like reinforced concrete or reinforced hollow block masonry without appropriate application of engineering knowledge, leading to significant seismic vulnerability (Arya et al., 2014). Although solving this complex problem goes beyond building code reform and input from design and construction professionals,³⁶ it can nevertheless be attributed in part to a lack of simplified design and construction provisions for small-scale buildings in many building codes.

Some countries are making efforts to reduce this risk by developing and formally adopting simplified design and construction code provisions and complementary guidelines for small-scale buildings. These can address vernacular materials and techniques, and also building types constructed using industrial materials and technologies such as confined and reinforced masonry. While the study results presented in Chapter 4 show that the inclusion of design provisions for vernacular construction materials such as earth and bamboo, and "rule of thumb" provisions for the construction of small-scale buildings is not widespread, there were a few exceptions in each region considered, notably in Colombia, Ghana, Nepal, and Vanuatu. These types of provisions must be paired with measures to support implementation compliance and quality control, including the training of homeowners and local builders on earthquake-resistant construction techniques. Addressing the serious risks posed by inadequately built non-engineered structures and inadequately engineered reinforced concrete structures is a broader challenge, requiring capacity development of stakeholders in the design and construction process and well designed and adequately resourced local building controls. The experience of Japan in addressing the seismic risk posed by traditional, non-engineered wooden buildings is a transferable example of a comprehensive policy-based approach (see Box 5.3).

³⁶ While the focus of this report is on building codes, the vulnerability of non-engineered or self-built buildings to earthquakes and other natural hazards must be addressed not only by the development of simplified design and construction guidance, but also through campaigns to build public awareness of these risks and training of homeowners and builders on appropriate and cost-effective construction approaches to support compliance (UNESCO, 2016).



Box 5.3 // An integrated approach to improving the seismic safety of traditional wooden houses in Japan

Traditional, non-engineered wooden houses in Japan were a significant source of seismic risk prior to a multi-pronged effort by the Japanese government to improve the seismic performance of these structures by integrating them into the formal legislative framework (Imai et al, 2017; World Bank, 2017). The main areas of intervention included:

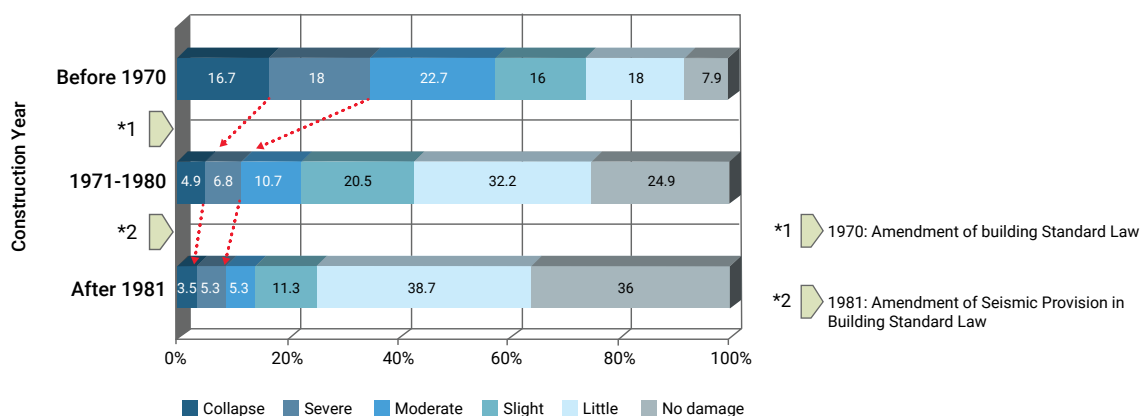
- » Integration of wooden building design and construction provisions in Japan's first building code in 1919;
- » The modernization of construction methods and materials including the introduction of pre-cut wood components for enhanced efficiency at construction sites and the simplification of wood connections using metal connectors;
- » The creation of a new category in the professional qualification system for architects and engineers specific to wooden structures;
- » Industry-wide capacity building through mass training and lecture programs leveraging partnerships between government and the private sector; and
- » Low-interest housing loans and associated technical assistance in the form of concessional housing loans offering low-interest and extended repay periods through the Government Housing Loan Corporation which required specific standards and quality control mechanisms for each house financed.



Traditional wooden houses in Iwami Ginzan, Japan. Photo credit: Tomohiro Nagai, iStock

As a result of these interventions over a century, the seismic risk posed by traditional wooden houses was reduced, as evidenced by damage assessments after the 1995 Great Hanshin Awaji Earthquake (see Figure B5.1).

Figure B5.1 // Level of damage to wooden houses caused by the 1995 Great Hanshin Awaji Earthquake, showing improved performance of newer construction due to revisions to building regulations over time.



Source: Imai et al, 2017.

5.3.3 Addressing seismic assessment and retrofitting provisions for existing buildings

A substantial portion of the existing building stock worldwide is vulnerable to earthquakes. This vulnerability is driven by different factors. Some buildings were constructed prior to advances in seismic design codes over the past 30 to 40 years; some are old and in poor condition; some sustained damage in past events; others were designed and constructed in places where comprehensive and up-to-date seismic design codes have not been adopted and/or effectively implemented. One study estimated that less than 13 percent of the global building stock was built according to design regulations with seismic provisions, with almost half of buildings worldwide exposed to moderate to high seismic hazard (Yepes-Estrada et al., 2023). For example, an assessment of existing school buildings in Cali, Colombia, found that approximately 30 percent of these buildings were vulnerable to collapse should they be exposed to the country's design-level earthquake per the current seismic design code (Government of Santiago de Cali, 2024). Although some countries, such as Chile and Mexico, have had basic seismic design provisions in place for more than 50 years, key improvements to the provisions were introduced over time, often following major damaging earthquakes. For example, the 1968 Tokachi Oki earthquake in Japan, the 1985 Mexico earthquake and the 1999 Türkiye earthquakes triggered significant updates to the seismic codes in those countries. To compound the issue, the seismic vulnerability of existing buildings is often exacerbated over time due to deterioration of building materials, lack of maintenance, unauthorized alterations or additions to a building's structure, or damage from past hazard events.

Box 5.4 // Pragmatic approaches to the seismic retrofit of buildings in Mexico City



Existing buildings in Mexico City. Photo credit: pixelrgb | iStock

Mexico City's 2023 Complementary Technical Norm (CTN) for the assessment and rehabilitation of existing buildings allows a more relaxed standard for seismic retrofits of existing buildings than for the design of new buildings. Depending on the age and vulnerability of the existing buildings, designs are permitted to comply with older versions of the Mexico City Building Code, with the goal of achieving a collapse-prevention performance objective for retrofitted structures. This approach recognizes that it is rarely technically or financially feasible for existing buildings to achieve the same level of compliance as new construction (Government of Mexico City, 2023). The CTN offers different retrofit approaches based on building typology, ranging from highly specialized engineering procedures for taller buildings and those with complex/irregular configurations, to less advanced procedures for simpler and regular structures. This methodology, which aims to balance risk reduction with a nuanced understanding of the technical and financial constraints of building retrofits, offers a practical model for other countries to consider.

Building code provisions supporting the seismic assessment and retrofit of existing buildings, complemented by implementation policies that trigger or incentivize retrofits, can support seismic risk reduction over time.

Only seven of the 22 study countries have some building code provisions for seismic assessment and retrofit of existing buildings (see Figure 5.13). One example is Mexico City, which in 2023 issued a new Complementary Technical Norm for the structural assessment and rehabilitation of existing buildings (see Box 5.4) (Government of Mexico City, 2023). Mexico City's provisions for seismic assessment and retrofit are paired with policies whereby the alteration of a building, or change of use, will trigger a retrofit. Mexico City also offers subsidies to incentivize the seismic retrofit of existing buildings. Such policies are more common in high-income countries but could be expanded to other countries through reforms and affordable financing schemes. The development of a long-term seismic risk reduction strategy could be another effective means of driving action on seismic assessment and retrofit. Japan has been a leader in advanced approaches to the seismic retrofit of existing buildings. Since the passage of the Act on Promotion of Seismic Retrofitting of Buildings in 1995 following the Great Hanshin-Awaji Earthquake, Japan's efforts targeting the retrofit of both public buildings and housing have led to consistent, progressive seismic risk reduction in the country (Moullier and Sakoda, 2018). San Francisco, California, is another leading example, having developed a 30-year Earthquake Safety Implementation Plan (Brown, 2011), initially targeting wood-frame buildings of three or more stories through a mandatory retrofit program, and currently developing an ordinance for the seismic retrofit of older reinforced concrete buildings.



6. Wind Design

6. Wind Design

In many parts of the world, changing weather patterns related to climate change are resulting in more frequent and intense strong wind events such as cyclones, hurricanes, typhoons and storms. Wind is a critical factor in building design and construction due to its significant impact on the structural integrity, safety, and longevity of buildings. Wind loading can also damage nonstructural components such as cladding, roofing, windows, and doors. Proper design for wind loading ensures that these elements remain intact and functional, preventing water ingress, debris impact, and other secondary damages that can compromise the building's usability and safety.

Recent disasters caused by hurricanes and typhoons have shown the impacts of wind damage on housing and buildings that provide critical services, causing economic losses, long-term disruption and displacement of populations. For example, in 2017, strong winds from Hurricane Irma badly damaged the roofs of numerous buildings of the Roy Lester Schneider Hospital in St. Thomas, U.S. Virgin Islands, the island's only hospital. While the main building structure remained intact, loss of the roof cladding led to significant water intrusion into the buildings (FEMA, 2018), disrupting the delivery of health-care services for months (Chowdhury et al., 2019). Approximately one-third of Puerto Rico's housing stock, more than 300,000 homes, were seriously damaged by strong winds, wind-driven rain and flooding in Hurricane Maria in 2017 (US-HUD, 2018). Roof and water damage was often left unrepaired for months or even years. Two years after Hurricane Maria, blue tarpaulins covering damaged roofs were still visible on thousands of homes in Puerto Rico (Florida, 2019).

Thus, it is critical for building codes to include adequate wind design provisions to ensure that buildings can sustain wind loads without experiencing failure of components, excessive deformation, or building collapse, thereby protecting life safety of occupants and minimizing damage. This chapter presents the findings of the assessment related to wind design provisions and discusses priority areas for further code development in this topic area.

6.1 WIND DESIGN PROVISION TOPICS

Statements related to the code provisions in 10 key topic areas related to wind design were evaluated for the 22 study countries, and the overall findings are presented in Figure 6.2. These topic areas are described in Table 6.1, followed by the study findings.

The most common approach in building codes is to ensure that building structures and their nonstructural components can withstand design wind loads with little or no damage. Design provisions for wind need to ensure that various building components are adequately connected to one another. For example, roofing (for example, clay tiles or metal sheets) needs to be adequately attached to the roof structure, the roof structure must be tied to vertical elements such as walls or frames, and the walls need to be adequately tied to the foundations. The type of roof shape and configuration influences the magnitude and distribution of wind pressures experienced by the structure. For example, hip-shaped roofs perform better than gable-shaped roofs under wind loading. Large roof overhangs or porch roofs can be particularly vulnerable to uplift from wind. Buildings that are heavier and more robust, such as reinforced concrete or reinforced masonry wall buildings, typically have a higher capacity to resist wind pressures than lighter-weight construction such as bamboo structures, or timber stud walls with plywood sheeting.

Table 6.1 // Topic areas for wind design

Topic Area	Description
Procedure to develop design wind loading	Codes typically provide procedures to develop wind loads for structural design. The loading calculation often begins by establishing the design wind speed or velocity at the site, and is modified by various factors such as topology, roughness of the terrain, proximity to the coast, and seasonal or directional factors (ASCE, 2021; JRC, 2002). Design wind velocities in the codes are expressed in different ways from country to country. Some use gust wind (average velocity over several seconds during the strongest wind) and others use the maximum wind velocity (usually average over several minutes). Care must be taken when comparing code requirements as different measures are used for design wind velocity. Then, the pressures on the walls and roof are determined based on the factored wind speed and parameters such as building floor elevation and building/roof shape. In addition, wind-load provisions for nonstructural elements such as cladding and building appendages are important (Stathopoulos and Alrawashdeh, 2020).
Simplified wind loading design procedures	For typical buildings, wind loads are usually calculated as minimum static design pressures on walls and roofs which are used in different load combinations. These simplified procedures assume that buildings are relatively stiff and regular in plan and elevation so dynamic wind effects do not need to be considered.
Country-specific wind-loading design criteria	To establish the level of wind loading at a site, country- or jurisdiction-specific wind-loading criteria are needed. These are most often provided in the form of wind speed maps, which are based on historic and sometimes predicted wind speeds. In countries subjected to strong wind events such as cyclones and hurricanes, the code may include both basic wind speeds and wind speed criteria for more intense, rare events.
Wind design procedure for tall buildings (for example, for dynamic effects)	For more flexible structures, such as high-rise buildings, dynamic effects from wind need to be considered, using more sophisticated analytical approaches and, in some cases, wind tunnel testing to physically model dynamic wind effects.
Wind importance factors	Buildings have different levels of importance to society, depending on their occupancy (that is, function). The importance factor accounts for risk to human life, as well as health and welfare associated with potential building damage related to wind events. For example, for higher importance buildings, the overall level of wind design load for the structure is increased by an importance factor greater than 1.
Design provisions for roof cladding and roof overhangs to resist wind	Often, roof cladding (roofing) and roof structures are the most vulnerable components of a building under wind loads. Buildings with roof overhangs can be particularly vulnerable to uplift from wind. These can trigger failure of the entire roof system. Codes may include specific provisions to check if the roof cladding is adequately designed to resist wind loads and if the roof overhangs can resist uplift.
Design of wall cladding/nonstructural appendages to resist wind	Other nonstructural components, such as wall cladding, and building appendages, such as canopies, awnings, parapets, equipment, signage and so forth, can also be vulnerable to wind actions. Codes may require that these nonstructural components are adequately designed to resist wind loads.
Design of façades to resist damage from wind-borne debris	In a strong wind event, flying debris can cause damage to buildings. Some codes require building façades to be able to withstand the impact of flying debris of a certain weight and velocity.
Façade detailing to resist water ingress from wind-borne rain	Strong wind events may include heavy precipitation, and buildings can experience wind-driven rain, which most significantly affects their exterior (façade) components. If façades are not designed and detailed to resist wind-driven rain, water ingress can occur, causing moisture damage and potential longer-term problems such as mold. Such damage can lead to the disruption of building operations and hamper longer term recovery.
Detailing of doors and door mechanisms to resist wind	For buildings that need to be operational during a strong wind event, it is advisable to ensure that doors and door mechanisms can maintain function under anticipated levels of wind loading.



6.2 SUMMARY OF FINDINGS: WIND DESIGN PROVISIONS

The assessment found that wind design provisions were generally less comprehensive than seismic design provisions. All countries have some form of procedure to develop wind loads, including simplified methods that typically apply to regular, low-rise buildings. Most countries—all but Indonesia and Mozambique—have country-specific wind design criteria, most often provided in the form of wind speed maps. In Indonesia, the design of the building's lateral system (for example, frames or walls) is typically governed by seismic loads and wind is less of a dominant load case. Nevertheless, the Indonesian design standard will be improved by the inclusion of a country-specific wind map which is currently under development.

For structural design provisions, common gaps are related to wind importance factors, dynamic procedures for tall buildings and specific provisions for the design of roof overhangs. For architectural provisions targeted to improve resilience, very few countries address the design of roof and wall cladding to resist wind loads, the design of façades to resist wind-borne debris, and the detailing of doors and door mechanisms to resist wind and maintain function during a strong wind event.

Attention to provisions for wind design are of particular importance to countries in this study exposed to risk from cyclonic wind events. These countries include Vanuatu, Samoa, the Philippines, Mozambique, Mexico and, to a lesser extent, Colombia (in order of AALR) (UNDRR, 2016). Of these, Colombia, Mexico, Samoa and the Philippines have relatively more comprehensive coverage in wind design topic areas. This further highlights the importance for Vanuatu and Mozambique to prioritize the development and enhancement of their wind design provisions.

The overall findings of the wind provisions assessment are presented in Figure 6.2 with countries ranked by the total number of topic areas that satisfied the assessment statements. **Most countries cover wind loading and design of the main structure for typical buildings, but fewer building codes address the design of nonstructural components** to resist wind or include architectural provisions to protect buildings from wind-borne debris or wind-driven rain. Both types of provisions are important to improve the safety and resilience of structures and reduce disruption after a strong wind event. Among the countries assessed, Colombia, Mongolia and the Philippines have the most comprehensive coverage across all wind design topics.

Figure 6.1 // Wind damage to roof cladding caused by Typhoon Haiyan in Boracay, Philippines in 2013



Roof damage from Super Typhoon Haiyan, Philippines. Photo credit: WhitcombeRD | iStock

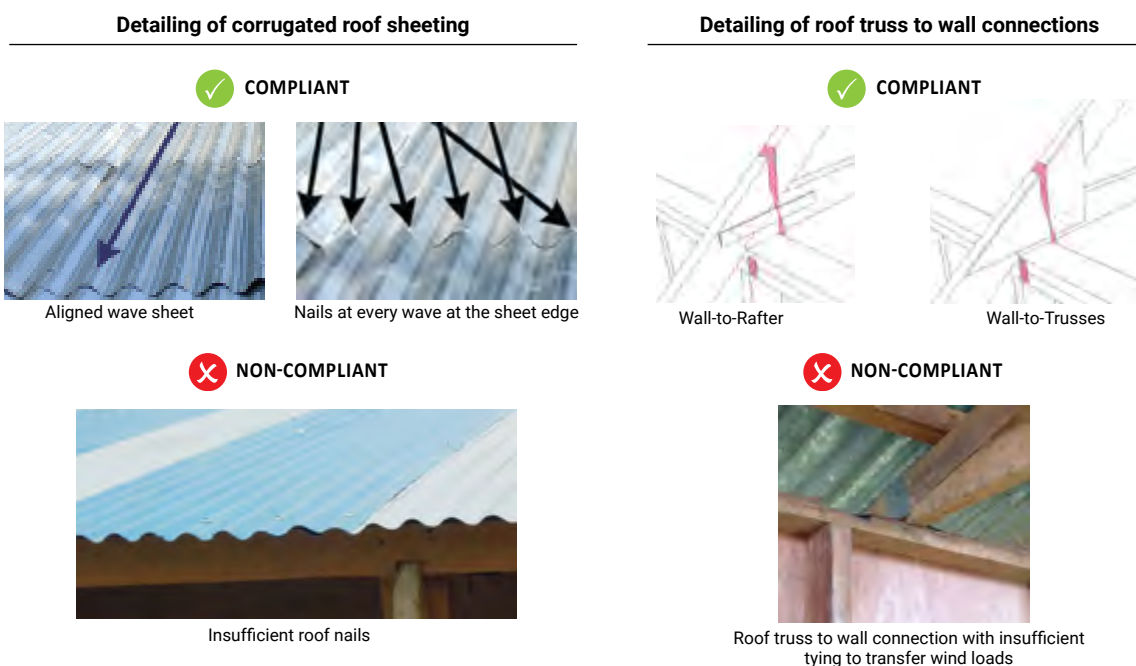


Box 6.1 // Design of roof cladding for wind actions

Roof structures and their cladding (also known as roofing) are often the most vulnerable parts of a building in strong wind events. In addition to prescribing procedures to determine wind pressures resisted by the roof structure, codes also need to have provisions to determine design wind pressures for cladding, spans for cladding elements, and fastener capacity, type, location and spacing for roof cladding. Additional fasteners can be required along the eaves and roof ridges, where wind pressures can be higher.

For example, the National Structural Code of the Philippines (NSCP-2015) has a section for the design of roof cladding and other façade components for wind effects, including load procedures for determining wind pressures for a specific site depending on the wind speed, building height, and roof shape. Figure B6.1 shows related details from a simplified guidance manual for timber housing seismic and wind retrofits in the Philippines (Build Change, 2015). The guideline specifies how corrugated steel roof sheeting should be attached to timber roof purlins to resist anticipated wind loads.

Figure B6.1 // Details from a simplified guidance manual for timber housing seismic and wind retrofits in the Philippines



Source: Building Change. 2015. Seismic and Wind Evaluation and Retrofit Manual for Timber Housing Construction in the Philippines.

Figure 6.2 // Summary of assessment of wind design provisions for the 22 countries

WIND PROVISIONS										
COUNTRY	Procedure to develop design wind loading	Simplified wind loading design procedures	Country-specific wind loading design criteria	Wind design procedures for tall buildings	Wind importance factors are used	Design provisions for roof cladding/roof overhangs to resist wind	Design of wall cladding/non-structural appendages to resist wind	Design of façade to resist damage from wind borne debris	Façade detailing to resist water ingress from wind-borne rain	Detailing of doors and door mechanisms to resist wind
Colombia										
Mongolia										
Philippines										
Chile										
Ghana										
Mexico										
Samoa										
Tajikistan										
Morocco										
South Africa										
Türkiye										
Bhutan										
El Salvador										
Nepal						U	U			
Tonga										
Vanuatu										
Algeria										
Indonesia										
Rwanda										
Uzbekistan										
Peru										
Mozambique			note 1							
TOTAL COUNTRIES	22	22	20	16	10	13	11	4	3	2

■ The country's code provisions satisfied the assessment for the topic area.
 □ The country's code provisions did not satisfy the assessment for the topic area.

Notes:

1. For Mozambique, a country specific wind map exists for a nationally adopted school construction guideline only.
2. Items marked U could not be verified (U=Unable to verify).

6.3 PRIORITIES FOR FURTHER DEVELOPMENT OF WIND DESIGN PROVISIONS

This section discusses priority topics for future code development of wind design provisions that may be applicable to the countries included in the assessment as well as other countries. These topic areas emerged through review of the assessment results presented in Section 6.2, further supplemented by desktop review.

6.3.1 Up-to-date country-specific wind maps

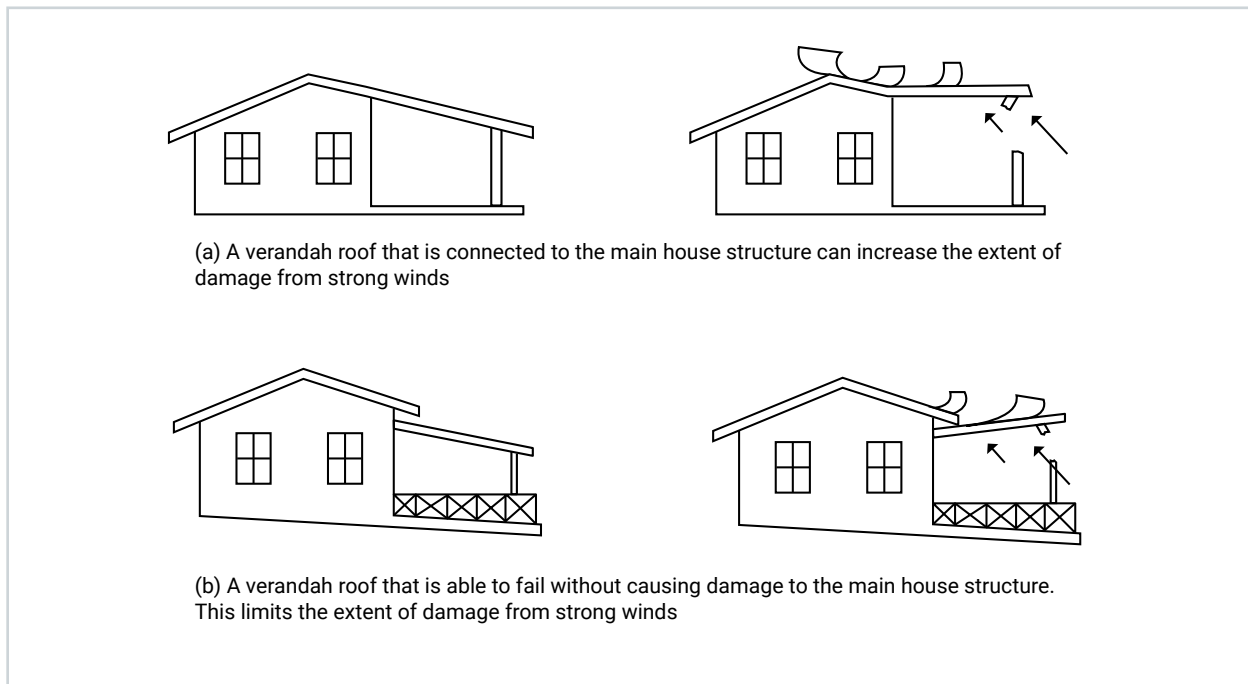
Overall, countries can benefit from periodically updated country-specific wind design criteria that consider climate change projections and are based on the latest meteorological data and hazard assessment methodologies. Across the study countries, on average, wind codes were developed over a period of 26 years, including two update cycles during that time. In terms of updates, only Mexico, Peru, Rwanda and South Africa have code documents containing country-specific wind criteria that have been published in the past five years. Considerations for developing up-to-date and comprehensive country-specific wind maps include the quality of the meteorological data that underpin that analysis to develop design wind speeds, projection of future trends such as increased frequency and severity of strong wind events, adequate granularity in maps (for example, avoiding maps with broad zonation that may not cover local variations), the use of more advanced, probabilistic methods to determine wind speeds and selection of appropriate return periods for wind design criteria (Lakshmanan et al., 2009; Li, 2022). For example, in Canada, building codes are regularly updated on a five-year cycle, allowing for the revision of design parameters for environmental loads, including wind, in each new edition of the building code (Government of Canada, 2020). Building codes in some countries set different performance requirements for buildings subjected to strong winds. For instance, while most countries use wind speeds with a 50-year return period for the design of structural elements such as walls and roofs, Mexico's building code requires that some buildings be designed for wind speeds with a 200-year return period, depending on their importance and/or risk category (Pozos-Estrada et al., 2023).

6.3.2 Improved code provisions and related guidance for wind resilience of small-scale housing

Some countries are supporting communities in breaking the cycle of repeated devastation by integrating more stringent wind provisions for small-scale housing into building codes, including guidance that is appropriate for light-frame and vernacular construction. Reforms to building codes are often prompted by particularly devastating, or repeated, wind events. For example, in response to significant damage from the Category 5 Hurricane Iota in 2020, Colombia amended its building code to increase the design wind speeds in the Archipelago Department of San Andrés, Providencia and Santa Catalina (Ministry of Environment, Housing and Territorial Development, 2021). Common design provisions to reduce the wind vulnerability of light frame buildings include the use of hurricane straps and improved connections to withstand wind loads and prevent roof damage. Following damage to approximately 90 percent of its housing stock due to Hurricane Maria in 2017, the Commonwealth of Dominica in the Caribbean updated its building regulations, including publishing a Guide to Housing Standards providing design and construction guidance for strong winds (Government of Dominica, 2018) (see Figure 6.3).³⁷ In addition to building code reforms related to wind performance, “beyond code” standards, such as the FORTIFIED Standard in the United States developed by the Insurance Institute for Business and Home Safety (IBHS) (FORTIFIED, n.d.), can support voluntary upgrades to enhance the resilience of homes to severe winds. These types of provisions can be included in simplified provisions tailored for common types of small-scale buildings. Also refer to Chapter 4, Section 4.1.2.7.

³⁷ As discussed for the seismic design of vernacular structures above, design and construction guidance alone is not sufficient and must be complemented by implementation and compliance support mechanisms such as homeowner engagement, builder training, and financial tools.



Figure 6.3 // Examples of simple illustrations of approaches to improve the performance of housing in strong winds

Source: Adapted from Government of Dominica, 2018.

6.3.3 Performance-based design approaches for the wind resilience of structural and nonstructural components

To reduce repeated economic losses from hurricanes and typhoons, building codes in some countries are introducing performance-based design approaches to control the extent of building damage and to set more stringent performance expectations for nonstructural components. Performance-based design, originally developed for seismic hazards, is also being extended to wind hazards, particularly for tall buildings and critical facilities, to support higher-resilience performance objectives in some high-income countries. This approach involves analyzing an explicit model of the structure that captures any potential damage experienced when subjected to wind response history analysis. Thus, the dynamic response of the structure under wind events and any nonlinear response is captured directly in the analysis model. Enhanced performance corresponding to limited damage of the building envelope in strong winds is a key component of performance-based wind design approaches. Recently introduced building code provisions include enhanced performance standards for doors, wall and roof cladding, and roof equipment, and aim to mitigate the impact of wind-borne debris and water intrusion on windows and façades. These provisions also aim to ensure that the building envelope remains intact and water- and air-tight in severe storms, going beyond minimum Life Safety performance objectives. At present, these performance-based approaches for wind design are rarely included in building codes.

In countries where capacity limits the applicability of performance-based design approaches, codes can embed higher performance targets for more critical and/or higher importance buildings using prescriptive provisions. These provisions can include more stringent requirements (above minimum Life safety) for structural and non-structural elements under wind loading and/or be tied to longer period return period design wind speeds.



7. Flood Design

7. Flood Design

As flood risk increases due to the impacts of climate change amid mounting pressure on land for development, building codes must address ways to mitigate the impact of flooding on buildings, beyond avoiding flood risk through site selection. Flood risks are predominantly managed through planning regulations that prohibit construction on flood-prone sites and help determine appropriate locations to construct buildings. In practice, many cities and regions either lack up-to-date and sufficiently detailed flood risk assessments to inform risk-based land-use planning maps, or jurisdictions fail to integrate flood risk into urban planning regulations. Furthermore, climate change is increasing the frequency and intensity of floods amid the land-use pressures of urban expansion. One study found that while general development in settlements around the world increased by 85 percent between 1985 and 2015, development in flood-hazard areas increased by 122 percent. In 2022, it was estimated that approximately one in five people in the world are directly exposed to 1-in-100-year floods, and that 89 percent of those are living in low- and middle-income countries (Rentschler et al., 2022). Thus, a more comprehensive approach is needed to reduce flood risk. This can be achieved by imposing land-use restrictions through urban planning, flood management, and, where it is difficult to reduce flood risk through site selection, by applying flood-proofing measures to buildings.

This chapter presents the findings of the assessment related to flood design provisions and discusses priority areas for further code development in this topic area.

7.1 FLOOD DESIGN PROVISION TOPICS

Six key topic areas related to design for flooding, described in Table 7.1, were evaluated to identify if the building code included some of the related provisions, and the overall findings are summarized in Figure 7.1 and discussed in the following text.

Table 7.1 // Topic areas for flood design provisions

Topic Area	Description
Load procedure for flood loading	Procedures to determine the loads on the structure related to flooding can include hydrostatic loads (the pressures from the static mass of water in contact with a structure), hydrodynamic loads (loads generated by water flowing against and around a structure), and wave loads caused by water waves propagating over the water surface and striking the structure. In addition, if vents, valves or other openings are not provided to equalize water pressure in flooded enclosed spaces, uplift pressures on the structure from flood waters may also need to be considered.
Structural and nonstructural material requirements in relation to flooding	To improve building safety and limit damage, some codes require that resistance to flood waters is considered when selecting structural and nonstructural materials. Requirements can relate to how easily water can penetrate the material, drying ability and if the material will retain its integrity and dimensions if subjected to flooding.
Requirements for vents, valves or other wall openings in enclosed spaces below the design flood level	To equalize hydrostatic flood pressures on both sides of a wall in enclosed spaces during a flood event, some codes require that vents, valves or other wall openings be incorporated in the design. This can reduce the risk of structural collapse in a flood event. Provisions can include minimum requirements for the size, number and location of openings.

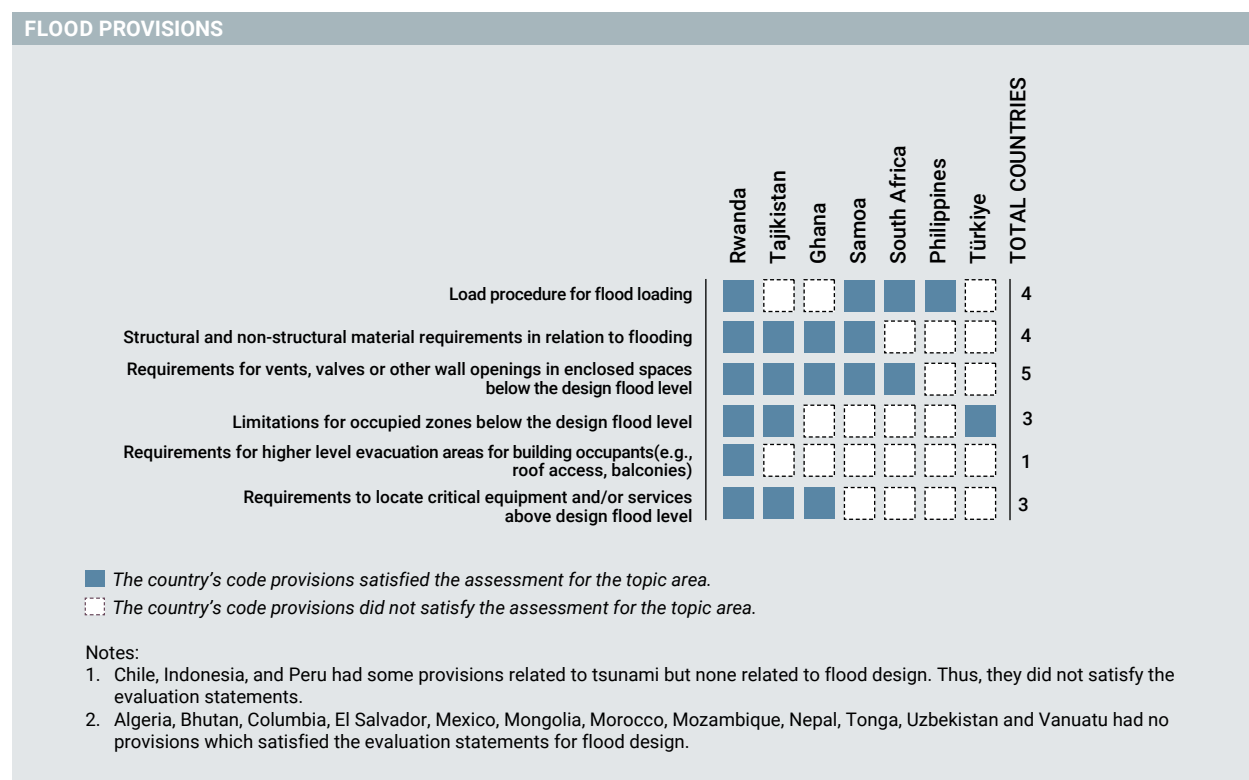


Table 7.1 // Topic areas for flood design provisions (cont.)

Topic Area	Description
Limitations for occupied zones below the design flood level	Some codes restrict the types of occupancy below the design flood level for the building. For example, such spaces may only be used as entrance lobbies or for storage—residential occupancy is often prohibited. Limited occupancy for such spaces reduces the risk to a building's occupants.
Requirements to locate critical equipment and/or services above the design flood level	If critical equipment, such as power, communications (ICT) or heating, ventilation and air conditioning (HVAC) equipment, is damaged by flood waters, it can endanger occupants and lead to significant building disruption and longer recovery times after a flood event. Therefore, some codes require that critical equipment be located above the design flood level.

7.2 SUMMARY OF FINDINGS: FLOOD DESIGN PROVISIONS

As expected, countries were found to have limited coverage of flooding-related design provisions for buildings compared to provisions for other hazards such as seismic and wind (see Figure 7.1). Of the countries assessed, 15 have no provisions related to flooding, including some of the countries with the most advanced codes, such as Colombia, El Salvador, and Mexico. Chile, Indonesia, and Peru have some provisions tailored for tsunami but do not satisfy the evaluation statements from this study because these are focused on flood-related design more broadly. For Rwanda, although flood provisions are generally more complete, it is unclear in the code how the design flood elevation should be determined for a site. Reference is made in the provisions to local flood maps, but it could not be verified how the maps should be obtained for a specific site.

Figure 7.1 // Summary of assessment of flood design provisions for the 22 countries

Countries with more complete provisions related to flooding include Ghana, Rwanda and Tajikistan. That said, it is still unclear if these provisions are well integrated with planning information about flood risks (for example, for designers to be able to find out the design flood level for a site). Procedures to develop flood loading, requirements for vents, valves, or other openings to equalize water pressures or requirements for improved durability under flooding for building materials (structural and nonstructural) are the most common flood resilience provisions. The codes studied rarely include architectural provisions—such as limitations on occupied zones or locating critical equipment below the design flood level, or requirements to provide safe zones at higher elevations for building occupants—that could significantly improve building safety and reduce disruption related to flood events.

Box 7.1 // Protecting critical equipment and services from flooding

Design measures, such as the inclusion of flood loads in structural design and the use of flood-resistant materials, must be complemented by strategies to protect critical services from flood-induced damage and ensure continued functionality during flood events. These provisions can include avoiding locating critical building services such as utilities, electrical services and outlets, water pumps, critical ICT, and emergency generators, below the design flood elevation. Other design provisions can include specifying that connections are detailed to ensure that floodwater cannot enter the building (for example, provide nonreturn valves in sewage pipes, seal gaps around pipework, and cable connections).

For example, the Ghana Building Code (2018) specifies that fire pumps must remain operational during flooding, electrical substations must be located at a minimum of 15 cm above the anticipated level of flooding, generators and their connections must be installed above the level of flooding, along with ventilation intake openings, exhaust outlets and other elements of mechanical, electrical and plumbing services.

7.3 PRIORITIES FOR FLOOD DESIGN PROVISIONS IN BUILDING CODES

As buildings are increasingly exposed to flood risk, more countries are introducing or improving building code provisions to mitigate damage and operational disruption due to flooding. In addition to integrating flood hazard mapping into risk sensitive planning regulations,³⁸ countries are recognizing the importance of mitigating flood risk through building codes. Flood damage to buildings may impact the operation of building utilities and cause permanent damage to building materials and contents, sometimes resulting in mold and long-term health concerns. Flooding may pose life safety risks for more vulnerable structures if badly damaged, or where occupants become trapped in flooded zones. Figure 7.2 below gives some areas that code provisions can potentially address including: structural design for flood loading, architectural provisions related to the design elevation of building elements, evacuation and type of occupancy, and flood proofing of structural elements, nonstructural elements and services (FEMA, 2008). Beyond building design provisions, for the wider site, permanent or temporary flood barriers, as well as nature-based or hard-engineered stormwater/drainage management measures, can also be used to reduce the site's exposure to flooding. Some measures, called 'dry proofing' have the goal of preventing flood waters from reaching and/or infiltrating the building. Other measures, called 'wet proofing', seek to limit damage and disruption if a building is flooded. These types of measures can be used in combination, but often one or the other approach is taken depending on the criticality of the building and the cost to implement various measures (see Figure 7.3). Although these types of design strategies are often not yet codified, they are increasingly being employed in the design of new buildings, especially hospitals and residential developments, due to greater awareness of the risks that flooding poses to building function.

³⁸ Although considerations related to incorporating better flood hazard maps into planning and development regulations are important, these lie beyond the scope of this study, where the focus is on building design regulations and related provisions. If code provisions reference a "design flood level", the code should ensure that users are able to identify this value for a specific site, potentially by referring to local planning maps or other official sources of flood risk data.

Figure 7.2 // Types of measures that can be addressed in building code provisions to mitigate the risk of flooding**SITE AND ELEVATION**

- Select a site with higher elevation or raise the elevation of the building
- Include storm water management as part of the site design
- Install flood walls or permanent or temporary flood barriers
- Allow for safe zones at higher elevation in building or on the site for evacuation
- Locate critical equipment (e.g., utilities, electrical services and outlets, water pumps, critical ICT, emergency generators) above the design flood level
- Limit occupancy types in zones below the design flood level

FLOOD LOADING

- Determine flood hazard for a site, including establishing design flood levels for a specified flood return period
- Follow flood loading procedures to develop design loads for the structure, including accounting for uplift forces for dry floodproofing
- Design vents, valves or other openings to equalize water pressure in case of flooding

BUILDING MATERIALS AND COMPONENTS

- Specify more flood-resistant structural and non-structural materials (consider water penetration, drying ability and if integrity and dimensions will be retained)
- Design flood-resistant building envelope including doors and windows¹
- Detail building services to prevent water ingress (e.g., provide non-return valves in sewage pipes, seal gaps around pipework, cable connections)¹

Note 1: Measures related to 'dry proofing' where flood waters are prevented from entering a building.

Figure 7.3 // Temporary flood gates being installed at the Kurashiki Central Hospital in Japan as part of a dry flood-proofing strategy

Photo credit: Kurashiki Central Hospital



8. Design for Wildfire

8. Design for Wildfire

Although an assessment of broader fire safety provisions was outside the scope of this study, incorporating provisions to address the risk of wildfire was identified as a key topic for consideration in building codes. Wildfires pose an increasing threat to communities driven by urbanization, climate change impacts and land management practices. Wildfire provisions were deemed to be too rare within building codes globally to warrant assessment in the 22 study countries.

This chapter presents an overview of current design provisions for wildfire and emerging approaches for addressing wildfire risk through building codes.

8.1 EMERGING PROVISIONS FOR DESIGN FOR WILDFIRE IN BUILDING CODES

Global wildfire risk to society is mounting as climate change exacerbates the likelihood of wildfires and urban development expands into the wildland-urban-interface (WUI). Around the world, wildfires are occurring more frequently and with greater intensity (Jones et al., 2024; MacCarthy et al., 2024). Climate change is driving this trend (Conradie et al., 2023), with increased periods of drought in many parts of the world, as is improper forest and land management. The exposure of communities and the built environment to wildfires has also significantly increased due to global development patterns, including rapid urban expansion over the past two decades into the WUI, defined as “places where homes and other man-made structures intermingle with trees and vegetation” (Bento-Goncalves et al., 2020; Guo et al., 2024; Tang et al., 2024; Chen et al., 2024). While the WUI represents only 4.7 percent of the world’s land surface, it is home to approximately half the world’s population (3.5 billion). Over the period from 2003 to 2020, approximately 400 million people lived near active wildfires, two-thirds of whom were in Africa (Schug, 2023). In recent years, wildfires have resulted in major disasters including the 2025 Los Angeles wildfires with projected losses of US\$ 150 billion (ECMWF, 2025), and the Black Saturday bushfires in Australia in 2009 which killed 173 people and destroyed 3,500 buildings (National Museum of Australia, n.d.).

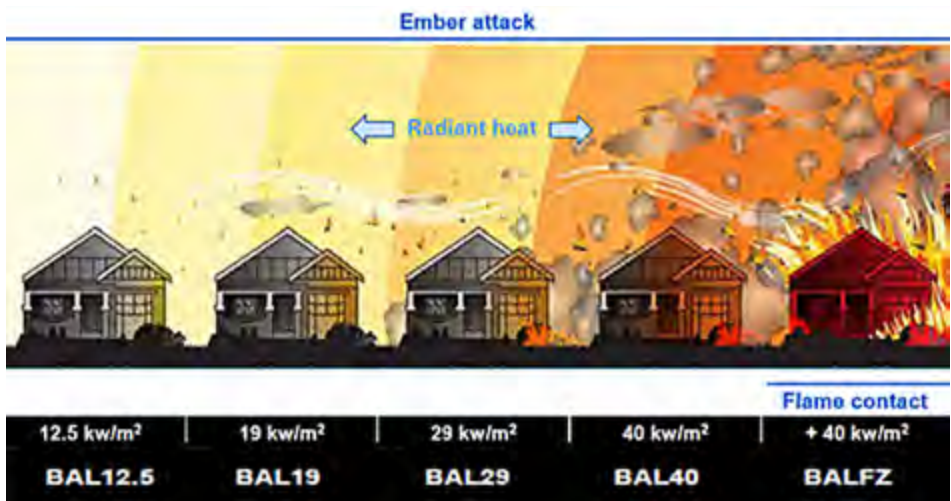
Some countries are incorporating design and construction provisions for wildfire resilience into building codes, but many countries with increasing wildfire risk have not yet taken this step. Wildfire mitigation involves a wide range of strategies related to land and ecosystem management and community preparedness. It also includes efforts to improve the resilience of buildings and infrastructure to withstand exposure to wildfires and reduce their spread. Standards for buildings provide both site-related and construction-focused strategies. Site strategies involve creating defensible spaces or buffer zones around buildings by managing vegetation and using firebreaks such as driveways or gravel paths. Code provisions can focus on improving the resistance of buildings to burning embers, radiant heat and/or flame contact, including the use of fire-resistant roofing and façade materials and the sealing or screening of vents, chimneys and other gaps or openings to prevent ember intrusion (Commonwealth of Australia, 2021) (see Figure 8.1). Australia’s National Construction Code (2022 edition) has one of the most advanced approaches to wildfire (or bushfire) mitigation, requiring that new residential buildings, as well as schools, childcare centers, hospitals, and elderly care facilities located in designated bushfire-prone areas comply with Australian Standard AS 3959 (HIA, 2021). This standard includes six Bushfire Attack Levels with differing performance requirements, based on the likelihood of a building’s exposure to ember attack, radiant heat, and/or flame (see Figure 8.2). Following the provisions is not meant to guarantee that a building will survive exposure to a bushfire, but it is expected that the risk of ignition will be reduced (Loveridge, 2020). Building codes in several US states including California also include mandatory wildfire provisions for new buildings, drawing on principles from ICC’s International Wildland-Urban Interface Code (ICC, 2021c; ICC, 2024c). Besides these early adopters, building

codes in few other countries with wildfire risk have included mandatory construction provisions for areas prone to wildfire. Other countries or jurisdictions at local level provide education and optional guidance to support voluntary mitigation such as Canada’s FireSmart program (FireSmart, n.d.).

Figure 8.1 // Types of measures that can be addressed in building code provisions to mitigate the risk of wildfire

BUILDING DESIGN	SITE MEASURES
• Understand the site's level of wildfire risk to determine the level of protection and mitigation measures required or recommended • Use fire resistant building materials for roofing, exterior cladding including glazing. In some cases, fire resistant shutters are an option • Consider the vulnerability to fire for building appendages (e.g., porches, sheds, fences) • Improve the resistance of buildings to wind blown embers (e.g., design of subflooring, screening of vents and other openings)	• Limit vegetation around building perimeter, consideration of overhanging trees • Prohibit or manage more flammable vegetation on the wider site • Use fire breaks with hardscaping such as gravel paths, driveways • Specify minimum separation distances to adjacent structures • Provide emergency water supply on site • Provide adequate access provided for fire fighting crews and equipment

Figure 8.2 // Bushfire Attack Levels in Australian Standard AS 3959



Source: Victoria State Government, n.d.



9. Green Building Design

9. Green Building Design

To improve the sustainability of the built environment, reduce greenhouse gas emissions and adapt to the impacts of climate change, many countries are incorporating green building provisions in their building regulatory frameworks. The World Green Building Council defines green buildings as those “that reduce or eliminate negative impacts on the climate and natural environment (...) while also creating positive impacts and that help preserve natural resources and improve quality of life.” (UKGBC, 2020). Green building features are broad in the types of sustainable aspects they address and relate to all phases of the building life cycle—design, construction, operation, and decommissioning. They include measures to improve energy efficiency, water efficiency, use of renewable energy sources, measures to reduce pollution and waste and enable reuse and recycling, consideration of occupants’ health and comfort such as adequate daylight and good indoor air quality, the use of non-toxic, ethically sourced, sustainable materials, and design outcomes that anticipate the need for future adaptation (World Bank, 2023a). It is important to note that different green building strategies may be more appropriate depending on the climatic conditions of the country or region and fire safety aspects need to be considered (see Boxes 4.5 and 9.1).

Improved green building codes and their effective implementation at scale are essential components to support decarbonization and a more sustainable built environment. The building sector accounts for 37 percent of total greenhouse gas (GHG) emission emissions worldwide (GlobalABC, 2024). As part of the 2015 Paris Agreement, the national plans of 161 countries to reduce GHG emissions³⁹ have actions to reduce emissions related to the building sector, including building code reforms (UN, 2023). Building emissions come from two primary sources: (i) operational emissions from energy use including heating, cooling, lighting and appliances (28 percent), and (ii) embodied energy from construction materials and processes (nine percent) (GlobalABC, 2024). Building codes—through energy efficiency provisions, low-carbon design provisions and provisions to promote a more circular economy in construction—have been recognized as essential instruments to reduce both sources of these emissions.

Building codes can also be used to address the growing problem of waste produced by the construction sector. The building sector is hugely resource intensive. It produces one-third of the world’s waste (Carpentier, 2024); in many countries, both the extractive processes needed to produce new materials and disposal of the sector’s waste contribute to environmental harm (Al-Raqeb et al., 2023). Codes can address this by improving their provisions for the rehabilitation, retrofit, and adaptation of existing buildings, thereby reducing the need for new construction. They can include simple procedures to promote low-carbon design, permit and support the use of modular construction techniques, and include provisions to promote the circular use of building materials (such as designing for deconstruction and encouraging the reuse and recycling of materials).

The incorporation of green building provisions into codes is needed to adapt to climate change impacts, reducing negative health impacts, fatalities, and disruption of essential services. Climate change impacts are resulting in more frequent and severe extreme temperature and weather events, along with changing rainfall patterns. These, in turn, are causing knock-on effects such as power blackouts and water scarcity (Seneviratne et al., 2021). Green building code provisions—such as for natural ventilation, solar shading and green and reflective roofs—can reduce solar heat gain in buildings and help to protect occupants during heat waves. Onsite renewable energy can act as a backup source of power if the wider power grid is disrupted (also see Chapter 4, Section 4.2.3) and requirements for water-efficiency measures in buildings can help regions experiencing water scarcity.

³⁹ Formally called National Determined Contributions (NDCs) per the Paris Agreement.



Lastly, an emerging priority in building regulations is improved indoor air quality, to reduce negative health impacts from pollution and airborne disease. Since the COVID-19 pandemic, and the recent publication of studies on the harms of indoor pollution, there is a growing awareness that further investment and regulations are needed to set minimum public health standards for indoor air. This is not unlike the public health standards introduced for clean water over the last century, as the medical and scientific establishment recognized the harms of waterborne disease.

This chapter first presents the findings of the assessment related to green building design provisions. Then, priority areas for further green building code developments are discussed with reference to carbon emission reduction (Section 9.2), climate change adaptation (Section 9.3), and clean indoor air (Section 9.4).

9.1 ASSESSMENT OF GREEN BUILDING CODE PROVISIONS

This study primarily focused on green building measures related to carbon emission reduction and climate adaptation. This section begins by presenting findings of the review of regulatory structure, organization, update cycle and accessibility of green building code provisions. This is followed by a discussion of the technical provisions associated with green building codes, and related findings .

9.1.1 Regulatory structure, organization, and accessibility of green building codes

With the exception of Mongolia and Mozambique, all the countries assessed had some form of green building code or provisions (see Figure 9.1 below and subsequent text).

- » **Regulatory jurisdictions:** Of the 20 countries with green building regulations, five have these regulations set at the regional or city level (in addition to national level); the other 15 countries only set these nationally.
- » **Organization of code documents:** Nine countries consolidate all provisions into one regulation; 11 provide them in a set of separate regulation documents.
- » **Code update cycle:** Three countries (Indonesia, Rwanda and South Africa) have fairly recently updated or introduced green building regulations (in the past 5 years); another five countries (Colombia, Ghana, Nepal, Philippines, and Samoa) have done so within the past 10 years; while the remaining 12 countries are operating under regulations established 10–30 years ago.⁴⁰
- » **Accessibility of code documents:** In 17 countries, all regulations are available online and are free of charge. In Tajikistan, no regulations are available online or free. In Mexico some regulations are available online and free of charge and some are not. Finally, in South Africa, regulations are available online, but for a fee.
- » **Mandatory or voluntary provisions:** Typically, green building provisions are a mix of mandatory and voluntary provisions, sometimes combined with incentives. Some provisions would be challenging to enact as mandatory provisions, such as those relating to building orientation, which is often dependent on the constraints of the site and surrounding buildings. Other provisions, such as those related to integrating renewable energy, can be highly dependent on associated costs, availability of relevant technology, and connection to other energy infrastructure. In such cases, some jurisdictions provide financial incentives in the forms of grants, tax benefits or low interest loans. Some green building measures, such as passive energy efficiency measures (for example, solar shading, ventilation, and daylighting) are more universally applicable across a range of contexts. Colombia is the only country assessed where all green building provisions are voluntary. Other countries, such as Rwanda and Bhutan, lean heavily toward voluntary rather than mandatory provisions. It was also found that green building provisions are often mandatory only for certain types of buildings (for example, for certain usage types, or buildings that exceed a certain threshold of total plan area).

⁴⁰ This was assessed based on the year of publication for the oldest regulation for each country.



- » **Provisions for new and existing buildings:** All countries, except for Mongolia and Mozambique, have some green building provisions for new buildings, while only 9 countries have some provisions related to existing buildings.

In general, green building provisions have been introduced more recently than structural design codes, are more likely to be contained in one document, and often contain voluntary provisions in addition to mandatory provisions. Most green building regulations focus on new construction and are less likely to include detailed guidance or enforceable requirements for existing buildings.

9.1.2 Green building technical provisions

In this study, 15 key topic areas for green building technical provisions were assessed to establish whether or not each code has provisions related to each area (see Table 9.1).

Table 9.1 // Topic areas for green building provisions

Topic Area	Description
Natural ventilation	To reduce dependence on air-conditioning and thereby saving energy, design for natural ventilation in buildings can be provided. Adequate ventilation and fresh air flow can also improve productivity and reduce the spread of airborne disease.
Daylighting	To save energy required for artificial lighting and increase occupant well-being, adequate daylighting is needed.
Insulation	Well insulated walls and roofs stop buildings from overheating during the summer and losing heat during the winter (low U-value walls). This includes the use of insulation along with structural materials, like masonry (constructed using concrete or clay blocks).
Building orientation	To improve occupant comfort and reduce energy needs for heating and cooling, buildings can be oriented to avoid excessive heating through solar radiation in warmer months, or to let in solar radiation during cooler months.
External solar shading	To block out excess heat from sunlight or prevent heat from escaping from the building, fixed and operable shade devices (including automated systems) can be provided. In addition, windows with low UV coatings can be provided.
Window-to-wall ratio (WWR)	Windows and other glazed façade systems provide light and ventilation, but in warm climates they also bring in unwanted heat, increasing the load on air-conditioning systems and thus increasing energy use. Having the optimum window-to-wall ratio (WWR) helps balance the two opposing requirements.
Reflective roofs and walls	Reflective roofs and/or walls, constructed either using solar reflective materials or reflective coatings, absorb less of the sun's energy and can reduce overheating of buildings. This is a relatively low-cost and highly effective measure to help regulate building temperatures in hot climates.
Green walls/roofs	Green walls and roofs can cool buildings both externally and internally. Vegetation (often drought-tolerant varieties like sedums) are planted in a growing medium over a waterproofing membrane on the roof structure. Such buildings must be structurally designed for the additional weight.
Energy-efficient lighting	Lighting consumes about 15 to 30 percent of the total energy of a typical building. LED lamps not only use less energy than incandescent bulbs—as much as 90 percent less—they also reduce internal heat gains in the buildings. Another measure to improve the efficiency of lighting is the use of daylight and occupancy sensors to automatically switch lights on and off to reduce energy consumption.
Energy-efficient mechanical heating, ventilation, and air conditioning (HVAC)	HVAC systems typically consume 40 to 60 percent of the total energy for a building. Therefore, specifying energy-efficient HVAC equipment is a key measure to reduce energy consumption.



Table 9.1 // Topic areas for green building provisions (cont.)

Topic Area	Description
Renewable energy	Renewable energy systems can include onsite renewable energy sources such as solar or geothermal energy, which will reduce energy needed from other sources to operate buildings.
Water-efficient fixtures and fittings	Water-efficient fittings and fixtures for toilets, showers and sinks such as low-flow taps, push taps, infrared tap sensors, low-flow shower heads and low-flow toilets can reduce water flow by roughly 15–20 percent.
Water collection/reuse	Rainwater can be harvested from roofs and stored in tanks or collection ponds for irrigation purposes and/or flushing of toilets. Greywater can also be collected and treated prior to being recycled for nonpotable purposes.
Recycled building materials	To reduce the embodied energy of the building, recycled materials can be used. For refits or existing building upgrades, the design can try to retain or reuse existing floors, walls and roofs. In addition, recycling or salvaging of materials can be carried out during construction. Facility design can also consider how building materials can be recycled at the end of the building design life. This can have the added environmental benefit of reducing construction waste.
Low embodied energy design approaches and materials	The use of sustainably sourced materials with lower embodied energy will reduce the carbon footprint of the design, as will more efficient use of construction materials in building design. For example, local, sustainably sourced timber would have a lower embodied energy than imported structural steel.

Source: World Bank, 2023a.

Box 9.1 // Tailoring green building provisions to climatic conditions

Appropriate selection of green building strategies and approaches depends on the climatic conditions of the country and/or region. The main climatic parameters that influence energy performance are solar radiation, air temperature, relative humidity,⁴¹ and wind (UN-Habitat, 2014). The following green building topics require a consideration of local climatic conditions:

Thermal mass	In temperate climates, buildings can benefit from having a higher thermal mass, as there are larger differences between day and nighttime temperatures (diurnal fluctuations). By contrast, in climates with narrower daily temperature variations, lighter-weight materials that release heat faster can be more appropriate, especially when combined with adequate natural ventilation.
Types of insulation	In warmer climates, reflective foil insulation, especially for roofs, is an effective way to reduce solar heat gain whereas in colder climates bulk insulation can be needed to retain heat within the building in cooler weather.
Performance requirements for indoor comfort	People's perception of what is comfortable for indoor air temperatures may vary depending on the local environment and climate conditions, the level of humidity, and the air flow experienced by building occupants. In hotter climates, the 'neutral temperature' (where a person is not aware of being hot or cold), can be higher than in more temperate climates. Setting requirements for cooling without consideration of this aspect may result in less efficient buildings.
Tailored strategies to control solar heat gain	Depending on the climatic conditions, different strategies may be needed for controlling solar heat gain. For example, in hot arid climates, solar shading, the use of reflective roofs and walls, and high-performance glass are among the most effective strategies to reduce solar heat gain. In climates with colder winters, buildings can be oriented to receive sun in winter whereas in warmer climates, the window-to-wall ratio must carefully balance the need for light and ventilation with the need to limit solar heat gain from glazing (UN-Habitat, 2014).

⁴¹ Relative humidity is defined as the ratio of the quantity of water vapor in the air, to the maximum amount that can be contained in the air just before condensation occurs.



9.1.3 Summary of findings: green building provisions

The development and adoption of dedicated Green Building Codes is relatively new;⁴² this is reflected in the study countries, where a wide range can be seen in the level of adoption of these types of provisions. Nine countries have relatively comprehensive coverage of green building provisions (see Figure 9.1),⁴³ although coverage in some of these countries is less complete for window-to-wall ratio provisions, green roofs and walls and low embodied energy provisions. Indonesia, South Africa, Morocco, the Philippines and Algeria can be considered to be in the process of developing their green building code provisions. Aside from Mongolia and Mozambique, where no provisions were identified, the rest of the study countries tend to satisfy some green building requirements, given that these are covered in their general architectural design provisions. Mandatory green building provisions tend to apply to buildings of a certain size and scale,⁴⁴ as is the case for Peru, Colombia, Ghana, the Philippines and Indonesia. Nine countries have some mandatory requirements to incorporate green building provisions for existing buildings—most often triggered when a wider building retrofit is undertaken.

Some types of provisions, which have historically been included in codes for the comfort of occupants or for public health reasons, can also improve the energy efficiency of buildings. These are passive measures,⁴⁵ such as adequate provision of natural ventilation in buildings, daylighting and insulation. The most common type of green building provision contained in the codes assessed relate to adequate natural ventilation. This may in part be because of the historical inclusion of minimum ventilation requirements in building codes for public health reasons. The next most common types of provisions are for daylighting and insulation, often covered by general architectural design provisions. Provisions related to building orientation, window-to-wall ratio, solar shading and green roofs and walls are less common. These types of provisions are more common in countries with a dedicated Green Building Code and were more likely to be voluntary.

For active energy-efficiency measures, where the equipment involved needs a power source, a majority of the countries have provisions for **energy-efficient lighting and energy-efficient mechanical heating, ventilation, and air conditioning (HVAC) systems**. Most provisions are mandatory for the building types specified in the codes (see notes in Figure 9.1). In addition, most of the countries have provisions related to providing a supply of **renewable energy** to the building. Incorporating renewable energy sources into building projects is more likely to be voluntary.

For provisions related to water efficiency, a majority of the countries have some provisions related to **water-efficient fixtures and fittings** and **water collection/reuse**. Provisions for **water collection and/or reuse** are more likely to be voluntary.

For provisions related to building materials, very few countries have provisions related to using recycled materials in construction, and only one-third of all countries include requirements related to approaches for **reducing embodied carbon and/or construction materials**. Approaches to reduce the carbon footprint of buildings are more likely to be voluntary.

⁴² Many countries in this study had adopted Green Building Codes within the past five or 10 years.

⁴³ It should be noted that some green building strategies are more appropriate to prioritize and implement depending on climatic conditions. Refer to Box 9.1.

⁴⁴ Or, in some cases, their usage category.

⁴⁵ Passive measures do not rely on mechanical equipment/energy.



Figure 9.1 // Summary of assessment of green building provisions for the 22 countries

GREEN BUILDING PROVISIONS																	
COUNTRY	Energy Efficiency Measures											Water Efficiency Measures	Building Materials		New Buildings	Existing Buildings	
	Demand side										Supply side						
	Natural ventilation to provide fresh air indoors and aid with cooling	Daylighting to provide adequate levels of natural light for building occupants	Insulation of walls, roofs and windows	Orientating the building to optimize the level of direct heat from the sun	External solar shading to control solar heat gain	Window-to-Wall Ratio (WWR) requirements	Reflective walls and roofs to reduce solar heat gain	Green walls/green roofs to cool buildings both externally and internally	Energy efficient lighting (e.g., LEDs, light sensors, etc.)	Energy efficient heating, ventilation, and air cooling systems	Renewable methods to supply the building with energy	Water efficient fixtures and fittings (e.g., low flow toilets, taps, etc.)	Water collection/water re-use	Requirements for building materials to be recycled or recyclable			Low embodied energy materials
Mexico				V	V	V	V	V			V		V	V	V		
Peru					V						V					note 7	
Rwanda	V	V	V	V	V	V	V	V		V	V				V	note 2	
Indonesia				V	V						V		V	V	V	note 1	
Chile				V	V		V				note 4		V				note 5
Colombia	V	V	V	V	V	V			V	V	V	V	V		V	note 1	
Samoa								V								note 3	note 3
Bhutan			V	V	V		V				V	V	V		V		
Morocco				V	V	V	V	V			V						
Ghana				V												note 1	
Türkiye				V	V										V		
Philippines					V											note 1	note 1
South Africa				V							V		V				
Algeria					V												
El Salvador																	
Tajikistan																	
Tonga													note 6			note 3	
Uzbekistan											V						
Vanuatu													note 6				
Nepal																	
Mongolia																	
Mozambique																	
Total countries	17	17	14	13	14	8	8	6	14	14	13	13	13	5	8	20	9

The country's code provisions satisfied the assessment for the topic area.

The country's code provisions did not satisfy the assessment for the topic area.

Notes:

1. Mandatory if plan area of building exceeds a certain size depending on building usage category.

2. Applies to commercial, public offices, social, cultural and assembly, health and educational buildings only.

3. Not mandatory for traditional buildings and single unit residential buildings.

4. Mandatory for public buildings only.

5. Only mandatory for existing buildings that are being retrofitted.

6. For Tonga and Vanuatu, it was not possible to verify if requirements for water collection and reuse were voluntary or mandatory.

7. Mandatory for public buildings if the plan area of the building exceeds a certain size depending on building usage category.

8. Provisions are mandatory unless denoted as voluntary (V).

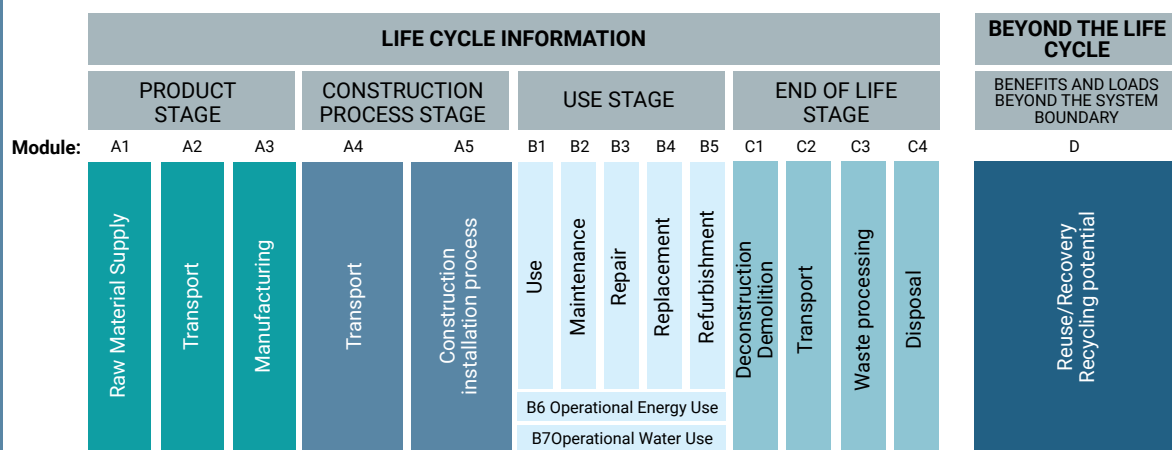
9. Items marked U could not be verified (U=Unable to verify).



Box 9.2 // Code provisions related to embodied carbon

According to the *Global Status Report for Buildings and Construction*, 37 percent of global carbon emissions are associated with the building sector—their materials, construction, operation and end of life (UNEP, 2022). Carbon emissions associated with each stage of the building life cycle can include: (i) the product stage, related to extraction, processing, manufacture, and transportation of materials; (ii) construction activities, related to transport of materials to the site, energy use on site or disposal of construction waste; (iii) building use, related to energy use and any repair/refurbishment; and (iv) end of life, related to decommissioning, deconstruction and transport and disposal of materials (IStructE, 2020). See Figure B9.1 for an example of a building life cycle from BS EN 15978:2011.

Figure B9.1 // Life cycle stages according to BS EN 15978:2011: Sustainability of construction works - assessment of environmental performance of buildings



Source: British Standards Institution, 2011 (Author and Publisher)

Building codes and standards and related requirements in the building control process have an important role associated with reducing carbon emissions within the building life cycle. For example, codes can include requirements and procedures to estimate embodied carbon at different stages of the building life cycle (for example, by using a life-cycle assessment (LCA)), or a disclosure about the embodied carbon for a project could be required ahead of building permit approval.

For example, the National Building Code of Samoa (2017) requires that for certain types of building usage, projects demonstrate that they have achieved an efficient use of materials and reduction in carbon emissions. This is demonstrated by using one of a set of specified tools including the Athena Impact Estimator (ASMI, 2025), Green Guide Calculator by BRE Global (BRE, n.d.) and others.

9.2 PRIORITIES FOR CODE PROVISIONS TO REDUCE CARBON EMISSIONS

Building codes can support a reduction in carbon emissions by increasing the energy efficiency of buildings and promoting low-carbon design approaches. Findings of this study indicate that all countries with green building provisions include some energy efficiency provisions in their building codes. These provisions include demand-side measures to reduce energy consumption (20 countries) and supply side-measures (13 countries) to reduce reliance on fossil fuels. See Table 9.2.



Table 9.2 // Examples of demand-side and supply-side measures to reduce energy consumption

Demand-side measures	» Building orientation » Use of daylighting » Natural ventilation » Solar shading » Insulation » Window-to-wall ratio requirements » Green walls or roofs » Reflective walls and roofs » Energy-efficient lighting, HVAC, use of energy-efficient equipment (for example, heat pumps)
Supply-side measures	» Onsite electricity generation (for example, solar panels) » Connection to offsite electricity generation (for example, solar grids, wind power) » Use of geothermal energy (on or offsite)

Energy-efficiency measures can be either prescriptive (for example, U-Value requirements for wall and roof assemblies or prescribed window-to-wall ratios) or performance-based (for example, specifying an Energy Use Intensity target). In addition to energy efficiency, some green building codes include requirements for low-carbon design, for example, the use of steel with recycled content or locally available construction materials to reduce embodied carbon.

Many green building provisions related to reducing building carbon emissions are voluntary, or they are mandatory for certain types of new buildings. Of the 22 countries in this study, 19 include some mandatory green building requirements for buildings, but in many cases, these entail traditional ventilation and daylighting provisions that antedate more recent green building code developments focused on reducing carbon emissions. Mandatory requirements related to energy efficiency and the reduction of embodied carbon are more common for new commercial buildings, as well as new public and residential buildings. For example, the Ghana building code currently includes mandatory green building requirements for private office, commercial and industrial buildings of more than 5,000 m² in gross floor area, and residential buildings larger than 75 m². The requirements also apply to public buildings located only in regional and district capitals that are larger than 500 m² in gross floor area (GSA, 2018). It was less common for green building measures to be mandatory for existing buildings, including energy efficiency requirements. See Figure 9.1.

Voluntary green building code provisions related to energy efficiency are often complemented by a variety of market-driven mechanisms to encourage uptake. Green building certification systems are frequently used to encourage wider adoption of voluntary green building provisions, showcasing inspiring examples for the wider market. These certification systems are most often led by the private sector, including associated third-party verification systems. For example, the Leadership in Energy and Environmental Design (LEED) Certification Program, originating in the United States (USGBC, n.d.) is one of the most prevalent certification programs globally, including usage in India, Brazil and Mexico. LEED is most often used for commercial and high-rise residential projects for reasons beyond meeting climate mitigation goals, including attracting investors and clients, marketing and enhanced property value, and reduction of operational costs. Another global certification system is the International Finance Corporation's EDGE (IFC, n.d.), developed to support green building practices in low- and middle-income countries. EDGE offers an affordable certification option and other services including a tool to calculate the costs and savings of green measures including their payback period, and a training and accreditation mechanism to foster local green building professionals. Some other green building certification systems, like BREEAM and certification from the German Sustainable Building Council (DGNB) are also well-recognized international systems, and many countries also have their own certification systems. Green building certification is often paired with financial incentives for energy efficiency and other green measures. For example, in India, the national government provides tax benefits and low-interest loans to developers of green certified buildings. State-level incentives such as subsidies and tax exemptions also encourage the construction of green buildings in India (GBCI, 2023). Certification programs



and incentives exist not only for new construction but also existing buildings, including EDGE for existing buildings, although the market penetration is not as wide for existing buildings. Voluntary green building programs can serve to prepare the market for mandatory code-related requirements.

9.2.1 Increase mandatory requirements related to energy efficiency and low-carbon design

As countries ramp up their commitments to combating the climate crisis, their building codes are moving toward mandatory requirements for reducing carbon emissions covering more types of new and existing buildings. As part of the Buildings Breakthrough announced in 2023 at COP28 in Dubai, 27 countries pledged commitment to achieving net-zero carbon emissions for new buildings by 2030 and for existing buildings by 2050⁴⁶ (GlobalABC, 2024). Together, these countries represent 34 percent of the global population and account for 51 percent of GHG emissions (UNEP, 2023a). Implementation actions to meet these targets issued in a 2024–2025 report include some related to building standards and certifications (GlobalABC, 2024). Despite these global efforts, the most recent *Global Status Report for Buildings and Construction* (UNEP, 2024) found that few countries are on track to meet net-zero targets, and that the majority of projected floor area growth by 2030 will occur in countries without green building codes or enforcement. Global advocacy efforts are urging countries with green building regulations in place to mandate tighter emissions standards for more types of buildings and enhance policies related to existing building upgrades. Some high-income countries are already doing this, including France and the UK (UNEP, 2024). The European Union’s Energy Performance of Buildings Directive, agreed upon in late 2023, requires zero emission standards for new public buildings by 2028 and all new buildings by 2030. It also mandates that EU countries reduce residential energy use by 2030 or 2035⁴⁷ focusing first on inefficient existing buildings (UNEP, 2024). In general, achieving zero emission standards will require a country’s code provisions to be tailored to minimize carbon through adaptive reuse of existing buildings, reuse of building materials, efficient design for new buildings, and the use of low-carbon materials alongside renewables. Countries that do not currently have green building requirements in place must urgently adopt them, with technical and financial support from the international community.

⁴⁶ The Buildings Breakthrough also includes a commitment to resilient buildings (addressing future climate risks) on the same timeline (GlobalABC, 2024).

⁴⁷ “Under the strengthened framework, residential and nonresidential buildings are addressed differently. As regards residential buildings, each Member State will adopt its own national trajectory to reduce their average primary energy use by 16 percent by 2030 and by 20 to 22 percent by 2035. The national measures will have to ensure that at least 55 percent of the decrease of the average primary energy use is achieved through the renovation of the worst-performing buildings, but Member States are free to choose which buildings to target and which measures to take. As regards non-residential buildings, the revised Directive foresees the gradual introduction of Minimum Energy Performance Standards to renovate the 16 percent worst-performing buildings by 2030 and the 26 percent worst-performing buildings by 2033. Member States will have the possibility to exempt certain categories of both residential and non-residential buildings from these obligations, including historical buildings or holiday homes.” (European Commission, 2024).



Box 9.3 // Mandatory green roof requirements in Basel, Switzerland

Basel, Switzerland, was one of the earliest jurisdictions in the world to enact mandatory requirements to install green roofs (Niranjan, 2025). The motivation for the requirements was to save energy, but the regulation has also resulted in significant benefits for biodiversity and climate adaptation (EEA, n.d.). Initially introduced as a voluntary measure with subsidized incentives in the mid-1990s, the mandatory green roof regulations were included in a 2002 amendment to the City of Basel's Building and Construction Law, and are as follows:



Rooftops in Basel Switzerland. Photo credit: Rafael Wiedenmeier | iStock

- » The growing medium should be native regional soils—the regulation recommends consulting a horticulturalist;
- » The growing medium should be at least 12 cm deep;⁴⁸
- » Mounds 30 cm high and 3 m wide should be provided as habitat for invertebrates;
- » Vegetation should be a mix of native plant species, characteristic to Basel; and
- » Green roofs on flat roofs over 1,000 m² require consultation with the city's green roof expert during design and construction.

Basel was recorded to have 5.71 m² of green roof per inhabitant in 2019, the greatest per capita ratio in the world. As solar panels have become more popular, the city is also promoting the design of green roofs with elevated solar panel installations, to maximize green building benefits.

9.2.2 Regulations to support the use of lower-carbon building materials

Public and private policies increasingly target the use of alternative construction materials with lower embodied carbon, including locally sourced materials, necessitating an expansion of building design provisions and quality control mechanisms. The production of cement and steel are together already responsible for 14–16 percent of global carbon emissions, and their consumption is projected to increase by 12–30 percent by 2050, making the need for more sustainable versions even more critical (WGBC, 2019). Efforts to drive GHG emissions reductions in concrete and steel include the creation of global certifications like the Concrete Sustainability Council (CSC) and Responsible Steel (WGBC, 2019). Standards have also been developed to evaluate the environmental impacts of building materials and buildings themselves through life-cycle assessments (eTool, n.d.). Most steel used today has at least some recycled content, in some cases as high as 90 percent (AISI, n.d.). Significant research and development is also being directed into more sustainable alternatives to traditional concrete, including the use of Portland cement substitutes like silica fume, as well as cement alternatives derived from seaweed or mycelium and Limestone Calcined Clay Cement. These alternatives are primarily restricted to smaller-scale, nonstructural applications. Widespread uptake, including structural applications, will require more development and testing to demonstrate their safety and durability. Mass timber is also gaining in popularity as an alternative to steel and concrete for large building structures because of its ability to absorb and sequester carbon from the atmosphere. Numerous design standards have been developed to support its increased use in buildings, primarily in high-income countries (Kurzinski et al, 2022). However, recent studies have now shown that timber is not always as sustainable as it is widely claimed to be (Searchinger et al., 2023). Moreover, the fire safety of buildings constructed

⁴⁸ In 2015, an amendment to the law increased the minimum thickness of soil from 10 cm to 12 cm.



with these alternative materials is still being researched, and measures to address fire risk may compromise sustainability benefits (Meacham et al. 2020). Finally, there is growing interest in and demand for the use of locally sourced, traditional materials, particularly in low-income contexts. Use of rammed earth, compressed stabilized earthen blocks, stone masonry, and bamboo reduce carbon emissions and engage local communities and economies.⁴⁹ As highlighted in Chapter 4, Section 4.1.2.4, code provisions for vernacular materials are lacking in many countries and clear guidance is needed for the safe, economical applications of these sustainable materials.

9.2.3 Code coverage of emerging construction technologies for more efficient design and construction

In addition to facilitating the use of alternative low-carbon building materials, building codes are just beginning to accommodate and regulate emerging construction technologies that support reduced carbon emissions, like offsite and modular construction.⁵⁰ Offsite construction involves fabricating and assembling building elements away from their final location and bringing them to site for final assembly. According to the International Code Council, modular construction used in residential and commercial buildings can speed up construction by up to 50 percent, reduce costs by up to 20 percent (ICC, n.d.), and at the same time support greater energy efficiency (Grosskopf, 2023) with improvements to insulation, airtightness, and durability. Offsite and modular construction approaches, enabled by computational modeling, for example, Building Information Modeling (BIM), are gaining in popularity due to their potential to improve building performance, reduce material use through design optimization, and enhance the speed and cost effectiveness of construction. Computational modeling is also enabling more efficient building energy retrofit solutions, allowing for the prefabrication of new, higher performance façades and roofs for existing structures. New advances related to circular construction and design for deconstruction are also emerging to support the reduction of construction waste and associated GHG emissions (Pristerà et al., 2024). Building regulations, including building codes, are only beginning to match the pace of research and development in this sector. Regulations will need not only to enable uptake of these promising technologies, but also to regulate their safety, quality, and effectiveness.⁵¹ The National Renewable Energy Laboratory in the US published a *Guide to Energy-Efficient Design for Industrial Construction of Modular Buildings* (Pless et al., 2022) to document efforts to integrate modular energy efficiency strategies into offsite construction. The International Code Council has also published several standards for offsite construction (ICC, 2023). These are only the beginnings of a wider industry revolution that will impact building codes in coming decades.

Figure 9.2 // Construction of modular mass timber building



Photo credit: JARAMA | iStock

⁴⁹ On the other hand, there is also growing evidence that the small-scale manufacture of some traditional building materials like burnt bricks is problematic for air pollution and energy consumption. Research into nonfired brick alternatives and efforts to transform the brickmaking industry in several countries including Bangladesh are under way (World Bank, 2011; UNEP, 2021).

⁵⁰ Other terms used for this are Modern Methods of Construction (MMC) or volumetric construction.

⁵¹ A significant concern related to offsite and modular construction is increased fire risk compared to traditional onsite construction (Meacham, 2022; FPA Media, 2024). Addressing this risk requires a concerted effort involving further research, testing, and aligned regulatory measures.

9.2.4 A greater focus on regulations and code provisions for adaptive reuse of existing buildings

To have a chance of meeting climate goals, experts warn that every country will need to target policies to drive the preservation and adaptation of existing building stock, including energy efficiency retrofits. As mentioned above, while 161 countries demonstrated building sector emission reduction commitments through NDCs, as of February 2024, only 28 countries worldwide signed on to the Buildings Breakthrough to commit to net-zero emissions for existing buildings by 2050 (UNEP, 2024). As of 2024, UNEP identified a significant deficit in progress related to the decarbonization of the world's existing building stock relative to established targets for 2030 and 2050⁵² (UNEP, 2024). UNEP's *Global Status Report* warns that unless all new buildings and 20 percent of existing buildings are net-zero by 2030, we will fail to meet our 2050 decarbonization goal (UNEP, 2024). More widespread policies to evaluate existing building energy performance, mandate upgrades, and support compliance through financial incentives are also needed. The UK is an example of a country that is combining these approaches. Since 2009, the country has required Energy Performance Certificates for residential, public and commercial buildings. The government also announced a tax (VAT) reduction for home energy retrofits (RDA, n.d.) as well as a GBP 6 billion fund in 2023 to provide subsidies for residential and commercial energy retrofits (Baker McKenzie, 2023). In parallel, the UK has introduced standards to support retrofits, including the introduction of PAS 2035, a comprehensive standard for whole-home energy retrofits (Hopkins, 2024). The adaptive reuse of existing, historic buildings and the design of buildings for future uses and flexibility are other important tactics for limiting carbon emissions within the buildings sector, with potential for greater impact if backed by formal guidelines and standards.

9.3 PRIORITIES FOR CODE PROVISIONS TO ADDRESS CLIMATE CHANGE ADAPTATION

Building codes have traditionally focused on setting minimum standards for safety and public health, but with a changing climate, they also support society's adaptation to more frequent climate stresses like extreme temperatures, heavy rainfall, and drought.⁵³

9.3.1 Building code provisions to adapt to extreme heat

While the deadly impacts of extreme heat are becoming more widely recognized, most buildings have not been designed with heat mitigation in mind. As explained in Chapter 2, early building codes had minimum requirements for ventilation, mainly for public health reasons. In places with more tropical climates, vernacular construction often favored building materials and architectural design approaches that naturally promoted air flow and ventilation, to keep occupants more comfortable. Traditional approaches that are well-adapted to local climates have often gone undocumented in building codes or were ignored, if countries adopted provisions from other countries. Due to global climate trends, more places are now exposed to extreme temperatures on a recurring basis (Mani et al., 2018; Liu et al., 2017; Zhao et al., 2021). According to the World Health Organization (WHO), between 2000 and 2016, the number of people exposed to heat waves worldwide increased by around 125 million (WHO, n.d.). Current exposure, as well as projected increases in extreme heat, are concentrated in urban areas. By 2050, it is predicted that 970 cities will regularly experience summer temperature highs over 35°C (C40, n.d.; Mackres et al., 2023). Extreme heat presents a growing threat to health, increasing the severity of existing conditions and contributing to heat-related deaths, but most building codes have not yet evolved to address and mitigate these effects through measures that help regulate indoor environments.

⁵² The UNEP's Global Buildings Climate Tracker indicates that "to align with the 2030 milestone, an annual increase of ten decarbonization points is now required, a substantial jump from the six points anticipated per year starting in 2015." (UNEP, 2024).

⁵³ The Global Resiliency Dialogue, made up of building code development and research organizations in Australia (ABCB), Canada (NRC), New Zealand (MBIE) and the USA (ICC), developed Global Building Resilience Guidelines, providing principles and strategies for the incorporation of future climate risks into building codes and standards (ICC, n.d.).



The risk of extreme heat in buildings is starting to be addressed by some building codes through provisions for natural ventilation, reflective building materials, green walls and roofs and external shading. Although extreme heat, like flooding, is increasingly recognized as being a significant concern for buildings' inhabitants, explicit approaches for mitigating it through building codes are still scarce. Worst case scenarios for cities include a combination of a severe heat wave with power outages—either due to the grid being overwhelmed from the demand for cooling or another hazard event such as a hurricane. Thus, building codes must consider the need for passive survivability in extreme heat events, where occupants remain safe even if power for mechanical cooling is unavailable. Provisions supporting heat mitigation tend to be integrated into green building approaches for ventilation, external solar shading, energy efficiency and green infrastructure. Ventilation requirements may be performance-based (for example, minimum ventilation rates for different occupancies) or prescriptive (for example, guidelines on opening size and placement). While performance-based requirements can sometimes only be satisfied with mechanical ventilation, some countries, including Rwanda, Indonesia, and Ghana, encourage or mandate the use of natural ventilation to reduce energy consumption and support passive survivability in the case of power loss. In some climates, where buildings cool down at night, extreme heat can also be mitigated through a combination of adequate ventilation and using building materials with higher thermal mass. Also refer to Box 9.1. Use of white or reflective coatings on roofs to reduce solar energy absorption (also referred to as cool roofs) as well as building orientation and shading to reduce solar heat gain are other strategies to address extreme heat and support passive survivability in buildings. Cool roof provisions have become mandatory in many national and local building codes. Passive strategies to mitigate extreme heat are important as air conditioning not only consumes significant energy but also expels heat outdoors, intensifying urban heat conditions. Wider urban measures, such as increased planting and trees, water features, reflective hard surfaces, and provisions for shade, work hand in hand with building-focused measures to mitigate the effects of extreme heat. Ghana's building code (GSA, 2018) includes a section on heat island mitigation (see Box 9.4), that addresses both building-specific measures and broader site measures.

Box 9.4 // Heat adaptation measures in the Ghana building code

Ghana's building code has provisions to mitigate the effects of extreme heat linked to urban heat island effects (Ghana Standards Authority, 2018). Urban heat island effects are where temperatures experienced are higher within cities due to concentrations of hardscaping and lower levels of vegetative cover. These include:

- » Provisions for providing exterior shading to buildings. This can be provided by adjacent buildings on the same plot, roof structures, and/or structures with exterior planting or trees. Elements that provide shading (including trees) must be shown on the construction documents;
- » Provisions that limit the area of site hardscaping to 50 percent of the total site area outside the building footprint and set a minimum solar reflectance value for hardscaping surfaces;
- » Provisions that require 75 percent of roof area be covered in vegetation in certain climatic zones; and
- » Provisions that specify requirements for solar reflectance of roofs linked to roof slope angle.



Shading from trees on a street. Photo credit: Kendo Nice | iStock

9.3.2 Building code provisions to adapt to water scarcity

Water conservation is becoming more critical as water scarcity grows; water efficiency, reuse and collection provisions can help address this need. It is estimated that roughly half of the world's population is suffering from water scarcity, for at least parts of the year. Climate change is impacting the available supply of fresh water, through loss of snow cover and glaciers, sea-level rise and other effects. Weather patterns are also becoming more erratic—with more intense periods of rainfall and more intense periods of drought in many parts of the world, which puts further pressure on management of water supplies (IPCC, 2022). Green building measures such as water-efficient fixtures and fittings, water reuse (in equipment systems or for grey water), water collection and drought tolerant landscaping for wider building sites can all help conserve precious water resources, especially in regions that are suffering from water scarcity. For example, the US City of San Francisco has ordinances that require property owners to install low-flow showerheads, and water-saving faucets/taps and toilets that are triggered when other works need a building permit or ahead of a property sale (City of San Francisco, 2025).

9.4 PRIORITIES FOR CODE PROVISIONS TO IMPROVE INDOOR AIR QUALITY

To improve population health and reduce economic and human losses in pandemics with airborne transmission, building codes must accelerate the adoption of provisions to improve the quality of indoor air. There is growing evidence that indoor air quality is markedly worse than outdoor air quality, even in the most polluted cities. This matters because it is estimated that people spend 90 percent of their time in buildings (EPA, 2024). In developing countries, domestic cooking with wood, charcoal or other dirty fuels is still common and drives indoor air pollution. For example, it is estimated that household smoke from solid fuels causes a staggering number of premature deaths per year—almost four million (The Economist, 2024). Lessons from the global COVID-19 pandemic demonstrated that cleaner indoor air could reduce the spread of airborne disease, saving lives and reducing the devastating social and economic disruption caused by the loss of essential services as health workers fell ill and many schools were forced to close. Code requirements for buildings to address these challenges include increased ventilation combined with air-cleaning technologies such as HEPA filtration and air-quality monitors—both for new construction and retrofits for existing buildings. These measures can significantly reduce the risk to society of future pandemics driven by airborne transmission as well as realize wider health benefits through reduced indoor pollution exposure, particularly for health facilities, schools and other building types which deliver essential services (Allan and McComber, 2022).

Some countries and standards organizations are leading the way in developing building design provisions for cleaner indoor air. For example, a new Clean Air Law was introduced in 2022 in Belgium. It applies to all public spaces in buildings and requires owners and/or operators to monitor air quality and conduct risk assessments. Buildings can demonstrate that they meet one of two levels of air quality certification. For example, Reference Level A in the law corresponds to CO₂ levels of 900 parts per million or a minimum ventilation and air purification rate of 40 m³ per hour per person, of which at least 25 m³ per hour per person is ventilation with outside air (WHN, 2025). Another cutting-edge standard which was recently introduced by ASHRAE in the USA is a pathogen mitigation standard for indoor air quality and infection control. As a basis for the provisions, it used probabilistic risk approaches to set acceptable levels for air quality to prevent disease transmission (ASHRAE, 2024).



10. Universal Accessibility Design

10. Universal Accessibility Design

Creating inclusive spaces means removing barriers, so that everyone can fully participate and contribute, regardless of age or ability. Universal accessibility provisions for the built environment play an important role in this so that people with diverse needs can live, work, and access services without suffering disadvantages or barriers. Universal accessibility is defined as ensuring an ease of independent or assisted approach, entry, evacuation, or use of a building and its services and facilities by all the building's potential users—including people of all ages and abilities—with an assurance of individual health, safety, and welfare during the course of those activities. These user groups can include, but are not limited to, people with mobility challenges, low visual capacity, hearing impairment, cognitive impairment, mental health conditions, pregnant women, children, and the elderly (World Bank, 2025).⁵⁴

Generally, universal accessibility provisions in building codes most commonly address the needs of people with mobility challenges. These include handrails, ramps for minor elevation changes in buildings and at building entrances, elevators (lifts) for vertical circulation, wider doors and entrances, and adapted fittings and fixtures and more generous spaces in toilets and washrooms. Other topics related to physical and sensory disabilities that are sometimes covered in universal accessibility provisions include color contrast, acoustics, thermal comfort, wayfinding/signaling, and signage for emergency exits and evacuation routes.

To achieve universal accessibility, aspects beyond the design of the physical building and its surrounding site need to be considered. These include the accessibility for users who travel to the site—via public transport or other means—and the implementation of training for staff and building users related to the use and maintenance of a building's accessibility features to ensure their maximum benefit is realized. These issues were beyond the scope of the assessment, as it focused on building code provisions.

This chapter presents the findings of the assessment related to universal accessibility design provisions and discusses priority areas for further code development in this topic area.

10.1 ASSESSMENT OF UNIVERSAL ACCESSIBILITY DESIGN PROVISIONS

This section presents findings of the review of regulatory structure, organization, update cycle and accessibility of universal accessibility code provisions.

10.1.1 Regulatory structure, organization, and accessibility of universal accessibility provisions in building codes

All 22 countries from this study have some form of universal accessibility provisions in their building codes. Country-specific findings are presented in Figure 10.2 and discussed in the following text.

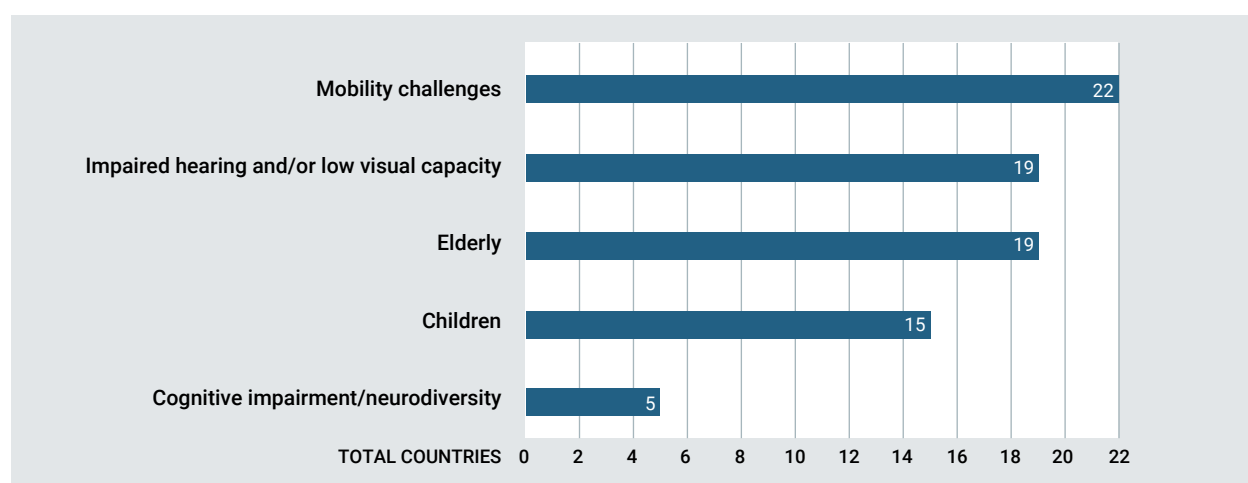
- » **Regulatory jurisdictions:** Across the 22 countries, this study found that universal accessibility regulations are set at national level for all countries, except for Mexico which has a federal system of government. Regulations assessed were for Mexico City.

⁵⁴ Also refer to the World Bank Building Code Checklist for Universal Accessibility (2025) for more detail on the types of comprehensive provisions needed for universal accessibility.



- » **Organization of code documents:** In terms of the organization of universal accessibility regulations, half of the countries have one code document that contains all universal accessibility provisions, while the remaining countries have the provisions contained in a set of separate code documents.
- » **Code update cycle:** Two countries, Uzbekistan and Mongolia, have recently updated or introduced regulations (in the last 5 years); another six countries (Bhutan, El Salvador, Indonesia, Nepal, Peru, and Samoa) in the last 10 years; while the remaining 14 countries have regulations that have been in place between 10 and 25 years.⁵⁵
- » **Accessibility of code documents:** In 14 countries, all regulations are available online and are free of charge. In Mongolia and Tajikistan, no regulations are available online or free. In Ghana, Morocco, and Türkiye some regulations are available online and are free of charge, and some are not. Finally, in Colombia, Rwanda, and South Africa, regulations are available online, but for a fee.
- » **Mandatory or voluntary provisions:** Universal accessibility provisions are mandatory in all countries except for Algeria, Bhutan, and South Africa, where all provisions are voluntary. In some countries, mandatory provisions only apply to certain types of buildings (for example, public buildings). Refer to Figure 10.2.
- » **Provisions for new and existing buildings:** All countries have some universal accessibility provisions for new buildings and 15 countries have provisions related to existing buildings.
- » **Types of needs addressed:** Countries addressed the following types of needs: mobility challenges, impaired hearing and/or low visual capacity, elderly persons, children, and cognitive impairment. **People with mobility challenges are considered in the provisions for all countries; by contrast, universal accessibility provisions for people with cognitive impairment and/or neurodiversity are least commonly addressed.** See Figure 10.1.

Figure 10.1 // Countries that address different types of needs in the universal accessibility provisions of their building codes



10.1.2 Topic areas for universal accessibility design provisions

In this study, a high-level review was performed in six main topic areas to identify countries with universal accessibility provisions in their building codes. These topic areas are described in Table 10.1, followed by the relevant findings.

⁵⁵ This was assessed based on the year of publication for the oldest regulation for each country.



Table 10.1 // Universal accessibility topic areas

Topic Area	Description
Accessible external environment (approach to building entrance, circulation routes, and so forth)	These provisions ensure that the external environment is accessible to users of all ages and abilities, including the design of access routes, facilities, and features provided around entrances to buildings, including parking, and circulation routes between buildings.
Accessible entrances, doors and lobbies	These provisions are provided to ensure independent access for users of all ages and abilities to enter buildings. Provisions can include measures to ensure barrier-free design of entrances, doors, lobbies, and reception areas, as well as accessible forms of pre-visitor information.
Accessible horizontal and vertical circulation within a building	These provisions ensure that horizontal and vertical circulation are clear and easy to navigate for all users. Types of provisions could include requirements for adequate space to allow all users to maneuver and pass one another, design to reduce obstacles, accidental collisions and trip hazards, design of stairs, ramps, and lifts/elevators which provide essential access to floors in multistory buildings.
Accessible building facilities (including WC/toilets)	These provisions ensure that spaces and facilities in a building are accessible and comfortable to use by the widest range of people, encouraging active participation by all users. These types of spaces can include WC/toilets, changing rooms, workstations and meeting rooms, refreshment facilities, quiet rooms, and seating arrangements, among others.
Fixtures and fittings to assist with orientation, wayfinding, and communication	Provisions for fixtures and fittings to help users of all ages and abilities to navigate the building, orient themselves, operate controls for lighting, temperature, and other systems, and find services within the building. This can include provisions for the building layout, the use of color and symbols, audible and tactile information, as well as the use of signage.
Accessible evacuation and safe egress	These types of provisions promote safe and efficient egress and evacuation for users of all ages and abilities as part of the building design and management. For example, these provisions should be considered in the design of wayfinding or emergency alert systems.

Source: Building Code Checklist for Universal Accessibility (World Bank, 2025).

10.1.3 Summary of findings: universal accessibility provisions

Due to the broad scope of the review, it was not possible to distinguish different levels of comprehensiveness for coverage in universal accessibility provisions among study countries. Figure 10.2 is a summary of results with countries ranked by the total number of topic areas that satisfied the assessment statements. It is encouraging that most countries have some provisions in all topic areas, as universal accessibility is a relatively new topic area for inclusion into building codes. That said, provisions mainly focus on people with mobility challenges and rather less on people with other types of needs.

All countries have some provisions related to **entrances, doors and lobbies, horizontal and vertical circulation and building facilities**. All countries (except Nepal) have some provisions related to the **external environment**. Some provisions for **fixtures and fittings** are covered by 20 countries (excluding Indonesia and Nepal). All countries, except Bhutan, Mozambique and Nepal,⁵⁶ have some provisions for **evacuation and safe egress**. Many countries have mandatory requirements for public buildings, and/or residential buildings, or for existing buildings undergoing modification.

⁵⁶ For Indonesia, it could not be verified whether or not there are provisions in place related to accessible evacuation and safe egress.



Figure 10.2 // Summary of the assessment of universal accessibility provisions for the 22 countries

UNIVERSAL ACCESSIBILITY PROVISIONS									
COUNTRY	Accessible external environment	Accessible entrances, doors and lobbies	Accessible horizontal and vertical circulation within a building	Accessible building facilities (including WC/toilets)	Fixtures and fittings to assist with orientation, wayfinding, etc.	Accessible evacuation and safe egress	New Buildings	Existing Buildings	
Algeria							V	V	
Chile							note 1	note 5	
Colombia								note 6	
El Salvador									
Ghana							note 1	note 1	
Mexico								note 2	
Mongolia							note 4	note 2	
Morocco									
Peru							note 3	note 3	
Philippines								note 2	
Rwanda									
Samoa									
South Africa							V	V	
Tajikistan							note 7	note 7	
Tonga									
Türkiye									
Uzbekistan							note 7	note 7	
Vanuatu									
Bhutan							V	V	
Mozambique							note 1	note 1	
Indonesia						U			
Nepal									
TOTAL COUNTRIES	21	22	22	22	20	18	22	15	

The country's code provisions satisfied the assessment for the topic area.
 The country's code provisions did not satisfy the assessment for the topic area.

Notes:

1. Mandatory for public buildings only.
2. Mandatory for existing buildings undergoing renovations, repairs or having a change of occupancy.
3. For public buildings and common spaces in residential building only.
4. Mandatory for public, residential and factory buildings only.
5. Mandatory for existing public buildings undergoing renovations, repairs or having a change of occupancy.
6. For existing public buildings, access ramps and lifts are required. No other provisions are specified.
7. Mandatory for public and residential buildings only.
8. Provisions are mandatory unless denoted as voluntary (V).
9. Items marked U could not be verified (U=Unable to verify).

Box 10.1 // Universal accessibility provisions for people with cognitive impairment and neurodiversity

Design codes and designers often neglect to consider the needs of people with cognitive impairments or neurodiversity, such as people with learning disabilities, dementia or autism (Tuckett et al., 2004). Some aspects to consider include avoiding high contrast flooring, as dark and light areas may be perceived as being at different elevations, using symbology on signs as well as words, provision of adequately lit spaces, and consideration of sensory overload for people with autism (for example, providing quiet spaces, limiting distracting noises from equipment, and so forth). Colombia, the Philippines, Samoa, Tonga and Vanuatu state in their universal accessibility regulations that people with cognitive impairment need to be considered. However, provisions related to accommodating neurodiversity or learning difficulties are also important. Overall, in these countries, only a few specific provisions explicitly addressed these needs, and the codes could benefit from a more comprehensive approach.

10.2 PRIORITIES FOR FURTHER DEVELOPMENT OF UNIVERSAL ACCESSIBILITY PROVISIONS

This section discusses priority topics for future code development for universal accessibility provisions, that may be applicable to the countries included in the assessment as well as other countries. The priority topic areas presented in this section were identified through review of the assessment results presented in Section 10.1, further supplemented by desktop review.

10.2.1 Improving universal accessibility for existing buildings

Mandatory provisions and/or incentives to improve the accessibility of existing buildings, including for buildings that provide essential services such as schools or health facilities and social housing, should be expanded.

Code provisions for universal accessibility have been relatively recently introduced; eight countries in this study had these types of provisions introduced in the last decade. Existing buildings are less often addressed by universal accessibility provisions. In Ghana, the 2006 Persons with Disabilities Act (Act 715) mandated that all people are entitled to equal access to public transit and public buildings. However, the Act allowed a 10-year moratorium for public buildings to be made accessible. Although this moratorium expired in 2016, universal accessibility has not yet been achieved in most public buildings in Ghana, including health care facilities and government buildings (Avevor, 2017; Ngnenbe, 2022). Many countries can benefit from code provisions to address retrofitting existing buildings to improve their accessibility, often in combination with incentives. For example, in Rio de Janeiro, Brazil, a government program called *Moradia e Acesso* provides financial support and technical assistance to promote improved accessibility for disabled children and youth living in low-income housing (World Bank, 2025). Other countries (such as in some jurisdictions in the USA) have used expedited building permitting as an incentive or included accessibility in broader building rating systems that recognize design quality and support resale value (for example, Germany, Netherlands, Japan) (World Bank, 2025).

10.2.2 Comprehensive consideration of different user needs in universal accessibility provisions

Universal accessibility design provisions in building codes are widening to accommodate a greater diversity of users. The International Standard *ISO 21542:2021 Building construction – Accessibility and usability of the built environment* (ISO, 2021), a leading international accessibility standard, covers a range of disabilities, including physical, sensory, cognitive, and temporary impairments. Provisions related to cognitive disabilities include clear and intuitive signage and wayfinding approaches, use of color-coding and other visual cues, and guidance on minimizing sensory overload such as noise and bright lights. An example of an approach to address physical disabilities, sometimes temporary (for example, pregnancy or injury), is the provision of rest areas at regular intervals along walkways or corridors.

These types of interventions are not only important for improving equity and establishing basic human rights: they can also benefit the economy. Few studies evaluate the economic benefits of universal accessibility and design in buildings, but research related to accessible transport (Casullo, 2017) and disability inclusion in the workforce (Graves, 2023) suggests that removing barriers to accessing services or resources reduces health and social care costs, strengthens labor markets, and improves productivity.

10.2.3 Tailoring universal accessibility provisions for the cultural context and practices

Universal accessibility design provisions are being customized locally or regionally to address specific cultural needs and practices. International standards such as ISO 21542:2021 provide broad coverage of types of provisions to promote universal accessibility, but they may need to be adapted for local cultural practices, depending on the country or jurisdiction of application. For example, a universal accessibility standard that was originally developed for use in Saudi Arabia (Prince Salman Center for Disability Research, 2010) fills gaps in the ISO Standard, including provisions for squat toilets and ablution areas, reflecting local culture and practices. Provisions from this standard have served as a reference for the Dubai Building Code (Government of Dubai, 2021) and accessibility guidelines in other Muslim countries.

10.2.4 Improved universal accessibility provisions for emergency response and evacuation

A wider range of planning and design approaches for emergency response and evacuation are being developed to accommodate diverse needs in emergency situations. Universal accessibility provisions are predominantly focused on fire safety and evacuation, including the dimensions of evacuation routes, audible and visual alarm systems, and clear and tactile signage. Efforts are emerging to better integrate disaster risk management with universal design, although these are often more focused on emergency planning rather than the building design stage (CIL, n.d.). One approach is to broaden the scope of disability risk assessments for facilities to identify additional accessibility risks related to emergency situations. For example, in a flood emergency where roof evacuation is provided, physical accessibility must be considered. For power outages and disruption to mechanical cooling, emergency lighting, easily operable windows, and accessible alternatives to elevators can be provided. In relation to heat waves, Dubai and Abu Dhabi have included building code provisions for minimum percentages of shaded areas in public spaces to support users who might be more sensitive to heat and sun exposure.



11. Code Implementation Environment

11. Code Implementation Environment

In addition to analyzing the ease of access, organization and technical contents of the building codes, the review also explored key aspects of code implementation, and the broader enabling environment in each country. Without effective implementation regulations and processes, the benefits of building codes cannot be realized.

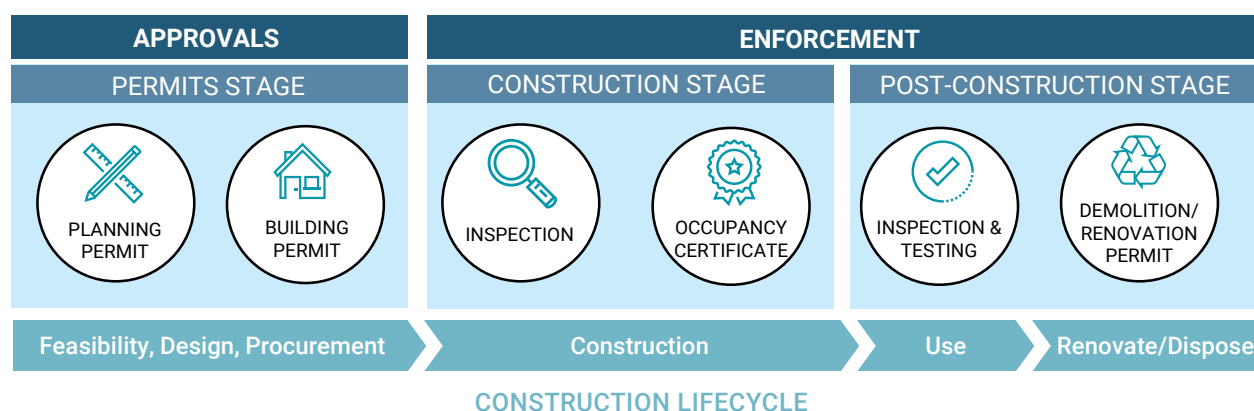
11.1 BUILDING REGULATORY APPROACHES FOR CODE IMPLEMENTATION

A well-implemented regulatory framework can protect people by achieving minimum health and safety standards for buildings, boost markets' competitiveness and operational efficiency, and protect compliant actors from being undercut by inferior actors. This section presents an overview of the building control process for implementing building codes, as well as the required capacity and enabling factors to create the ecosystem of a well-functioning building regulatory framework. As part of this, building control processes supported by digital platforms have the potential to improve efficiency and reduce uncertainties and human errors throughout the construction life cycle. Additionally, other enabling factors such as professional accreditation and licensing/registration mechanisms, and insurance for building professionals comprise the rest of the key elements for an enabling environment to support effective implementation of building regulations.

11.1.1 Building control process: approvals and enforcement

Building control processes differ from country to country. A typical building control process includes approvals (permit stage) and enforcement (at different stages of the construction life cycle), as illustrated in Figure 11.1.

Figure 11.1 // Building control process throughout the construction life cycle



Source: Adapted from World Bank, 2024a

Most commonly, the building control processes are managed by local governments' building departments. In some cases, the private sector may also provide support in functions such as building design checks prior to building permit approvals and/or in carrying out site inspections.

Effective, transparent and efficient building control mechanisms integrate aspects such as:

- » **Simple and clearly defined processes and requirements** (for example, clarity in the requirements for document submission for plan checks and other technical reviews, inspection requirements and timing);
- » **Transparent and efficient processes** (for example, accessibility of regulations and other guidance, online and digital systems for users and authorities);
- » **Optimized approval processes** with requirements linked to the building size, occupancy type, complexity and other factors to target resources and requirements toward higher risk projects;
- » **A balanced approach** which combines proportionate penalties for noncompliance with incentives that benefit those who comply; and
- » **User support, two-way communication and dispute resolution mechanisms.**

The investment needed for effective building control processes can seem high, yet the cost of ensuring compliance is far outweighed by the benefits of a safe, resilient, sustainable built environment and competitive construction sector.

11.1.2 Capacity requirements for code implementation

Effective code implementation involves continuous investment in capacity building—in both the public and private sectors. The following sections describe the types of capacity needed and some common challenges.

11.1.2.1 Public-sector capacity

Local governments typically oversee building control activities but may be constrained by lack of resources and technical capacity. Although overall building control frameworks are often set at the national level,⁵⁷ it is usually the responsibility of local government building departments to implement and enforce building codes and regulations at the local level. Local authorities are therefore on the front line of building control. While the local authorities are knowledgeable about the local conditions and construction environment, common challenges observed are a lack of human and financial resources (for example, to meet the cost of visits to construction sites for inspections and access necessary equipment) and technical capacity (for example, professionals with appropriate educational and practical backgrounds) in building departments. Where the capacity of local governments is constrained, some countries allow the private sector to take on some building control activities to bring added capacity (see Box 11.1). This model only functions well when robust safeguard mechanisms with transparency and accountability are in place for the private sector to ensure outcomes and avoid conflicts of interest.

11.1.2.2 Private-sector capacity

Continuous investment in capacity building in the design and construction sector, as well as systems for professional accreditation, are necessary for effective code compliance. Clearly written and comprehensive building codes more effectively facilitate compliance with code requirements by building designers and construction professionals during the design and construction processes respectively. Because the government is generally in charge of developing and updating building codes, it is beneficial for government authorities to work with relevant professional authorities and associations to invest in continuous capacity building for building professionals, particularly when codes undergo major revisions. This can include trainings, certifications and issuing of guidance documents.

⁵⁷ In some cases, such as in Federal countries, building regulations are set at the territorial level. For example, in Mexico, each state has the power to set its own building regulations and building control processes.



Building professionals such as architects and engineers are often registered after going through professional credentialing or licensing processes. Registration or licensure is usually also contingent on maintaining competency through continuing professional development (education). However, some countries do not currently have mechanisms for licensure. Licensure, particularly when renewals are required, also allows for the monitoring of poor performers through customer or peer complaints and provides a mechanism for suspending a professional from continued work in the sector. Professional certification mechanisms to ensure technical competency of professionals who will be involved in building design and construction can reduce risk to the built environment and directly benefit people's safety and society overall. Professional societies (for example, institutes of architects or societies of engineers) can provide an additional level of competence and assurance through training, codes of conduct and best practice development.

In addition to mechanisms to ensure individual professional qualifications, countries with robust building regulatory frameworks require registration of companies involved in building design and construction processes. Countries provide criteria for companies to register for qualified categories of works (for example, depending on prior experience on past projects, field of expertise, number of licensed professionals they employ, and so forth). By requiring legal registration and appropriate accreditation, governments can help protect building users and facilitate good practices to help ensure that design and construction works meet minimum quality and safety standards set by the building codes.

Higher education and technical training programs are the foundation of such professional capacity development. In some low- and middle-income countries, universities may not offer a complete range of degrees in engineering, architecture and planning fields, and there may be only limited availability of technical education programs or vocational training. To develop and maintain the quality and quantity of competent professionals in the construction industry, investing in education and technical training for engineers, architects, planners and construction trades is vital.

11.1.3 Other enabling factors

Other enabling factors discussed below for the code implementation environment include insurance and liability regimes in place in the country and dispute resolution mechanisms provided within the building regulatory framework.

11.1.3.1 Insurance and liability

As accredited and qualified building professionals and companies are often liable for design and construction, insurance plays a critical role to protect them from potential risks and disputes, while also protecting the final building users. However, insurance products that cover individual professionals and companies are not widely available, particularly in low- and middle-income countries. There are also behavioral hurdles to overcome. For example, a study conducted in Anambra state in Nigeria in 2021 illustrates the lack of awareness of the requirements of the provision (namely section 64 of the National Insurance Act of 2003) requiring builder's liability insurance for buildings of more than two floors. Only 45 percent of study respondents even knew of this requirement. Respondents also reported that the nonchalant attitude of construction firms toward insurance policies was the main reason why insurance was not obtained. This attitude is perpetuated by the lack of enforcement of provisions of the Insurance Act by the government (Okongwu et al., 2021).

Building code compliance relies on a shared responsibility among stakeholders involved such as designers, builders, and building control authorities, yet the responsibilities of each stakeholder and accountability mechanisms are often not clearly defined, widely understood, or implemented. When insurance mechanisms are not

in place, building professionals, construction companies and building users may be at risk, particularly if no dispute resolution mechanisms have been established. Therefore, a legal framework for insurance and liability should be in place as well as efforts to support the development of an insurance market for the construction industry.

Box 11.1 // Ways to increase private-sector responsibility for code implementation

The case of Japan: private sector participation in design reviews and building inspections

In 1995, the Great Hanshin Awaji Earthquake caused extensive damage to Hyōgo prefecture including Kobe city in Japan.

Although a robust building regulatory framework was in place in the country, one factor identified for improvement was capacity in building control, particularly for plan checking and site inspections. At that time, only 30 percent of building projects received a final inspection before occupancy.

In 1998, an amendment to the Building Standard Law allowed private sector participation in building control process for the first time. As of 2024, over 90 percent of projects are certified by the private sector, and capacity to undertake building control activities has been markedly enhanced.

Above all, strict controls are in place for private-sector involvement. Private-sector firms are required to demonstrate adequate staff number and qualifications. Government building control authorities regularly conduct surveillance on private-sector firms by reviewing their outputs documents, and other relevant documentation, and based on the results of these checks, penalties for misconduct may be imposed (ERI Holdings Co., Ltd., 2014; World Bank, 2015b).

The case of increased private-sector responsibility through liability requirements in France

In France, the primary mechanism to ensure the safety and quality of construction is the requirement for design and construction professionals to hold liability insurance for a minimum of 10 years as set out by the French Civil Code. In other words, if any defect or safety issue emerges in the 10-year period after a building is constructed, it is automatically clear who is liable and must remediate the problem or pay compensation.

There is limited involvement by the government in building inspections; by contrast, the private sector conducts most checks and the insurance companies play a key role in shaping standards for contracts and other industry requirements.

Although the law does in some cases allow for the state to act as a facilitator to resolve disputes, most disputes are settled between insurers without going to court. Overall, the system works well, and results related to building safety in France are comparable to other countries in Western Europe that exercise more direct state oversight of building control (IFC, 2013).

11.1.3.2 Dispute resolution mechanisms

Disputes can happen during design or construction due to the dynamic and complex nature of building projects.

Disputes can take various forms: between a project owner and a building control authority if a permit is refused, for example, or when specific conditions are attached to the building permit; between a building's owner and a contractor when the quality of work is unsatisfactory; or between different stakeholders (project owner, designers and builders) involved in a project. In the absence of effective dispute resolution mechanisms, stakeholders may not feel motivated to comply with building regulations, and delays in the building approval process are likely to result (World Bank, 2023c, 83).

Establishing a clear and efficient legal framework for dispute resolution mechanisms is the key for a successful, competitive construction sector, and consumer protection. Effective dispute resolution mechanisms:

i) are supported by a clearly defined legal instrument that references a formal appeal process for building control



decisions; (ii) are independent of the building control authority; (iii) are executed by bodies with relevant technical expertise; and (iv) address all processes and stages of the building regulatory process (World Bank, 2023c).

Box 11.2 // Dispute resolution mechanisms in Victoria, Australia



Building construction in Melbourne, Australia. Photo credit: Elias Bitar | iStock

A survey in Victoria, Australia in 2016 found that one in four residential building projects involved a dispute between the homeowner and the builder. This led to the establishment of the Domestic Building Dispute Resolution Victoria (DBDRV, n.d.) being set up in 2017 with the objective to resolve disputes as informally as possible. When agreement could not be reached through conciliation, DBDRV would have the legislative power to issue binding orders to resolve the dispute.

Generally, the DBDRV has made it easier for builders and building owners to access an online, tailored dispute resolution service, which is free, fair and fast. The resolution process has three possible outcomes: (a) an agreement if the dispute is resolved, (b) a dispute resolution order if the parties either partially resolve their dispute or are unable to resolve their dispute, or (c) a certificate of conciliation if the parties are unable to resolve their dispute. Parties with unresolved disputes may make an application to the Victorian Civil and Administrative Tribunal (VCAT).

From April 2017 to October 2023, DBDRV has resolved 7,484 disputes that would have cost more for both parties had they been dealt with by the VCAT, making domestic building dispute resolution more cost-effective for both the government and stakeholders.

11.2 ASSESSMENT OF THE CODE IMPLEMENTATION ENVIRONMENT

The assessment focused on the following topics: (i) at what level of jurisdiction the building control framework is administered; (ii) if established building control processes are in place; (iii) how accessible the information and processes is; (iv) if building control processes are optimized depending on the level of complexity and risk for projects; (v) if clear requirements and processes for site inspections are in place; (vi) if dispute resolution mechanisms are defined; and (vii) if professional certification and registration systems exist. Refer to Table 11.1 for a more detailed description of each topic area.

Table 11.1 // Topic areas for the building code implementation environment

Topic Area	Description
Type of jurisdiction for administration of the building control framework	Building control laws and regulations may be administered at the national level, at a territorial or city level (local level) or through a hybrid system (a mix of national and local level administration depending on the type of regulation or process). For example, some planning restrictions may be set at national level (for example, for protected lands), but local or city level planning regulations may also need to be followed to obtain permission to develop a site.
Established building control processes	It is important for building control processes to be clearly defined in the country's legal framework. This includes the type of processes (planning and building permit, inspections, occupancy permit, and so forth), the requirements and any other relevant details.
Accessibility of building control regulations and information on processes	To ensure effective implementation, building control regulations and processes must be accessible. Two areas were assessed: » Whether there is a functional online permit system either in major cities in the country or at national level. A functional online permit system will allow the user to apply online, track the status of applications, and pay any fees due, throughout the planning, design and construction phases. » How easy it is for the public to access information about building control regulations and processes, and how they can be accessed (either online or in print). Generally, information on building control will be available through the website of the relevant ministry or through the website of the relevant municipality, reinforcing transparency of related processes.
Optimized process	Countries can optimize their building control processes by aligning the types of processes, levels of checks and stakeholders involved in the review of applications in different types of building categories. Defining specific processes depending on the risk or complexity of projects can simplify and accelerate the issuance process for less risky buildings, while releasing more resources for complex or more risky projects.
Defined building inspection framework	Site inspections are a critical component of the building control process. It should be clear when site inspections by the relevant authority are required during different stages of the construction process and what the specific requirements are. Site inspections should be performed by registered professionals and/or third-party inspectors, depending on the type of building, to ensure the strict and unbiased application of relevant regulations.
Dispute resolution mechanism	Clear and efficient processes for dispute resolution are needed as part of the building control process as they have the potential to increase compliance, trust, and accountability. Within the regulatory framework, these dispute resolution mechanisms should be defined, including appeal processes for building control authority decisions and arbitration or mediation measures to solve any conflict between involved stakeholders (public or private).
Professional certification and registering system	Certification and/or registration systems for the different professionals operating within the built environment sector (architects, engineers, builders and other more specialist consultants) can help to regulate the work of the different professionals to increase confidence in the quality of construction sector professionals. This also creates pathways to mandate continuing education as code requirements are updated, along with mechanisms to penalize companies and professionals for violations of building regulations and related procedures.

11.2.1 Findings of the code implementation assessment

Gaps are observed in the effective building control regulations, processes and related aspects of the wider enabling environment for code implementation in the study countries. Even if a country has an excellent building code, if well-functioning processes and resources are not in place to ensure compliance, the fundamental aims of the code for the built environment will not be achieved. For example, in Türkiye, which was found to have one of the most comprehensive codes in this study, the February 2023 Türkiye-Syria earthquake sequence demonstrated the benefits of strict inspection requirements for buildings during construction. Despite the severity of the ground shaking, which in some places exceeded the code design levels, public buildings such as schools and hospitals generally performed well (EEFIT, 2024). Many private buildings, such as residential and commercial buildings,



Figure 11.2 // Summary of code implementation environment assessment for the 22 countries

CODE IMPLEMENTATION ENVIRONMENT								
COUNTRY		Jurisdictional level of oversight and enforcement of building control regulations	Building control processes are clearly defined in any regulations or government documents	Information regarding the building control processes is accessible to the public	The building control framework integrates and details dispute resolution mechanisms	The country has professional certification and registration mechanisms	The building control framework integrates inspections from the authority in charge during the construction process	The building control process integrates a building categorization system to optimize existing human resources and application requirements.
Chile	H							
Colombia	L							
El Salvador	H							
Mexico	L							
Mongolia	N							
Morocco	L							
Peru	L							
Philippines	L							
South Africa	L							
Indonesia	N							
Nepal	L							
Rwanda	H							
Türkiye	H							
Bhutan	L							
Tonga	N							
Uzbekistan	N							
Algeria	H							
Mozambique	L							
Tajikistan	H							
Ghana	L							
Samoa	N							
Vanuatu	N							
TOTAL COUNTRIES ¹		17	14	13	13	13	11	9

■ Yes - The country meets the requirements of the statement
 ■ Partial - The country meets some aspects or contains incomplete information to fully implement
 ■ No - The country does not meet the requirements of the statement
 [N] National level
 [L] Local level
 [H] Hybrid (depending on the characteristics of the project)

Note 1: Total countries that fully satisfy the requirements of the statement.

where inspection requirements were limited, suffered severe damage and collapse, leading to many casualties, displacement of populations and the need for temporary shelter.

The findings also show a wide range of coverage in the key areas related to the code implementation environment. Refer to Figure 11.2 for the findings of the assessment for all countries. No country fully satisfies all topic areas of the assessment. Priority areas where there are gaps, even in countries with more complete coverage, include processes to ensure building inspections and optimized building control processes to target resources toward higher risk buildings. These countries include Chile, El Salvador, Mexico, with respect to inspections and the Philippines, South Africa and Indonesia with respect to optimized processes. For example, country experts observed that, in the Philippines and Indonesia, although inspection requirements exist, a lack of resources in building control authorities, in some cases, prevents inspections of common types of smaller-scale buildings from being carried out in practice. Less than half of the study countries fully satisfy the statement related to online approvals systems; such systems play a crucial role in improving efficiency, reducing errors and ensuring greater transparency for building control officials and users. Countries that satisfy the assessment in fewer topic areas, such as Ghana, Samoa and Vanuatu, have invested in code development in recent years, but could benefit from further development of building control regulations, processes and capacity development for code compliance.

For effective code implementation, a combination of appropriate regulations, efficient and optimized processes, qualification requirements, adequate resources for capacity building and enforcement, and accessibility of information and systems for users must be in place.

Figure 11.3 // Construction workers casting concrete on site



Photo credit: som340 | iStock

11.3 CODE IMPLEMENTATION: CHALLENGES AND OPPORTUNITIES

Although this study does not focus in detail on code implementation, an overview of the following common challenges linked to possible strategies to respond to them to increase code compliance is presented in Figure 11.4.

Figure 11.4 // Common challenges in code implementation and related strategies to improve compliance

Code Implementation Challenges	Transparent and accessible building regulations, complementary guidance and information on related processes	Streamlined and efficient processes and requirements	Risk-informed planning regulations	Optimized processes linked to a building categorization /risk level system	Digitized systems (e.g., for building control, online approvals)	Robust inspections framework linked to permitting	Private sector participation in building control with adequate safeguards in place	Well-functioning insurance/liability mechanisms	Independent and effective dispute resolution mechanisms	Professional certification and registration systems	Professional bodies involved in training, regulating professional conduct, and technical provisions development	Design and construction sector training and degree programs	Building codes with provisions well-tailored to local construction environment and capacity	Incentives to improve compliance	Penalties for non compliance	Dangerous structures reporting mechanisms/requirements for periodic assessment of selected higher risk buildings	Public communication campaigns about benefits of compliance/risks of non-compliance
Lack of awareness/access to building regulations and related requirements	✓	☐	☐	☐	✓	☐	☐	☐	☐	☐	☐	✓	☐	✓	☐	☐	✓
Mis-match between local capacity and complexity of building regulation requirements	✓	✓	☐	✓	✓	☐	☐	☐	☐	✓	☐	✓	✓	☐	☐	☐	☐
Cost of compliance is too high for some groups (e.g., affordable housing)	☐	✓	☐	✓	✓	☐	☐	✓	☐	☐	☐	☐	✓	✓	✓	☐	✓
Prevalence of informal/risky development	✓	✓	✓	✓	☐	✓	☐	☐	✓	☐	☐	✓	✓	✓	✓	✓	✓
Lack of budgetary and/or physical resources for building control authorities	☐	✓	☐	✓	✓	☐	✓	✓	✓	☐	✓	✓	☐	☐	✓	✓	✓
Lack of public sector capacity	☐	✓	✓	✓	✓	☐	✓	✓	☐	✓	✓	✓	✓	✓	✓	✓	✓
Lack of private sector capacity	☐	✓	✓	✓	✓	☐	☐	✓	☐	✓	✓	✓	✓	☐	☐	☐	✓
Participation of unqualified people for roles in design and construction sector	✓	☐	☐	✓	☐	✓	☐	☐	✓	✓	✓	✓	☐	☐	✓	✓	✓
Lack of trust in building authorities	✓	✓	☐	✓	✓	✓	☐	✓	✓	☐	✓	☐	✓	✓	☐	✓	✓

Clear communication of building control requirements as well as capacity building are required to increase compliance. For example, barriers to accessing building control regulations and processes, can be reduced by making information easy to find online, at no charge. Awareness can be raised through training for those in the design and construction sector as well as broader public communication campaigns on the benefits of complying with building regulations. Box 11.3 gives an example of capacity building to enhance public- and private-sector compliance with the building regulations in Dominica.

Box 11.3 // Capacity building to enhance code compliance in Dominica

In 2023, as part of the World Bank's Caribbean Physical and Financial Resilience Building (CPFRB) technical assistance project, and in collaboration with the Ministry of Housing and Urban Development, a train-the-trainer program was delivered in Dominica. The objective was to build capacity for public- and private-sector professionals to improve compliance with the OECS 2015 Building Code (OECS). Modules included 'Understanding and Applying National Building Codes, The Hazard-Housing Nexus', 'Risk Mitigation: The Three Cs and Risk Mitigation through Code Compliance', and 'Risk Communication and Stakeholder Engagement' (World Bank, 2024d).



Buildings in Dominica. Photo credit: BriBar | iStock

Streamlined and efficient processes, including digitization of processes, and linking the level of requirements for building control to the risk level of the project can reduce the cost of compliance. For example, see Box 11.4 on Rwanda's building permit management system. Effective insurance and liability mechanisms encourage compliance by reducing potential liabilities and assist property owners in managing residual risks. Financial incentives can also drive compliance.

Box 11.4 // Rwanda's Building Permit Management System (BPMIS)

The BPMIS project was designed and is being implemented by Rwanda Housing Authority in collaboration with the World Bank Group WBG/IFC and launched in May 2013. The main functionalities of the system support the administration of construction permits, including data archiving, enforcement tasks, architect registration, building proposal submission, payment evidence submission, as well as approval-related processes (extension, demolition, refurbishment) and occupancy permits. It also provides comprehensive reporting functionalities for key aspects of permit approval and allows building inspectors to profile ongoing construction, capturing inspection data via mobile devices. Additionally, the system allows inspectors to access all documents related to an inspected site or plot using QR Code scanning, detecting forged documents or permits. The system assigns building control requirements linked to five building risk categories depending on the building size, occupancy level and usage type.

The website hosting the BPMIS (www.bpmis.gov.rw) also allows the users to consult the legal framework for building control and view the list of registered professionals.



Building construction in Kigali. Photo credit: Sloop | iStock

If building control authorities lack adequate resources, they can supplement their capacity with assistance from the private sector. This can improve the efficiency of the operations (for example, through streamlined and optimized processes and use of digital systems), improve wider capacity building of staff, and increase support from professional bodies such as architectural and engineering organizations. Box 11.5 below gives an example of effective use of the private sector to enhance building control capacity in Colombia.

Box 11.5 // The urban curators: privatization of the building permit review process in Colombia

In 1995, Colombia established the position of Urban Curator, defined as a person acting on behalf of the public administration in charge of building control, responsible for reviewing, rejecting, or approving different types of building permits related to territorial development and urban planning in municipalities with more than 100,000 inhabitants. Currently, there are 99 Urban Curators spread across 48 cities. The Urban Curators are supported by an interdisciplinary team, including engineers, architects, lawyers, and administrative staff. Urban Curators are appointed by the mayor following a merit-based competition and serve a five-year term and are autonomous in the exercise of their functions with disciplinary, fiscal, civil, and criminal responsibilities for any damages and losses caused to users, third parties, or the public administration in the exercise of their public function. Nonetheless, the tasks and duties of the urban curators exclude control and verification of the works, violations of land-use regulations and visits to construction sites (Colegio Nacional de Curadores Urbanos, n.d.). The additional private capacity for building permit approvals has reduced the time needed to obtain a permit from an average 1,080 days in 1995 to 132 days in 2020 (World Bank, 2009; World Bank, 2020).



Building construction in Colombia. Photo credit: Giorgio Morara | iStock

Lastly, it is important to emphasize that code provisions and compliance mechanisms go hand in hand. When introducing new code provisions, the related code implementation processes and available capacity in building control and the country's design and construction sector should be considered. In countries where resources are limited, it may be better to introduce code requirements incrementally, with a focus on simplified provisions for common types of construction and/or targeting more rigorous code requirements toward higher-risk building types, while building capacity over time.



12. Key Findings and Recommendations

12. Key Findings and Recommendations

Effective building regulatory frameworks are the foundation of a safe, resilient, sustainable, and accessible built environment. In our current changing climate with evolving disaster risks, the role of building codes and broader regulatory frameworks is becoming increasingly important to manage risk and enhance the resilience and sustainability of buildings.

This report provides an overview of the status of building codes and their implementation in selected countries with differing socioeconomic and hazard contexts across six different geographical regions. It represents an extension of related earlier studies providing regional analysis of building codes, including previous regional studies on the status of building codes carried out in [Latin America and the Caribbean](#) (IDB, 2023), [Sub-Saharan Africa](#) (World Bank, 2023c), and [Pacific Island countries](#) (PFI, 2021), as well as the flagship report: [Building Regulation for Resilience: Managing Risks for Safer Cities](#). This body of work aims to identify opportunities for governments and regulators to advance the safety, resilience, sustainability and accessibility of the built environment through improvements to building codes. Other key mechanisms to improve the wider building regulatory environment include legal and regulatory reforms, building control process reforms, institutional reforms of national and local government entities involved in building regulation, capacity building of building professionals, and enhancements to the enabling environment such as professional licensing and insurance.

This chapter provides key recommendations based on the findings of this report, primarily focused on building code provisions and intended for countries that are on the path to enhancing their building codes and broader regulatory frameworks. The 22 countries in the study were selected based on regional distribution, level of maturity of their building codes, and level of exposure to selected disaster risks. For evaluation purposes, most had relatively well-developed codes and standards. They are not necessarily representative of countries globally. A wider selection of countries would result in a greater diversity in maturity level—from countries without any adopted codes and standards and limited capacity to countries with highly developed buildings codes and higher capacity. Further work is required to more comprehensively assess global trends and identify appropriate reforms for specific countries. Nevertheless, this report aims to provide a useful basis for dialogue in the 22 countries that may initiate beneficial regulatory reforms to make their built environment more resilient, greener, and more inclusive.

12.1 OVERALL FINDINGS

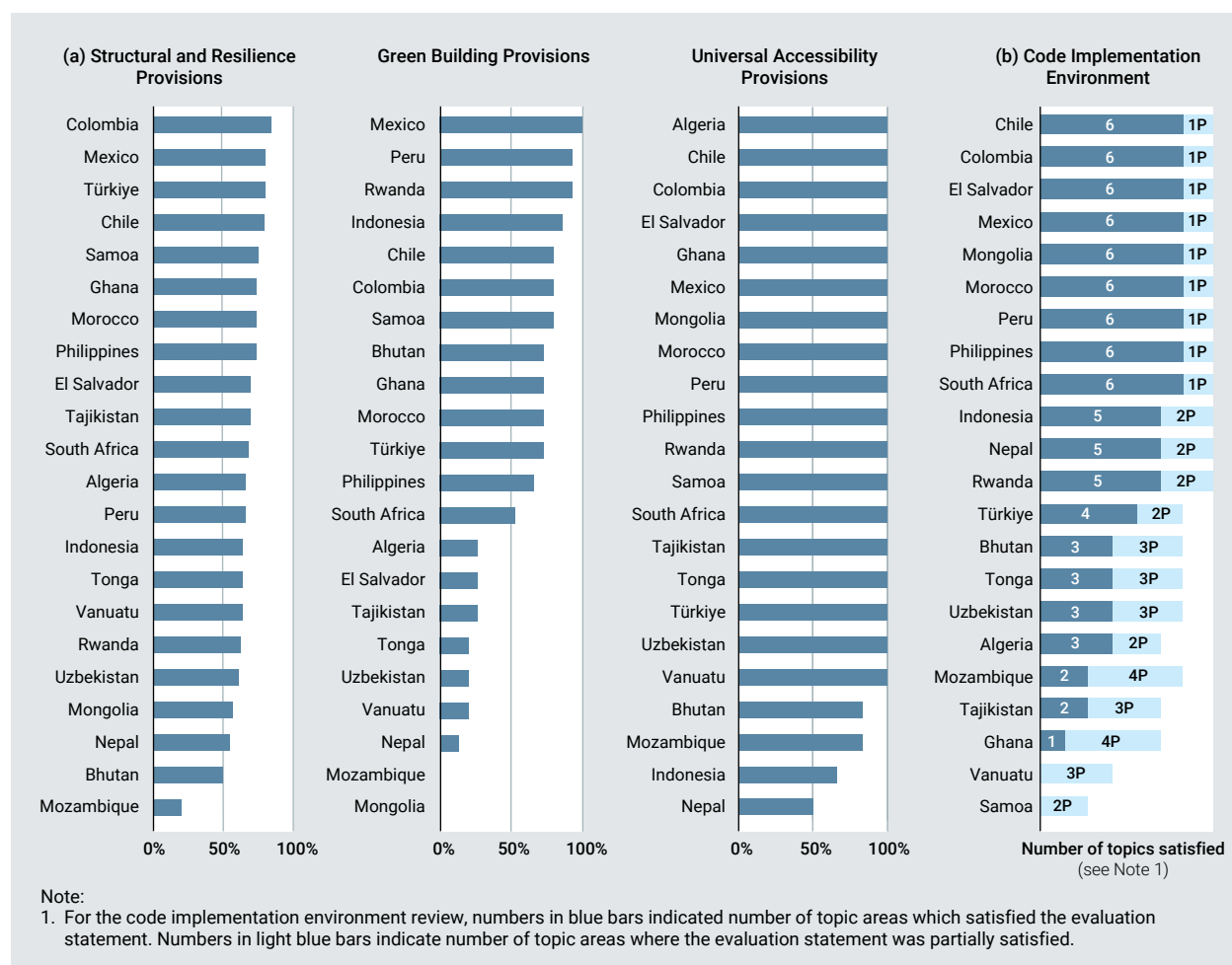
The study provides insights into which areas to prioritize for code development and where further investment in aspects of the code implementation environment could improve code compliance. Figures 12.1 and 12.2 below summarize the results for each country, in each main topic area category, and as a percentage of topics covered for the code contents assessment and for the code implementation environment assessment. Countries are ranked by how comprehensive their coverage of building code topic areas is—with the caveat that this assessment was performed at a high level, especially for the code implementation environment aspects. In addition, refer to the Country Profiles in Annex A for a summary of results for each study country.

The high-level assessment shows different levels of advancement among countries in establishing mature building regulatory environments. Some countries have advanced the development of their building codes in the



three main areas assessed to the point where they already have good coverage in their code contents of the key elements needed for a robust code implementation environment. These countries include Chile, Colombia, and Mexico. Other countries—such as Ghana and Samoa—have made progress in code development but more investment is needed to build capacity and complementary mechanisms for effective code implementation. Finally, countries such as Mozambique have less comprehensive and up-to-date building regulatory environments overall—in terms of building code coverage of key topics and code implementation environment. The rest of the study countries were at an intermediate level of maturity for their codes and implementation environment.

Figure 12.1 // (a) Summary of code coverage for structural and resilience provisions, green building provisions and universal accessibility provisions; and (b) Code implementation environment evaluation



In addition, different types of code provisions display varying levels of maturity and adoption in the study countries. Some, such as general structural provisions, are generally more mature and have higher levels of coverage of the assessed topic areas. In contrast, provisions related to flood design or green building are still emerging and have yet to be fully incorporated into many country codes. Figure 12.3 below lists areas where gaps were more often identified in the technical provisions of the countries studied.

Figure 12.2 // Summary of coverage of structural and resilience provisions (a) general structural provisions, (b) seismic design provisions, (c) wind design provisions, and (d) flood design provisions

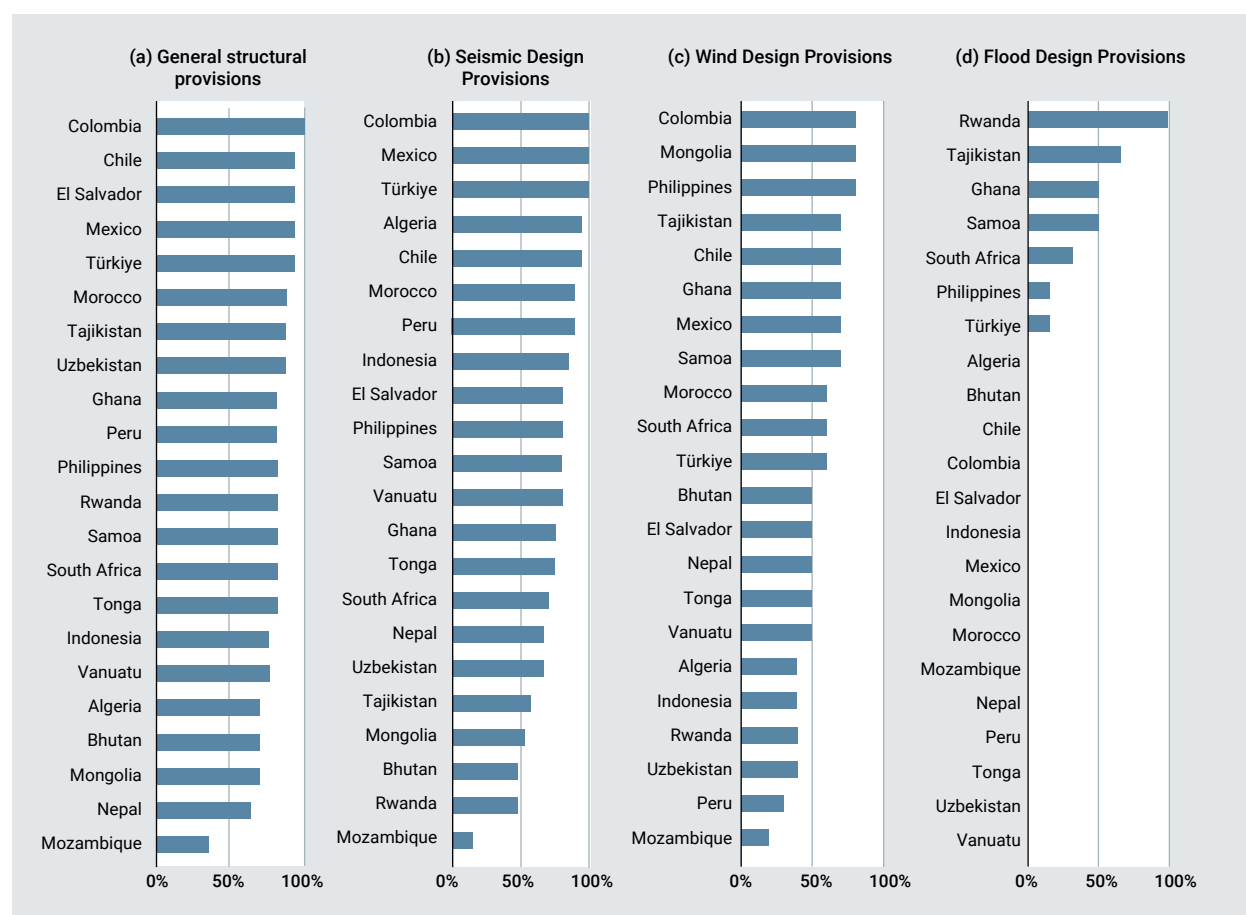


Figure 12.3 // Priority topic areas for building code development based on the findings in the study countries

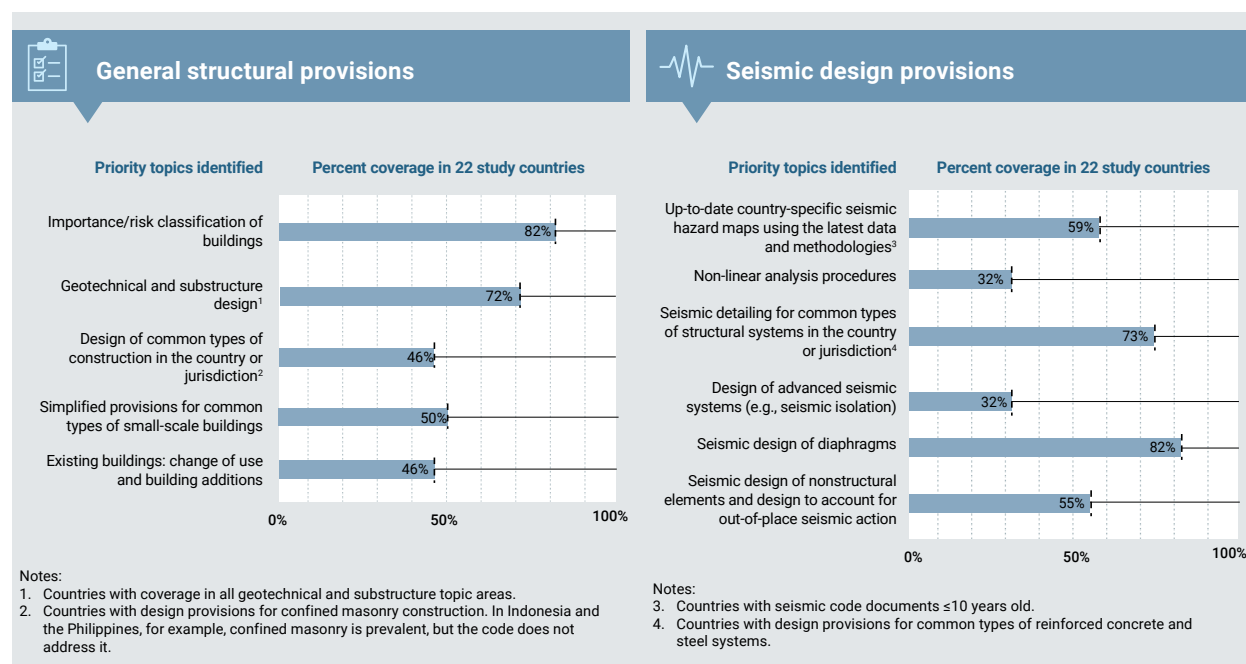
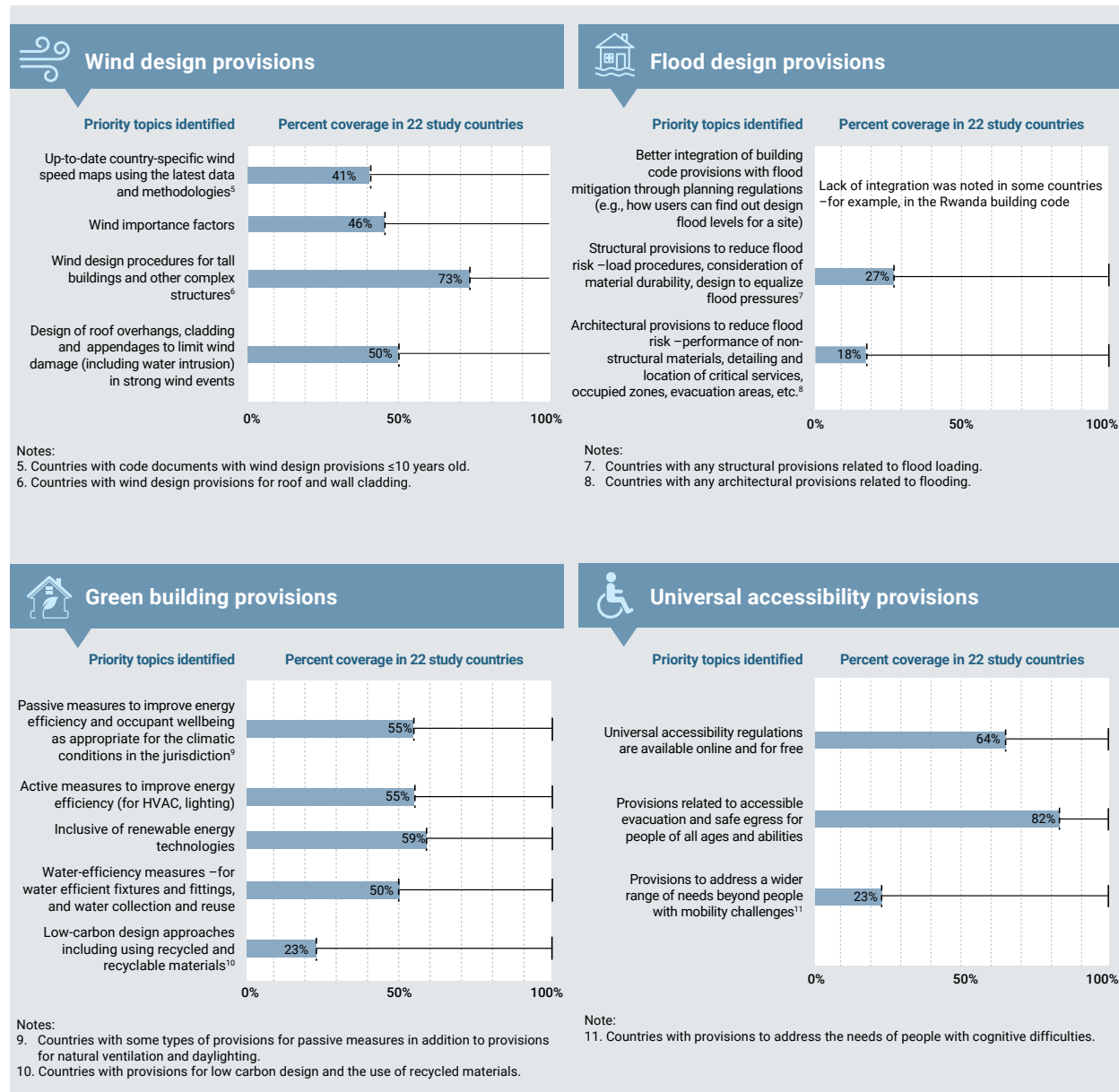


Figure 12.3 // Priority topic areas for building code development based on the findings in the study countries

Most countries have code documents that have not been updated in the last 10 years. For example, for structural and resilience provisions (including seismic, wind, and flooding-related design), only four of the 22 countries have code documents less than 10 years old. For green buildings and universal accessibility provisions, more countries have recently updated provisions, with eight countries having code documents with universal accessibility provisions published no later than 2014 and eight with green building provisions published no later than 2014. However, the benefits of updating codes should be weighed alongside the time and resources required to draft and approve updates, and the capacity of the design and construction industry to comply with them.

Code development is a continuous process, requiring ongoing efforts and investment, with one key driver being the need to respond to a changing landscape of hazards and risks. For example, data were collected relating to how seismic and wind codes evolved over time in the study countries. It was found that, on average, seismic code provisions have been evolving over a period of 36 years and wind code provisions over 26 years. Over these



development periods, seismic code provisions have been updated on average over four cycles, and wind code provisions over two cycles. Regularly updating codes for natural hazards impacting the built environment is vital as the knowledge and understanding of these hazards rapidly evolve. Additionally, hazards such as strong wind events, flooding, and extreme heat are increasing in frequency and severity due to the impacts of climate change in many regions of the world.

Based on a high-level review of the code implementation environment it was noted that even countries with mature building codes could benefit from improved building control processes and compliance support.

Priorities identified for improvement from the country findings include the need for more transparent and streamlined processes, prioritizing resources for building types of higher importance, and comprehensive mechanisms and resources for building inspections. Relatively few countries offer free, online access to all building code documents. In addition, in some cases, regulation documents are not available in the official language of the country. Lack of access to building codes and building control regulations and requirements creates barriers for compliance.

12.2 RECOMMENDATIONS

Recommendations linked to key findings are presented for the following key topics in the report: code development, general structural provisions, seismic design provisions, wind design provisions, provisions related to climate hazards (extreme heat, flooding and wildfire), green building and universal accessibility provisions, and aspects related to the code implementation environment. Given the level of evaluation in the study, the recommendations are necessarily generalized but nevertheless highlight key challenges and areas for improvement in building code content and enforcement. These can serve as a starting point ahead of more detailed analysis to inform prioritized actions for specific countries. Examples of action plans for two country profile types are provided in Figures 12.4 and 12.5 to give indicative examples of prioritized actions for sample types of countries with distinct characteristics.

Topic 1: Building Code Development

R1.1 Set clear processes for code development with defined roles and responsibilities, stakeholders, activities, data requirements, and timelines, supported by adequate resources.

Developing building codes is an intensive exercise. It requires clearly defined processes, roles, responsibilities, and resource allocation, with wide stakeholder participation and a complex validation process that can often take from two to 10 years. Code updates can be based on set cycles or triggered by other criteria, including the need to learn from disasters, technological advances, changes in construction practices, or evolving hazards and risks. Where neighboring countries have similar challenges and/or commonalities in their construction practices, they can often benefit from sharing resources and knowledge through regional code development activities.

R1.2 Ensure that building codes are well-tailored to the country context.

Building codes need to be well-tailored to the local context, including local development patterns, hazards, climatic conditions, social and cultural factors, common construction practices, and construction sector capacity. For example, Peru and Mozambique lack simplified code provisions for small-scale buildings although they have a high proportion of informal development (UN-Habitat, 2022); such provisions could reduce the complexity and associated costs of code compliance for community- and self-builders. Adapting model codes or another country's code to a new country or jurisdiction can be more efficient than developing new codes from scratch, but it still requires substantial effort. For example, country-specific design criteria for hazards are generally needed, and modifications to the code may be needed to align with local capacity and common construction practices. For example, the Indonesian building codes, which are based on US codes and standards, do not include design provisions for confined masonry construction—although this is a common construction typology in Indonesia, especially for schools and single-family housing.



R1.3 Ensure that building code provisions are complete and consistent.

This study did not evaluate the quality or comprehensiveness of code provisions in detail. Nevertheless, areas where building codes could be improved were noted. For example: (i) some countries have design provisions that lack clear compliance procedures—for instance, in seismic design, the absence of a complete procedure for calculating country-specific seismic-design loads; and (ii) some codes contain inconsistent or incompatible provisions, possibly due to referencing outdated or conflicting international standards.

R1.4 Harmonize code provisions across different topic areas.

In most cases, code provisions are developed by expert specialists in a siloed manner, whereas a multidisciplinary approach would better balance risks and benefits and achieve harmonization of provisions across topic areas: for example, consideration of fire risk in green building measures, incorporation of universal accessibility provisions in evacuation requirements, or integration of low-carbon design approaches into structural design provisions.

Topic 2: Code Provisions for Small-Scale Buildings

R2.1 Include simplified provisions for common types of small-scale buildings.

Only half of the study countries have simplified provisions for small-scale buildings. Including simplified provisions, communicated in a straightforward manner for common types of small-scale buildings, can increase code compliance and promote safe construction. This approach better tailors the provisions to local capacity and the types of buildings commonly constructed by communities, often without input from design and construction professionals.

R2.2 Incorporate code provisions for vernacular construction that are adapted for local hazards.

Some of the study countries have made efforts to include code provisions related to vernacular construction types that are adapted for local hazards. This approach recognizes the benefits of promoting safe construction practices for local materials and techniques. For example, in Bhutan, the government has formally adopted construction guidelines for improving the seismic resistance of new vernacular stone masonry buildings through seismically detailed connections, provision of timber ring beams, and through-stones in the walls.

Topic 3: Code Provisions for Existing Buildings

R3.1 Include code requirements for modifications and/or change of use of existing buildings.

Building codes predominantly address the design and construction of new buildings. However, to address risks to existing buildings and provide clear guidance on adaptive reuse of existing buildings to improve sustainability, code provisions should also cover existing buildings. This study found that only 10 out of 22 countries have provisions for existing buildings that cover additions or alterations and change of building usage.

R3.2 Include code provisions for building assessment, rehabilitation and retrofit.

Half of the study countries have some provisions related to the assessment of the structural condition of existing buildings, and only seven have provisions related to the seismic assessment and retrofit of these buildings. Proactive assessment and retrofitting of buildings can improve safety and reduce damage from disaster events, protecting lives and leading to faster recovery times.

Topic 4: Code Provisions for Seismic Design

R4.1 Review and periodically update country-specific seismic hazard maps.

Although the study did not evaluate the quality of seismic hazard maps in detail, it was noted that Bhutan and Mozambique do not have country-specific seismic hazard criteria, and 7 out of 22 countries have seismic hazard maps that have not been updated in over 10 years. Countries can benefit from improving the quality and resolution of seismic hazard maps in the building codes to more accurately reflect the best available information, using up-to-date methodologies to inform building design criteria.

R4.2 Improve critical elements of seismic design code requirements, such as geotechnical provisions, ductile detailing provisions, and diaphragm design provisions.

While most study countries have made significant advances in incorporating geotechnical provisions into their building codes, six countries have no provisions for design of retaining walls, and four have no provisions for geotechnical site investigations. These types of provisions are particularly critical in seismic regions, to ensure that foundations can withstand seismic actions and reduce the likelihood of excessive settlement or tilting of entire buildings. Of the 22 countries, 18 have some provisions for the seismic design of floor and roof diaphragms. Diaphragms are a critical component to effectively transfer lateral loads to the buildings' main lateral system. Ductile detailing provisions for structural elements are essential to ensure they can absorb and dissipate earthquake-induced energy through deformations—as opposed to failing in an undesirable, brittle manner, which may lead to partial or total building collapse. The study found that the codes in Mongolia, Mozambique, Rwanda, and Tajikistan do not contain ductile detailing provisions.

R4.3 Improve code provisions for the design of nonstructural components to protect occupants and limit service disruption after major earthquakes.

Although 19 out of 22 countries have some provisions related to the seismic design of nonstructural components, it was noted that many countries lack comprehensive provisions in this topic area. These include provisions to limit building's lateral displacements, and design/detailing requirements for verifying seismic safety of nonstructural elements and their connections, such as masonry infills and partition walls, facades, parapets, and equipment. Preventing damage to nonstructural components will reduce harm to occupants and assets within buildings and ensure that services can be restored more quickly after an earthquake.

R4.4 Consider the inclusion of seismic design provisions to limit damage and service disruption after an earthquake, especially for selected types of higher importance/critical buildings.

While all study countries include some seismic design provisions, they focus primarily on limiting loss of life and ensuring the structural integrity of the buildings for a design-level earthquake; this is commonly referred to as Life Safety (LS) performance. Recent earthquakes have shown that buildings designed for LS performance are often uneconomical to repair. It is possible to incorporate code provisions intended to achieve enhanced performance, including functional recovery objectives, and as a result limit damage in the structural and nonstructural building systems through more stringent prescriptive requirements, performance-based design approaches and nonlinear seismic analysis procedures, and/or application of advanced seismic systems (such as base isolation devices and dampers). The appropriate performance level targeted for a specific building can depend on its occupancy level, and its importance in a post-disaster situation (for example, whether the building has been designated to provide critical services for emergency response).

Topic 5: Code Provisions for Wind Design

R5.1 Review and periodically update country-specific wind design maps.

While the study did not evaluate the quality of wind design maps in detail, it was noted that 11 out of 22 countries have code documents with wind design provisions that have not been updated in more than 10 years. In addition, Indonesia and Mozambique lack country-specific design wind-design maps. Codes in some countries can benefit from including up-to-date wind design maps, developed using a probabilistic methodology, to ensure the safety of occupants and limit damage and disruption caused by strong wind events.

R5.2 Improve wind design provisions for roofs, cladding, and other nonstructural components to increase the resilience of buildings to strong wind events.

Only 11 study countries have some provisions related to the design of roof overhangs, roof cladding, wall cladding and other appendages to resist wind loading. Through relatively low-cost improvements, damage to building components from wind loads and water ingress can be reduced, leading to faster recovery times after strong wind events.

R5.3 Depending on the in-country capacity, consider the inclusion of performance-based design approaches in the code provisions for wind design of tall buildings and other complex structures.

Procedures and special provisions for the wind design of more complex structures, such as tall buildings, are included in the codes of 16 countries. Codes often prescribe special design and analysis procedures to capture dynamic behavior under wind loading, hence performance-based design approaches can be included to ensure the safety of tall buildings and other complex structures.



Topic 6: Code Provisions to Address Climate Hazards

R6.1 Incorporate green building measures to mitigate the impacts of extreme heat.

Provisions to reduce the risks of extreme heat for building occupants were not directly assessed in this study, because only a few countries include them. For example, Ghana has code provisions that explicitly address building adaptation to extreme heat events. Types of provisions to mitigate the impact of extreme heat include passive measures such as natural ventilation, green and/or 'cool' roofs, and external solar shading. Codes can also combine green building measures with other strategies related to the wider site: Ghana's building code, for example included requirements for external planting to provide shade, and specifications for the solar reflectivity of site hardscaping. See also the recommendations in Topic 7.

R6.2 Incorporate provisions to mitigate the impacts of flooding.

Flood risks are predominantly managed through planning regulations that prohibit construction on flood-prone sites and help determine appropriate locations for construction. As flood risk is increasing due to the impacts of climate change and pressure on land for development, there is a need for building codes to address flooding. These can include structural provisions to design for flood loading and architectural provisions to limit any disruption to building services from flooding. Only seven of the 22 study countries have any building design provisions related to flooding. Some countries with flooding-related provisions, such as Ghana, link these to the level of risk of flooding for the site (such as by setting a design flood level), but it is unclear how to obtain this information from local flood hazard maps for specific sites.

R6.3 Incorporate provisions for buildings and their surrounding sites to reduce the risk of wildfires.

Although the study did not evaluate building code provisions to reduce the risk of wildfires (still very rarely included in building codes), wildfires are becoming a growing problem due to the impacts of climate change. Chapter 8 presents a high-level overview of different building code approaches to reduce the risk of wildfire. These include measures such as fire-resistant materials, detailing to prevent ignition from wind-blown embers, and site-related measures such as controlling flammable vegetation.

Topic 7: Green Building and Universal Accessibility Provisions

R7.1 Increase the adoption of green building provisions related to energy efficiency.

The study found that 17 of the 22 countries include some green building provisions to improve energy efficiency in their building codes, while 12 have more comprehensive coverage of green building provisions. Many provisions are mandatory for buildings of a certain size or usage type. This is a common approach for countries transitioning to stricter energy efficiency requirements for buildings; it has the benefit of making building operations more affordable while supporting global sustainability goals. Also see R 7.4.

R7.2 Increase the adoption of green building provisions related to water efficiency, collection, and reuse.

The study found that 13 countries have some building code provisions related to water-efficient fixtures and fittings, but only five countries have provisions related to water collection and reuse. Such measures are often relatively easy to implement and can help to address the problem of water scarcity, which is increasingly common due to the impacts of climate change.

R7.3 Incorporate provisions for low-carbon design.

The building sector accounts for 37 percent of total greenhouse gas (GHG) emissions worldwide, with around one quarter of those emissions associated with embodied carbon (GlobalABC, 2024). Only eight countries studied have some limited provisions related to achieving lower-carbon buildings, and in six of these countries, the provisions are voluntary. Building codes can promote low-carbon design through additional requirements related to the use of lower-carbon materials, consideration of life-cycle approaches (such as recycling and recyclable materials), and expanding existing building provisions to enable adaptive reuse of existing buildings.

R7.4 Introduce mandatory provisions to advance green buildings and universal accessibility where appropriate.

The study found that green building provisions and universal accessibility provisions are often voluntary. For example, Colombia's green building provisions are entirely voluntary, and other countries have a mix of mandatory and voluntary provisions. For universal accessibility provisions, three countries have entirely voluntary provisions and seven have mandatory provisions for selected building types for new construction. Countries can support the



transition to stricter requirements for buildings by mandating green building and universal accessibility requirements for public buildings, while supporting market-driven mechanisms such as green building certification systems and financial incentives for privately-owned buildings. In addition, these provisions should be expanded to address retrofits to existing buildings.

Topic 8: Building Code Implementation

R8.1 Ensure that efficient and transparent building control processes are in place, with streamlined processes and information available online.

A lack of transparency and overly complex processes can discourage compliance. Less efficient processes can also increase the time and resources needed within building control. The study found that 13 countries have clearly defined building control processes where information is easily accessible to the public, while an online approval process is available in nine countries.

R8.2 Target building control resources toward buildings of higher importance.

Optimized building control processes were seen in 11 study countries, with the level of review and inspection requirements linked to a categorization based on project risk level and/or importance of the building. Such optimized processes can ensure that building control requirements are proportionate, and less onerous for typical buildings. Benefits include a more effective use of resources for building control and reduced barriers for compliance.

R8.3 Leverage the engagement of the private sector paired with mechanisms to monitor the performance of the private sector.

Selected case studies revealed the benefits of supplementing building control capacity with private-sector participation, such as the creation of the “Urban Curator” role to assist with permitting in Colombia. To ensure quality control and avoid conflicts of interest, mechanisms are required to ensure that personnel are appropriately qualified, alongside systems to monitor the performance of private-sector engagement more generally.

R8.4 Where appropriate, consider incentives for compliance.

Many of the countries studied have some code requirements that are voluntary. For example, 14 countries have universal accessibility provisions which are entirely voluntary or only mandatory for certain types of buildings, while all but two countries have some voluntary green building provisions. Depending on the resources available, it can be useful to introduce incentives to facilitate investment in the safety, resilience, sustainability and universal accessibility of buildings, for both existing and new private buildings. Incentives can be financial—such as grants, subsidies, tax breaks, or government-backed low-interest loans—or involve expedited or relaxed building control processes, or recognition through certification or awards (World Bank, 2025).

R8.5 Invest in capacity building to support code compliance.

A detailed assessment of the code implementation environment in each country was beyond the scope of this study. Nevertheless, previous country-specific assessments⁵⁸ have demonstrated that continuous investment in capacity building is essential to support code compliance. Capacity building can take the form of guidance and training for public- and private-sector stakeholders, including formal routes to professional licensing and/or certification (this is in place in 13 of the study countries). In addition, public communication campaigns and community engagement can raise awareness of the benefits of code compliance and gather valuable feedback on how best to implement building codes in practice. Investment in capacity building is particularly important when new regulations, guidance, or building control systems are introduced.

⁵⁸ World Bank, 2025. Building Regulation for Resilience, “Country Reports”. <https://www.gfdrr.org/en/building-regulation-for-resilience>



Figure 12.4 // Sample action plan for Country Type A



Photo credit: aroundtheworld.photography



Figure 12.5 // Sample action plan Country Type B

COUNTRY TYPE B		Characteristics • High risk (earthquakes, strong winds, flooding) • Lower population growth and more limited urbanization • Building code is outdated with some gaps in structural provisions; a green building code exists but is not widely implemented; provisions for universal accessibility are available • Unauthorized building alterations are common • Limited resources available for building control and enforcement mechanisms are weak
Priority actions may include:		
A Improve hazard data used in planning and design	Where deficiencies are identified in the quality of earthquake, wind and flood hazard data, invest in research and partnerships to generate and/or incorporate the best available data into planning instruments and building codes, including accounting for the effects of climate change.	
B Put in place a system to enable periodic building code updates to address gaps and incorporate new information	Incorporate mandatory criteria to trigger regular building code updates and establish institutional structures such as government-appointed, multidisciplinary steering committees or advisory councils to guide code development and reforms.	
C Address identified gaps related to life safety performance	Conduct a review of the building code to identify and prioritize critical gaps to address in code updates (such as geotechnical provisions or ductile detailing provisions).	
D Expand mandatory accessibility and green building requirements for new buildings	Develop a phased approach for introducing mandatory requirements to more buildings based on building size and occupancy type.	
E Incorporate new provisions for improved resilience (to reduce damage and downtime)	• Architectural and structural provisions related to flood loading and design. • Provisions related to strong winds and wind-driven rain, including requirements for components and cladding and for advanced analysis for tall buildings. • Provisions related to the seismic performance of nonstructural components such as infill walls. • Performance-based design approaches, nonlinear seismic analysis procedures, and/or application of advanced seismic systems.	
F Invest in local training and capacity building to support compliance	• Select realistic performance requirements for retrofits, recognizing technical and financial constraints. • Identify efficient ways of integrating resilience, green design and accessibility upgrades into retrofit approaches.	
G Adopt regulations and policies to guide ongoing retrofits and improvements of existing buildings	• Consider mandatory retrofit requirements for cases of change of occupancy or significant building modifications to improve safety, sustainability and accessibility. • Consider phased requirements based on building typology or use. • Consider incentivizing policies to encourage voluntary retrofits including subsidies, tax deductions, insurance-related mechanisms or preferential treatment with respect to regulatory processes	
H Drive innovation through pilot projects	Leverage the private sector and academia to integrate new research and innovation related to more harmonized approaches for resilient and green design into priority projects that can serve as pilots for learning and development.	
I Improve building control capacity	• Ensure building codes and guidelines are easily accessible online and in local languages. • Use a risk-based approach: allocate more resources to higher-risk projects and streamline processes for lower-risk ones. • Strengthen government oversight capacity for site inspections during construction and for building modifications. • Leverage the private sector to supplement capacity while maintaining oversight and transparency. • Evaluate the need to strengthen certification requirements for building professionals.	

Photo credit: iboter



12.3 THE WAY FORWARD – ENHANCING BUILDING CODES FOR A SAFER, GREENER, AND MORE INCLUSIVE BUILDINGS

Building codes and broader building regulatory frameworks play a critical role in promoting safer, healthier and higher-quality built environments. They have the potential to address critical issues related to disaster resilience and climate change adaptation and mitigation, and to promote more inclusive societies.

This study, albeit broad in scope and from a high-level perspective, can provide a starting point for countries seeking to enhance their building codes and code implementation mechanisms. To establish specific actions and priorities tailored for individual countries, more detailed assessment and collaboration between government and wider stakeholders is needed. Successful implementation will require long-term commitment, adequate resources, and technical capacity development at multiple levels.

To advance the building regulatory agenda and implement the recommendations on a broader scale, partnerships and knowledge sharing are key. Many good examples and models already exist, and learnings from emerging practices and initiatives can be used to improve existing practices. Knowledge accumulated in international code development bodies, such as the European Commission and the International Code Council (ICC), and from international standards bodies, such as the International Organization for Standardization (ISO) and ASTM International (ASTM) can be useful. In addition, knowledge developed in some regions, including in the Caribbean (such as OECS building code for Eastern Caribbean states) and Africa (such as EAC's Standards for construction and building materials), can provide valuable insights.

To promote safe, green, and inclusive built environments, the World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR) initiated a global line of work titled Building Regulation for Resilience (BRR) in 2016. This report is one resource among several other knowledge products developed by the BRR team. The BRR team offers support for countries through analytical work and advisory services including:

- » **Building Regulatory Capacity Assessment (BRCA):** This tool can be applied to understand existing building regulatory frameworks and develop targeted and actionable recommendations for priority reforms and investments. The BRR's Building Regulatory Capacity Assessment methodology 2.0 (BRCA 2.0) can also be extended to include a review of current building control processes to identify potential reforms and explore digitalization opportunities, and to develop a basis for updating building control processes for enhanced efficiency and transparency.
- » **Building Code Checklists:** If a country is developing a building code or updating its existing building code, a suite of Building Code Checklists covering structural resilience, fire safety, green buildings, and universal accessibility can be a useful resource to assess the coverage and scope of provisions in a systematic manner. The checklists were developed based on a review of key elements in global building codes by subject matter experts.
- » **Capacity Building:** The BRR team also supports governments in developing training activities and materials to enhance the capacity of the public or private sector, including government officials involved in building control processes as well as private-sector engineers and architects required to comply with codes and regulations in the design of buildings.

The BRR team leverages partnerships with an international network of experts and professional organizations to offer appropriate support in specific country or regional contexts. The team's objective is to address the needs of individual countries, while continuing to expand the global knowledge base urgently needed to help create a more resilient, green and inclusive built environment.⁵⁹

⁵⁹ For more information, see GFDRR's Building Regulation for Resilience at <https://www.gfdr.org/en/building-regulation-for-resilience>.



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Annex A:

Country Profiles

Annex A contains Country Profiles presenting key data for each country based on the study results. Each Country Profile includes an overview of the results of the assessment of building code contents related to structural safety and resilience, green building, and universal accessibility as well as the assessment of the code implementation environment. Key statistics are also provided for each country.^{1, 2, 3, 4}

The tables in the profiles indicate which evaluation statements were satisfied in the assessment of the country's building code or code implementation environment. A checkmark (✓) in the table indicates that the building code and/or code implementation environment satisfied the statement. Note that the assessment did not evaluate the quality and comprehensiveness of the code provisions in detail. An (✗) in the table indicates that the statement was not satisfied.

- 1 **Total Population data source:** World Bank, 2024. "Total population, based on the United Nations Population Division's World Urbanization Prospects: 2024 Revision." World Bank Databank. <https://data.worldbank.org/indicator/SP.POP.TOTL>
- 2 **Capital city population data source:** United Nations Department of Economic and Social Affairs, Population Division, 2023. Demographic Yearbook 2023. https://unstats.un.org/unsd/demographic-social/products/dyb/dyb_2023/. For capital city population, population is for the 'city proper' except for Mexico City, Mexico, Ankara, Türkiye and Nuku'alofa, Tonga where the population for the capital city urban agglomeration is given.
- 3 **Population in urban areas data source:** World Bank, 2024. "Urban population (% of total population), based on United Nations Population Division. World Urbanization Prospects: 2018 Revision." World Bank Databank. <https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS>
- 4 **Average urban growth data source:** World Bank, 2024. "Urban population growth (annual %), based on the United Nations Population Division's World Urbanization Prospects: 2018 Revision." World Bank Databank. <https://data.worldbank.org/indicator/SP.URB.GROW>

Algeria

142


46.2m
Population

2.7m
Capital city
population

75%
Total population living
in urban areas

2.6%
Average urban growth
(2014–2023)

COUNTRY SUMMARY

Technical regulations in Algeria include dedicated codes for the structural and seismic design of buildings. The general rules governing development, town planning and construction are set out in Executive Decree 91-175. The seismic design code has evolved significantly since its first edition in 1981, through subsequent updates in 1988, 1999, 2003, and 2024. Algerian codes contain provisions for the structural design of reinforced concrete, reinforced masonry, steel, and timber structures. The design of unreinforced masonry (URM) structures is not addressed by the structural design codes as URM construction is prohibited.

The 2024 seismic design code provisions are relatively comprehensive and include a country-specific seismic hazard map. The code permits application of various seismic analysis procedures, including nonlinear static analysis. Although the seismic code includes ductile detailing provisions, it does not define or provide requirements for structures of different ductility levels. The code does not contain provisions related to the structural and seismic evaluation and retrofitting of existing buildings.

Wind provisions were first introduced in the country's regulations in 1999 with updates in 2013. The code addresses the design for buildings up to 200 meters in height, and it contains country-specific wind design criteria for four different regions in the country. However, it does not contain design provisions for nonstructural components of buildings subjected to the effects of strong winds and floods.

Green building regulations are included in a few national standards, including DTR C3T on building thermal regulation (published in 2011). These standards do not include key provisions related to energy efficiency, water efficiency, or building materials.

Universal accessibility provisions are included in Algerian Standard 16227 (2009), based on Decree 06-455 (2005). The application of this standard is currently not mandatory, but the government encourages its application for the design of public buildings.

Algeria's building control legal framework defines general processes; however, it is not easily accessible, and there is no online permitting system. Processes for dispute resolution and requirements for professional registration are defined within the law.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✓
Wind loading	✓	✓	✗	Unreinforced masonry (URM)	✗
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	✗	Not assessed	Not assessed	Earth	✗
Geotechnical Design				Bamboo	✗
Site investigation requirements				Structural Design: Existing Buildings	
Design of foundations				Existing buildings - change of use or occupancy	✗
Design of retaining walls				Existing buildings - additions (extensions)	✗
				Seismic assessment and retrofit	✗

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



Algeria (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✓	Timber lateral resisting systems	✓
Design of nonstructural components	✓	Confined masonry systems	✓
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	✗	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✗	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✗	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✗
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✗
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✗
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✓
		Energy efficiency - HVAC systems and lighting	✗
Horizontal and vertical circulation	✓	Renewable energy	✗
Building facilities (sanitary or other)	✓	Green walls and roofs	✗
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✗
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✗



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	H	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	✓
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	P
Information regarding the building control processes is accessible to the public	✗	The building control framework includes a dispute resolution mechanism	✓
An online approval system is available in the country	✗	The country has professional certification and registration mechanisms	P

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Bhutan



0.79m
Population



0.12m
Capital city
population



44%
Total population living
in urban areas



2.6%
Average urban growth
(2014–2023)

COUNTRY SUMMARY

Bhutan's current building code, published in 2018, is the first in its history. This code (BCB 2018) references Indian codes and standards for the structural design of reinforced concrete and steel buildings since 1997. BCB 2018 does not address the structural design of load-bearing masonry buildings, a common construction typology in Bhutan. Design provisions for timber buildings are outdated and do not fully reflect features of local timber construction typologies.

A seismic hazard map for Bhutan is not available; however, seismic hazard parameters for design purposes are assigned based on the Indian seismic hazard map, and the highest seismic zone V has been assigned for the entire country. That Indian map (from India's IS 1893 standard) was developed on a deterministic basis and does not take into account all relevant earthquake sources for Bhutan. In terms of seismic design and detailing, there are no specific provisions for "ordinary" structural systems with lower ductility levels, nor provisions related to the seismic design of walls for out-of-plane seismic effects, nonstructural elements, or floor/roof diaphragms. Although the code does not contain provisions related to existing buildings, some seismic design considerations for building extensions are contained in Bhutan Building Regulations 2023. The design of vernacular stone masonry buildings is addressed by government guidelines.

The design of building structures for wind is addressed by Indian design standard IS 875 (Part 3), which contains a detailed design

procedure, and has been used in Bhutan since 1997. Design provisions for nonstructural components for the effects of strong winds are currently not in place, and the code does not address the design of building components for the effects of fire or flooding.

Green building design provisions are included in BCB 2018, which refers to Bhutan Green Design Guidelines 2013; however, window-to-wall ratio and energy efficient HVAC systems are not addressed.

Universal accessibility provisions are addressed by BCB 2018 and Guidelines for Differently Abled Friendly Construction 2017. The provisions do not address evacuation and safe egress of building occupants.

The building control legal framework of Bhutan establishes clear procedures. Related documents, including details of different processes, are available online through the webpage of the Ministry of Infrastructure and Transport. There is still no online permitting system, although some attempts have been made to remedy this. Bhutan does not optimize its building control processes based on building categorization, and inadequate staffing constrains the efficiency of the inspection framework.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✗
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✗
Wind loading	✓	✓	✗	Unreinforced masonry (URM)	✓
Seismic loading	✓	✗	✓	Timber	✓
Flood loading	✗	Not assessed	Not assessed	Earth	✗
				Bamboo	✗
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements				Existing buildings - change of use or occupancy	✓
Design of foundations				Existing buildings - additions (extensions)	✓
Design of retaining walls				Seismic assessment and retrofit	✗

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



Bhutan (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✗
Requirements related to building regularity	✓	Steel moment resisting frames	✗
Diaphragm design	✗	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✗	Timber lateral resisting systems	✗
Design of nonstructural components	✗	Confined masonry systems	✗
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	✓	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✗	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✗	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✗
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✗
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✓
		Energy efficiency - HVAC systems and lighting	✗
Horizontal and vertical circulation	✓	Renewable energy	✓
Building facilities (sanitary or other)	✓	Green walls and roofs	✗
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✓
Evacuation and safe egress	✗	Low carbon and/or recycled building materials	✓



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	L	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	P
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	P
Information regarding the building control processes is accessible to the public	✓	The building control framework includes a dispute resolution mechanism	P
An online approval system is available in the country	✗	The country has professional certification and registration mechanisms	✓

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Colombia



52.3m
Population



7.9m
Capital city
population



82%
Total population living
in urban areas



1.7%
Average urban growth
(2014–2023)

COUNTRY SUMMARY

Colombian regulations for structural design and resilience have evolved over time, influenced by historical seismic events. The Colombian Seismic Resistant Construction Regulation (NSR-10) is the current regulatory base, reflecting a comprehensive and modern approach enriched by various areas of governmental and private research. The code began with basic standards in the 1970s and 1980s, evolving to NSR-98 and finally NSR-10, adopting principles from ASCE 7 and other international standards.

NSR-10 provides detailed data on seismic hazards, with seismic hazard maps dividing the country into seismic zones based on seismic activity and defining base design parameters for buildings including maximum ground acceleration and spectral response. Other defined parameters include site coefficients, importance factors, dissipation capacity of structural materials, and degree of building irregularity. Colombian regulations also include a detailed procedure for the analysis and design of certain new buildings to a higher seismic performance standard. They also include provisions for the seismic assessment, rehabilitation and seismic retrofit of existing buildings reflecting the regulatory requirements applicable at the time the building was originally constructed.

For wind design, the regulations include wind-speed maps and exposure classifications based on local conditions. A shortcoming of

NSR-10 is that it does not consider structural or nonstructural design provisions for floods or tsunamis, despite the fact that the country has a large coastal area.

Green building regulations in Colombia established in Resolution #549 of 2015 define mandatory energy and water savings requirements for new buildings according to building typology (such as housing, commercial, or education). Financial incentives at municipal level such as Cali and Bogotá were also introduced in 2023 to encourage green building.

National standards (NTC 6002, 6047 and 4595) include mandatory provisions for the design of new residential, public and educational buildings, including requirements for people with mobility, visual and hearing impairments, among others.

Colombia has a complete legal framework defining building control requirements. While the legal framework is easily accessible through the webpage of the ministry in charge, the online permitting system is not available throughout the country. Supervision of construction is the responsibility of the owner as inspections by government authorities are limited. Colombia requires academic training and professional experience to obtain professional registration for architects and engineers.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✓
Wind loading	✓	✓	✓	Unreinforced masonry (URM)	✓
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	X	Not assessed	Not assessed	Earth	X
Bamboo					✓
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements				Existing buildings - change of use or occupancy	✓
Design of foundations				Existing buildings - additions (extensions)	✓
Design of retaining walls				Seismic assessment and retrofit	✓

(✓) = The country's code satisfied the assessment statement for the topic area.

(X) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



Colombia (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✓	Timber lateral resisting systems	✓
Design of nonstructural components	✓	Confined masonry systems	✓
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	✓	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✓	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✓	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✗
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✗
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✓
		Energy efficiency - HVAC systems and lighting	✓
Horizontal and vertical circulation	✓	Renewable energy	✓
Building facilities (sanitary or other)	✓	Green walls and roofs	✗
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✓
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✓



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	L	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	✓
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	✓
Information regarding the building control processes is accessible to the public	✓	The building control framework includes a dispute resolution mechanism	✓
An online approval system is available in the country	P	The country has professional certification and registration mechanisms	✓

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Chile

148



19.7m
Population



0.54m
Capital city
population



88%
Total population living
in urban areas



1.1%
Average urban growth
(2014–2023)

COUNTRY SUMMARY

Chile has developed a robust regulatory framework for structural design and seismic resilience, influenced by historical experience of devastating earthquakes. Current Chilean regulations are based on the Chilean Standard for Seismic Design of Buildings (NCh433) and other complementary regulations. The code's evolution began in the 1930s, with major revisions following significant earthquakes and the adoption of principles from international standards, such as ACI and ASCE.

NCh433 provides detailed data on seismic hazard, including seismic zoning maps that divide the country by intensity level with design accelerations based on probabilities of exceedance. Chile uses dynamic and static analysis for seismic design, also considering seismic protection systems such as energy dissipators and base isolators. Seismic provisions also include limits on lateral drifts and the use of high ductility materials. Chilean regulations include special requirements for essential structures but no specific designs for hospitals, schools, and so forth. The Ministry of Health incorporated seismic isolation requirements for hospitals, but they are not part of the regulations. The structural rehabilitation and seismic retrofit of existing buildings is not fully detailed in the codes. Single family homes are regulated by municipalities; modifications to homes are generally not carried out by professionals. The code includes some provisions for the seismic design of heritage structures.

For wind, the standards consider basic design speeds and exposure factors, adjusting to specific regional conditions. Pressure coefficients

and structural analysis methods ensure that buildings can withstand significant wind loads. Chile has standards for the elevation and protection of structures in areas exposed to tsunamis, including efficient drainage and flood control systems, but no flood design provisions.

Green building provisions in Chile are regulated by the Ordenanza General de Urbanismo y Construcciones (OGUC), which focuses on public and residential construction. These provisions relate to the thermal performance of the building envelope. National certification for green building will soon be mandatory for public and residential construction.

Chile's universal accessibility regulations are largely mandatory for public buildings or buildings intended for public use. They are currently voluntary for private residences.

Chile has a complete and clear building control framework, and most major municipalities within the country use an online permit system to ensure compliance and issue building permits. The legal framework is accessible online through dedicated webpages. Optimized processes with different requirements and timelines for different building classifications are defined within the regulations, as is the use of an alternative dispute resolution mechanism. Registration with the Ministry of Housing and Urbanism is mandatory for design professionals.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✓
Wind loading	✓	✓	✓	Unreinforced masonry (URM)	✗
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	✗	Not assessed	Not assessed	Earth	✗
Geotechnical Design				Bamboo	✗
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements				Existing buildings - change of use or occupancy	✓
Design of foundations				Existing buildings - additions (extensions)	✓
Design of retaining walls				Seismic assessment and retrofit	✓

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).





TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✓	Timber lateral resisting systems	✓
Design of nonstructural components	✓	Confined masonry systems	✓
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	✓	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✓	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✗	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✗
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✓
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✓
		Energy efficiency - HVAC systems and lighting	✓
Horizontal and vertical circulation	✓	Renewable energy	✓
Building facilities (sanitary or other)	✓	Green walls and roofs	✗
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✓
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✗



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	H	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	✓
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	P
Information regarding the building control processes is accessible to the public	✓	The building control framework includes a dispute resolution mechanism	✓
An online approval system is available in the country	✓	The country has professional certification and registration mechanisms	✓

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



El Salvador



6.3m
Population



0.20m
Capital city
population



75%
Total population living
in urban areas



1.3%
Average urban growth
(2014–2023)

COUNTRY SUMMARY

The design of buildings in El Salvador is governed by the Regulation for the Structural Safety of Constructions of 1996. The regulation provides minimum requirements to ensure the integrity and safety of buildings during seismic and wind events. Salvadoran regulations include design, construction, and inspection criteria for reinforced concrete, steel, wood, and confined and reinforced masonry structures, incorporating international regulations while adapting them to the local context.

Seismic regulations have evolved over time, especially in the aftermath of earthquakes in El Salvador in 1965, 1989, and 1996. Updates to the code are currently under development. Current seismic regulations, based on seismic response spectra and structural behavior factors, define seismic zones and classify soils to calculate fundamental periods. Detailed seismic design requirements are provided relating to ductility and the detailing of reinforcement. However, the current code does not cover provisions related to the nonlinear performance of structures, or for the analysis and design of structures with base isolation devices and supplemental damping systems. The code does not address the seismic retrofit of existing buildings.

Before 1996, El Salvador depended mainly on international regulations and common practices for wind design. Current regulations for wind design establish basic criteria for structural resistance to wind loads

and include reference wind speeds and importance factors based upon building type; however, they lack detailed regionalization. No provisions related to the design of nonstructural components for strong winds are included. Furthermore, there are no provisions related to flooding, tsunami or the fire resistance of structural elements.

National regulations related to green building in El Salvador include only mandatory provisions for energy-efficient equipment for commercial buildings. Regulations covering the metropolitan area of San Salvador include some mandatory provisions for natural lighting and ventilation.

El Salvador has strong universal accessibility policies with comprehensive mandatory provisions for publicly accessible buildings based upon NTS 11.69.01:14.

The regulatory framework in El Salvador thoroughly defines building control processes, which involve a categorization system that defines specific requirements for each project category. Additionally, the planning office of the capital city San Salvador has a dedicated online system allowing users to consult all laws and regulations. The legal framework integrates the use of an Alternative Dispute Resolution Mechanism and mandatory registration of professionals with the Ministry of Housing.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
Natural hazard actions	Load Procedure	Country Specific Criteria	Importance Factor	Confined masonry	✓
Wind loading	✓	✓	✓	Unreinforced masonry (URM)	U
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	✗	Not assessed	Not assessed	Earth	✓
Geotechnical Design				Bamboo	✗
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements				Existing buildings - change of use or occupancy	✓
Design of foundations				Existing buildings - additions (extensions)	✓
Design of retaining walls				Seismic assessment and retrofit	✗

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



El Salvador (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✗	Timber lateral resisting systems	✗
Design of nonstructural components	✓	Confined masonry systems	✓
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	✗	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✗	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✗	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✗
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✗
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✗
		Energy efficiency - HVAC systems and lighting	✓
Horizontal and vertical circulation	✓	Renewable energy	✗
Building facilities (sanitary or other)	✓	Green walls and roofs	✗
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✗
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✗



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	H	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	✓
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	P
Information regarding the building control processes is accessible to the public	✓	The building control framework includes a dispute resolution mechanism	✓
An online approval system is available in the country	✓	The country has professional certification and registration mechanisms	✓

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Ghana



33.8m
Population



1.6m
Capital city
population



59%
Total population living
in urban areas



3.3%
Average urban growth
(2014–2023)

COUNTRY SUMMARY

The 2018 Ghana Building Code (GhBC), based on the 2018 International Building Code and International Green Building Code, is the first legally adopted code in the country. Earlier draft building codes in Ghana referenced British Standards and included seismic provisions as far back as 1988. The GhBC includes extensive seismic and wind design provisions based on US standards for most common reinforced concrete structural systems. Few design provisions for steel, masonry or timber structural systems are provided in the code, and users are referred to US standards that are often not easily accessible. The code also includes occasional references to British Standards and Eurocodes; this lack of a harmonized approach can create inconsistency.

The seismic hazard map in the code is based on a seismic hazard assessment using a deterministic approach. The GhBC has limited provisions for the seismic design of nonstructural components. It also has no provisions for additions to existing buildings or for the seismic assessment and retrofit of existing buildings.

Wind-speed maps have remained mostly unchanged from past draft codes, and their basis is unclear. The GhBC includes provisions for the design of structural and nonstructural components for strong winds.

There are no provisions for flood loading in the current code, although it refers to requirements for buildings in flood hazard zones including requirements to elevate or dry-proof buildings.

The GhBC includes green building requirements for larger private commercial, public, and residential buildings related to solar shading, green or cool roofs, water efficiency, water re-use, energy efficient lighting and HVAC, and solar PV systems.

Comprehensive universal accessibility provisions are incorporated into the GhBC and are mandatory for all public buildings, including existing buildings, based on Disability Act 715 (2006). However, the Act allowed a moratorium on this mandate through 2016, and to date few buildings have incorporated these requirements.

Building control regulations exist in Ghana, albeit with a lack of clarity in many cases. There is no online permitting system, and legal documents are not easy to access. Ghana does not use a system of building classification to improve the efficiency of building permitting. The inspection framework is defined within the building code.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✗
Wind loading	✓	✓	✗	Unreinforced masonry (URM)	✗
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	✗	Not assessed	Not assessed	Earth	✓
Geotechnical Design				Bamboo	✓
Site investigation requirements				Structural Design: Existing Buildings	
Design of foundations				Existing buildings - change of use or occupancy	✓
Design of retaining walls				Existing buildings - additions (extensions)	✗
				Seismic assessment and retrofit	✗

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



Ghana (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✗	Timber lateral resisting systems	✓
Design of nonstructural components	✓	Confined masonry systems	✗
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✗	Flood resistant structural and non-structural materials	✓
Design of roof overhangs/roof cladding	✓	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✓	Requirements to locate critical equipment and/or services above design flood level	✓
Requirements to design façade to resist damage from wind-borne debris	✗	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✓
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✗
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✗
		Energy efficiency - HVAC systems and lighting	✓
Horizontal and vertical circulation	✓	Renewable energy	✓
Building facilities (sanitary or other)	✓	Green walls and roofs	✓
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✓
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✗



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	L	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	✗
Clearly defined building control regulations	P	The building control framework integrates inspections by the authority in charge during the construction process	✓
Information regarding the building control processes is accessible to the public	P	The building control framework includes a dispute resolution mechanism	P
An online approval system is available in the country	✗	The country has professional certification and registration mechanisms	P

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

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Indonesia



281m
Population



10.6m
Capital city
population



59%
Total population living
in urban areas



2.1%
Average urban growth
(2014–2023)

COUNTRY SUMMARY

Current Indonesian building regulations and design standards consist of mandatory government regulations (for example, ministerial regulations) and SNI (Standar Nasional Indonesia) at national level. The SNI standards related to buildings are mostly developed under the coordination of the Ministry of Public Works and Housing and are issued by the National Standardization Agency (BSN). The SNI standards include provisions related to building classification and risk levels, structural design, building services design (mechanical, electrical, and plumbing), fire safety, accessibility, and energy efficiency. Structural design provisions are primarily based on recent US standards.

The country's seismic design standards have evolved over the past 50 years, with the most current standard issued in 2019. It includes an updated seismic hazard map, developed in 2017 for a 2,475-year return period earthquake, and updated design provisions to address lessons learned from past earthquakes internationally and in Indonesia. Although the standards are modeled on well-regarded and up-to-date international building design codes, improvements are still needed to tailor the standards for the Indonesian context. For example, some common forms of construction in Indonesia are not covered in the current seismic design standards, including confined masonry and the

seismic design of infill walls. A seismic assessment and retrofit standard is currently in development although a standard related to retrofit with fiber reinforced polymer (FRP) has already been adopted.

Indonesia's wind provisions use a single basic wind-speed value for all regions including inland and coastal areas, although wind-speed maps are currently under development. Indonesia's SNI standards include selected provisions to address tsunami risk but do not address flooding.

Green building provisions cover most key topic areas, except for provisions for green walls and roofs.

In terms of universal accessibility, there are limited provisions for fixtures and fittings and for egress.

Building control processes are clearly defined within the regulations and are accessible through an electronic platform. The building inspection framework is well defined, and dispute resolution mechanisms as well as certification and registration mechanisms for professionals are defined within the existing legal framework.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✗
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✗
Wind loading	✓	✗	✗	Unreinforced masonry (URM)	✗
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	✗	Not assessed	Not assessed	Earth	✗
Geotechnical Design				Bamboo	✗
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements				Existing buildings - change of use or occupancy	✗
Design of foundations				Existing buildings - additions (extensions)	✗
Design of retaining walls				Seismic assessment and retrofit	✗

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).

Indonesia (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✓	Timber lateral resisting systems	✓
Design of nonstructural components	✓	Confined masonry systems	✗
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✗	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	✗	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✓	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✓	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✗
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✓
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✗
		Energy efficiency - HVAC systems and lighting	✓
Horizontal and vertical circulation	✓	Renewable energy	✓
Building facilities (sanitary or other)	✓	Green walls and roofs	✗
Building fixtures and fittings	✗	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✓
Evacuation and safe egress	U	Low carbon and/or recycled building materials	✓



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	N	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	P
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	✓
Information regarding the building control processes is accessible to the public	✓	The building control framework includes a dispute resolution mechanism	✓
An online approval system is available in the country	P	The country has professional certification and registration mechanisms	✓

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

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Mexico



130m
Population



22m
Capital city
population



82%
Total population living
in urban areas



1.3%
Average urban growth
(2014–2023)

COUNTRY SUMMARY

Mexico is a federal republic with a political, administrative, and legal structure that provides flexibility and autonomy to its regions while promoting national unity. Mexico City is governed by the Federal District Building Code, first issued in the 1920s and last updated in 2021. It promotes the safety, accessibility, and sustainability of buildings, covering architectural design, materials, fire safety, and structural and nonstructural design for seismic and wind loads. Mexico City's regulations reflect the country's commitment to developing and staying current with the latest design methodologies. Design standards exist for concrete, steel, masonry, wood, and foundations.

The Complementary Technical Norm for Seismic Design in Mexico City, last updated in 2023, ensures structural safety against earthquakes. It considers seismic microzoning and new methodologies for structural analysis and design, including requirements for seismic damping and isolation systems. Recent earthquakes have pushed the country to improve seismic assessments and rehabilitation norms to repair buildings following seismic events, positioning Mexico as a leader in Latin America in reflecting the latest advancements in seismic design and engineering in its code.

Similarly, the Complementary Technical Norm for Wind Design in Mexico City, last updated in 2023, determines wind loads based on speed and topography, considering turbulence and pressure effects. It includes formulas for calculating forces, requirements for nonstructural components, and guidelines for building stability and safety. Seismic and wind resilience requirements for school and health care

facilities are also included in the design standards. Standards for flood design have not been developed even though areas of Mexico City are exposed to a high risk of flooding during extreme rain events.

Mexico has mandatory and voluntary standards for green building at the federal level focused on energy efficiency and renewable energy, including lighting, thermal envelope, mechanical systems, and cooling systems. NMX-AA-164-SCFI-2013 is a national voluntary standard for sustainable building, applicable to all types of buildings in all sectors, new and existing. It includes provisions for site management, energy consumption and water savings.

Mexico has a law at the federal level mandating universal accessibility; however, specific provisions are given at the state level, including the Complementary Technical Norm for Architectural Projects of the Mexico City Building Code, which includes robust and comprehensive considerations for public buildings, public spaces, and transport infrastructure.

States and municipalities within Mexico each define their own building control processes in their regulations. Most states have developed online permitting systems and make related laws and regulations available online. Mexico City uses a project classification system to define specific requirements relating to the hiring of professionals for plan review and the supervision of works. Additionally, all building professionals must be registered by the responsible Ministry.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
Natural hazard actions	Load Procedure	Country Specific Criteria	Importance Factor	Confined masonry	✓
Wind loading	✓	✓	✓	Unreinforced masonry (URM)	✓
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	X	Not assessed	Not assessed	Earth	✓
Geotechnical Design				Bamboo	✓
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements				Existing buildings - change of use or occupancy	✓
Design of foundations				Existing buildings - additions (extensions)	✓
Design of retaining walls				Seismic assessment and retrofit	✓

(✓) = The country's code satisfied the assessment statement for the topic area.

(X) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



Mexico (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✓	Timber lateral resisting systems	✓
Design of nonstructural components	✓	Confined masonry systems	✓
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	✓	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✓	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✗	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✗
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✓
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✓
		Energy efficiency - HVAC systems and lighting	✓
Horizontal and vertical circulation	✓	Renewable energy	✓
Building facilities (sanitary or other)	✓	Green walls and roofs	✓
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✓
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✓



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	L	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	✓
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	P
Information regarding the building control processes is accessible to the public	✓	The building control framework includes a dispute resolution mechanism	✓
An online approval system is available in the country	✓	The country has professional certification and registration mechanisms	✓

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Mongolia



3.5m
Population



1.7m
Capital city
population



69%
Total population living
in urban areas



2.0%
Average urban growth
(2014–2023)

COUNTRY SUMMARY

Dedicated national codes are in place in Mongolia for the structural design of reinforced concrete structures, as well as reinforced and unreinforced masonry, timber and steel structures.

The national seismic design code, BNbD 22-01-21, issued in 2022, is based on the 2018 Russian Seismic Design Code and includes a country-specific seismic hazard map for design earthquakes with return periods of 500 and 2,500 years. Seismic intensity ranges from V to X on the MSK-64 scale, depending on the site location. The code provisions address various seismic analysis and design aspects. The code does not include provisions for the seismic design and ductile detailing of reinforced concrete, steel, timber and masonry structures. It also lacks provisions for the seismic design of walls, for out-of-plane seismic effects, and for the design of existing buildings or small buildings.

The design of structures for wind loads is addressed by a dedicated national code, BNbD 20-04-17, issued in 2017 based on a Soviet code. Country-specific wind design criteria for different regions of the country are included in the climate and geophysics code, BNbD 23-01-09.

Some provisions related to the design of structural and nonstructural elements for the effects of strong winds have been addressed by the relevant codes. A dedicated code addresses the design of building components for fire resistance.

Green building design provisions are not included in the current codes in Mongolia.

Universal accessibility provisions are addressed by a dedicated national code published in 2022. The code is mandatory for new buildings, including residential buildings, public buildings, and factories. The provisions address accessibility needs for a variety of disabilities.

Mongolia's regulations related to building control are relatively comprehensive and available online to users. Mongolia has an online permitting system that was developed in 2019. Specific requirements of the building control process are based on a project categorization system. Inspection tasks are undertaken by municipalities, specific state agencies or certified private firms depending on a project's scale.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings			U	Reinforced concrete	✓
Dead and live loads specified			✓	Structural steel	✓
Load combinations			✓	Reinforced masonry	✓
Natural hazard actions	Load Procedure	Country Specific Criteria	Importance Factor	Confined masonry	✗
Wind loading	✓	✓	✓	Unreinforced masonry (URM)	✓
				Timber	✓
Seismic loading	✓	✓	✓	Earth	✗
Flood loading	✗	Not assessed	Not assessed	Bamboo	✗
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements			✓	Existing buildings - change of use or occupancy	✗
Design of foundations			✓	Existing buildings - additions (extensions)	✗
Design of retaining walls			✓	Seismic assessment and retrofit	✗

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



Mongolia (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	X
Drift limits	✓	Concrete shear walls	X
Requirements related to building regularity	✓	Steel moment resisting frames	X
Diaphragm design	✓	Steel braced frames	X
Design of advanced systems (base isolation, dampers)	U	Timber lateral resisting systems	X
Design of nonstructural components	✓	Confined masonry systems	X
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	X
Design of roof overhangs/roof cladding	✓	Limitations on occupied zones below the design flood level	X
Requirements to design façade cladding and appendages to resist strong winds	✓	Requirements to locate critical equipment and/or services above design flood level	X
Requirements to design façade to resist damage from wind-borne debris	X	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	X
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	X
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	X
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	X
		Energy efficiency - HVAC systems and lighting	X
Horizontal and vertical circulation	✓	Renewable energy	X
Building facilities (sanitary or other)	✓	Green walls and roofs	X
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	X
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	X



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	N	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	✓
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	✓
Information regarding the building control processes is accessible to the public	✓	The building control framework includes a dispute resolution mechanism	P
An online approval system is available in the country	✓	The country has professional certification and registration mechanisms	✓

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Morocco



37.7m
Population



0.54m
Capital city
population



65%
Total population living
in urban areas



2.0%
Average urban growth
(2014–2023)

COUNTRY SUMMARY

The codes and standards specified for the structural design of public buildings in Morocco are a variety of independent standards, most of which are derived from French standards. In France, meanwhile, many of those French reference standards have been superseded by the Eurocode, leading to a lack of clarity in approach for Moroccan engineers, particularly for reinforced concrete and steel structural design. Even though Moroccan law requires private buildings to be designed by an accredited structural firm for permitting, it does not impose specific design codes or standards.

The first seismic design standards were published in 1960 following the Agadir earthquake. Current Seismic Construction Regulations (RPS2000), based upon French standards, were last updated in 2011 and are currently being updated. RPS2000 applies both to new buildings and changes to existing buildings. It includes two seismic hazard maps with five zones. To facilitate implementation of the seismic code, the Moroccan government issued a practical guide to using the code in 2023. It contains basic guidance on change of use and extensions to existing buildings, including seismic assessment and retrofit. A separate standard published in 2013 covers seismic regulations for earthen construction.

Wind-loading calculations are based on a Moroccan wind-speed map in a specifications document (CPC) issued by the Ministry of Water and Equipment that indirectly references the French standard NV65.

Eurocode 1 is also used in practice, and a Moroccan version of it is in development. Wind standards have limited provisions for the design of nonstructural components in strong winds. Moroccan regulations have no provisions for the design of buildings in flood hazard areas.

Considerable efforts have been made to improve the energy efficiency of buildings in Morocco, including a 2014 decree specifying both prescriptive and performance-based energy-efficiency requirements for new residential and tertiary buildings as well as actions to support the implementation of the energy-efficiency measures through communication, awareness-raising and training.

Morocco has adopted a law on accessibility and decrees to implement it with the ISO standard for universal accessibility (Moroccan version NM) addressing all major topic areas, as well as a technical guide for applying the accessibility rules. The rules are mandatory for most types of public buildings including collective housing and transport infrastructure.

The country has a complete building control legal framework, and online permitting systems are available in most of the major provinces of the country. Legislation is available through dedicated webpages. With the exception of engineers designing private buildings, building professionals must be registered and certified to work in the country.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✓
Wind loading	✓	✓	✓	Unreinforced masonry (URM)	✓
Seismic loading	✓	✓	✓	Timber	✗
Flood loading	✗	Not assessed	Not assessed	Earth	✓
Geotechnical Design				Bamboo	✗
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements				Existing buildings - change of use or occupancy	✓
Design of foundations				Existing buildings - additions (extensions)	✓
Design of retaining walls				Seismic assessment and retrofit	✓

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



Morocco (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✗	Timber lateral resisting systems	✗
Design of nonstructural components	✓	Confined masonry systems	✓
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	✓	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✗	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✗	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✗
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✓
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✓
		Energy efficiency - HVAC systems and lighting	✓
Horizontal and vertical circulation	✓	Renewable energy	✓
Building facilities (sanitary or other)	✓	Green walls and roofs	✓
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✗
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✗



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	L	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	✓
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	✓
Information regarding the building control processes is accessible to the public	✓	The building control framework includes a dispute resolution mechanism	✓
An online approval system is available in the country	✓	The country has professional certification and registration mechanisms	P

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Mozambique



33.6m
Population



1.1m
Capital city
population



39%
Total population living
in urban areas



4.4%
Average urban growth
(2014–2023)

162

COUNTRY SUMMARY

Mozambique's legally adopted building design codes are based on former Portuguese codes from the colonial period and lack country-specific design provisions. These codes offer limited and outdated provisions, particularly for structural design. More recent design guidance has been adopted for schools, including some country-specific recommendations for design to resist seismic and wind loads. There are no provisions related to flooding or the design of nonstructural components for strong wind events.

Mozambique does not have any green building regulation at present although this could be developed in the future to support climate action as part of Mozambique's Nationally Determined Contribution (NDC) Roadmap 2020–2025.

For universal accessibility, a 2008 regulation includes some basic provisions for new buildings and the adaptation of existing buildings for improved access.

Although a building permit process is defined for the municipality of Maputo, there is no online approval system available in Mozambique, and information on building control processes is very limited (and difficult to access due to internet constraints). Inspection-related processes are insufficient, and no building categorization system is available to improve building control efficiency.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✗
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✗
Wind loading	✓	✗	✗	Unreinforced masonry (URM)	✗
Seismic loading	✓	✗	✗	Timber	✗
Flood loading	✗	Not assessed	Not assessed	Earth	✗
Bamboo					✗
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements				Existing buildings - change of use or occupancy	✗
Design of foundations				Existing buildings - additions (extensions)	✓
Design of retaining walls				Seismic assessment and retrofit	✗

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



Mozambique (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	X	Concrete moment frames	X
Drift limits	X	Concrete shear walls	X
Requirements related to building regularity	X	Steel moment resisting frames	X
Diaphragm design	X	Steel braced frames	X
Design of advanced systems (base isolation, dampers)	X	Timber lateral resisting systems	X
Design of nonstructural components	X	Confined masonry systems	X
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	X	Flood resistant structural and non-structural materials	X
Design of roof overhangs/roof cladding	X	Limitations on occupied zones below the design flood level	X
Requirements to design façade cladding and appendages to resist strong winds	X	Requirements to locate critical equipment and/or services above design flood level	X
Requirements to design façade to resist damage from wind-borne debris	X	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	X
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	X
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	X
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	X
		Energy efficiency - HVAC systems and lighting	X
Horizontal and vertical circulation	✓	Renewable energy	X
Building facilities (sanitary or other)	✓	Green walls and roofs	X
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	X
Evacuation and safe egress	X	Low carbon and/or recycled building materials	X



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	L	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	P
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	P
Information regarding the building control processes is accessible to the public	P	The building control framework includes a dispute resolution mechanism	✓
An online approval system is available in the country	X	The country has professional certification and registration mechanisms	P

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

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Nepal



29.7m
Population



0.86m
Capital city
population



22%
Total population living
in urban areas



2.8%
Average urban growth
(2014–2023)

COUNTRY SUMMARY

Dedicated codes for the architectural, structural, and seismic design of buildings are in place in Nepal, but current codes related to the structural design of reinforced concrete, steel, and timber are based on the corresponding Indian codes. Although masonry construction is common in Nepal, the design of modern masonry structures, for example, reinforced masonry with hollow concrete blocks and confined masonry, is not addressed by the codes.

Nepal's first seismic design code was published in 1994 and updated in 2020. Seismic design provisions address relevant aspects and include a country-specific seismic hazard map. In terms of seismic design and detailing, the code does not contain specific provisions for limited ductility reinforced concrete systems which are common in local construction practice. Provisions related to the seismic design of walls for out-of-plane seismic effects, and floor/roof diaphragms are also missing. Although the codes do not contain provisions for existing buildings, a separate guideline for vulnerability assessments of private and public buildings is used for seismic assessment purposes in practice. Provisions related to the design of small buildings are addressed by dedicated standards containing prescriptive rules related to nonengineered masonry and reinforced concrete buildings.

The design of structures for wind loads has been addressed by a dedicated code since 1994. The code does not contain wind design

criteria for specific sites, but the country has been divided into two zones based on wind speed. The codes do not address the design of building components for the effects of fire or flooding.

Limited green building provisions are included in NBC 206:2015, which outlines architectural design requirements and prescribes mandatory daylighting and natural ventilation requirements.

Universal accessibility provisions, addressed by NBC 206:2015, are mandatory for all buildings; however, the buildings are classified as partially or fully accessible. Most buildings, with the exception of hospitals and large public buildings, are required to be only partially accessible, which does not enable adequate access. These provisions are also limited to persons with motor disabilities.

Nepal's building control framework is defined at municipal level in specific by-laws. It is not easily accessible to users despite the existence of building permit systems for different municipalities throughout the country, including Kathmandu. Specific processes for building permit issuance and inspection are defined for different types of buildings. Professional registration is required for architects, engineers and contractors, and specific related processes are also available online.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✗
Wind loading	✓	✓	✓	Unreinforced masonry (URM)	✓
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	✗	Not assessed	Not assessed	Earth	✓
Geotechnical Design				Bamboo	✓
Site investigation requirements				Structural Design: Existing Buildings	
Design of foundations				Existing buildings - change of use or occupancy	✗
Design of retaining walls				Existing buildings - additions (extensions)	✗
				Seismic assessment and retrofit	✗

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).





TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✗	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✗	Timber lateral resisting systems	✗
Design of nonstructural components	✓	Confined masonry systems	✗
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	U	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	U	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✗	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✗
Universal Accessibility		Green Building	
External environment	✗	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✗
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✗
		Energy efficiency - HVAC systems and lighting	✗
Horizontal and vertical circulation	✓	Renewable energy	✗
Building facilities (sanitary or other)	✓	Green walls and roofs	✗
Building fixtures and fittings	✗	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✗
Evacuation and safe egress	✗	Low carbon and/or recycled building materials	✗



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	L	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	✓
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	✓
Information regarding the building control processes is accessible to the public	P	The building control framework includes a dispute resolution mechanism	P
An online approval system is available in the country	✓	The country has professional certification and registration mechanisms	✓

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

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Peru



33.8m
Population



11.3m
Capital city
population



79%
Total population living
in urban areas



1.5%
Average urban growth
(2014–2023)

COUNTRY SUMMARY

Although Peruvian construction regulations date back to the 1940s, development of its seismic codes formally began around 1970. Peru regularly updates its building regulations through a permanent committee to ensure continuity of efforts and the integration of best practices in the sector and region. In recent decades, seismic and wind provisions have improved with each update, incorporating data developed by national institutes and associations, both private and public. Peruvian regulations are based on international standards including ACI and ASCE.

Peru has incorporated some regulations for seismic resilience, including seismic base isolation requirements for hospitals and other health care facilities. The country has established building standards for traditional materials such as reinforced earth and bamboo to support the safe construction of homes. Specific requirements for the seismic assessment and retrofit of existing buildings are not included in the code, but a US guideline for incremental retrofit is referenced (FEMA P-420).

Although Peru has simplified wind-loading design procedures, it has no dynamic procedures or provisions for the design of components and cladding in strong winds, mainly because wind events have been less damaging historically than earthquakes. Although regulatory efforts have been initiated related to providing facilities for vertical

evacuation in the event of tsunamis, there are no comprehensive provisions related to the risk of tsunamis, nor any flood-related loading and design provisions.

Green building design in Peru has a solid national basis in the Technical Code for Sustainable Construction (CTCS), created in 2015 and updated in 2021, including mandatory provisions for public buildings and voluntary provisions for residential buildings. The main scope of CTCS includes the building envelope, water savings, daylighting and indoor environmental quality. Peru also has regulatory incentives at the district level for sustainable construction.

Peru has robust and comprehensive universal accessibility policies, based on laws complemented by national plans for 2030 that are technically regulated by NT A.120 requiring that public and residential buildings integrate universal accessibility in their design.

Building control processes are well defined within regulations, and laws and regulations are available online through the webpage of the ministry in charge. However, the use of an online permit system varies across municipalities and is not yet universally applied. The general process integrates a project categorization system and the participation of third parties for inspection-related tasks.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✓
Wind loading	✓	✓	✗	Unreinforced masonry (URM)	✓
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	✗	Not assessed	Not assessed	Earth	✓
Geotechnical Design				Bamboo	✓
Site investigation requirements				Structural Design: Existing Buildings	
Design of foundations				Existing buildings - change of use or occupancy	✗
Design of retaining walls				Existing buildings - additions (extensions)	✗
				Seismic assessment and retrofit	✓

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



Peru (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✓	Timber lateral resisting systems	✓
Design of nonstructural components	✓	Confined masonry systems	✓
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✗	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	✗	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✗	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✗	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✗
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✗
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✓
		Energy efficiency - HVAC systems and lighting	✓
Horizontal and vertical circulation	✓	Renewable energy	✓
Building facilities (sanitary or other)	✓	Green walls and roofs	✓
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✓
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✓



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	L	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	✓
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	✓
Information regarding the building control processes is accessible to the public	✓	The building control framework includes a dispute resolution mechanism	✓
An online approval system is available in the country	P	The country has professional certification and registration mechanisms	✓

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Philippines



115m
Population



1.8m
Capital city
population



48%
Total population living
in urban areas



1.7%
Average urban growth
(2014–2023)



COUNTRY SUMMARY

The Philippines has a well-established building regulatory framework that contains building design codes addressing key aspects related to structural safety, green building and accessibility as well as building control regulations for implementation. The building design code was last updated in 2015 with complete procedures to develop country-specific wind and seismic design criteria based on country-specific maps. The code provisions are based on US codes and standards (UBC 1997, IBC 2009, ASCE 7-10 and other referenced US material standards). Areas where the structural design provisions could be strengthened include additional provisions for the design of retaining walls, provisions for the design of seismic isolation systems, and inclusion of design provisions for confined masonry buildings and vernacular timber building types. In addition, the code lacks simplified structural design provisions for the design and construction of common, small-scale building types. For existing buildings, there is a need to develop provisions for assessment and retrofit as well as to clarify requirements for building modifications and changes of occupancy. Further advancements in the regulations could be made for provisions to address resilience to strong wind events and flooding.

The green building code has mandatory requirements for buildings above a certain total plan area (10,000 m² for most building types). It has some gaps in provisions, including for green roofs, building orientation, renewables, use of recycled materials and low embodied energy design.

For universal accessibility, the code covers most key topics, and provisions are mandatory for public buildings and spaces of public use as well as for changes of occupancy to existing public buildings.

The Philippines' building control framework establishes clearly defined processes, aided by an online permit system available in various municipalities and easy online access to legal documents. The inspection framework is well defined and integrates the participation of various stakeholders such as fire services. An appeal process and dispute resolution mechanism are in place to address conflicts.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✗
Wind loading	✓	✓	✓	Unreinforced masonry (URM)	✓
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	✓	Not assessed	Not assessed	Earth	✗
Geotechnical Design				Bamboo	✗
Site investigation requirements				Structural Design: Existing Buildings	
Design of foundations				Existing buildings - change of use or occupancy	✓
Design of retaining walls				Existing buildings - additions (extensions)	✗
				Seismic assessment and retrofit	✗

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



Philippines (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✗	Timber lateral resisting systems	✓
Design of nonstructural components	✓	Confined masonry systems	✗
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	✓	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✓	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✓	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✗
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✓
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✓
		Energy efficiency - HVAC systems and lighting	✓
Horizontal and vertical circulation	✓	Renewable energy	✗
Building facilities (sanitary or other)	✓	Green walls and roofs	✗
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✓
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✗



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	L	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	P
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	✓
Information regarding the building control processes is accessible to the public	✓	The building control framework includes a dispute resolution mechanism	✓
An online approval system is available in the country	✓	The country has professional certification and registration mechanisms	✓

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Rwanda



14.0m
Population



0.86m
Capital city
population



18%
Total population living
in urban areas



2.8%
Average urban growth
(2014–2023)

COUNTRY SUMMARY

The 2019 Rwanda Building Code (RBC) has been updated every two to five years since its origin in 2006. It includes many reference standards, available for a fee, where the detailed design requirements are typically provided. Some of these are Rwanda Standards which are largely based on Eurocodes while others reference ISO codes. For timber and unreinforced masonry, there are some simple provisions within the code; however, detailed design codes have not been referenced.

Rwanda's seismic provisions were created in 2015, when a single Peak Ground Acceleration (PGA) for seismic design was established for the entire country. In 2023, seismic hazard was divided into three PGA values assigned by district. There is evidence to suggest this is still somewhat conservative and could be further refined. The code references ISO 3010 for seismic design, which includes high-level principles. It has limited provisions for detailed seismic design for buildings of different importance, materials, ductilities, ground conditions, and so on. This lack of specificity leaves decisions to the market and could result in wide-ranging variations in building safety and resilience. The code does not include provisions for the seismic retrofit of existing buildings.

Wind design is covered in RS 114-2, which largely uses a Eurocode methodology. It includes a wind map and typical wind pressures. The

RBC does not specifically cover strong winds except to say that buildings should be reinforced accordingly. It is generally advised not to build in flood-prone areas, but where this is unavoidable, flood design loading and the effects of scour on foundations are included in the RBC.

The Green Building Minimum Compliance System is an Annex to the RBC. It is applicable to various nonresidential building types and comprises five focus areas with indicators, some of which are mandatory, targeting energy efficiency, water efficiency, environmental protection, indoor environmental quality, innovation and other green features.

Mandatory requirements for universal accessibility can be found in referenced standard RS 115 covering mostly physical and sensory disabilities and varying between basic and detailed coverage on different areas.

Rwanda possesses a complete and sound legal framework regarding building control, accessible through the webpage of the Rwanda Housing Authority. An online permit system has existed since 2013, was updated in 2017, and is now available in six secondary cities. Regulations are also in place to frame and define the roles and responsibilities of professionals in the construction sector.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✗
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✗
Wind loading	✓	✓	✓	Unreinforced masonry (URM)	✓
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	✓	Not assessed	Not assessed	Earth	✓
Geotechnical Design				Bamboo	✓
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements				Existing buildings - change of use or occupancy	✓
Design of foundations				Existing buildings - additions (extensions)	✓
Design of retaining walls				Seismic assessment and retrofit	✗

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



Rwanda (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✗
Drift limits	✓	Concrete shear walls	✗
Requirements related to building regularity	✓	Steel moment resisting frames	U
Diaphragm design	✗	Steel braced frames	U
Design of advanced systems (base isolation, dampers)	✗	Timber lateral resisting systems	✗
Design of nonstructural components	✗	Confined masonry systems	✗
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✗	Flood resistant structural and non-structural materials	✓
Design of roof overhangs/roof cladding	✗	Limitations on occupied zones below the design flood level	✓
Requirements to design façade cladding and appendages to resist strong winds	✗	Requirements to locate critical equipment and/or services above design flood level	✓
Requirements to design façade to resist damage from wind-borne debris	✗	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✓
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✓
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✓
		Energy efficiency - HVAC systems and lighting	✓
Horizontal and vertical circulation	✓	Renewable energy	✓
Building facilities (sanitary or other)	✓	Green walls and roofs	✓
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✓
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✓



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	H	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	✓
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	P
Information regarding the building control processes is accessible to the public	✓	The building control framework includes a dispute resolution mechanism	P
An online approval system is available in the country	✓	The country has professional certification and registration mechanisms	✓

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Samoa



0.22m
Population



0.036m
Capital city
population



18%
Total population living
in urban areas



-0.1%
Average urban growth
(2014–2023)



COUNTRY SUMMARY

The island nation's current building regulation is the 2017 National Building Code (NBC) of Samoa, a performance-based code that references Australian, New Zealand and joint Australian/New Zealand standards (AS/NZS) as "deemed to satisfy". These international standards define loading and design provisions for reinforced concrete, steel, timber and other common structures. The NBC has no explicit provisions for the design of foundations and retaining walls. Design provisions for traditional small buildings indigenous to Samoa, including those constructed from biomass materials, are not covered by the NBC; however, some guidance on these types of buildings may be available independently of the NBC.

For seismic loading, the NBC refers to a superseded NZ standard with the seismic zone factor adjusted to 1.05 for all of Samoa. Incompatibility between the superseded NZ standard and currently enforced joint AS/NZS loading standards creates confusion in the seismic provisions. While the NBC is applicable to alterations and extensions of existing buildings, it has no provisions for the seismic assessment and retrofit of buildings.

For wind loading, the NBC refers to a joint AS/NZS with the basic wind speed amended to 70 m/sec across Samoa for ultimate limit

state. Inconsistencies between NBC and AS/NZS reference standards related to wind speed and importance factors create ambiguity in how to determine wind loads. It includes a few basic provisions for the design of nonstructural components in strong winds. The NBC does not restrict building in flood hazard areas, and it includes some provisions for flood loading on buildings, and material and design requirements for building below the design flood level.

The NBC includes mandatory green building requirements for some types of buildings as well as voluntary provisions related to energy efficiency, renewable energy, water efficiency and low embodied energy building materials. The NBC covers all main categories of provisions for universal accessibility at a basic level, including both voluntary and mandatory provisions, focusing on larger facilities and those serving essential disaster and community functions.

The legal framework for building control in Samoa is outdated and lacks detailed regulations, requirements and related information. Legal documents are not easily accessible, and there is no online permit system in the country. Regulations related to site inspection tasks as well as professional registration processes and requirements are insufficiently detailed.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
Natural hazard actions	Load Procedure	Country Specific Criteria	Importance Factor	Confined masonry	✗
Wind loading	✓	✓	✗	Unreinforced masonry (URM)	✗
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	✓	Not assessed	Not assessed	Earth	✗
				Bamboo	✗
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements				Existing buildings - change of use or occupancy	✓
Design of foundations				Existing buildings - additions (extensions)	✓
Design of retaining walls				Seismic assessment and retrofit	✗

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



Samoa (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✗	Timber lateral resisting systems	✓
Design of nonstructural components	✓	Confined masonry systems	✗
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	✓
Design of roof overhangs/roof cladding	✓	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✓	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✗	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✓
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✗
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✓
		Energy efficiency - HVAC systems and lighting	✓
Horizontal and vertical circulation	✓	Renewable energy	✓
Building facilities (sanitary or other)	✓	Green walls and roofs	✓
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✓
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✓



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	N	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	✗
Clearly defined building control regulations	✗	The building control framework integrates inspections by the authority in charge during the construction process	✗
Information regarding the building control processes is accessible to the public	✗	The building control framework includes a dispute resolution mechanism	P
An online approval system is available in the country	✗	The country has professional certification and registration mechanisms	P

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



South Africa



63.2m
Population



0.74m
Capital city
population



69%
Total population living
in urban areas



2.2%
Average urban growth
(2014–2023)

174

COUNTRY SUMMARY

South Africa has a well-established set of national level building standards for structural design, first enacted in 1989 with the latest major revision in 2020/2021. The standards are predominantly based on British Standards (as in use in the UK before Eurocodes took effect). The structural provisions are well developed and comprehensive but could benefit from the addition of advanced analytical procedures for seismic and wind analyses (such as nonlinear procedures for seismic design and procedures for considering the dynamic effects of wind). The standards also lack provisions addressing the seismic assessment and retrofit of existing buildings. Another area for improvement would be to develop and formally adopt simplified structural design provisions (or 'rules of thumb') for small-scale structures to reduce the cost and complexity of code implementation for common types of buildings. Structural and architectural provisions relating to resilience to flooding and strong wind events could be expanded and improved.

The country has energy and water efficiency regulations which contain a mix of mandatory and voluntary provisions. Areas where green building provisions could be enhanced include additional provisions for passive measures to improve energy efficiency and comfort such as daylighting, natural ventilation, cool and green roofs, and requirements focused on reducing the embodied carbon footprint of buildings.

Universal accessibility regulations could be strengthened. The code has some basic provisions in place for key topics, but provisions are voluntary, lack detail, and focus predominantly on motor disabilities.

South Africa has high-quality practices for building control, including a complete and easily accessible legal framework, and public online approval systems. Additionally, the legal framework integrates professional certification and registration as well as specific processes for building inspections at different stages of construction.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
Natural hazard actions	Load Procedure	Country Specific Criteria	Importance Factor	Confined masonry	✗
Wind loading	✓	✓	✓	Unreinforced masonry (URM)	✓
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	✓	Not assessed	Not assessed	Earth	✗
Geotechnical Design				Bamboo	✗
Site investigation requirements				Structural Design: Existing Buildings	
Design of foundations				Existing buildings - change of use or occupancy	✗
Design of retaining walls				Existing buildings - additions (extensions)	✓
				Seismic assessment and retrofit	✗

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



South Africa (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✗	Timber lateral resisting systems	✗
Design of nonstructural components	✓	Confined masonry systems	✗
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✗	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	✓	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✓	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✗	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✓
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✗
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✗
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✓
		Energy efficiency - HVAC systems and lighting	✓
Horizontal and vertical circulation	✓	Renewable energy	✓
Building facilities (sanitary or other)	✓	Green walls and roofs	✗
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✓
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✗



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	L	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	P
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	✓
Information regarding the building control processes is accessible to the public	✓	The building control framework includes a dispute resolution mechanism	✓
An online approval system is available in the country	✓	The country has professional certification and registration mechanisms	✓

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Tajikistan



10.4m
Population



0.82m
Capital city
population



28%
Total population living
in urban areas



2.9%
Average urban growth
(2014–2023)

176

COUNTRY SUMMARY

Dedicated national codes, based on codes from the Soviet Union and the Russian Federation, address the structural design of reinforced and precast concrete structures, reinforced and confined masonry, and steel structures. The design of timber structures is not addressed. A dedicated code on the structural design of high-rise buildings was issued in 2021.

The first national seismic design code in Tajikistan was issued in 2000, and was subsequently updated in 2007, 2013, 2015, and 2019. Code provisions address various seismic analysis and design aspects and include a country-specific deterministic seismic hazard map. The basic seismic analysis procedure is response spectrum method; however, response history analysis is required for buildings taller than 50 meters, new structural systems, and buildings equipped with seismic isolation and/or supplemental damping systems. The code does not include relevant provisions for the design and detailing of ductile reinforced concrete, steel, and masonry structures. Prescriptive provisions are included for the seismic design of nonstructural elements and out-of-plane seismic effects. Provisions related to existing buildings are included, but simplified procedures for the design of small-scale buildings is not addressed by the codes.

The design of structures for wind loads is addressed by a dedicated national code, issued in 2016, which contains country-specific wind

design criteria for different regions. The design of structural and nonstructural elements for the effects of strong winds and floods is addressed by relevant codes and standards. Some flood-related design provisions exist but do not address flood loading on structures. A dedicated code addresses the design of building components for fire resistance.

Some green building design provisions are included in dedicated standards, but they do not fully address relevant aspects of energy efficiency, water efficiency, or building materials.

Universal accessibility provisions are addressed by a dedicated national code, published in 2013, based on the corresponding code from the Russian Federation. The code is mandatory for new and existing buildings, and the provisions to some extent address accessibility needs for different types of disabilities. As the concept of universal accessibility is new in Tajikistan, it is expected that the provisions will evolve in future versions of the code.

Basic building control processes are defined within the legal framework; however, elements are scattered throughout different documents, limiting their effective application. There is no online permitting system in the country and no certification and registration system for building professionals.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✓
Wind loading	✓	✓	✗	Unreinforced masonry (URM)	✓
Seismic loading	✓	✓	✓	Timber	✗
Flood loading	✗	Not assessed	Not assessed	Earth	✓
				Bamboo	✗
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements				Existing buildings - change of use or occupancy	✓
Design of foundations				Existing buildings - additions (extensions)	✓
Design of retaining walls				Seismic assessment and retrofit	✓

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



Tajikistan (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✗
Drift limits	✓	Concrete shear walls	✗
Requirements related to building regularity	✓	Steel moment resisting frames	✗
Diaphragm design	✓	Steel braced frames	✗
Design of advanced systems (base isolation, dampers)	✗	Timber lateral resisting systems	✗
Design of nonstructural components	✓	Confined masonry systems	✗
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	✓
Design of roof overhangs/roof cladding	✓	Limitations on occupied zones below the design flood level	✓
Requirements to design façade cladding and appendages to resist strong winds	✓	Requirements to locate critical equipment and/or services above design flood level	✓
Requirements to design façade to resist damage from wind-borne debris	✗	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✓
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✗
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✗
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✓
		Energy efficiency - HVAC systems and lighting	✗
Horizontal and vertical circulation	✓	Renewable energy	✗
Building facilities (sanitary or other)	✓	Green walls and roofs	✗
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✗
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✗



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	H	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	✓
Clearly defined building control regulations	P	The building control framework integrates inspections by the authority in charge during the construction process	✓
Information regarding the building control processes is accessible to the public	P	The building control framework includes a dispute resolution mechanism	P
An online approval system is available in the country	✗	The country has professional certification and registration mechanisms	✗

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Tonga



0.10m
Population



0.034m
Capital city
population



23%
Total population living
in urban areas



-0.3%
Average urban growth
(2014–2023)



COUNTRY SUMMARY

According to the 2016 Building Control and Standards Act, Tonga's governing building regulation is the 2007 National Building Code (NBC) of the Kingdom of Tonga, a performance-based code referencing Australian, New Zealand and joint Australian/New Zealand standards (AS/NZS) as "deemed to satisfy". Many standards cited in the 2007 code have been replaced by newer standards, creating incompatibilities. The standards define loading and design provisions for reinforced concrete, steel, and other common structures. The NBC has no explicit provisions for foundation or retaining wall design but allows the use of any code or standard as required. Design provisions for small-scale buildings indigenous to Tonga are not covered, but reference is made to a New Zealand standard for small-scale buildings.

Seismic loading and design provisions may be satisfied either by the Australian earthquake standard, which includes detailing approaches intended for low-seismicity areas, or by the California Building Code, with a seismic zone factor adjusted to 0.4. It has no structural provisions for building extensions or for the seismic assessment and retrofit of buildings.

For wind loading, the NBC refers to a joint AS/NZS with the basic wind speed amended to 70 m/sec across Tonga for ultimate limit state.

Inconsistencies between NZ and AS/NZS reference standards related to wind speed and importance factors create ambiguity in determining wind loads. The code has no explicit provisions for the design of nonstructural components in strong winds. It also lacks provisions for flood loading or for the design of buildings in flood hazard areas.

The NBC includes some requirements for daylighting and ventilation and some provisions for rainwater capture, but no specific provisions related to energy efficiency or use of low-carbon materials.

The NBC, by reference to a NZ accessibility standard, covers all main categories of provisions for universal accessibility at a basic level for new buildings.

Although Tonga's legal framework for building control is available through the website of the Ministry of Infrastructure, it lacks specific regulations detailing the required processes for building permitting. The permit process does not depend upon the categorization of a project, but inspection processes and the possibility to appeal are defined within the law.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✗
Wind loading	✓	✓	✗	Unreinforced masonry (URM)	✗
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	✗	Not assessed	Not assessed	Earth	✗
				Bamboo	✗
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements				Existing buildings - change of use or occupancy	✓
Design of foundations				Existing buildings - additions (extensions)	✓
Design of retaining walls				Seismic assessment and retrofit	✗

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



Tonga (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✗	Timber lateral resisting systems	✓
Design of nonstructural components	✓	Confined masonry systems	✗
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	✗	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✗	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✓	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✗
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✗
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✗
		Energy efficiency - HVAC systems and lighting	✗
Horizontal and vertical circulation	✓	Renewable energy	✗
Building facilities (sanitary or other)	✓	Green walls and roofs	✗
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✓
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✗



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	N	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	P
Clearly defined building control regulations	P	The building control framework integrates inspections by the authority in charge during the construction process	✓
Information regarding the building control processes is accessible to the public	✓	The building control framework includes a dispute resolution mechanism	✓
An online approval system is available in the country	✗	The country has professional certification and registration mechanisms	P

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Türkiye



85.3m
Population



5.8m
Capital city
population



77%
Total population living
in urban areas



1.8%
Average urban growth
(2014–2023)

180

COUNTRY SUMMARY

The primary regulations related to structural safety and resilience for new and existing building design in Türkiye are the Turkish Buildings Earthquake Code (TBDY 2018) and TS500:2000, a standard covering the design of reinforced concrete structures. Both regulations have been partly adapted from US standards including ASCE 7 and ACI 318. Many other independent standards exist for defining actions on structures and designing other structural systems and their foundations.

The seismic provisions in Türkiye are comprehensive. TBDY 2018 includes an interactive seismic hazard map for all locations and soil types in the country. While seismic assessment and retrofit are covered in Türkiye's standards, these standards require retrofitted buildings to conform to the performance requirements of new buildings, limiting the practicality of implementation. The standards also have gaps in structural considerations related to additions to existing buildings.

Wind loads are defined by a general loading standard published in 2021 and a wind standard published in 2007, both directly based on Eurocode wind provisions, with wind speeds provided for different regions in Türkiye. The wind standards have some very basic

provisions for the design of some nonstructural components in strong winds. Türkiye's regulations include limited, basic provisions related to the design of buildings in flood hazard areas.

There is no mandatory green building regulation in Türkiye, but it has a Green Certificate System (YeS-TR) for new and existing buildings covering many common provisions related to energy efficiency, water efficiency and low-carbon building materials. An Energy Identity Certificate (EIC) is mandatory for buildings based on Energy Efficiency Law No. 5627.

Following the adoption of the “Accessibility Monitoring and Control Regulation” in 2018, all new buildings and all existing public buildings must conform to the requirements of TS 9111, a comprehensive Turkish accessibility standard.

Building control processes are defined within the law and easily available to the public online. Site inspections are conducted by Certified Building Companies (BCC). Nonetheless, while a professional certification system exists, the requirements to obtain certification are low, and professional insurance is not mandatory.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
Natural hazard actions	Load Procedure	Country Specific Criteria	Importance Factor	Confined masonry	✓
Wind loading	✓	✓	✗	Unreinforced masonry (URM)	✓
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	✗	Not assessed	Not assessed	Earth	✓
Geotechnical Design				Bamboo	✗
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements				Existing buildings - change of use or occupancy	✓
Design of foundations				Existing buildings - additions (extensions)	✗
Design of retaining walls				Seismic assessment and retrofit	✓

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).





TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✓	Timber lateral resisting systems	✓
Design of nonstructural components	✓	Confined masonry systems	✓
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	✓	Limitations on occupied zones below the design flood level	✓
Requirements to design façade cladding and appendages to resist strong winds	✓	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✗	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✗
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✗
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✓
		Energy efficiency - HVAC systems and lighting	✗
Horizontal and vertical circulation	✓	Renewable energy	✓
Building facilities (sanitary or other)	✓	Green walls and roofs	✗
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✓
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✓



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	H	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	✗
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	✓
Information regarding the building control processes is accessible to the public	✓	The building control framework includes a dispute resolution mechanism	✓
An online approval system is available in the country	P	The country has professional certification and registration mechanisms	P

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Uzbekistan



35.7m
Population



3.0m
Capital city
population



51%
Total population living
in urban areas



1.7%
Average urban growth
(2014–2023)

COUNTRY SUMMARY

Current structural design codes in Uzbekistan are based on Soviet codes; however, important modifications and updates have been introduced since the 1990s. A national code exists for the structural design of reinforced and precast concrete structures, but the structural design of masonry, steel and timber structures is performed according to Russian codes.

The first seismic design code in Uzbekistan was published in 1996 and updated in 2019. The code provisions address various seismic analysis and design aspects and include a country-specific seismic hazard map. The basic seismic analysis procedure is the spectral method; however, dynamic analysis is required for buildings taller than 40 meters, and for major construction projects. The code does not contain design and detailing provisions for ductile reinforced concrete shear walls or for frame structures at different levels of ductility. There are no provisions for the seismic design of tall buildings or for structural elements under out-of-plane seismic effects. The current codes contain provisions related to the change of occupancy of existing buildings. Provisions related to seismic evaluation and retrofitting of existing buildings are not currently in place but will be addressed by a code in development (ShNK 2.01.21-22). Provisions related to the design of small buildings constructed using low-strength masonry are included.

The design of structures for wind loads is addressed by a dedicated code issued in 1996, which contains country-specific wind design criteria for different regions and is partially based on the 1985 Soviet code. There are no provisions for the design of nonstructural components subjected to strong winds or for flood design. A dedicated code is in place to address the design of building components for fire resistance.

Some green building design provisions are included in dedicated national codes and are mandatory for all buildings except industrial facilities.

Universal accessibility provisions, addressed by a dedicated national code published in 2022, are mandatory in the design of residential buildings and public areas and consider the needs of persons with disabilities and the elderly.

While a building control process is defined within regulations, its component elements are not easily accessible, and only the follow-up of the permitting process is available online for users.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✓
Wind loading	✓	✓	✗	Unreinforced masonry (URM)	✓
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	✗	Not assessed	Not assessed	Earth	✓
Bamboo					✗
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements				Existing buildings - change of use or occupancy	✓
Design of foundations				Existing buildings - additions (extensions)	✗
Design of retaining walls				Seismic assessment and retrofit	✗

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).



Uzbekistan (cont.)



TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✗
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✗	Timber lateral resisting systems	✗
Design of nonstructural components	✓	Confined masonry systems	✓
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	✗	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✗	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✗	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✗
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✗
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✗
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✓
		Energy efficiency - HVAC systems and lighting	✗
Horizontal and vertical circulation	✓	Renewable energy	✓
Building facilities (sanitary or other)	✓	Green walls and roofs	✗
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✗
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✗



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	N	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	P
Clearly defined building control regulations	✓	The building control framework integrates inspections by the authority in charge during the construction process	✓
Information regarding the building control processes is accessible to the public	✗	The building control framework includes a dispute resolution mechanism	P
An online approval system is available in the country	P	The country has professional certification and registration mechanisms	✓

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Vanuatu



0.32m
Population



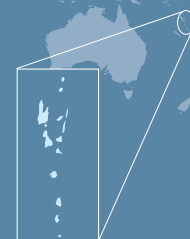
0.049m
Capital city
population



26%
Total population living
in urban areas



2.8%
Average urban growth
(2014–2023)



COUNTRY SUMMARY

Published in 2000, the National Building Code (NBC) for Vanuatu was enacted in 2013. It is a performance-based code referencing Australian, New Zealand and joint Australian/New Zealand standards (AS/NZS). Many standards cited in the code have been replaced by newer standards, creating a lack of clarity about which standards to apply. The international standards define loading and design provisions for reinforced concrete, steel, and other common structures. The NBC has no explicit provisions for foundation design but generally allows the use of US or British codes as necessary to fill gaps in Australian and New Zealand standards. Design provisions for small buildings indigenous to Vanuatu are not covered, but a home building manual has been published separately.

A 1992 New Zealand earthquake standard that has since been superseded is referenced for seismic loading and design provisions, with the seismic zone factor being replaced by 0.7 or 0.8. It has no structural provisions for building extensions or for the seismic assessment and retrofit of buildings but permits reference to Australian or New Zealand standards.

For wind loading, the NBC refers to a joint AS/NZS with the basic wind speed amended to 70 m/sec across Vanuatu for ultimate limit state. Inconsistencies between superseded NZ and AS/NZS reference standards related to wind speed and importance factors create ambiguity in determining wind loads. The code has no explicit provisions for the design of nonstructural components in strong winds. It has no provisions for flood loading or the design of buildings in flood hazard areas.

The NBC includes some requirements for daylighting and ventilation and some provisions for rainwater capture, but no specific provisions related to energy, water efficiency, or use of low-carbon materials.

By reference to a NZ accessibility standard, the NBC covers all main categories of provisions for universal accessibility at a basic level for new buildings.

Vanuatu does not have a clear legal framework for building control, and related processes are not well-defined. Online access to legal documents is difficult as they are not centralized in one place. Processes for inspections and appeals also lack detail. No professional registration or certification systems exist in Vanuatu.



TECHNICAL PROVISIONS IN THE BUILDING CODE

Structural Design: Actions on Structures				Structural Design: Construction Materials	
Importance or risk classification of buildings				Reinforced concrete	✓
Dead and live loads specified				Structural steel	✓
Load combinations				Reinforced masonry	✓
<i>Natural hazard actions</i>	<i>Load Procedure</i>	<i>Country Specific Criteria</i>	<i>Importance Factor</i>	Confined masonry	✗
Wind loading	✓	✓	✗	Unreinforced masonry (URM)	✗
Seismic loading	✓	✓	✓	Timber	✓
Flood loading	✗	Not assessed	Not assessed	Earth	✗
				Bamboo	✗
Geotechnical Design				Structural Design: Existing Buildings	
Site investigation requirements				Existing buildings - change of use or occupancy	✗
Design of foundations				Existing buildings - additions (extensions)	✗
Design of retaining walls				Seismic assessment and retrofit	✗

(✓) = The country's code satisfied the assessment statement for the topic area.

(✗) = The country's code did not satisfy the assessment statement for the topic area.

(U) = Items marked U were unable to be verified (U = unable to verify).





TECHNICAL PROVISIONS IN THE BUILDING CODE (cont.)

Seismic Design		Seismic Detailing	
Ductility requirements and factors	✓	Concrete moment frames	✓
Drift limits	✓	Concrete shear walls	✓
Requirements related to building regularity	✓	Steel moment resisting frames	✓
Diaphragm design	✓	Steel braced frames	✓
Design of advanced systems (base isolation, dampers)	✗	Timber lateral resisting systems	✓
Design of nonstructural components	✓	Confined masonry systems	✗
Wind Design		Flood Design	
Wind design for tall buildings/dynamic procedures	✓	Flood resistant structural and non-structural materials	✗
Design of roof overhangs/roof cladding	✗	Limitations on occupied zones below the design flood level	✗
Requirements to design façade cladding and appendages to resist strong winds	✗	Requirements to locate critical equipment and/or services above design flood level	✗
Requirements to design façade to resist damage from wind-borne debris	✓	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures	✗
Universal Accessibility		Green Building	
External environment	✓	Energy efficiency - natural ventilation and daylighting	✓
		Energy efficiency - window-to-wall ratio, solar shading and reflective roofs or walls	✗
Entrances, doors, and lobbies	✓	Energy efficiency - insulation	✗
		Energy efficiency - HVAC systems and lighting	✗
Horizontal and vertical circulation	✓	Renewable energy	✗
Building facilities (sanitary or other)	✓	Green walls and roofs	✗
Building fixtures and fittings	✓	Water efficiency - fixtures and fittings and/or water re-use and/or collection	✓
Evacuation and safe egress	✓	Low carbon and/or recycled building materials	✗



BUILDING CONTROL PROCESSES AND IMPLEMENTATION ENVIRONMENT

Type of jurisdiction for administration of building control regulations	N	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources	✗
Clearly defined building control regulations	P	The building control framework integrates inspections by the authority in charge during the construction process	P
Information regarding the building control processes is accessible to the public	✗	The building control framework includes a dispute resolution mechanism	P
An online approval system is available in the country	✗	The country has professional certification and registration mechanisms	✗

(P) = For code implementation environment topic areas, a rating of P indicates that the country partially satisfies the evaluation statement.

(N, L, H) = For the jurisdiction administering building control regulations, N = national level, L = local level, H = hybrid approach with some aspects administered at national level and some at local level.



Annex B:

List of Documents Reviewed

The following documents (predominantly regulations and standards) were reviewed for this global assessment. For each of the 22 countries, the documents are listed in order of topic: structural and resilience provisions; green building; universal accessibility; and, finally, building control. English translations are given for all titles originally in other languages.

Annex B:

List of Documents Reviewed

Country	Name of Code or Standard	Date of Publication
Algeria	D.T.R. B.C. 2-48 Algerian Seismic Rules RPA 2024 (D.T.R. B.C.2-48 Règles Parasismiques Algériennes RPA 2024)	2024
	D.T.R. B.C. 2-41 Rules for Design and Calculation of Reinforced Concrete Structures C.B.A.93 (D.T.R. B.C. 2-41 Règles de Conception et de Calcul des Structures en Béton Armé C.B.A.93)	1993
	D.T.R. B.C. 2.2 Permanent loads and live loads (DTR B.C. 2.2 Charges Permanentes et Charges d'Exploitation)	1988
	D.T.R. C2-4.7 Snow and Wind Rules "R.N.V. 1999" (D.T.R. C 2-4.7 Règlement Neige et Vent "R.N.V. 1999")	1999
	DTR B.C.2.1 General principles for checking the safety of structures (DTR B.C.2.1 Principes Généraux pour vérifier la sécurité des Ouvrages)	1988
	DTR B.C.2-44 Rules for Design and Calculation of Metal Structures CCM 97 (DTR B.C.2-44 Règles de Conception et de Calcul des Structures en Acier CCM 97)	n.d.
	DTR C2.4.6 Rules for design and calculation of timber structures (DTR C2.4.6 Règles de Conception et de Calcul des Structures en Bois)	2009
	D.T.R. C 3-2 Thermal regulations for residential buildings. Thermal loss evaluation. (D.T.R. C 3-2 Réglementation thermique des bâtiments d'habitation. Règles de calcul des déperditions calorifiques)	1998
	D.T.R. C 3-4 Air conditioning. Rules for calculating the heat input of buildings (D.T.R. C 3-4 Climatisation. Règles de calcul des apports)	n.d.
	D.T.R. C 3.31 Natural ventilation for residential buildings (D.T.R. C 3.31 Ventilation Naturelle. Locaux à usage d'habitation)	2006
	Algerian Standard 16227 : 2009 Accessibility for Disabled People to the Built Environment and Facilities Open to the Public (Norme Algérienne (NA) 16227 : 2009 Accessibilité des Personnes Handicapées à l'Environnement Bâti et aux Equipements Ouverts au Public)	2009
	Executive Decree 06-455 of 11 December 2006 establishing the Accessibility of the Physical, Social, Economic and Cultural Environment for Persons with Disabilities (Décret exécutif n° 06-455 du 11 Décembre 2006 fixant les Modalités d'Accessibilité des Personnes Handicapées à l'Environnement Physique, Social, Economique et Culturel)	2006
	Law No. 90-29 of December 1, 1990 relating to planning and urban development (Loi n°90-29 du 1er décembre 1990 relative à l'aménagement et l'urbanisme)	1990
	Executive Decree No. 15-19 of January 25, 2015 establishing the procedures for the instruction and issuance of urban planning documents (Décret exécutif n° 15-19 du 25 janvier 2015 fixant les modalités d'instruction et de délivrance des actes d'urbanisme)	2015
	Executive Decree No. 20-342 of November 22, 2020 amending and supplementing Executive Decree No. 15-19 of January 25, 2015 setting out the procedures for the instruction and issuance of urban planning documents (Décret exécutif n° 20-342 du 22 novembre 2020 modifiant et complétant le décret exécutif n°15-19 du 25 janvier 2015 fixant les modalités d'instruction et de délivrance des actes d'urbanisme)	2020



Country	Name of Code or Standard	Date of Publication
Algeria (cont.)	Executive Decree No. 06-55 of January 30, 2006 establishing the conditions and procedures for designating authorized agents to investigate and record violations of legislation and regulations relating to planning and urban development, as well as control procedures (Décret exécutif n°06-55 du 30 janvier 2006 fixant les conditions et les modalités de désignation des agents habilités à rechercher et à constater les infractions à la législation et à la réglementation en matière d'aménagement et d'urbanisme ainsi que les procédures de contrôle)	2006
	Code of Civil and Administrative Procedure. (Code de Procédure civile et administrative)	2008
	Legislative Decree No. 94-07 of May 18, 1994, amended by Law No. 04-06 of August 14, 2004, relating to the conditions of architectural production and the exercise of the profession of architect (Décret législatif n°94-07 du 18 mai 1994 modifié par la loi n°04-06 du 14 août 2004 relatif aux conditions de la production architecturale et à l'exercice de la profession d'architecte)	2004
	Code of Architects Professional Duties. (Code des devoirs professionnels des architectes)	2010
	Order of July 11, 2002 approving the nomenclature of engineering activities and specialties in the construction sector subject to approval (Arrêté du 11 juillet 2002 portant approbation de la nomenclature des activités et spécialités d'ingénierie du secteur du bâtiment soumises à agrément)	2002
	Law No. 08-15 of 17 Rajab 1429 corresponding to July 20, 2008, establishing the rules for compliance of constructions and their completion (Loi n° 08-15 du 17 Rajab 1429 correspondant au 20 juillet 2008 fixant les règles de mise en conformité des constructions et leur achèvement)	2008
	Algerian Civil Code. (Code Civil Algérien)	1975
	Law No. 11-10 of 20 Rajab 1432 corresponding to June 22, 2011 relating to the municipality. (Loi n° 11-10 du 20 Rajab 1432 correspondant au 22 juin 2011 relative à la commune)	2011
Bhutan	Building Code of Bhutan 2018	2018
	IS:875 (Part 1) 1987 Indian Standard Code of Practice for design loads (other than earthquakes) for buildings and structures, Part 1	1987 (reaffirmed 2018)
	IS:875 (Part 2) 1987 Indian Standard Code of Practice for design loads (other than earthquakes) for buildings and structures – Part 2 Imposed Loads	1987 (reaffirmed 2018)
	IS:875 (Part 3) 2015 Indian Standard Design loads (other than earthquakes) for buildings and structures - Code of Practice – Part 3 Wind Loads	2015 (reaffirmed 2020)
	IS:875 (Part 4) 2021 Indian Standard Design loads (other than earthquakes) for buildings and structures - Code of Practice – Part 4 Snow Loads	2021
	IS:875 (Part 5) 1987 Indian Standard Code of Practice for design loads (other than earthquakes) for buildings and structures – Part 5 Special loads and combinations	1987 (reaffirmed 2018)
	IS:1893 (Part 1) 2016: Indian Standard Criteria for Earthquake Resistant Design of Structures – Part 1 General Provisions and Buildings	2016
	IS:4326-2013 Indian Standard Earthquake Resistant Design and Construction of Buildings - Code of Practice	2013 (reaffirmed 2018)
	IS:13920-2016 Indian Standard Ductile detailing of reinforced concrete structures subjected to seismic forces - Code of Practice	2016 (reaffirmed 2021)
	IS:456-2000: Indian Standard Plain and Reinforced Concrete - Code of Practice	2000 (reaffirmed 2021)
	IS:800-2007: General Construction in Steel - Code of Practice	2007 (reaffirmed 2017)
	Earthquake Resilient Stone Masonry Construction, EARRD-A001/2020	2020
	IS:1904-2021 Indian Standard General Requirements Design and Construction of Foundations in Soils - Code of Practice	2021
	NUDC/007/1985 - Royal Government of Bhutan - Timber Roof Trusses	1985
	NUDC/002/1985 - Royal Government of Bhutan - Manual for Timber Engineering Design	1985
	Bhutan Building Regulation 2023	2023
	Design and Construction of Stone Masonry Retaining Walls – A Quick Guide	n.d.



Country	Name of Code or Standard	Date of Publication
Bhutan (cont.)	Bhutan Green Building Design Guidelines	2013
	Guidelines for Differently-Abled Friendly Construction	n.d.
	Guidelines for building drawing approval process 2021	2021
	Spatial Planning Standards	2017
	The Constitution of the Kingdom of Bhutan	2008
	Local Government Act of Bhutan	2007
	Timphu Tromde (TT) Development Control Regulations	2017
	Consumer Protection Act of Bhutan 2012	2012
	Consumer Protection Rules and Regulations of 2015	2015
	Procurement Rules and Regulations 2019	2019
	Mediation Handbook for consumer disputes	2022
Chile	NCh 427/1 Construction — Steel structures — Part 1: Specification for Structural Steel Buildings (NCh 427/1 Construcción — Estructuras de acero — Parte 1: Requisitos para el cálculo de estructuras de acero para edificio)	2016
	NCh 428. Of57. Structural steel in building construction (Norma Chilena Oficial - NCh428. Of57 Ejecución de construcciones de acero)	1957 (reprinted 2000)
	NCh 430. Of2008 Reinforced concrete - Design and calculation requirements (Norma Chilena Oficial - NCh430. Of2008 Hormigón armado - Requisitos de diseño y cálculo)	2008
	Decree No.60 Approval of the Regulation establishing the design and calculation requirements for reinforced concrete and Repeal of Decree No.118, of 2010 (Decreto n° 60 Aprobación del Reglamento que fija los requisitos de diseño y cálculo para el hormigón armado y derogación del decreto N° 118, de 2010)	2011
	NCh 431. Of77 Construction - Snow loads (Norma Chilena Oficial - NCh 431. Of77 Construcción - Sobrecarga de nieves)	1977 (reprinted in 1999)
	NCh 432-2010 Structural design - Wind loads (Norma Chilena - NCh 432-2010 Diseño estructural - Cargas de viento)	2010
	NCh 433.Of1996 Modified in 2009 – Earthquake-resistant design of buildings (Norma Chilena Oficial - NCh 433. Of1996 Modificada en 2009 - Diseño sísmico de edificios)	1996 (modified in 2009)
	Decree No.61 Approval of the Regulation establishing earthquake design of buildings and Repeal of Decree No.117 of 2021 (Decreto N° 61 Aprobación del Reglamento que fija el diseño sísmico de edificios y deroga el D.S. N°117, de 2010)	2011
	NCh 1198 Wood – Wood construction – Calculation (Norma Chilena - NCh 1198 Madera - Construcciones en madera - Cálculo)	2014
	NCh 1537-2009 Structural Design - Dead and Live Loads (Norma Chilena - NCh 1537-2009 Diseño estructural - Cargas permanentes y cargas de uso)	2009
	NCh 1928.Of1993 Modified 2003 Reinforced masonry - Requirements for structural design (Norma Chilena Oficial - NCh 1928.Of1993 Modificada en 2003 Albañilería armada - Requisitos para el diseño y cálculo)	1993 (modified in 2003)
	NCh 2369.Of2003 Earthquake-resistant design of industrial structures and facilities (Norma Chilena Oficial - NCh 2369.Of2003 Diseño sísmico de estructuras e instalaciones industriales)	2003
	NCh 3363 Structural design - Buildings in risk areas of flooding due to tsunamis or seiche (Norma Chilena - NCh 3363 Diseño estructural - Edificaciones en áreas de riesgo de inundación por tsunami o seiche)	2015
	Proposal for actualization of NCh. NCh 3171: Structural design - general ordinances and combinations of load (Propuesta de actualización Norma Chilena - NCh 3171 Diseño estructural - Disposiciones generales y combinaciones de cargas)	2016
	NCh 2123Of.1997 Modified 2003 Confined masonry - Requirements for structural design (Norma Chilena Oficial - NCh 2123Of.1997 Modificada en 2003 Albañilería confinada - Requisitos de diseño y cálculo)	2003
	NCh 3357 Seismic design of nonstructural components and systems (Norma Chilena - NCh 3357 Diseño sísmico de componentes y sistemas no estructurales)	2015



Country	Name of Code or Standard	Date of Publication
Chile (cont.)	prNCh2745 Analysis and design of buildings with seismic isolation (prNCh2745 Análisis y diseño de edificios con aislación sísmica)	2013
	Standardized Terms of Reference with Energy Efficiency and Environmental Comfort Parameters, for Design and Construction Tenders of the Architecture Directorate, According to Geographical Areas of the Country and According to Building Typologies (Términos de Referencia Estandarizados con Parámetros de Eficiencia Energética y Confort Ambiental, para Licitaciones de Diseño y Obra de la Dirección de Arquitectura, Según Zonas Geográficas del País y Según Tipologías de Edificios)	2016
	Sustainable Building Certification – CES – Evaluation and Qualification Manual (Certificación Edificio Sustentable – CES – Manual de Evaluación y Calificación)	2022
	Decree 7. Establishment of the Atmospheric Decontamination Plan for the City of Coyhaique and its Surrounding Area (Decreto 7. Establecimiento del Plan de Descontaminación Atmosférica para la Ciudad de Coyhaique y su Zona Circundante)	2018
	Law 21.305 on Energy Efficiency (Ley 21.305 Sobre Eficiencia Energética)	2021
	Law 20.422 Establishment of Rules on Equal Opportunities and Social Inclusion of Persons with Disabilities (Ley 20.422 Establecimiento de Normas sobre Igualdad de Oportunidades e Inclusión Social de Personas con Discapacidad)	2010 (modified in 2023)
	Decree No.50 of 2015 Modification of the Supreme Decree No. 47 of 1992, General Ordinance on Urban Planning and Construction, in order to update its regulations to the provisions of Law No. 20.422, on equal opportunities and social inclusion of people with disabilities (Decreto n° 50 de 2015. Modificación del decreto supremo n° 47 de 1992, Ordenanza General de Urbanismo y Construcciones, en el sentido de actualizar sus normas a las disposiciones de la ley n° 20.422, sobre igualdad de oportunidades e inclusión social de personas con discapacidad)	2015
	Guidelines on Accessible Solutions for Public Spaces and Housing (Guía de Soluciones Accesibles para espacios públicos y viviendas)	2018
	General Law on Urban Planning and Construction (Ley General de Urbanismo y Construcciones)	1975
	General Ordinance of the General Law on Urban Planning and Construction (Ordenanza General de la Ley General de Urbanismo y Construcciones)	1992
	Law 19799 on Electronic Documents, Electronic Signature and Certification Services for that Signature (Ley 19799 sobre documentos Electrónico, Firma Electrónica y Servicios de Certificación de dicha Firma)	2002
	Law 20.703 creates and regulates the national registries of Technical Inspectors of Works (ITO) and of reviewers of Structural Calculation projects, modifies legal norms to guarantee the quality of constructions and expedite applications to the Municipal Works Departments (Ley 20.703 crea y regula los registros nacionales de Inspectores Técnicos de Obras (ITO) y de revisores de proyectos de Cálculos Estructurales, modifica normas legales para garantizar la calidad de las construcciones y agilizar las solicitudes ante las direcciones de Obras Municipales)	2013
	Law 20285 on Access to Public Information (Ley 20285 sobre Acceso a la Información Pública)	2008
	Code of Civil Procedure (Código de Procedimiento Civil)	1902
	Decree 75 – Regulations for Public Works Contracts (Decreto 75 – Reglamento para Contratos de Obras Públicas)	2004
	Decree 127 – Approves New Regulations for the National Registry of Contractors of the Ministry of Housing and Urban Development (Decreto 127 – Aprueba Nuevo Reglamento del registro Nacional de Contratistas del Ministerio de Vivienda y Urbanismo)	1977
	Law 7211 creates the College of Architects; determines the composition of the General Council, and establishes its functions and powers (Ley 7211 crea el Colegio de Arquitectos; determina composición del Consejo General, y le fija funciones y atribuciones)	1942
	Decree 1214 – Regulation of Law No. 7211 on the College of Architects of Chile (Decreto 1214 – Reglamento de la Ley numero 7211 sobre Colegio de Arquitectos de Chile)	1943
	Law 12851 Creates the College of Engineers and the College of Technicians (Ley 12851 crea el Colegio de Ingenieros y el Colegio de Técnicos)	1980



Country	Name of Code or Standard	Date of Publication
Colombia	Colombian Regulation for Earthquake Resistant Construction NSR-10 (Reglamento Colombiano de Construcción Sismo Resistente NSR-10)	2010
	Decision No. 0549 to regulate Chapter 1 of Title 7 of Part 2, Book 2 of Decree 1077 of 2015, regarding the parameters and guidelines for sustainable construction, and to adopt the Guide for saving water and energy in buildings (Resolución nº 0549 Por la cual se reglamenta el Capítulo 1 del Título 7 de la parte 2, del Libro 2 del Decreto 1077 de 2015, en cuanto a los parámetros y lineamientos de construcción sostenible y se adopta la Guía para el ahorro de agua y energía en edificaciones)	2015
	Decree 582 of 2023 - Eco-urbanism and Sustainable Construction Manual (Decreto 582 de 2023 - Manual de Ecurbanismo y Construcción Sostenible)	2023
	Agreement 0574 of 2023 to adopt the Sustainable construction Manual for the special, sports, cultural, tourist, business and service district of Santiago de Cali (Acuerdo 0574 de 2023 por el que se adopta el Manual de construcción sostenible para el distrito especial, deportivo, cultural, turístico, empresarial y de servicio de Santiago de Cali)	2023
	CONPES 3919 of 2018. National Policy for the promotion of sustainable building construction (CONPES 3919 de 2018. Política Nacional para el fomento de la construcción de edificaciones sostenibles)	2018
	NTC 4145 Accessibility to built environment. Buildings and urban and rural spaces. Stairs (Norma Técnica Colombiana - NTC 4145 Accesibilidad de las personas al medio físico. Edificios y Espacios Urbanos y Rurales. Escaleras)	2012
	NTC 6047 Accessibility to Physical Environment. Citizen Service Spaces in Public Administration. Requirements (Normativa Técnica Colombiana - NTC 6047 Accesibilidad al Medio Físico. Espacios de Servicio al Ciudadano en la Administración Pública. Requisitos)	2013
	NTC 4595 Civil Engineering and Architecture. Planning and Design of School Facilities and Environments (Norma Técnica Colombiana - NTC 4595 Ingeniería Civil y Arquitectura. Planeamiento y Diseño de Instalaciones y Ambientes Escolares)	1999
	Decree 1077 of 2015, which issues the Single Regulatory Decree for the Housing, City and Territory Sector (Decreto 1077 del 2015 por medio del cual se expide el Decreto Único Reglamentario del Sector Vivienda, Ciudad y Territorio)	2015
	Law 1712 of 2014, which creates the Law of Transparency and Right of Access to National Public Information and dictates other provisions (Ley 1712 del 2014 por medio de la cual se crea la Ley de Transparencia y del Derecho de Acceso a la Información Pública Nacional y se dictan otras disposiciones)	2014
	Decree 1078 of 2015 Information and Communications Technology Sector (Decreto 1078 del 2015 Sector de Tecnologías de la Información y las Comunicaciones)	2015
	Law 1801 of 2016, which issues the National Code of Security and Citizen Coexistence (Ley 1801 del 2016 por la cual se expide el Código Nacional de Seguridad y Convivencia Ciudadana)	2016
	Law 435 of 1998, which regulates the practice of the profession of Architecture and its auxiliary professions, creates the National Professional Council of Architecture and its auxiliary professions, dictates the Code of Professional Ethics, establishes the Disciplinary Regime for these professions, restructures the National Professional Council of Engineering and Architecture into the National Professional Council of Engineering and its auxiliary professions and other provisions (Ley 435 de 1998 por la cual se reglamenta el ejercicio de la profesión de Arquitectura y sus profesiones auxiliares, se crea el Consejo Profesional Nacional de Arquitectura y sus profesiones auxiliares, se dicta el Código de Ética Profesional, se establece el Régimen Disciplinario para estas profesiones, se reestructura el Consejo Profesional Nacional de Ingeniería y Arquitectura en Consejo Profesional Nacional de Ingeniería y sus profesiones auxiliares y otras disposiciones)	1998
	Law 842 of 2003, which modifies the regulations for the practice of engineering, its related professions and its auxiliary professions, adopts the Code of Professional Ethics and establishes other provisions (Ley 842 de 2003 por la cual se modifica la reglamentación del ejercicio de la ingeniería, de sus profesiones afines y de sus profesiones auxiliares, se adopta el Código de Ética Profesional y se dictan otras disposiciones)	2003



Country	Name of Code or Standard	Date of Publication
Colombia (cont.)	Decree 1898 - Statute of Alternative Dispute Resolution Mechanisms (Decreto 1898 - Estatuto de los Mecanismos Alternativos de Solución de Conflictos)	1998
	Decree 1469 - Regulating the provisions relating to urban planning licenses, building inspections, the public functions performed by officials in charge of building permits, and issuing other provisions (Decreto 1469 - Por el cual se reglamentan las disposiciones relativas a las licencias urbanísticas; al reconocimiento de edificaciones; a la función pública que desempeñan los curadores urbanos y se expiden otras disposiciones)	2010
El Salvador	Decree No. 105 - Regulation for the Structural Safety of Construction (Decreto N° 105 - Reglamento para la Seguridad Estructural de las Construcciones)	1996
	Technical regulation for earthquake design and its comments (Norma Técnica para diseño por sismo y sus comentarios)	1997
	Technical regulation for wind design and its comments (Norma Técnica para diseño por viento y sus comentarios)	1997
	Special regulation for housing design and construction (Norma especial para diseño y construcción de viviendas)	1997
	Regulation for design and construction of hospitals and health facilities (Norma para diseño y construcción de hospitales y establecimientos de salud)	n.d.
	Modernization of the provisions governing seismic design (Modernización de las provisiones que rigen el diseño sísmico)	2021
	Technical standard for structural design and construction of masonry (Norma técnica para diseño y construcción estructural de mampostería)	1994
	Technical standard for foundation design and slope stability (Norma Técnica para diseño de cimentaciones y estabilidad de taludes)	1997
	Technical standard for design and construction of steel structures (Norma Técnica para diseño y construcción de estructuras de acero)	1994
	Technical standard for design and construction of concrete structures (Norma Técnica para diseño y construcción de estructuras de concreto)	1994
	Technical standard for design and construction of wooden structures (Norma Técnica para diseño y construcción de estructuras de madera)	1994
	Technical standard for quality control of structural materials (Norma Técnica para control de calidad de los materiales estructurales)	1997
	Flood Disaster Risk Profile for El Salvador (Perfil de Riesgo de Desastres por Inundaciones para El Salvador)	2014
	Decree No. 70: Regulations to the Urban Planning and Construction Law regarding subdivisions and residential developments (Decreto N° 70: Reglamento a la Ley de Urbanismo y Construcción en lo relativo a parcelaciones y urbanizaciones habitacionales)	1991
	Law on the Development and Territorial Planning of the Metropolitan Area of San Salvador and the Surrounding Municipalities (Ley de Desarrollo y Ordenamiento Territorial del Área Metropolitana de San Salvador (AMSS) y de los Municipios Aledaños)	1994 (updated 2023)
	Regulations to the Law on the Development and Territorial Planning of the Metropolitan Area of San Salvador and the Surrounding Municipalities (Reglamento a la Ley de Desarrollo y Ordenamiento Territorial del Área Metropolitana de San Salvador (AMSS) y de los Municipios Aledaños)	1994 (updated 2023)
	RTS 29.02.01:21 Electrical Products. Luminaires (lighting fixtures). Energy Efficiency Specifications (Reglamento Técnico Salvadoreño - RTS 29.02.01:21 Productos Eléctricos. Luminarias. Especificaciones de Eficiencia Energética)	2021
	Sustainable El Salvador Plan (Plan El Salvador Sustentable)	2018
	RTS 23.01.01:15 Energy Efficiency. Central, Packaged or Split Air Conditioners. Limits, Test Methods and Labeling (Reglamento Técnico Salvadoreño - RTS 23.01.01:15 Eficiencia Energética. Acondicionadores de Aire Tipo Central, Paquete o Dividido. Límites, Métodos de Prueba y Etiquetado)	2015



Country	Name of Code or Standard	Date of Publication
El Salvador (cont.)	NTS 11.69.01:14 Accessibility to the built environment. Urban planning and architecture. Requirements (Norma Técnica Salvadoreña - NTS 11.69.01:14 Accesibilidad al medio físico. Urbanismo y Arquitectura. Requisitos)	2014
	Technical Standard for Urban and Architectural Accessibility for Transport and Communications (Norma Técnica de Accesibilidad Urbanística y Arquitectónica de Transporte y Comunicaciones)	n.d.
	Decree No. 672 Special Law for the Inclusion of Persons with Disabilities (Decreto N° 672 Ley Especial de Inclusión de las Personas con Discapacidad)	2021
	Law on Urban Planning and Construction. (Ley de Urbanismo y Construcción)	1951
	Regulations of the Law on Urban Planning and Construction regarding Subdivisions and Housing Developments. (Reglamento de la Ley de Urbanismo y Construcción en lo relativo a Parcelaciones y Urbanizaciones Habitacionales)	1991
	Law on Mediation, Conciliation and Arbitration (Ley de Mediación, Conciliación y Arbitraje)	2002
	General Regulations of the Law on Mediation, Conciliation and Arbitration. (Reglamento General de la Ley de Mediación, Conciliación y Arbitraje)	2003
	General Law for Digital Modernization (Ley General para la Modernización Digital)	2023
	Law on access to public information (Ley de acceso a la información pública)	2011
Ghana	GS 1207:2018 Ghana Building Code (GhBC). Building and Construction	2018
	L.I. 2465 Building Regulations, 2022	2022
	Local Governance Act no. 936	2016
	Land Use and Spatial Planning Act no.925	2016
	Land Use and Spatial Planning Regulations	2019
	Guidelines on Development Permitting in Ghana	n.d.
	Right to Information Act (Act 989)	2019
	Accra Metropolitan Assembly (Building / Physical Development) Bye-Law, 2017	2017
	Alternative Dispute Resolution Act	2010
	Ghana Institution of Engineers Act	1969
Indonesia	Architects Act 1969	1969
	SNI 1726-2019 Earthquake Resistance Design Procedures for Building and Non-Building Structures (SNI 1726-2019 Tata cara perencanaan ketahanan gempa untuk struktur bangunan gedung dan nongedung)	2019
	SNI 1727-2020 Minimum Design Loads and Related Criteria for Buildings and Other Structures (SNI 1727-2020 Beban desain minimum dan kriteria terkait untuk bangunan gedung dan struktur lain)	2020
	SNI 2847-2019 Structural Concrete Requirements for Building and Explanations (SNI 2847-2019 Persyaratan beton struktural untuk bangunan gedung dan penjelasan)	2019
	SNI 1729-2020 Specifications for Structural Steel Buildings (SNI 1729- 2020 Spesifikasi untuk bangunan gedung baja struktural)	2020
	SNI 7860-2020 Seismic Provisions for Structural Steel Buildings (SNI 7860-2020 Ketentuan seismik untuk bangunan gedung baja struktural)	2020
	SNI 7972-2020 Prequalified Connections for Special and Intermediate Steel Moment Frames in Seismic Applications (SNI 7972-2020 Sambungan terprakualifikasi untuk rangka momen khusus dan menengah baja pada aplikasi seismik)	2020
	SNI 8460-2017 Geotechnical Design Requirements (SNI 8460-2017 Persyaratan Perancangan Geoteknik)	2017
	SNI 8899-2020 Procedures for Selection and Modification of Ground Motion for Earthquake-Resistant Building Design (SNI 8899-2020 Tata cara pemilihan dan modifikasi gerak tanah permukaan untuk perencanaan gedung tahan gempa)	2020
	SNI 7973-2013 Design Specifications for Wood Construction (SNI 7973-2013 Spesifikasi desain untuk konstruksi kayu)	2013



Country	Name of Code or Standard	Date of Publication
Indonesia (cont.)	ISBN 978-602-5489-01-3 Indonesia Earthquake Source and Hazard Map 2017 (ISBN 978-602-5489-01-3 Peta Sumber dan Bahaya Gempa Indonesia Tahun 2017)	2017
	SNI 8971-2021 Design and Implementation Guide for External Fiber Reinforced Polymer Sheet Systems for Strengthening Concrete Structures (SNI 8971-2021 Panduan Perancangan dan Pelaksanaan Sistem Lembaran Serat Berpolimer Terlekat Eksternal untuk Perkuatan Struktur Beton)	2021
	Regulation of the Minister of Public Works and Public Housing - Number 21 of 2021 - Green Building Performance Assessment (Peraturan Menteri Pekerjaan Umum dan Perumahan Rakyat - Nomor 21 Tahun 2021 - Penilaian Kinerja Bangunan Gedung Hijau)	2021
	SNI 03-2396-2001 Procedures for designing natural lighting systems in buildings. (SNI 03-2396-2001. Tata cara perancangan sistema pencahayaan alami pada bangunan gedung)	2001
	SNI 6197-2020 Energy conservation in lighting systems (SNI 6197-2020 Konservasi energi pada sistem pencahayaan)	2020
	SNI 6389-2020. Energy conservation of building envelopes (SNI 6389-2020 Konservasi energi selubung bangunan pada bangunan gedung)	2020
	Regulation of the Minister of Public Works and Public Housing - Number 14/PRT/M/2017 - Building Accessibility Requirements (Peraturan Menteri Pekerjaan Umum dan Perumahan Rakyat - Nomor 14/PRT/M/2017 - Persyaratan Kemudahan Bangunan Gedung)	2017
	PP No. 16/2021 on Implementation of Law No. 28/2002 on Buildings	2021
	Law No. 11/2014 on Engineers	2014
	Law No. 2/2017 on Construction Services	2017
	Law No. 14/2008 on Public Information Openness	2008
	Law No. 30/1999 on Arbitration and Alternative Dispute Resolutions	1999
	Law No. 6/2017 on Architects	2017
	Law No. 19/2016 on Amendment to Law Number 11 of 2008 concerning Electronic Information and Transactions	2016
	Law No. 6/2023 on Implementation of Law No. 2/2022 on Job Creation become Law	2023
Mexico	Complementary technical standard for earthquake design (Norma técnica complementaria para el diseño por sismo)	2023
	Complementary technical standard for wind design (Norma técnica complementaria para el diseño por viento)	2023
	Complementary technical standards for the design and construction of concrete structures (Norma técnica complementaria para diseño y construcción de estructuras de concreto)	2023
	Complementary technical standard for the design and construction of steel structures (Norma técnica complementaria para diseño y construcción de estructuras de acero)	2023
	Complementary technical standard for the design and construction of wooden and bamboo structures (Norma técnica complementaria para diseño y construcción de estructuras de madera y bambú)	2023
	Complementary technical standard for the design and construction of foundations (Norma técnica complementaria para diseño y construcción de cimentaciones)	2023
	Complementary technical standard for the design and construction of masonry structures (Norma técnica complementaria para diseño y construcción de estructuras de mampostería)	2023
	Complementary technical standard on criteria and actions for the structural design of buildings (Norma técnica complementaria sobre criterios y acciones para el diseño estructural de las edificaciones)	2023
	Construction Regulations for Mexico City (Reglamento de Construcciones para el Distrito Federal)	2004 (last reform: 2021)
	Complementary technical standard for evaluation and structural rehabilitation of existing buildings (Norma técnica complementaria para evaluación y rehabilitación estructural de edificios existentes)	2023



Country	Name of Code or Standard	Date of Publication
Mexico (cont.)	Complementary technical standard for the review of the structural safety of buildings (Norma técnica complementaria para la revisión de la seguridad estructural de las edificaciones)	2023
	Mexican Official Standard NOM-006-SEGOB-2015. Tsunamis.- Characteristics and specifications for prevention, warning, and evacuation (Norma Oficial Mexicana NOM-006-SEGOB-2015. Tsunamis.- Características y especificaciones de prevención, alertamiento y evacuación)	2017
	Agreement issuing Specific Operation Guidelines to address damages triggered by disruptive natural phenomena (Acuerdo por el que se emiten los Lineamientos de Operación Específicos para atender los daños desencadenados por fenómenos naturales perturbadores)	2021
	CDMX Resilience Strategy - Adaptive, inclusive and equitable transformation (Estrategia de Resiliencia CDMX - Transformación adaptativa, incluyente y equitativa)	2016
	Special Program derived from the National Development Plan 2019 - 2024 (Programa especial derivado del Plan Nacional de Desarrollo 2019-2024)	2022
	Preventive Program: Rains 2024 (Programa Preventivo: Lluvias 2024)	2024
	DRAFT of the Mexican Official Standard PROY-NOM-006-SEDATU-2024, Classification, characterization and delimitation of areas not suitable for human settlement in primary zoning due to presenting critical risks originating from hydrometeorological, geological and climate change threats or due to having environmental or cultural value in the instruments that make up the General Territorial Planning System (PROYECTO de Norma Oficial Mexicana PROY-NOM-006-SEDATU-2024, Clasificación, caracterización y delimitación de zonas no susceptibles para asentamientos humanos en la zonificación primaria por presentar riesgos críticos originados por amenazas hidrometeorológicas, geológicas y las asociadas al cambio climático o por tener valor ambiental o cultural en los instrumentos que conforman el Sistema General de Planeación Territorial)	2024
	Housing Building Code (Código de Edificación de Vivienda (CEV))	2017
	International Energy Conservation Code (IECC) (Código Internacional de Conservación de Energía (IECC))	2018
	NMX-U-125-SCFI-2016 Building industry — buildings — roof surfaces with high solar reflectance index — specifications and test method (NMX-U-125-SCFI-2016 Industria de la construcción — edificaciones — revestimientos para techo con alto índice de reflectancia solar — especificaciones y métodos de ensayo)	2016
	NMX-AA-171-SCFI-2014 Environmental performance requirements and specifications for lodging establishments (NMX-AA-171-SCFI-2014 Requisitos y especificaciones de desempeño ambiental de establecimientos de hospedaje)	2014
	NMX-AA-164-SCFI-2013 Sustainable building - criteria and minimal environmental requirements (NMX-AA-164-SCFI-2013 Edificación sustentable - criterios y requerimientos ambientales mínimos)	2013
	Mexican Official Standard NOM-020-ENER-2011, Energy efficiency in buildings. - Buildings for residential use (Norma Oficial Mexicana NOM-020-ENER-2011 Eficiencia energética en edificaciones. - Envolvente de edificios para uso habitacional)	2011
	Mexican Official Standard NOM-008-ENER-2001 Energy efficiency in buildings, non-residential building envelope (Norma Oficial Mexicana NOM-008-ENER-2001, Eficiencia energética en edificaciones, envolvente de edificios no residenciales).	2001
	Sustainable Building Certification Program (Programa de Certificación de Edificaciones Sustentables)	2012
	Sustainable Housing - Sisevive-Ecocasa - Operational Guide (Vivienda Sustentable - Sisevive-Ecocasa - Guía Operativa)	2021
	Accessibility Law for Mexico City (Ley de la Accesibilidad para la Ciudad de México)	2017
	National Program for Work and Employment for Persons with Disabilities 2014-2018 (Programa Nacional de Trabajo y Empleo para Personas con Discapacidad 2014-2018)	2014
	Complementary technical standard for architectural projects (Norma técnica complementaria para el proyecto arquitectónico)	2011



Country	Name of Code or Standard	Date of Publication
Mexico (cont.)	Manual of Technical Standards for Accessibility (Manual de Normas Técnicas de Accesibilidad)	2024
	Law on Urban Development for the Federal District (Ley de Desarrollo Urbano del Distrito Federal)	2010
	Construction Regulations for the Federal District (Reglamento de Construcciones para el Distrito Federal)	2004
	Regulatory Law of Article 5 of the Constitution, relating to the exercise of professions in Mexico City (Ley reglamentaria del artículo 5o. constitucional, relativo al ejercicio de las profesiones en la ciudad de México)	1945
	General Law on Alternative Dispute Resolution Mechanisms (Ley General de mecanismos Alternativos de Solución de Controversias)	2023
	General Law on Transparency and Access to Public Information (Ley General de Transparencia y Acceso a la Información Pública)	2015
	Political Constitution of the United Mexican States (Constitución Política de los Estados Unidos Mexicanos)	1917
	Law on Digital Citizenship of Mexico City (Ley de Ciudadanía Digital de la Ciudad de México)	2022
	Federal Labor Law (Ley Federal del Trabajo)	2024
Mongolia	Loads and Actions BNbD 20-04-17 (Ачаа ба үйлчлэл БНбД 20-04-17)	2017
	Seismic Building Design Code BNbD 22-01-21 (Газар хөдлөлтийн бүс нутагт барилга төлөвлөх БНбД 22-01-21)	2021
	Fire Precaution Norm of Construction Design Drawings BNbD 21-02-02 (Барилга байгууламжийн галын аюулгүй байдал БНбД 21-02-02)	2002
	Climate and Geophysical Evidence of Construction BNbD 23-01-09. (Барилгад хэрэглэх уур амьсгал ба геофизикийн үзүүлэлт БНбД 23-01-09)	2009
	Cast in situ Reinforced Concrete Structures BNbD 52-02-05 (Цутгамал бетон, төмөр бетон бүтээц. БНбД 52-02-05)	2005
	Wooden Structure Design BNbD 54-01-21 (Модон бүтээцийн төсөллөлт БНбД 54-01-21)	2021
	Masonry Structure BNbD 51-02-05. (Өрөгт бүтээц БНбД 51-02-05)	2005
	Masonry and Reinforced Masonry Structure BNbD 2.03.02-90 (Өрөгт ба арматурласан өрөгт бүтээц БНбД 2.03.02-90)	1990
	Steel Structures BNbD 53-03-22 (Ган бүтээц БНбД 53-03-22)	2022
	Designing accessibility to buildings and facilities for people with disabilities BNbD 35-01-22 (БАРИЛГА, БАЙГУУЛАМЖИД ХӨГЖЛИЙН БЭРХШЭЭЛТЭЙ ИРГЭНИЙ ХҮРТЭЭМЖИЙГ ТӨЛӨВЛӨХ БНбД 35-01-22)	2022
	Law on Construction ("Барилгын тухай хууль")	2016
	United Acceptance Standard for Building Construction Quality ("Барилгын чанарыг хүлээн авах нэгдсэн стандарт")	2023
	The Mongolian Construction Norms and Rules	Varies
	The Law of Mongolia on Information Transparency and Right to Information	2011
	Receiving and Resolving Construction Permit Requests Electronially and Providing a One-Stop Service for the Construction Industry ("Бйрилгын Үйл Ажиллагаанд Холбогдсон Зөвшөөрөл Олгох Хүсэлтийг Цахимаар Хүлээн Авч Шийдвэрлэх Болон Барилгын Салбарт Нэг Цэгийн Үйлчилгээ Үзүүлэх")	2022
Morocco	Law No. 12-90 relating to urban planning (Loi n° 12-90 relative à l'urbanisme)	1992
	The Seismic Construction Regulations - RPS 2000-2011 version (Le Règlement de Construction Parasismique - RPS 2000-Version 2011)	2013



Country	Name of Code or Standard	Date of Publication
Morocco (cont.)	Decree No. 2-12-666 approving the earthquake-resistance regulations for earthen constructions and establishing the National Committee for Earthen Constructions (Décret n° 2-12-666 approuvant le règlement parasismique pour les constructions en terre et instituant le Comité national des constructions en terre)	2013
	Rules BAEL 91 reviewed 99 - Technical rules for the design and calculation of structures and constructions in reinforced concrete using the limit states method - BAEL 91 (Règles BAEL 91 révisées 99 - Règles techniques de conception et de calcul des ouvrages et constructions en béton armé suivant la méthode des états limites)	1992 (updated in 2000)
	Rules NV 65 - Rules defining the effects of snow and wind on buildings and annexes (Règles NV 65 - Règles définissant les effets de la neige et du vent sur les constructions et annexes)	2009
	Rules for calculating steel constructions (Règles de calcul des constructions en acier)	1976
	Practical guide to using RPS 2000 seismic construction regulations «2011 version» (Guide pratique d'utilisation du règlement de construction parasismique RPS 2000 «version 2011»)	2013
	Decree No. 2-14-499 approving the general construction regulations establishing the safety rules against the risks of fire and panic in constructions and establishing the national committee for the prevention of fire and panic risks in constructions (Décret n° 2-14-499 approuvant le règlement général de construction fixant les règles de sécurité contre les risques d'incendie et de panique dans les constructions et instituant le comité national de la prévention des risques d'incendie et de panique dans les constructions)	2014
	Law No. 36-15 on Water (Loi n° 36-15 relative à l'eau)	2016
	Finance Law No. 40-08 for the budgetary year 2009 (Loi de finances n° 40-08 pour l'année budgétaire 2009)	2009
	Law No. 110-14 establishing a coverage system for the consequences of catastrophic events and amending and supplementing Law No. 17-99 on the Insurance Code (Loi n° 110-14 instituant un régime de couverture des conséquences d'événements catastrophiques et modifiant et complétant la loi n° 17-99 portant code des assurances)	2016
	Morocco National Disaster Risk Management Strategy 2020–2030 (Stratégie Nationale de Gestion des Risques des Catastrophes Naturelles 2020–2030)	2020
	Framework Law No. 99-12 establishing the National Charter for the environment and sustainable development (Loi-Cadre n° 99-12 portant charte nationale de l'environnement et du développement durable)	2014
	Law No. 47-09 On Energy Efficiency (Loi n° 47-09 relative à l'efficacité énergétique)	2011
	Decree No. 2-13-874 approving the general construction regulations setting the rules for energy performance of buildings and establishing the national committee for energy efficiency in building (Décret n° 2-13-874 approuvant le règlement général de construction fixant les règles de performance énergétique des constructions et instituant le comité national de l'efficacité énergétique dans le bâtiment)	2014
	Decree No. 2-17-746 relating to the mandatory energy audit and energy audit organizations (Décret n° 2-17-746 relatif à l'audit énergétique obligatoire et aux organismes d'audit énergétique)	2019
	Law No. 13-09 relating to renewable energies (Loi n° 13-09 relative aux énergies renouvelables)	2010
	Law No. 58 - 15 amending and supplementing Law No. 13-09 on renewable energies (Loi n° 58-15 modifiant et complétant la loi n° 13-09 relative aux énergies renouvelables)	2016
	Draft of Moroccan Standard PNM 14.2.303 Energy labeling of electrical products and household appliances – Requirements for lamps and lighting fixtures (Projet de Norme Marocaine PNM 14.2.303 Etiquetage énergétique des produits électriques et des appareils électroménagers – Exigences pour les lampes et les luminaires)	2020
	Guide - Design, sizing and implementation of solar installations in collective housing. Integration of solar water heaters into collective buildings (Guide - Conception, dimensionnement et réalisation des installations solaires dans les logements collectifs. Integration des chauffe-eau solaires dans le bâtiment collectif)	2017

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Morocco (cont.)	Guide for best practices in energy management - at the city and housing level (Guide des bonnes pratiques pour la maîtrise de l'énergie - à l'échelle de la ville et de l'habitat)	2014
	Professionals in the tourism sector in Morocco: Your technical guide to energy efficiency (Professionnels du secteur touristique au Maroc: Votre guide technique en efficacité énergétique)	n.d.
	Technical Guide for heating, ventilation and air conditioning (Guide technique pour le chauffage, la ventilation et la climatisation)	n.d.
	Law No. 28-00 relating to waste management and its elimination (Loi n° 28-00 relative à la gestion des déchets et à leur élimination)	2006
	Draft of Moroccan Standard PNM EN 12665 IC 00.3.205/2023 Light and lighting – Basic terms and criteria for specifying lighting requirements (Projet de Norme Marocaine PNM EN 12665 IC 00.3.205/2023 Lumière et éclairage – Termes de base et critères pour la spécification des exigences en éclairage)	2023
	Decree of the Minister of Employment and Vocational Training No. 93-08 establishing the general and specific implementing measures relating to the principles set out in articles 281 to 291 of the labor code (Arrêté du ministre de l'emploi et de la formation professionnelle n° 93-08 fixant les mesures d'application générales et particulières relatives aux principes énoncés par les articles de 281 à 291 du code du travail)	2008
	Numerous Moroccan Standards (MN) related to water fixtures (e.g. NM 10.4.291 Maintenance service activities for faucets in real estate complexes - Contribution to controlling water consumption) (NM 10.4.291 Activités de service de maintenance de robinetterie dans les ensembles immobiliers - Contribution à la maîtrise des consommations d'eau)	2002 – 2024
	Law No. 10-03 on accessibility (Loi n° 10-03 relative aux accessibilités)	2003
	Decree No. 2-11-246 implementing Law No. 10-03 on accessibility (Décret n° 2-11-246 portant application de la loi n° 10-03 relative aux accessibilités)	2011
	Joint decree of the Minister of Industry, Investment, Trade and the Digital Economy, Acting Minister of National Planning, Urban Planning, Housing and Urban Policy and the Minister of the Interior No. 2306-17 establishing the technical specifications and measures of the various accessibility measures in terms of urban planning (Arrêté conjoint du ministre de l'industrie, de l'investissement, du commerce et de l'économie numérique, ministre de l'aménagement du territoire national, de l'urbanisme, de l'habitat et de la politique de la ville par intérim et du ministre de l'intérieur n° 2306-17 fixant les spécificités techniques et les mesures des différentes accessibilités en matière d'urbanisme)	2017
	Joint Decision of the Minister of National Land Use Planning, Urban Planning, Housing and City Policy and the Minister of the Interior No. 3146.18 of February 28, 2019 specifying the technical characteristics related to architectural accessibility	2019
	Guide for applying accessibility rules. Technical requirements and practical recommendations (city and housing). (Guide d'application des règles d'accessibilité Prescriptions techniques et recommandations pratiques (ville et logement))	2019
	Decree No. 2-18-577 of June 12, 2019 approving the general construction regulations setting out the form and conditions for issuing authorizations and documents required in application of the legislation relating to urban planning and subdivisions, groups of dwellings and divisions as well as the texts adopted for its application (Décret n° 2-18-577 du 12 juin 2019 approuvant le règlement général de construction fixant la forme et les conditions de délivrance des autorisations et des pièces exigibles en application de la législation relative à l'urbanisme et aux lotissements, groupes d'habitations et morcellements ainsi que des textes pris pour son application)	2019
	Joint Order of the Minister of National Regional Planning, Urban Planning, Housing and Urban Policy and the Minister of the Interior No. 337-20 of January 21, 2020 setting out the constituent documents of the files required for authorization applications in application of the legislation relating to urban planning and subdivisions, housing complexes and land parceling as well as the texts adopted for its application (Arrêté conjoint de la ministre de l'aménagement du territoire national, de l'urbanisme, de l'habitat et de la politique de la ville et du ministre de l'intérieur n° 337-20 du 21 janvier 2020 fixant les pièces constitutives des dossiers exigibles aux demandes d'autorisation en application de la législation relative à l'urbanisme et aux lotissements, groupes d'habitations et morcellements ainsi que des textes pris pour son application)	2020



Country	Name of Code or Standard	Date of Publication
Morocco (cont.)	Law 66-12 relating to the control and prosecution of violations in matters of urban planning and construction (Loi 66-12 relative au contrôle et à la répression des infractions en matière d'urbanisme et de construction)	2016
	Law No. 55-19 relating to the simplification of administrative procedures and formalities (Loi n° 55-19 relative à la simplification des procédures et des formalités administratives)	2020
	Decree No. 2-98-984 of March 22, 1999 establishing, for the award of certain service contracts on behalf of the State, a system of approval of natural or legal persons carrying out studies and project management services (Décret n° 2-98-984 du 22 mars 1999 instituant, pour la passation de certains marchés de services pour le compte de l'Etat un système d'agrément des personnes physiques ou morales exécutant des prestations d'études et de maîtrise d'œuvre)	1999
	Decree No. 2-94-223 of June 16, 1994 establishing, on behalf of the Ministry of Public Works, Vocational Training and Executive Training, a system of qualification and classification of construction and public works companies. (Décret n°2-94-223 du 16 juin 1994 instituant, pour le compte du Ministère des Travaux Publics de la Formation Professionnelle et de la Formation des Cadres, un système de qualification et de classification des entreprises de bâtiment et de travaux publics)	1994
	Law No. 95-17 relating to arbitration and conventional mediation (Loi n° 95-17 relative à l'arbitrage et la médiation conventionnelle)	2022
	Law 31-13 relating to the right of access to information (Loi 31-13 relative au droit d'accès à l'information)	2018
	Circular No. 7.22 relating to the appointment of inspectors in the field of urban planning and construction and the coordination and monitoring of inspection operations. (Joint circular of the Ministry of the Interior and the Ministry of National Land Use Planning, Urban Planning, Housing and Urban Policy). (La circulaire n°7.22 relative à la nomination des contrôleurs dans le domaine de l'urbanisme et de la construction et la coordination et le suivi des opérations de contrôle (Circulaire conjointe du Ministère de l'Intérieur et du Ministère de l'Aménagement du territoire national, de l'Urbanisme, de l'Habitat et de la Politique de la Ville)	2022
	Decree No. 1-92-7 of June 17, 1992 promulgating Law No. 25-90 relating to subdivisions, housing groups and divisions (Dahir No. 1-92-7 du 17 juin 1992 portant promulgation de la loi No. 25-90 relative aux lotissements, groupes d'habitations et morcellements)	1992
	Decree No. 1-60-063 of June 25, 1960 relating to the development of rural agglomerations (Dahir No. 1-60-063 du 25 juin 1960 relatif au développement des agglomérations rurales)	1960
	Decree No. 2.18.475 of June 12, 2019 establishing the measures and procedures for granting authorizations for repair, maintenance, regularization and demolition. And Decree extending the regularization deadlines by an additional 2 years: No. 2.23.103 of May 8, 2023 (Décret No. 2.18.475 du 12 juin 2019 fixant les mesures et les modalités d'octroi des autorisations de réparation d'entretien, de régularisation et de démolition. Et Décret de prolongation des délais de régularisation de 2 ans supplémentaires: No. 2.23.103 du 08 mai 2023)	2019
	Decree No. 2-92-832 of October 14, 1993 issued for the application of Law No. 12-90 relating to urban planning (Décret No.2-92-832 du 14 octobre 1993 pris pour l'application de la loi No. 12-90 relative à l'urbanisme)	1993
	Decree No. 2-92-833 of October 12, 1993 issued for the application of Law No. 25-90 relating to subdivisions, groups of dwellings and parcels of land (Décret No. 2-92-833 du 12 octobre 1993 pris pour l'application de la loi No. 25-90 relative aux lotissements, groupes d'habitations et morcellements)	1993
	Decree No. 2.19.409 of October 8, 2019 relating to the methods of monitoring and prosecution of violations in the area of urban planning and construction (Décret No.2.19.409 du 08 octobre 2019 relatif aux modalités de contrôle et répression des infractions en matière de l'urbanisme et de construction)	2019
	Joint Circular No. 07-17 of August 1, 2017 relating to the control and prosecution of violations in the area of urban planning (Circulaire conjointe No.07-17 du 1er août 2017 relative au contrôle et répression des infraction en matière de l'urbanisme)	2017



Country	Name of Code or Standard	Date of Publication
Morocco (cont.)	Joint Circular No. 19-09 regarding the granting of regularization permits for noncompliant construction. Joint Circular of the Ministry of the Interior and the Ministry of National Land Use Planning, Urban Development, Housing and Urban Policy (Circulaire conjointe No. 19-09 relative à l'octroi du permis de régularisation des constructions non réglementaires. Circulaire conjointe du Ministère de l'Intérieur et du Ministère de l'Aménagement du territoire national, de l'Urbanisme, de l'Habitat et de la Politique de la Ville)	2020
	Organic Law 113-14 relating to municipalities (Loi organique 113-14 relative aux communes)	2015
	Joint decree of the Minister of Regional Planning, Housing and Urban Policy and the Minister of the Interior No. 792-22 of March 7, 2022 establishing the document templates relating to the control and prosecution of violations in matters of urban planning and construction (Arrêté commun du ministre de l'aménagement du territoire, de l'habitat et de la politique de la ville et du ministre de l'intérieur n° 792-22 du 7 Mars 2022 fixant les modèles de documents relatifs au contrôle et à la répression des infractions en matière d'urbanisme et de construction)	2022
	Joint circular of April 28, 2023 relating to the simplification of the construction authorization procedure in rural areas (Circulaire conjointe du 28 avril 2023 relative à la simplification de la procédure d'autorisation de construction dans le milieu rural)	2023
	Law No. 25-90 relating to subdivisions, housing complexes and land parceling (Loi n° 25-90 relative aux lotissements, groupes d'habitations et morcellements)	1993
	Guide to the control and prosecution of urban planning violations - Annex to circular no. 07.22 (Guide de contrôle et de répression d'infraction en matière d'urbanisme - Annexe à la circulaire n° 07.22)	2022
Mozambique	Decree No. 44 041 Approval of Code for Actions for Buildings and Bridges (Decreto n° 40 041 Aprovação do Regulamento de Solicitações em Edifícios e Pontes)	1961
	Decree No. 47 723 Approval of Code for Reinforced Concrete Structures (Decreto n° 47 723 Aprovação do Regulamento de Estruturas de Betão Armado)	1967
	Decree No. 46 160 Approval of Code for Steel Structures for Buildings (Decreto n° 46 160 Aprovação do Regulamento de Estruturas de Aço para Edifícios)	1965
	Ministerial Decree No. 122/221 - Guidelines on Resilience to Natural Hazards, Environmental and Social Safeguards for School Buildings (Diploma Ministerial n° 122/221 - Diretrizes sobre Resiliência às Ameaças Naturais, Salvaguardas Ambientais e Sociais para as Edificações Escolares)	2021
	Decree No. 53/2008 - Regulations for the Construction and Maintenance of Technical Devices for Accessibility, Circulation and Use of Service Systems and Public Places for Persons with Physical Disabilities or Mobility Restrictions (Decreto n° 53/2008 - Regulamento de Construção e Manutenção dos Dispositivos Técnicos de Acessibilidade, Circulação e Utilização dos Sistemas de Serviços e Lugares Públicos à Pessoa Portadora de Deficiência Física ou de Mobilidade Condicionada)	2008
	Decree No. 79/2022: Regulation on the Contracting of Public Works, Supply of Goods and Provision of Services to the State (Decreto n.º 79/2022: Regulamento de Contratação de Empreitada de Obras Públicas, Fornecimento de Bens e Prestação de Serviços ao Estado)	2022
	Ministerial Decree No. 76/2015 Regulation of the Licensing of the Activity of Construction Consultancy (Diploma Ministerial nr. 76/2015 Regulamento do Licenciamento da Actividade de Consultoria de Construção Civil)	2015
	Ministerial Decree No. 77/2015 Regulation of the Licensing of the Activity of Civil Construction Contractor (Diploma Ministerial nr. 77/2015 Regulamento do Licenciamento da Actividade de Empreiteiro de Construção Civil)	2015
	Decree No. 94/2013: Regulation of the Practice of the Activity of Civil Construction Contractor and Consultant (Decreto n.º 94/2013: Regulamento do Exercício da Actividade de Empreiteiro e de Consultor de Construção Civil)	2013
	Ministerial Decree No. 12/2017: Operating Regulations of the Commission for the Licensing of Civil Construction Contractors and Consultants (Diploma Ministerial n.º 12/2017: Regulamento de Funcionamento da Comissão de Licenciamento de Empreiteiros e de Consultores de Construção Civil)	2017



Country	Name of Code or Standard	Date of Publication
Mozambique (cont.)	Law No. 16/2002: Creates the Order of Engineers of Mozambique and approves its statute (Lei nr. 16/2002: Cria a Ordem dos Engenheiros de Moçambique e aprova o seu estatuto)	2002
	Decree No. 2/2004 Licensing regime for Private Works (Decreto nº2/2004 Regime de licenciamento de Obras Particulares)	2004
	Decree No. 83/2018: Creates the General Inspectorate of Public Works, a Public Institute abbreviated as IGOP-IP (Decreto n.º 83/2018: Cria a Inspeção-Geral de Obras Públicas, Instituto Público abreviadamente designada por IGOP-IP)	2018
	Resolution No. 54/2022: Approves the Strategy for Electronic Public Procurement (Resolução n.º 54/2022: Aprova a Estratégia para Contratação Pública Electrónica)	2022
	Law No. 3/2017: Law on Electronic Transactions (Lei n.º 3/2017: Lei de Transacções Electrónicas)	2017
	Law No. 11/99 Governs Arbitration, Conciliation and Mediation as alternative means of conflict resolution (Lei nº11/99 Rege a Arbitragem, a Conciliação e a Mediação como meios alternativos de resolução de conflitos)	1999
	Standard Contract - Public Works Contract Competition Document (Contrato Padrão - Documento De Concurso Para Empreitada De Obras Públicas)	2023
	Law No. 34/2014: Right to Information Act (Lei n.º 34/2014: Lei do Direito à Informação)	2014
	Maputo Municipal Assembly. Resolution No. 76/AM/2017 of 19 June 2018 (Assembleia Municipal de Maputo. Resolução n.º 76/AM/2017 de 19 de Junho 2018)	2018
Nepal	NBC 000:1994 Requirements for State-of-the-Art Design – An Introduction	1994
	NBC 101:1994 Materials Specification	1994
	NBC 102:1994 Unit Weight of Materials	1994
	NBC 103:1994 Occupancy Load (Imposed Load)	1994
	NBC 104:1994 Wind Load	1994
	NBC 105:2020 Seismic Design of Buildings in Nepal	2020
	NBC 106:1994 Snow Load	1994
	NBC 107:1994 Provisional Recommendation on Fire Safety	1994
	NBC 108:1994 Site Consideration for Sesimic Hazards	1994
	NBC 109:1994 Masonry: Unreinforced	1994
	NBC 110: 1994 Plain and Reinforced Concrete	1994
	NBC 111:1994 Steel	1994
	NBC 112:1994 Timber	1994
	NBC 113:1994 Aluminium	1994
	NBC 114:1994 Construction Safety	1994
	NBC 201:1994 Mandatory Rules of Thumb - Reinforced Concrete Buildings with Masonry Infill	1994
	NBC 202:2015 Guidelines on Load Bearing Masonry	2015
	NBC 203:2015 Guidelines for Earthquake Resistant Building Construction: Low Strength Masonry	2015
	NBC 204:2015 Guidelines for Earthquake Resistant Building Construction: Earthen Building (EB)	2015
	NBC 205:2024 Ready-to-use Detailing Guideline for Low Rise Reinforced Concrete Buildings without Masonry Infill	2024
	NBC 206:2024 Architectural Design Requirements	2024
	NBC 207:2003 Electrical Design Requirement for (Public Buildings)	2003
	NBC 208:2003 Sanitary and Plumbing Design Requirements	2003

Country	Name of Code or Standard	Date of Publication
Nepal (cont.)	IS 875 (Part 3) Design Loads (other than Earthquake) for Buildings and Structures - Code of Practice - Part 3 Wind Loads	2015 (reaffirmed 2020)
	Seismic Vulnerability Evaluation Guideline for Private and Public Buildings	2011
	The Building Act, 2055	2008
	The Building Rule, 2066	2009
	Building By-laws for Kathmandu Valley, 2064	2007
	Kathmandu Metropolitan City, Building Construction Procedures, 2080	2008
	Right to information Act	2007
	The Construction Business Rules	2000
	The Arbitration Act, 1999 (2055)	1999
	The Mediation Act, 2011 (2068)	2011
	The Engineer Council Act	1999
	Reference Book on Building By-laws and Building Permit System	2023
Peru	Supreme Decree No. 011-2006-Housing - National Building Regulations— RNE (Decreto Supremo N° 011-2006-Vivienda - Reglamento Nacional de Edificaciones—RNE)	2006
	RNE - Rule E.010 Wood (Reglamento Nacional de Edificaciones - Norma E.010 Madera)	2020
	RNE - Rule E.020 Loads (Reglamento Nacional de Edificaciones - Norma E.020 Cargas)	2020
	RNE - Rule E.030 Earthquake-resistant Design (Reglamento Nacional de Edificaciones - Norma E.030 Diseño Sismorresistente)	2020
	RNE - Rule E.031 Seismic Isolation (Reglamento Nacional de Edificaciones - Norma E.031 Aislamiento sísmico)	2020
	RNE - Rule E.040 Glass (Reglamento Nacional de Edificaciones - Norma E.040 Vidrio)	2020
	RNE - Rule E.050 Soils and foundations (Reglamento Nacional de Edificaciones - Norma E.050 Suelos y cimentaciones)	2020
	RNE - Rule E.060 Reinforced concrete (Reglamento Nacional de Edificaciones - Norma E.060 Concreto armado)	2020
	RNE - Rule E.070 Masonry (Reglamento Nacional de Edificaciones - Norma E.070 Albañilería)	2020
	RNE - Rule E.080 Design and construction with reinforced earth (Reglamento Nacional de Edificaciones - Norma E.080 Diseño y construcción con tierra reforzada)	2020
	RNE - Rule E.090 Metal Structures (Reglamento Nacional de Edificaciones - Norma E.090 Estructuras metálicas)	2020
	RNE - Rule E.100 Bamboo (Reglamento Nacional de Edificaciones - Norma E.100 Bambú)	2020
	Ministerial Decision No. 219-2021-Housing - Guidelines for the design of buildings for vertical evacuation in the face of tsunamis (Resolución Ministerial N° 219-2021-Vivienda - Lineamientos para el diseño de construcciones para evacuación vertical frente a tsunamis)	2021
	Technical Code for Sustainable Construction (Código Técnico de Construcción Sostenible)	2021
	Rule EM.110 Thermal and lighting comfort with energy efficiency (Norma EM. 110 Confort térmico y lumínico con eficiencia energética)	2014
	Certification procedure for projects from “Mivivienda” program (Procedimiento de certificación de proyectos del programa Mivivienda sostenible)	2020
	Ministerial Decision No. 191-2021-Housing - Modification of Technical Standard A.010, General Conditions of the Design of the National Building Regulation (Resolución Ministerial N° 191-2021-Vivienda - Modificación de la Norma Técnica A.010, Condiciones Generales de Diseño del Reglamento Nacional de Edificaciones)	2021



Country	Name of Code or Standard	Date of Publication
Peru	Ministerial Decision No. 188-2021-Housing - Modification of Technical Standard A.020 "Housing" from the National Building Regulation (Resolución Ministerial N° 188-2021-Vivienda - Modificación de la Norma Técnica A.020 "Vivienda" del Reglamento Nacional de Edificaciones)	2021
	Ordinance No. 618/MM - Ordinance that establishes, regulates and promotes conditions for sustainable buildings in the district of Miraflores (Ordenanza N° 618/MM Ordenanza que establece, regula y promueve condiciones para edificaciones sostenibles en el distrito de Miraflores)	2023
	Ministerial Decision No. 075-2023-Housing - Modification of Technical Standard A.120 "Universal Accessibility in Buildings" from the National Building Regulation (Resolución Ministerial N° 075-2023-Vivienda - Modificación de la Norma Técnica A.120 "Accesibilidad Universal en Edificaciones" del Reglamento Nacional de Edificaciones)	2023
	National Multisectoral Policy on Disability for Development by 2030 (Política Nacional Multisectorial en Discapacidad para el Desarrollo al 2030)	2021
	National Accessibility Plan 2018-2023 - Proposal/Working document (Plan Nacional de Accesibilidad 2018-2023 - Propuesta/Documento de trabajo)	n.d.
	Technical Standard "General Design Criteria for Educational Infrastructure" (Norma Técnica "Criterios Generales de Diseño para Infraestructura Educativa")	2021
	Law 29090 – Law for Regulation of Urban and Buildings Modifications (Ley 29090 – Ley de Regulación de Habilitaciones Urbanas y de Edificaciones)	2017
	Supreme Decree 029-2019 that establishes the Regulation of Urban Modifications Licenses and Building Licenses (Decreto Supremo 029-2019 que aprueba el Reglamento de Licencias de Habilitación Urbanas y Licencias de Edificación)	2019
	Supreme Decree 002-2017 that establishes the Administrative and Technical Verification Regulation (Decreto Supremo 002-2017 que aprueba el Reglamento de Verificación Administrativa y Técnica)	2017
	Legislative Decree 1412 - Digital Government Law (Decreto Legislativo 1412 - Ley de Gobierno Digital)	2018
	Law 27806 – Law on Transparency and access to public Information (Ley 27806 - Ley de Transparencia y acceso a la información pública)	2002
	Technical Standard G.030 Rights and Responsibilities (Norma Técnica G.030 Derechos y Responsabilidades)	2006
	Law No. 27444 - General Administrative Procedure Law (Ley n°27444 - Ley del Procedimiento Administrativo General)	2017
	Law No.26872 - Law of Conciliation (Ley n°26872 - Ley de Conciliación)	2008
	Law 28966 - Law that complements the existing legal framework regarding the professional practice of architects (Ley 28966 - Ley que complementa el marco legal vigente referido al ejercicio profesional del arquitecto)	2007
	Regulation of Law 28858, Law that complements Law No.16053, Law that authorizes the College of Engineers of Peru, to supervise Engineering professionals of the Republic (Reglamento de la Ley 28858, Ley que complementa la Ley n°16053, Ley que autoriza al Colegio de Ingenieros del Perú, para supervisar a los profesionales de Ingeniería de la República)	2008
	Law 27972 - Organic Law of Municipalities (Ley 27972 - Ley Orgánica de Municipalidades)	2003
	Law 30225 – Law on State Contracts (Ley 30225 - Ley de Contrataciones del Estado)	2018
Philippines	NSCP C101-15 - National Structural Code of the Philippines 2015, Vol I - Buildings, Towers and Other Vertical Structures	2016
	Implementing Rules and Regulations of the National Building Code of the Philippines (PD 1096) - 2005 Revised Edition	2005
	The Philippine Green Building Code	2015
	National Law No. 344 (Accessibility Law) and its Implementing Rules and Regulations (Batas Bambansa Bilang 344)	2008



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Philippines (cont.)	Ease of Doing Business and Efficient Government Service Delivery Act	2018
	Alternative Dispute Resolution Act	2004
	Local Government Code of the Philippines	1991
	Civil Engineering Law	1956
	The Architecture Act	2004
	Contractors' License Law	1965
	Freedom of information Act	2016
Rwanda	Rwanda Building Code - Version 2 - 2019	2019
	RS 112:2011 - Basis of Structural Design	2011
	RS 114-2:2021 - Structural Design - Actions on structures - Part 2: Wind actions	2021
	RS ISO 3010:2017 - Bases for design structures - Seismic actions on structures	2017
	Complementary provisions to the Rwanda Building Code (2019) in relation to Peak Ground Acceleration	2023
	RS 113:2021 - Geotechnical design - General requirements	2021
	RS 142:2021 - Design of concrete structures - General rules and rules for buildings - Code of practice	2021
	Technical Guidelines in Adobe Block (Rukarakara) Construction in Rwanda	2022
	Rwanda Green Building Minimum Compliance System (Official Gazette no. Special of 16/04/2019 - Annex 3)	2019
	RS 115:2011 - Building Construction - Design of facilities for people with disability - Code of practice	2011
	Law No. 10/2012 Governing Urban Planning and Building in Rwanda	2012
	Ministerial Order No.03/CAB.M/019 of 15/04/2019 determining Urban Planning and Building regulations	2019
	Rwanda Building Inspection Guidelines	2012
	Construction Permit Procedure Guidelines (City of Kigali)	2013
	Law No.26/2012 governing the professions of architecture and engineering and establishing the institute of architects and the institute of engineers in Rwanda	2012
	Law No.04/2013 Relating to Access to Information	2013
	Ministerial Order No.02/CAB.M/019 of 15/04/2019 determining categorization of buildings and procedures for applying for and granting building permits	2019
	Law No.24/2016 Governing Information and Communication Technologies	2016
	Ministerial Instructions No.01/CAB.M/017 of 28/04/2017 determining inspection of types of Buildings in Relation to their Anticipated Risks	2017
Samoa	National Building Code of Samoa	2017
	AS/NZS 1170.0:2002 - Structural design actions - Part 0: General principles	2002 - incorporating amendments up to 2011
	AS/NZS 1170.2:2011 - Structural design actions - Part 2: Wind actions	2011
	NZS 4203:1992 - Code of Practice for General Structural Design and Design Loadings for Buildings	1992
	AS 1170.4:1993 - Minimum design loads on structures - Part 4: Earthquake loads	1993
	NZS 1170.5:2004 - Structural design actions - Part 5: Earthquake actions - New Zealand	2004 - includes amendment in 2016
	NZS 3101.1:2006 and NZS 3101.2:2006 - Concrete structures standard - Part 1: The design of concrete structures - Part 2: Commentary on the design of concrete structures	2006



Country	Name of Code or Standard	Date of Publication
Samoa (cont.)	AS 3600:2001 - Concrete structures	2001
	NZS 4230:2004 - Design of reinforced concrete masonry structures	2004
	NZS 4229:2013 - Concrete masonry buildings not requiring specific engineering design	2013
	NZS 3404.Part 1:1997 - Steel Structures Standard & NZS 3404.Part 2:1997 - Commentary to the Steel Structures Standard	1997
	AS 4100:2020 - Steel structures	2020
	NASH Standard - Part Two: 2019 - Light Steel Framed Buildings	2019
	BS 8004:1986 - Code of practice for Foundations	1986
	AS 4678:2002 - Earth-retaining structures	2002
	AS 1720.1:2010 - Timber Structures - Part 1: Design methods	2010
	NZS 3603:1993 - Timber Structures Standard	1993
	NZS 4210:2001 - Masonry Construction: Materials and Workmanship	2001
	Planning and Urban Management Act 2004	2004
	Ministry of Works Act 2002	2002
	Planning and Development Guidelines for Housing	2006
	Alternative Dispute Resolution Act 2007	2007
	Professional Engineers (Registrations) Act 1998	1998
	Companies Amendment Act 2006	2006
South Africa	SANS 10400-B:2020 – The application of the National Building Regulations – Part B: Structural Design (Edition 4)	2020
	SANS 10160-1:2019 – Basis of structural design and actions for buildings and industrial structures – Part 1: Basis of Structural Design (Edition 1.3)	2019
	SANS 10160-2:2011 – Basis of structural design and actions for buildings and industrial structures – Part 2: Self-weight and imposed loads (Edition 1.1)	2011
	SANS 10160-3:2019 – Basis of structural design and actions for buildings and industrial structures – Part 3: Wind actions (Edition 2.1)	2019
	SANS 10160-4:2017 – Basis of structural design and actions for buildings and industrial structures – Part 4: Seismic actions and general requirements for buildings (Edition 2)	2017
	SANS 10160-5:2021 – Basis of structural design and actions for buildings and industrial structures – Part 5: Basis for geotechnical design and actions (Edition 1.2)	2021
	SANS 10100-1:2000 – The structural use of concrete – Part 1: Design (Edition 2.2)	2000
	SANS 10162-1:2011 – The structural use of steel – Part 1: Limit-states design of hot-rolled steelwork (Edition 2.1)	2011
	SANS 10163-1:2012 – The structural use of timber – Part 1: Limit-states design (Edition 2.3)	2012
	SABS 0163-2:2001 – The structural use of timber – Part 2: Allowable stress design	2001
	SABS 0164:Part 1-1980 – Code of practice – The structural use of masonry – Part 1: Unreinforced masonry walling	1980 (amended in 1986 and 1987)
	SANS 10164-2:2008 – The structural use of masonry – Part 2: Structural design and requirements for reinforced and prestressed masonry (Edition 1.2)	2008
	SANS 10162-2:2011 – The structural use of steel – Part 2: Cold-formed steel structures (Edition 2)	2011
	SABS 0162-4:1997 – Structural use of steel – Part 4: The design of cold-formed stainless steel structural members (First edition)	1997
	National Building Regulations and Building Standards Act 103 of 1977	1977
	SANS 10100-2:2014 – The structural use of concrete – Part 2: Materials and execution of work (Edition 3)	2014
	National Water Act 36 of 1998	1998



Country	Name of Code or Standard	Date of Publication
South Africa (cont.)	SANS 10400-Part P:2010 – The application of the National Building Regulations – Part P: Drainage	2010
	SANS 10400-XA:2021 – The application of the National Building Regulations – Part XA: Energy usage in buildings (Edition 2)	2021
	SANS 3088:2019 – Water Efficiency in Buildings (Edition 1)	2019
	SANS 10400-S:2011 – The application of the National Building Regulations – Part S: Facilities for persons with disabilities (Edition 3)	2011
	Construction Regulations 2014	2014
	Construction Permit Management System User Manual for Architects, Homeowners and Agents	2022
	Architectural Profession Act	2000
	Engineers Profession Act	2000
	Construction Industry Development Board Act 38	2000
	The Constitution of the Republic of South Africa	1996
	Promotion of Access to Information Act	2000
	Local Government Municipal Systems Act	2000
	Arbitration Act 42	1965
Tajikistan	SNiP RT 22-07-2018 Earthquake Engineering (Сейсмостойкое строительство)	2019
	GNiP RT 20-01-2012 Loads and Influences (Нагрузки и воздействия)	2016
	SNiP RT 50-01-2021 Foundations of building and structures (Основания зданий и сооружений)	2022
	GNiP RT 50-02-2015 Pile foundations (Свайные фундаменты)	2015
	MKS ChT 52-02-2022 Bearing and envelope structures (Несущие и ограждающие конструкции)	2022
	GNiP RT 51-01-2013 Masonry and reinforced masonry structures (Каменные и армокаменные конструкции)	2016
	GNiP RT 52-04-2012 Steel structures (Стальные конструкции)	2016
	SNiP RT 52-03-2020 Concrete and reinforced concrete structures (Бетонные и железобетонные конструкции)	2021
	SNiP RT 21-01-2018 Fire Safety of buildings and structures (Пожарная безопасность зданий и сооружений)	2019
	SNiP RT 31-18-2021 High-rise buildings and complexes (Высотные здания и комплексы)	2021
	SNiP RT 31-09-2021 Healthcare institutions (Учреждения здравоохранения)	2022
	SNiP 1.02.07-87 Engineering surveys for construction (Инженерные изыскания для строительства)	1988
	SNiP 2.06.15-85 Engineering protection of territories from flooding and waterlogging (Инженерная защита территории от затопления и подтопления)	1985
	GNiP RT 20-01-2012 Loads and Influences (Нагрузки и воздействия)	2012
	SNiP 2.01.14-83 Determination of design hydrological characteristics (Определение расчетных гидрологических характеристик)	1983
	SNiP RT 50-01-2021 Foundation of buildings and structures (Основания зданий и сооружений)	2021
	SNiP II-26-76 Roofs (Кровли)	1976
	SNiP 2.01.15-90 Engineering protection of territories, buildings and structures from dangerous geological processes. Basic design provisions (Инженерная защита территорий, зданий и сооружений от опасных геологических процессов. Основные положения)	1990



Country	Name of Code or Standard	Date of Publication
Tajikistan (cont.)	SNiP RT 31-18-2021 High-rise buildings and complexes (Высотные здания и комплексы)	2021
	SNiP RT 31-02-2007 Public buildings and structures (Общественные здания и комплексы)	2007
	GOST 30971-2012 Installation joints of window assemblies adjoined to wall openings. General specifications (Швы монтажные узлов примыкания оконных блоков к стеновым проемам. Общие технические условия)	2012
	SNiP RT 23-02-2021 Construction thermotechnics	2021
	SNiP RT 01-41-2009 Heating, ventilation and air conditioning	2009
	GNiP RT 35-01-2012 Accessibility of buildings and structures for low-mobility groups of the population	2012
	(RDS RT 11-201-2020 Composition and procedure for developing detailed designs for the construction of buildings and structures	2020
	GniP RT 30-01-2018 Urban planning. Planning and development of settlements	2018
	GNiP RT 01/31/2018 Residential multi-apartment buildings	2018
	SNiP RT 35-02-2019 Social institutions for disabled children	2019
	SNiP RT 31-02-2007 Public buildings and structures	2007
	Law of Republic of Tajikistan: "Urban planning code", #1348	2016
	Law of Republic of Tajikistan on Informatization, #7	2001
	Law of Republic of Tajikistan on the Right of Access to Information, 2008	2008
	The order of administrative procedures related to the implementation of urban planning activities. Resolutions of the Government of the Republic of Tajikistan from 17.11.2016, #477, updated in 02.05.2019, #234	2016
	Law of Republic of Tajikistan on the permit system, #802, updated 04.07.2020, #1703	2012
	Regulation on the Agency for Construction and Architecture under the Government of the Republic of Tajikistan, dated 2.02.2009, #78, last updated 03.10.2012, #559	2009
	Rules of building in the Republic of Tajikistan	2017
	GNiP RT 11-06-2006 Regulations on Architectural Supervision of Construction of Buildings and Structures	2006
	The Law of RT "The Economic procedural Code of Republic of Tajikistan", approved 14.11.2007, #787	2007
Tonga	National Building Code of the Kingdom of Tonga	2007
	NZS1170.0: Structural design actions, Part 0: General principles	2002
	AS/NZS1170.1: Structural design actions, Part 1: Permanent, imposed and other actions	2002
	AS/NZS1170.2: Structural design actions, Part 2: Wind actions	2021
	AS1170.4: Minimum design loads Structures, Part 4: Earthquake loads (Australia)	1993
	California Building Code	1998
	NZS3101 (Part 1 and 2): The Design of Concrete Structures (Standard and Commentary)	2006
	AS3600: Concrete structures	2018
	NZS3109: Concrete construction	1997
	NZS4230: Design of reinforced concrete masonry structures	2004
	NZS4229: Concrete masonry buildings not requiring specific engineering design	2004
	AS3700: Masonry Structures	2018
	NZS4210: Masonry construction: Materials and workmanship	2001
	NZS3404 (Part 1 and 2): Steel Structures (Standard and Commentary)	1997
	AS4100: Steel structures	2020



Country	Name of Code or Standard	Date of Publication
Tonga (cont.)	AS/NZS1664.1	1997
	AS2159: Piling - Design and installation	1995
	AS2870.1: Residential slabs and footings, Part 1: Construction	1988
	NZS/AS1720.1: Timber Structures	2022
	NZS/AS1720.2: Timber Structures, Part 2: Timber properties	1990
	NZS3603: Timber Structures Standard	1993
	Building Code of Australia – Volume 1	2004
	Building Control and Standards Act	2004 (revised 2020)
	Building Control and Standards Regulations	2005 (revised 2020)
	Technical Record 440: Guidelines for the testing and evaluation of products for cyclone-prone areas	1978
	New Zealand Standard NZS 4121	2001
	National Spatial Planning and Development Act	2012
	Business Licenses Regulations 2007	2007
	Supreme Court Rules	2007
	Tonga National Qualifications and Accreditation Regulations 2007	2010
Türkiye	TBDY 2018 (TBEC 2018) Turkish Buildings Earthquake Code	2018
	TS500:2000 Basic Principles for Design of Reinforced Structures	1984; 2000
	TS498:2021 Loads due to use and occupancy in residential and public buildings	1987; 1997; 2021
	TÇY 2016 (Regulatory for design and construction of steel structures)	2016
	ABTY 2024 (Code for Wooden buildings: design and construction)	2024
	TKDY 2020 (Design Code for Bridges under Earthquake Effect)	2020
	BYKHY (Code for fire resistance of buildings)	2021
	TS EN 1991-4 Turkish Standard for Wind action on Structures	2007
	Law No. 6306 on Transformation of Lands Under Risk of Disaster	2012
	Regulation for Fire Resistance of Buildings	2007
	Law No. 5902 on the Establishment and Duties of the Disaster and Emergency Management Directorate	2010
	Forest Law No. 5174	1995
	Environmental Law No. 4363	1993
	Planned Areas Reconstruction Regulation	2017
	YeS-TR (Green Certificate)	2016
	B.E.S.T (Ecological and Sustainable Design in Buildings)	2013
	Accessibility Monitoring and Control Regulation	2016
	Law on Disabled Persons No. 5378	2005
	TS 9111 “The requirements of accessibility in buildings for people with disabilities and mobility constraints”	2011
	Zoning Law No. 3194	1985
	Law No. 4708: Building Inspection	1985
	Records of Building Contractors and Site Heads and Regulations on Certified Masters	2010
	Law No. 6325 on Mediation in Civil Disputes	2012
	Right to Information Act 2003	2003



Country	Name of Code or Standard	Date of Publication
Uzbekistan	KMK 2.01.03-19 Construction in Seismic Areas (Строительство в сейсмических районах) (Сейсмик-худудларда-қўрилиш)	2019
	KMK 2.01.07-96 Loads and impacts (Нагрузки и воздействия) (Юклар ва таъсирлар)	1996
	SHNK2.01.02-04 Fire safety of buildings and structures (Пожарная безопасность зданий и сооружений)(Бинолар ва иншоотларнинг ёнғин хавфсизлиги)	2004
	2.03.01-96 Concrete and reinforced concrete structures (Бетонные и железобетонные конструкции) (Бетон ва темирбетон конструкциялар)	1996
	ShNK 2.07.05-19 Residential and public buildings: Rating system for assessing the sustainability of the built environment	2019
	KMK 2.01.18-2018 Standards of energy consumption for heating, ventilation and air conditioning of buildings and structures	2018
	ShNK 2.04.14-23 Photovoltaic power stations (systems) on approval of city planning norms and rules	2023
	KMK 2.04.05-97* Heating, ventilation and air conditioning	2011
	KMK 2.01.04-97* Construction thermotechnics	2012
	ShNK 2.08.02-09* Design of energy-saving solutions for public buildings	2012
	ShNK 2.07.02-22 Design of construction projects taking into account the needs of people with disabilities and the elderly	2022
	SanPIN 0266-09 Design and construction of residential and public buildings, residential formations used by people with disabilities and low-mobility groups of children and adults	2009
	ShNK 1.03.07-2010 Regulations on author's and technical supervision in construction	2010
	№ 3PY-676 Law on approval of the urban planning complex	2021
	Act of the Cabinet of Ministers of the Republic of Uzbekistan, No. 200 "On approval of unified administrative construction regulations in the field of construction"	2022
	Presidential Decree No. UP-151 On measures for the effective organization of public administration in the field of construction and housing and communal services within the framework of administrative reforms	2023
	ShNK 1.03.06-13 Rules for conducting the state control of pre-design and urban planning documentation	2013
Vanuatu	National Building Code for Vanuatu	2000
	AS/NZS1170.2: Structural design actions, Part 2: Wind actions	2021
	NZS4203: General structural design and Design Loading for Buildings	1992
	NZS3101 (Part 1 and 2): The Design of Concrete Structures (Standard and Commentary)	2006
	NZS3109: Concrete construction	1997
	NZS3124: Specification for concrete construction for minor works	1987
	NZS4230: Design of reinforced concrete masonry structures	2004
	NZS4229: Concrete masonry buildings not requiring specific engineering design	2013
	NZS4210: Masonry construction: Materials and workmanship	2001
	NZS3404 (Part 1 and 2): Steel Structures (Standard and Commentary)	1997
	AS/NZS1664.1 – Aluminum Structures: Limit State Design	1997
	AS2159: Piling - Design and installation	1995
	NZS/AS1720.1: Timber Structures	2022
	NZS3603: Timber Structures Standard	1993
	AS 2870.1: Residential slabs and footings, Part 1: Construction	1988
	TR440: Guidelines for the testing and evaluation of products for cyclone prone areas	1978



Country	Name of Code or Standard	Date of Publication
Vanuatu (cont.)	Home building manual for Vanuatu	1990
	Building Act No. 36 of 2013	2013
	New Zealand Standard NZS 4121	2001
	National Land-use Planning Policy	2013
	Physical Planning Act CAP 193	1986
	Physical Planning (Amendment) Act 2021	2021
	Right to Information Act	2016

Annex C:

Code Influences Data

The following table provides the data used to generate Figure B2.1 in Chapter 2 indicating how model codes and international codes have influenced code development in different countries.

Data Sources: World Bank, 2023c; PRIF, 2023; ICC, 2024a; JRC, 2024b; Paz, 1994; IISEE, 2024; GEM, 2022.

Annex C:

Code Influences Data

Country name	Country code influenced by:	Country name	Country code influenced by:
Afghanistan	IBC (USA)	Grenada	Caribbean Uniform Building Code (CUBiC)
Algeria	UBC (USA)	Guam	IBC (USA)
Antigua and Barbuda	Caribbean Uniform Building Code (CUBiC)	Guatemala	UBC (USA)
Armenia	SNIP (former USSR)	Haiti	IBC (USA)
Australia	Australian codes and standards	Honduras	UBC (USA)
Austria	Eurocode (EU)	Hungary	Eurocode (EU)
Azerbaijan	SNIP (former USSR)	Iceland	Eurocode (EU)
Bangladesh	IBC (USA)	India	Indian code
Barbados	Caribbean Uniform Building Code (CUBiC)	Indonesia	IBC (USA)
Belarus	SNIP (former USSR)	Iraq	IBC (USA)
Belgium	Eurocode (EU)	Ireland	Eurocode (EU)
Bhutan	Indian code	Italy	Eurocode (EU)
Brazil	Pre-Eurocode Portuguese codes	Jamaica	IBC (USA)
Bulgaria	Eurocode (EU)	Jordan	IBC (USA)
Colombia	UBC (USA)	Kazakhstan	Eurocode (EU)
Cook Islands	New Zealand codes and standards	Korea, Rep.	IBC (USA)
Croatia	Eurocode (EU)	Kyrgyz Republic	SNIP (former USSR)
Cyprus	Eurocode (EU)	Latvia	Eurocode (EU)
Czechia	Eurocode (EU)	Lithuania	Eurocode (EU)
Denmark	Eurocode (EU)	Luxembourg	Eurocode (EU)
Djibouti	Eurocode (EU)	Malta	Eurocode (EU)
Dominica	Caribbean Uniform Building Code (CUBiC)	Moldova	SNIP (former USSR)
Dominican Republic	IBC (USA)	Mongolia	SNIP (former USSR)
Ecuador	UBC (USA)	Montenegro	Eurocode (EU)
Estonia	Eurocode (EU)	Morocco	Pre Eurocode French codes
Eswatini	South African Standards (SABS)	Mozambique	Pre Eurocode Portuguese codes
Fiji	Australian and New Zealand codes and standards	Myanmar	IBC (USA)
Finland	Eurocode (EU)	Namibia	South African Standards (SABS)
France	Eurocode (EU)	Nepal	Indian code
French Polynesia	Pre Eurocode French codes	Netherlands	Eurocode (EU)
Georgia	SNIP (former USSR)	New Zealand	New Zealand codes and standards
Germany	Eurocode (EU)	North Macedonia	Eurocode (EU)
Ghana	IBC (USA)	Norway	Eurocode (EU)
Greece	Eurocode (EU)	Pakistan	IBC (USA)
Greenland	pre Eurocode Danish codes	Panama	IBC (USA)
		Papua New Guinea	Australian codes and standards



Country name	Country code influenced by:	Country name	Country code influenced by:
Peru	UBC (USA)	Sweden	Eurocode (EU)
Philippines	UBC (USA)	Switzerland	Eurocode (EU)
Poland	Eurocode (EU)	Syrian Arab Republic	UBC (USA)
Portugal	Eurocode (EU)	Tajikistan	SNIP (former USSR)
Puerto Rico	IBC (USA)	Thailand	UBC (USA)
Romania	Eurocode (EU)	Tonga	Australian and New Zealand codes and standards
Russian Federation	SNIP (former USSR)	Trinidad and Tobago	Caribbean Uniform Building Code (CUBiC)
Rwanda	Eurocode (EU)	Tunisia	Pre Eurocode French codes
Samoa	Australian and New Zealand codes and standards	Türkiye	Eurocode (EU)
Saudi Arabia	IBC (USA)	Turkmenistan	SNIP (former USSR)
Serbia	Eurocode (EU)	Turks and Caicos Islands	IBC (USA)
Slovak Republic	Eurocode (EU)	Tuvalu	Australian and New Zealand codes and standards
Slovenia	Eurocode (EU)	Ukraine	Eurocode (EU)
Solomon Islands	Australian and New Zealand codes and standards	United Arab Emirates	IBC (USA)
South Africa	Eurocode (EU)	United Kingdom	Eurocode (EU)
Spain	Eurocode (EU)	United States	IBC (USA)
St. Kitts and Nevis	Caribbean Uniform Building Code (CUBiC)	Uzbekistan	SNIP (former USSR)
St. Lucia	Caribbean Uniform Building Code (CUBiC)	Vanuatu	Australian and New Zealand codes and standards
St. Vincent and the Grenadines	Caribbean Uniform Building Code (CUBiC)	Venezuela, RB	UBC (USA)
Suriname	Caribbean Uniform Building Code (CUBiC)	Virgin Islands (U.S.)	IBC (USA)

Annex D:

Assessment Statements

The following tables list the topics, subtopics and corresponding statements used to evaluate the structural safety and resilience, green building, and universal accessibility provisions in the documents reviewed for each country. For the assessment of the code provisions, a checkmark (✓) indicates that the requirements of the statement were satisfied and a cross (✗) indicates that the requirements of the statement were not satisfied. In some cases, where there was insufficient information to determine if the statement was satisfied, the item is marked with a 'U' (Unable to verify). Note that beyond the country's code satisfying the statement, the assessment did not evaluate the quality and/or comprehensiveness of the provisions in detail. For the assessment of the code implementation environment, a checkmark (✓) indicates the statement was satisfied, a cross (✗) indicates the statement was not satisfied, and a (P) indicates that the statement was partially satisfied.

Annex D:

Assessment Statements

Table D.1 // General Structural Provisions

Topic	Subtopic	Statement
Basis of design	Importance or risk classification of buildings	The code contains importance and/or risk classification of buildings (sometimes also called consequence classes).
Fire resistance	Fire resistance of structural elements	Some provisions related to fire resistance of the main structural elements are included in the code.
Actions on structures	Dead and live loading	Provisions for determining dead loads and minimum live loads are included in the code.
	Load combinations	The building regulation document contains load combinations for all applicable loads and materials that are covered within the document.
Geotechnical	Site investigation	The codes includes provisions for performing geotechnical site investigations and, in some cases, the code requires site investigation to be carried out.
	Design of foundations	Some provisions of the code relate to the design of foundations for buildings (including how to develop foundation design parameters based on soil type, soil data, and so on).
	Design of retaining walls	Some provisions relate to the design of retaining walls for buildings (including how to develop retaining wall design parameters based on soil type, soil data, and so on).
Materials	Minimum material requirements for concrete and reinforcing bars	The code specifies minimum structural material requirements for reinforced concrete (minimum compressive strength, minimum strength and ductility requirements for reinforcing steel).
	Provisions for construction materials	Some structural design provisions are in place for: » reinforced concrete; » precast concrete; » reinforced masonry and/or reinforced grouted hollow block masonry; » unreinforced masonry (hollow block and/or brick and/or stone); » timber; » structural steel; » confined masonry; » earth (including adobe, soil stabilized block, rammed earth, and so on); and » bamboo.
Existing buildings	Structural requirements for additions (extensions)	The code includes some provisions related to structural considerations (including seismic design where applicable) for horizontal and/or vertical building extensions (this may include addressing incremental construction practices).
	Structural requirements for change of occupancy/use	The code includes some provisions that would prompt consideration of the existing structural system capacity (including seismic design where applicable) when a change of use or occupancy is made.
	Structural assessment	The code includes provisions related to assessment of the structural condition of existing buildings.
Prescriptive rules	Simplified design rules for small-scale buildings (or “rules of thumb”)	Simplified provisions for certain types of small-scale buildings are permitted by the code and these design rules are included in the building regulation document.



Table D.2 // Seismic Design Provisions

Topic	Subtopic	Statement
Actions on structures	Procedure for seismic design criteria	The code contains a procedure to determine seismic design parameters, with at least some partial information required to perform seismic design for a specific building (for example, a procedure that specifies some elements which may include the level of design seismic hazard for a specific site and/or a procedure to determine the design level of seismic base shear).
	Country specific seismic criteria	The code contains country-specific seismic hazard parameters for design (for example, seismic hazard maps, seismic zonation maps or other seismic criteria parameters by site location or city, region, and so on).
	Consideration of soil effects in seismic design criteria	Effect of soil conditions is considered in seismic analysis/design according to the code.
	Seismic importance factors	The importance of different buildings in a post-earthquake situation is considered based on their occupancy/function (for example, importance category).
	Simplified seismic analysis procedures (for example, equivalent static)	A procedure to perform Equivalent Static Seismic Analysis is included in the code.
	Dynamic seismic analysis procedures (for example, response spectra, response time history analysis)	Procedures to perform dynamic analysis, for example, Response Spectra (multimodal) analysis and/or response history analysis, are included in the code and are required in some cases.
	Nonlinear static seismic analysis procedures (for example, pushover)	A procedure to perform nonlinear static seismic analysis (pushover analysis) is included in the code.
Seismic design	Ductility requirements and factors	Seismic force modification factors are prescribed for reinforced concrete and structural steel systems which are expected to be designed to perform at different ductility levels.
	Drift limits	Lateral displacement limits (for example, maximum inter-story displacement/drift) are prescribed for different buildings depending on their importance category.
	Requirements for building regularity (vertical and horizontal)	Provisions regarding analysis/design of structures with horizontal (plan) and vertical (elevation) irregularities are included in the code.
	Ductile detailing of lateral resisting systems	Seismic design provisions that ensure ductile seismic performance of different structural systems (for example, the Capacity Design approach and/or prescriptive requirements that ensure ductile behavior) are included in the code for the following structural systems: » Concrete moment resisting frames - medium and/or high ductility (also called intermediate and/or special); » Concrete shear wall - medium and/or high ductility; » Steel moment resisting frames - medium and/or high ductility (also called ordinary and/or special); » Steel braced frame systems (concentric, eccentric and/or buckling restrained brace frame); » Confined masonry systems; » Timber lateral resisting systems (nailed plywood shear walls and/or other types); » Masonry systems.
	Diaphragms	Some provisions for seismic design of floor diaphragms are included (specify in comments the types of provisions included - for example, diaphragm material (concrete/steel/timber), design forces, diaphragm stiffness considerations, collector and connection forces, anchorage of walls).
	Advanced systems (base isolation, added damping systems, and so on)	Analysis and design provisions for structures equipped with base isolation devices and/or supplemental damping systems are included.

Table D.2 // Seismic Design Provisions (cont.)

Topic	Subtopic	Statement
Seismic design (cont.)	Provisions related to nonstructural components	Some provisions for seismic design of nonstructural components are included in the code (please specify in the comments whether the code does or does not cover seismic design of critical components such as façade/building envelope; parapets; nonstructural/infill walls; mechanical, electrical, plumbing—MEP—equipment).
	Provisions related to out-of-plane earthquake actions	There are provisions that capture out-of-plane seismic actions for the design of structural and nonstructural elements in the code.
Existing buildings	Provisions for seismic assessment and retrofit of existing buildings	The code includes provisions related to seismic assessment and retrofit of existing buildings.

Table D.3 // Wind Design Provisions

Topic	Subtopic	Statement
Actions on structures	Procedure to develop design wind loading	The code contains a procedure to determine wind loading, with at least some partial information required to perform wind design for a specific building (for example, a procedure which includes some elements to develop the level of wind loads based on the location, exposure and so forth, and/or specifies type and level of design wind speeds for a site).
	Country-specific wind-loading design criteria	The code contains country-specific wind design criteria for a site (for example, country, region or city specific wind speed maps).
	Simplified wind-loading design procedures	The effect of wind (suction or pressure) is simulated as static wind pressure for the design of structural and nonstructural elements and their connections.
	Wind importance factors	Importance of different buildings based on their occupancy/function (for example, importance factor) is considered in the design for wind.
	Wind design procedure for tall buildings	Dynamic effects of wind are considered in the design of tall buildings according to the code-prescribed procedure.
Design and detailing for wind	Design provisions for roof cladding and roof overhangs	Requirements to design roof cladding and roof overhangs to resist strong winds. These could also include provisions related to roof shape.
	Design of wall cladding and non-structural appendages	Requirements to design nonstructural cladding and appendages (cladding, gutters, equipment, and so on) to resist strong winds.
	Design of façade	Requirements to design façade to resist damage from wind-borne debris.
	Façade detailing	Requirements to detail façade to resist water ingress during a strong wind event.
	Detailing of doors and door mechanisms	Requirements to detail doors and door mechanisms to resist strong winds.

Table D.4 // Flood Design Provisions

Topic	Subtopic	Statement
Design for flooding	Load procedure for flood loading	Provisions for determining loading from flooding, and/or storm surge.
	Higher level evacuation areas	Requirements for higher level evacuation areas for building occupants (for example roof access, balconies) in case of a flood event.
	Limitations on occupied zones below the design flood level	Provisions that limit or prohibit occupied zones below the design flood level.
	Critical equipment and services	Requirements to locate critical equipment and/or services above design flood level.
	Structural and nonstructural materials	Provisions related to structural and nonstructural material requirements in relation to flooding.
	Vents, valves or other wall openings	Requirements for the design of vents, valves or other openings in the walls of enclosed spaces below the design flood level to equalize lateral water pressures.

Table D.5 // Green Building Provisions

Topic	Subtopic	Statement
Energy Efficiency – Demand Side	Building orientation	Orientating the building to optimize the level of direct heat from sunlight entering the building. The regulation includes some voluntary provisions on building orientation to control solar heat gain and/or improve natural ventilation.
	Daylighting	Daylighting to provide adequate levels of natural light for building occupants. The regulation document specifies voluntary or mandatory provisions related to daylighting (for example, that a certain percentage of habitable building area must be adequately lit through daylight).
	Natural ventilation	Natural ventilation to provide fresh air indoors and support cooling. The regulation document contains provisions which require a certain amount of operable window, glazing, or perforation area with respect to the room's usable floor area.
	Solar shading	External solar shading to control solar heat gain. The regulation document provides guidance on various types of shading implements and related design provisions (voluntary or mandatory).
	Insulation of walls, roofs and windows (U-value requirements)	Insulation of walls, roofs and windows to stop over-heating in hot weather and heat loss in cold weather. The regulation documents specify mandatory U-value requirements for the walls, roofs and/or window assemblies.
	Window-to-Wall Ratio (WWR)	Window-to-Wall Ratio (WWR) requirements to balance the need for light and ventilation with the amount of solar heat gain from glazed areas. The regulation documents have mandatory provisions related to WWRs (and provide a formula to calculate WWR). These can include requirements for minimum or maximum WWR and/or different WWRs for differently oriented walls.
	Reflective walls and roofs	Reflective walls and roofs to reduce solar heat gain. The regulations specify mandatory solar reflectance index (SRI) values for walls and/or roofs.
	Green walls and roofs	Green walls or roofs to cool buildings both externally and internally. The regulations document addresses their design and construction. If the provisions are mandatory, they may include minimum standard for such roofs and walls in terms of area covered by vegetation.
	Energy efficient lighting	Energy efficient lighting (for example, LEDs, light sensors, and so on). The regulation document specifies light power density for various types of buildings and/or a minimum level of lumens per watt for lighting fixtures and/or requirements for sensors such as daylight sensors and/or occupancy sensors to control the use of lighting depending on user needs.
	Energy-efficient Heating Ventilation and Air Conditioning (HVAC) systems	Energy-efficient heating ventilation and air conditioning (HVAC) mechanical systems. The regulation document contains some mandatory provisions related to measures to improve energy efficiency of HVAC systems and other equipment. These could include requirements for pipe and duct insulation, ceiling fans, air economizers, setting a minimum coefficient of performance for air conditioning and/or heating equipment, heat recovery from return air and/or requirements for variable frequency drives.



Topic	Subtopic	Statement
Energy Efficiency – Supply Side	Renewable energy	Renewable methods to supply the building with energy (for example, solar panels, geothermal). The regulation document includes some provisions related to onsite generation of electricity through solar power or wind and/or connection to a grid that provides off-site renewable energy (voluntary or mandatory).
	Water-efficient fixtures and fittings	Water-efficient fixtures and fittings (for example, low-flow toilets, taps, and so on). The regulation document includes mandatory provisions related to water-efficient fixtures and fitting. For example, it may specify flow rates by type of fixture or fitting (for example, faucets, showers, toilets).
	Water collection/water re-use	Water collection/water re-use (for example, rainwater harvesting, use of grey water for certain functions). The regulation document includes some voluntary or mandatory provisions for this (for example, condensate recovery, rainwater harvesting, re-use of treated water for potable and nonpotable uses).
	Recycled building materials	Recycled building materials (for example, requirements for a building to use recycled materials and/or be recyclable). The regulation document specifies a mandatory percentage of building materials to be made of recycled materials.
	Low embodied energy materials	Low embodied energy materials (for example, materials with lower carbon footprints). The regulation document encourages or prescribes the use of low embodied energy materials and/or gives guidance on how to calculate the carbon footprint of the building materials and optimize building material used to reduce the carbon footprint.

Table D.6 // Universal Accessibility Provisions

Topic	Subtopic	Statement
Design for Universal Accessibility	External Environment	External environment (for example, approach to building entrance, circulation routes, and so on). The regulation document contains some provisions on universal accessibility requirements related to the external environment.
	Entrances, doors, and lobbies	The regulation document contains some provisions related to universal accessibility requirements for entrances, doors and/or lobbies.
	Horizontal and vertical circulation within a building	The regulation document contains some provisions related to universal accessibility requirements for horizontal and vertical circulation.
	Building facilities	The regulation document contains some provisions related to universal accessibility requirements for building facilities, including WC/toilets.
	Building fixtures and fittings to assist with orientation, wayfinding, and communication	The regulation document contains some provisions related to universal accessibility requirements for building fixtures and fittings.
	Evacuation and safe egress	The regulation document contains some provisions related to universal accessibility requirements for evacuation and safe egress.

Table D.7 Code Implementation Environment

Topic	Evaluation Statement	CODE IMPLEMENTATION ENVIRONMENT RATING		
		Yes (meets the requirements of the statement)	Partial (meets some aspects or contains insufficient information for full implementation)	No (does not meet the requirements of the statement)
Established building control processes	The building control processes are clearly defined in any regulations or government documents.	The country has a complete and detailed framework defining the building control processes.	Only some of the main steps of the building control processes are defined within the legal framework.	The country lacks a defined building control process, or the process defined in the regulations is very general or fails to consider all the main steps (application, issuance, inspection and occupancy certificate).
Accessibility of building control regulations and information on processes	There is an online approval system available in the country.	There is an online approval system available in the country or in the main cities of the country allowing the users to apply online, and follow up their application (including during the inspection phase) until issuance of the occupancy certificate.	The online approval system only allows certain tasks to be undertaken by the users or is only implemented in the main city (or capital) of the country.	There is no online approval system available for the users in the country.
	The information regarding the building control processes is clearly available to the public through an official website or websites.	All the needed information is available online through official websites (at central and/or local level). The information is complete, clear and easy to obtain.	The information is mainly available through a central official website, but vital aspects are still scattered elsewhere among other official websites	The information is not available online or difficult to obtain through official governmental websites.
Optimized process	The building control process integrates a tiered system of building categories to determine application requirements and allocate human resources.	There is a clear categorization system within the building control regulations that introduces clearly differentiated requirements and processes for different categories of buildings based on parameters such as height, total size, and so forth.	There is no clear categorization system within the regulations; instead, only performance requirements for specific types of buildings.	There is no categorization system of buildings. The process and requirements are almost the same for every building subject to the building permit issuance process.
Defined building inspection framework	The building control framework integrates inspections by the authority in charge during the construction process.	Regulations have defined a clear inspections framework, setting out who is in charge of site visits and when, with responsibilities clearly stated.	The inspection framework is mentioned within the regulations, but no specific processes are defined within the regulations or inspections tasks remain vague.	There is no mandatory inspections framework within the regulations specifying the construction step (phase) when inspections must take place.
Dispute resolution mechanism	The building control framework integrates and details a dispute resolution mechanism	Regulations define clearly the appeal process and give a clear framework for an ADR mechanism.	The appeal process is mentioned but there is insufficient elucidation of the precise process. ADR mechanisms are part of the legal framework of the country.	The country does not foresee in detail the appeal process and does not have any Alternative Dispute Resolution (ADR) legally in place.
Professional certification and registration system	The country has a professional certification and registration mechanism	There is a clear and mandatory registration system for all professionals in the construction industry. A classification and qualification system also exists for contractors.	Two of three mandatory registration systems exist (architects, engineers, contractors).	There is no registration system for the main stakeholders of the construction industry (professionals and contractors).

Annex E:

Glossary

Annex E:

Glossary

A

Act » a high-level measure passed through the law-making process of the legislative arm of a national government, such as Parliament. Distinct from case law created by courts.

Adaptive reuse » a process of renovating, retrofitting or repurposing an existing building to extend its useful life and improve functionality, safety, and/or sustainability. The term is often applied to refer to the process of converting an existing building for a new use.

Alternative solutions » procedures or methods which may differ from those set out in the building code but can nevertheless demonstrate compliance of the design with the code's performance requirements.

Average Annual Loss (AAL) » the expected annual average economic losses from a type of disaster risk. The AAL is estimated by correlating the probable losses of multiple events and their annual probability of occurrence.

Average Annual Loss Ratio (AALR) » the average annual loss expressed as a proportion of the total value of the assets at risk. For a building, this can take account of the building contents in addition to the building itself. See Average Annual Loss (AAL).

B

Beyond code » designing a building beyond (to surpass) the minimum requirements of the code to enhance performance. This may mean enhanced performance to limit structural damage, or improved recovery times after exposure to hazards, or enhance energy efficiency and other aspects of green building.

Building code » a set of requirements for the design and construction of buildings, promulgated by local or national governments, which often refers to or incorporates various reference standards, thus making those standards legal requirements to be followed in all design and construction work in that building code's jurisdiction. Also sometimes referred to as building regulations or building design regulations.

Building control » the process of ensuring that building construction complies with building codes and regulations. It includes mechanisms and processes for reviews and checks of design and construction information (for example, drawings, specifications and material testing results), issuing construction and occupancy permits, inspecting the quality and completeness of construction activities, and enforcing regulatory framework requirements, including through incentives and penalties (adapted from World Bank, 2024a).

Building interstory drift » building drift is the lateral movement of buildings caused by wind or earthquakes. Interstory drift denotes a ratio of the relative lateral displacements between the top and bottom of an individual story and the corresponding story height.

Building regulations » regulations as part of building regulatory systems, including planning regulations, building design codes and standards, and building control regulations. Also see building regulatory framework and building code.

Building regulatory framework » the set of laws, regulatory documents, compliance mechanisms, education and training requirements, product testing and certification processes, professional qualifications, and licensing schemes that support a safe and sustainable built environment. It has two core components: (i) legislation and regulations that together form building regulatory systems, including legal acts that reference the planning regulations, building design codes and standards, and building control regulations; and (ii) implementation/compliance mechanisms and capacity.

C

Climate change adaptation » the process of adjusting to actual or expected changes in climate and their effects. For buildings, climate adaptation refers to the process of designing, retrofitting and managing built environments to withstand and respond to the impacts of climate change. This includes measures to address rising temperatures, extreme weather events, sea-level rise, and changing precipitation patterns to enhance resilience, reduce vulnerability and ensure long-term functionality and safety.



Compliance mechanisms » the methods and processes used to ensure that buildings meet the required codes and standards.

Cultural heritage » encompasses buildings and sites that society considers valuable across a number of dimensions: symbolic, historic, artistic, aesthetic, ethnological or anthropological, and scientific (adapted from UNESCO Institute for Statistics, 2009).

D

Damping » a property of materials or system in which components behave in such a way as to reduce the vibrations and oscillations of the structure by dissipating its energy. During an earthquake, damping in a building can be due to damage or rocking of the entire structure or its components, or due to the presence of advanced systems, such as seismic isolation devices or devices with added damping.

Demand-side measures » measures in green building design that reduce a building's consumption of energy. These include building orientation, use of daylighting, natural ventilation, solar shading, insulation and reflectivity of the building envelope, energy efficient lighting, HVAC systems and other equipment efficiencies.

Design for deconstruction (circular construction) » the design of buildings, products and components in a way that allows them to be taken apart, recovered, and reused at the end of their service life, including through such techniques as reversible connections (screws and bolts, for example, rather than glue or other chemical fixings). By considering the end of life of a building during design, a greater percentage of materials can be reclaimed and reused (adapted from UKGBP, 2024).

Disaster » a serious disruption (or shock), of the functioning of a system, community, or society at any scale caused by a hazardous event interacting with conditions of exposure, vulnerability, and capacity (ability to respond and recover). This leads to human, material, economic, and/or environmental damage and impacts.

Distributional effects » the overall outcomes of a policy change in terms of the redistribution of the final gains and costs derived from the direct gains and costs. For example, a change in building code may impact different groups in society or the market in different ways, with some seeing overall benefits and some groups experiencing economic or social costs.

Ductility » Ductility is the ability of a structure or a structural element to deform beyond the elastic range and avoid sudden, brittle failures (adapted from Allen et al., n.d.).

Ductility factor » a way to approximate the effect of expected ductility, damping and overstrength (deliberate extra load resistance) of a structural component or an entire structural system for seismic design purposes. Examples of ductility factors (sometimes called response modification factors) include R factors in the International Building Code or q factors in the Eurocodes.

E

Embodied energy » the energy content of all the materials used in a building and its technical installations, and energy consumed at the time of erection/construction and renovation of the building. Initial and recurring embodied energy are the two major components of embodied energy. Initial embodied energy is the sum of the energy required for extraction and manufacture of a material together with the energy required for its transportation during the initial building construction. The recurring embodied energy in buildings represents the sum total of the energy embodied in the material used due to maintenance, repair, restoration, refurbishment or replacement during the service life of the building (adapted from Building and Environment, 2017).

Energy Use Intensity (EUI) » an indicator of the energy efficiency of a building's design and/or operations. EUI can be thought of as the miles-per-gallon rating of the building industry. It is used in different ways, including to set a target for energy performance for design purposes, to benchmark a building's designed or operational performance against others of the same building type, or to evaluate compliance against energy code requirements. EUI varies with building type and is expressed as energy per square foot or meter per year. It is calculated by dividing the total energy consumed by the building in one year by the total gross floor area of the building (adapted from AIA California, n.d.).

Exposure » the location, attributes, and value of important community assets that are exposed to the hazard, such as people, buildings, agricultural land, and infrastructure (adapted from World Bank, 2024a).

F

Flood barrier (or gate) » in the context of buildings, a flood barrier or flood gate is a structure that blocks or redirects water to prevent flooding of a site, building, or complex of buildings. Flood barriers may be permanent and built into landscaping and site infrastructure, or they can be temporary (deployable), such as metal sheeting, water-filled tubes, or sandbags.

Flood design level » the highest water level that is expected to occur at a building site, often with additional buffer included (freeboard), used to inform decisions about flood risk mitigation and to design structures to withstand flooding.



Floodproofing (dry/wet) » structural and/or nonstructural measures in building design to mitigate damage from flooding. A dry floodproofing approach makes a building or site watertight to keep floodwaters out. A wet floodproofing approach allows water to enter a building in a flood event (sometimes through break-away walls) but includes measures to minimize flood damage such as using flood vents and flood-proof materials, and raising up critical equipment.

Functional Recovery » to support resilience goals at the community level, there is a need to establish a link between the design, construction, and retrofit of individual buildings and lifeline infrastructure systems, and community resilience, as measured by time required to recover their function. The concept of functional recovery has been introduced to serve as this link, defined as a post-earthquake performance state in which a building or lifeline infrastructure system is maintained, or restored, to safely and adequately support the basic intended functions associated with the pre-earthquake use or occupancy of a building, or the pre-earthquake service level of a lifeline infrastructure system. A key concept for functional recovery is that basic intended functions are something less than full pre-earthquake functionality, but more than what would be considered the minimum sufficient for re-occupancy of buildings or temporary provision of lifeline services (FEMA, 2021).

G

Green building provisions » design requirements for buildings to be more sustainable and resource efficient throughout their life cycle—from siting, design, and construction to operation, maintenance, renovation and demolition. These include measures to improve the energy efficiency and water efficiency of building services and systems, as well as methods to assess and reduce the environmental footprint of building materials and construction activities. Green building provisions can also help to reduce the inequities of energy burden on households.

Greenhouse Gas (GHG) emissions » include the release of carbon dioxide, methane and other gases into the atmosphere due to the burning of fossil fuels, deforestation, agriculture and other human activities. These emissions contribute to the greenhouse effect and climate change (UNEP, 2023b).

H

Hazard » a natural or anthropogenic phenomenon that may cause loss of life, injury or other health impacts, property damage, social and economic disruption, or environmental degradation. Hazards relate to natural processes (such as floods, storms, droughts, earthquakes) and may be single, sequential, or combined in their origin and effects. They may differ in intensity or magnitude, scale, and frequency and are often classified by cause, such as hydrometeorological or geological. Anthropogenic hazards relate to hazards caused by human activity (adapted from World Bank, 2024a).

I

Importance (risk, occupancy, consequence) category » Importance categories (and associated factors) are assigned to buildings in building codes based on occupancy type to account for the consequences and risks to human life in the event of a building failure due to an extreme event like an earthquake or strong windstorm. The intent is to assign higher criteria for structural/seismic design to buildings whose failure would have more significant impacts in terms of human life or the provision of essential community services necessary to cope with an emergency.

Informal construction » a structure built without obtaining formal planning or construction permission; and/or a semi-permanent structure that does not meet building regulations. Such structures often fail to meet minimum expectations of safety, weather protection, comfort and other aspects addressed by the building code. Informal buildings are most frequently self-built, either by low-income households themselves or by landowners for rental properties (adapted from World Bank, 2024a).

Inspection framework » a structured approach to conducting inspections to verify compliance with building codes and standards.

L

Land-use regulations » any type of ordinances, laws, or rules governing the development and use of land. This includes, for example, the permitted use of land; the density or intensity of use; subdivision requirements; the maximum height and size of proposed buildings; and the provisions for reservation or dedication of land for public purposes. Regulations not only control existing buildings and uses but also guide future development. Land-use maps and development plans form an essential part of land-use regulations at all territorial scales.

Life-cycle assessment (LCA) » a process of evaluating the effects that a building and delivery of related services have on the environment over the entire period of its life, with a view to increasing resource-use efficiency and decreasing liabilities. LCA helps build an understanding of the energy use and other environmental impact associated with all the phases of a building's life cycle: procurement, construction, operation, and decommissioning. The output of an LCA can be thought of as a wide-ranging



environmental footprint of a building, including aspects such as energy use, global warming potential, habitat destruction, resource depletion, and toxic emissions (adapted from EEA, n.d., and AIA, 2023).

Life safety performance » a level of building performance where a building can sustain significant damage to both structural and nonstructural components due to extreme events, for example, a design earthquake or fire, but still retains a margin of safety against either partial or total structural collapse. This assures a low risk of loss of life, life-threatening injuries, or entrapment.

Low Damage Seismic Design » Low Damage Seismic Design (LDSD) is a design philosophy that goes beyond minimum regulatory compliance and enhances the seismic resilience of buildings. This approach to building design provides greater confidence in a building's performance, including the ability to continue using the building after an earthquake (adapted from MBIE, 2024).

M

Model building code » a set of requirements for the design and construction of buildings that are developed and maintained by a standards development organization, that can either be adopted without modification or adapted by jurisdictions to enact it as their own building code.

Modular construction (offsite or volumetric construction, or Modern Methods of Construction—MMC) » a building construction method in which standardized or prefabricated components or modules of a structure, or in some cases entire buildings, are produced in an offsite construction facility, and subsequently transported to the building site and erected in the final position (Journal of Building Engineering, 2021).

N

Nonengineered construction » buildings that have been designed and constructed with little or no input from architects or engineers. In some cases, modern construction materials are used, but elsewhere, construction of these buildings follows traditional building practices, using local materials. The latter type is also referred to as 'vernacular' construction (see definition below). Also sometimes referred to as informal construction.

Nonlinear static analysis » a seismic analysis procedure where static load is applied to the structure in an incremental fashion, and nonlinear (inelastic) structural behavior is simulated. It is typically used to obtain an advanced understanding of building performance for seismic design or retrofit purposes. This type of analysis is sometimes called a 'pushover' analysis.

Nonlinear response history analysis » a seismic analysis procedure where a numerical model of the structure is subjected to dynamic effects of a real or an artificially generated acceleration record of an earthquake. Nonlinear (inelastic) behavior of structural elements is simulated, and structural response (internal forces and displacements) is obtained at specific time steps corresponding to the earthquake record used as input for the analysis. This type of analysis is used for seismic design of complex structures, such as irregular or tall structures.

Nonstructural component (or element) » equipment and building components that are not part of the structural system of a building but can experience damage and adversely affect building performance in extreme events such as severe windstorms or earthquakes (adapted from Whittaker and Soong, 2003).

P

Passive survivability » a building's ability to maintain critical life-supporting conditions for its occupants should external services such as power, heating fuel, or public water supply be interrupted for an extended period (Sustainability Directory, 2025)

Performance-based design » an engineering approach to designing elements of a building based on meeting specific performance objectives or goals, such as for energy efficiency or for a building's structural performance in different hazard scenarios, without prescribing a method or specific design requirements by which to achieve these goals.

Performance objective (or goal) » a defined outcome or level of functionality targeted in the design and/or operation of a building. Performance objectives may be related to a variety of intended building functions or performance areas: for example, achieving a life safety performance level in structural and nonstructural systems when exposed to a 475-year return period earthquake, or meeting a specific Energy Use Intensity (EUI) target.

Prescriptive design approach » in contrast to the performance-based approach, prescriptive design provisions in codes provide simplified (step-by-step) procedures which could include engineering calculations or simply "rules of thumb" for nonengineered buildings. The assumption is that if the code user follows these prescriptive rules, the code is satisfied, and users do not need to demonstrate that a structural design complies with the intended performance objectives.



R

Reference standards » technical documents, which building codes often refer to, that contain specific design and construction provisions, material-specific design requirements, products testing and certification, or other topics. They are developed by national or international standards development organizations such as the ISO or ASTM, typically through consensus-based processes to support broad acceptance.

Rehabilitation » for a building, rehabilitation aims to enhance the condition of the building's structural and nonstructural components. Existing buildings may have suffered damage from past hazard events or may be in poor condition owing to age or lack of maintenance; hence, rehabilitation is required. In some cases, rehabilitation and repair may be combined with retrofit.

Response spectrum analysis » a widely used dynamic analysis procedure in the seismic design of buildings that involves use of a linear elastic numerical model of a structure to estimate its seismic response, including internal forces and lateral displacements. The model is subjected to a response spectrum that simulates a range of different earthquake scenarios relevant for the location, and the response depends on dynamic characteristics of the structure, such as its periods of vibration and the corresponding mode shapes.

Retrofit » modifications to an existing building to improve the building performance. This could include strengthening and/or other design modifications to improve its resistance and performance in the event of earthquakes and other hazards or upgrading the building to improve energy efficiency or *universal accessibility*.

Resilience » the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions (IPCC, 2012). In the context of the built environment, resilience in buildings refers to those that are designed, built and operated to support the resilience of their occupants and the broader community, including being able to withstand exposure to a range of shocks and stresses with limited or no damage or disruption.

Regulatory impact assessment » aims to understand the short- and longer-term costs and benefits of regulatory decisions. It begins by defining a problem that the regulatory change aims to solve, then evaluates costs and benefits considering how the regulation will be implemented in practice. The process could help decision-makers to compare the costs and benefits of alternative regulatory and nonregulatory approaches with the overall aim to select a regulatory approach that provides the greatest net public benefit (adapted from OECD, 2008).

Return period » the mean (average) time between expected occurrences of a hazard event, corresponding to a probability (chance) of exceedance for a certain hazard level (for example, a certain level of flooding or earthquake at a site).

Risk » likelihood of the loss of life, injuries, damage or destruction of assets that could occur in a system, society, or community over a specific time period and can be defined through the combination of three terms: hazard, exposure, and vulnerability.

S

Seismic assessment » a building study to understand and manage potential damage, life safety risks and economic losses from an earthquake. A seismic assessment informs building owners and users about building vulnerabilities and associated risks and encourages strengthening of vulnerable buildings to address these identified risks (adapted from Building Performance, 2024).

Seismic isolation » a flexible connection introduced between the ground and the structure, usually with a mechanism to dissipate energy through added damping. Seismic isolation systems include, among others, rubber bearings and friction pendulum devices. An isolated building has a longer period of vibration and greater effective damping, leading to significantly reduced inter-story drifts and lower accelerations in the structure above the isolation system level than a conventional, fixed-base structure. Lateral displacements and energy dissipation are concentrated within the flexible isolation zone (adapted from NZSEE, 2019).

Shocks » disruptive events whose intensity builds up instantaneously, for example, a severe flood event, hurricane, or earthquake. Shocks, which are rapid onset events, are distinct from the other class of disruptive events and stresses (see Stresses) which exhibit slow onset. (Mentges et al., 2023).

Soft story » a type of vertical irregularity where one level in the building, referred to as "a soft story", is more flexible and is weaker than other stories. Under earthquake loads, this often leads to a concentration of damage or collapse at the soft story level.

Soil liquefaction » a phenomenon where loose saturated sands and silts act as a liquid due to earthquake ground shaking of a certain intensity and duration. During the shaking, the soil is compacted or densified and a portion of the water and soil are forced out of the saturated soil. During an earthquake, buildings founded on the liquefied soils may sink and settle dramatically, while underground structures may float like submerged rigid boxes (adapted from BSSC, 2010).



Stresses » disruptive processes whose intensity increases over a longer period of time, for example, deterioration of a structure due to lack of maintenance or increased frequency and intensity of extreme temperatures further to climatic changes. It should be noted that a slow-onset stress could still lead to a sudden collapse, for example, a spontaneous building collapse (adapted from Mentges et al., 2023).

Structural component (or element) » a load-bearing component necessary for the structural stability of a building (such as foundations, columns, beams and girders, load-bearing walls, structural floor systems, or lateral bracing elements).

Structural safety » the ability of a building's structural system to withstand gravity and environmental loads while remaining stable. Structural safety can be defined in terms of performance levels for different hazard scenarios such as Collapse Prevention (CP) or Life-Safety (LS).

Supply-side measures » measures in green building design that reduce a building's reliance on fossil fuels, implemented through actions intended to ensure the efficient generation, transmission and distribution of energy.

T

Thermal mass » the capacity of a building material to absorb, store and then release heat (adapted from Passive House+, n.d.)

Torsional effects » the behavior of a building that tends to twist as well as deflect horizontally due to lateral loads from wind or earthquakes. Torsional behavior depends on the layout and distribution of vertical elements of the building's lateral-force-resisting system at a story level. These vertical elements include braced frames, moment frames, and/or loadbearing walls (adapted from BSSC, 2010).

U

Universal accessibility » ease of independent approach, entry to, evacuation from, and use of a building and its services and facilities by all of the building's potential users—including people of all ages and abilities—with an assurance of individual health, safety, and welfare during the course of those activities (adapted from World Bank, 2024b).

Universal design » the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability or disability (CEUD, n.d.).

U-Value » a measurement of the thermal transmittance of a building enclosure defined as the coefficient of heat transmission (air to air) through a building material, component or assembly (adapted from Energy and Buildings, 2023).

V

Vernacular construction » small-scale buildings designed and built using local materials and traditional construction methods passed down through tradition and community knowledge (adapted from World Bank, 2024a).

Vulnerability » conditions determined by physical, social, economic, and environmental factors or processes that influence the expected extent of damages from hazards suffered by an individual, a community, a building or other assets, or infrastructure systems.

Wildland-Urban Interface (WUI) » the geographical area where human development, including structures and other infrastructure, meets or intermixes with undeveloped wildlands (NIST, n.d.).

The world is undergoing a transformative era of rapid population growth and urbanization, with the population living in urban areas projected to rise from the current level of 55 percent to 70 percent by 2050. This means that a significant proportion of global building stock that will exist in 2050 is yet to be built. Much of this anticipated growth will occur in Africa, Asia, and Latin America. This growth and transformation opens up the opportunity to shape the future of our cities, ensuring they are safe, healthy, and sustainable. However, it also brings formidable challenges, including the impacts of natural disasters, and the complexities of urbanization. By crafting modern building codes that are finely tuned to local contexts—considering development patterns, hazards, climatic conditions, social and cultural factors, construction practices, and local capacity—we can create vibrant, resilient urban landscapes that stand the test of time.

www.gfdr.org The Global Facility for Disaster Reduction and Recovery (GFDRR) is a global partnership that helps low- and lower-middle-income countries better understand and reduce their vulnerabilities to natural hazards and adapt to climate change. GFDRR provides grant financing, technical assistance, training and knowledge sharing activities to mainstream disaster and climate risk management in national and regional policies, strategies, and investment plans. The Program Management Unit, located within the World Bank, manages grant resources to carry out GFDRR's mission.