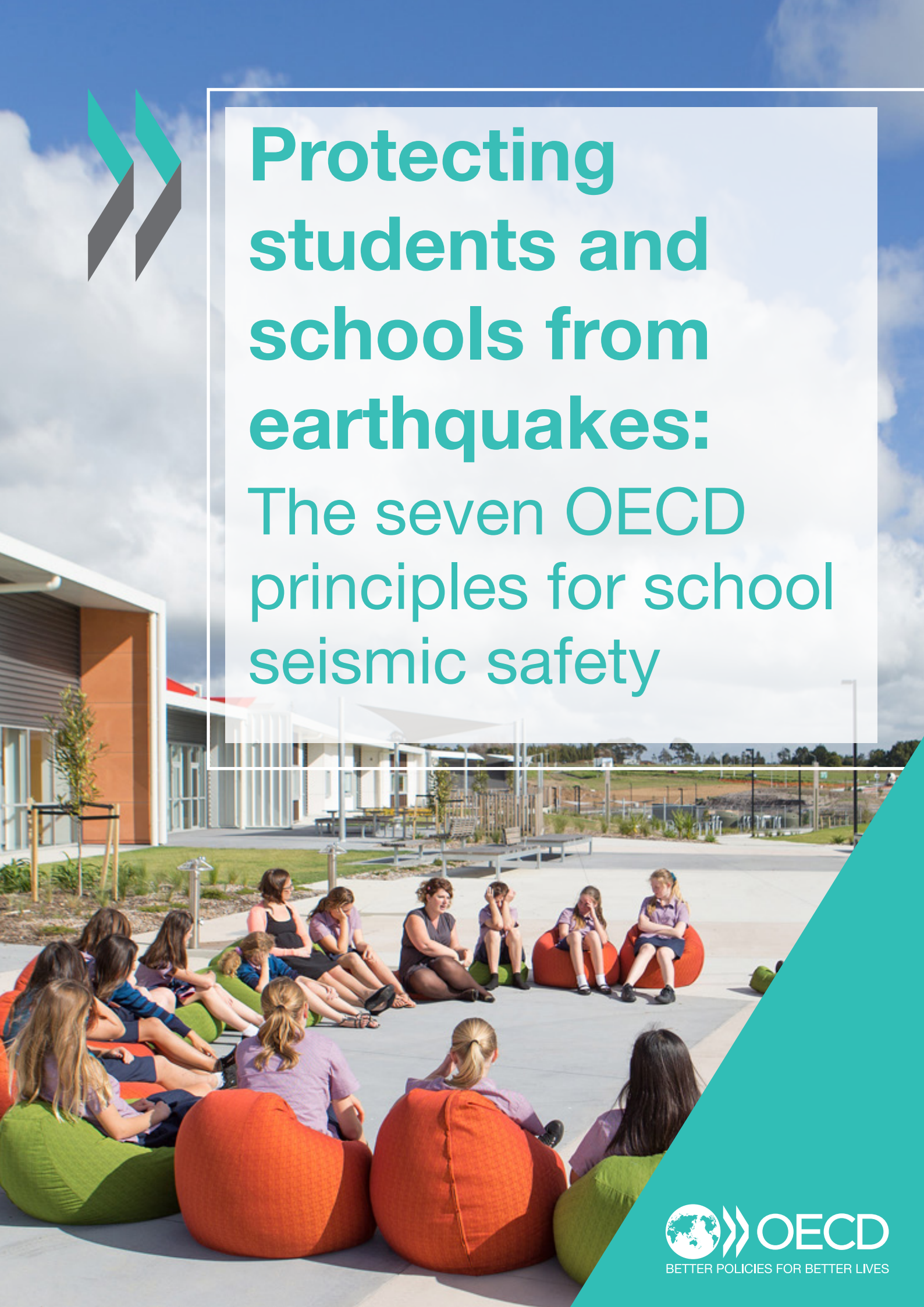
Protecting students and schools from earthquakes:

The seven OECD principles for school seismic safety



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BETTER POLICIES FOR BETTER LIVES

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Protecting students and schools from earthquakes:
The seven OECD principles for school seismic safety

This publication is an illustrated version of the 2014 Report on the Implementation of the Recommendation of the Council Concerning Guidelines on Earthquake Safety in Schools. It emphasises the seven principles addressed by the Recommendation and the significant progress that the member countries have made regarding earthquake safety since the previous report in 2010.

"*Protecting students and schools from earthquakes: The seven OECD principles for school seismic safety*" targets the following stakeholders involved directly or indirectly in making schools safe:

- Governments for creating an atmosphere conducive to implementing policies;
- Policy makers for setting and driving overall policy;
- Policy advisors for drawing together best practices;
- Regulatory bodies for creating standards and codes and overseeing their implementation;
- Construction professionals for designing and constructing safe schools; and
- School principals and teachers for carrying out procedures when an earthquake hits a school.

This publication was prepared by the Learning Environments Evaluation Programme (LEEP) of OECD.

Foreword

Schools are places of learning for future generations and society's most vulnerable members, the students, our children. We cannot allow that school buildings still collapse in earthquakes leading to loss of life or injury, when we have the scientific expertise and the technical means to build safe schools. **It is our responsibility to make earthquake safety a priority.**

Protecting students and schools from earthquakes: The seven OECD principles for school seismic safety looks at how countries apply the OECD Council's recommendation adopted in 2005 regarding earthquake safety in schools. The guidelines provide a practical framework that sets standards for countries and their policymakers. The seven principles to improve seismic safety, outlined in the recommendation, were drawn up by 33 world leading experts on seismic safety, policy, and related issues, representing academia, business, international and non-governmental organisations.

By monitoring the implementation of the Council's recommendations, the OECD looks at best practices in school seismic safety: how countries ensure a high level of safety in order to reduce the number of potential deaths in schools and minimise structural damage to schools caused by earthquakes. Projects vary from retrofitting existing school buildings to make them seismically safe to improving preparedness and planning to community participation programmes. However, evidence suggests that further effort is needed. Enforcing building codes for new and existing infrastructure is one area where countries can continue to make improvements.

Regularly monitoring how seismically-active countries implement the OECD Council's recommendations contributes to improving school seismic safety programmes. The UN Sustainable Development Goal 4.a demands that we "Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, nonviolent, inclusive and effective learning environments for all". Ensuring the safety of our children before disaster strikes should be a top priority for countries at risk. Together, let us take action to make all schools safe and ensure the safety of our children!

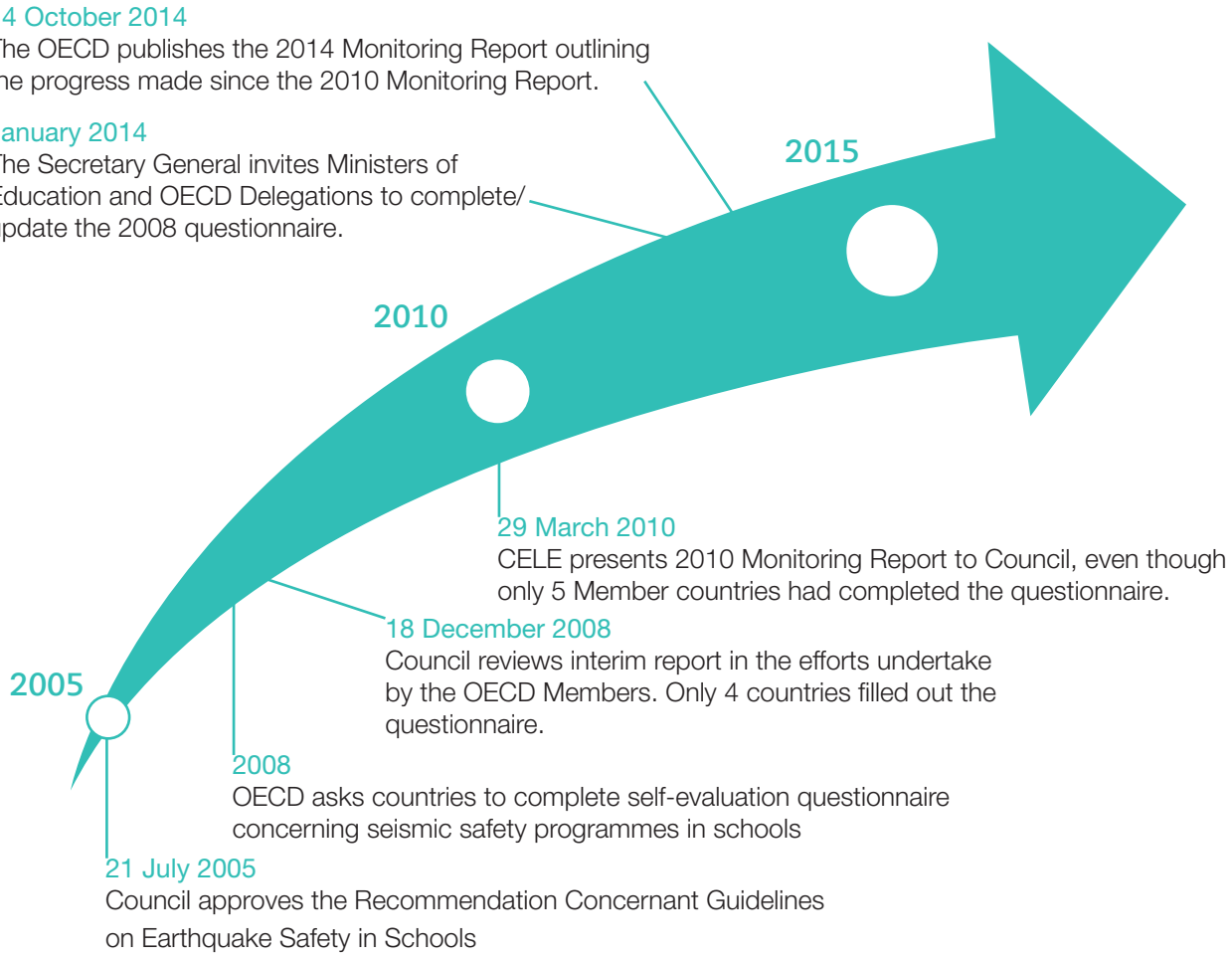
Andreas Schleicher
Director for Education and Skills
and Special Advisor on Education Policy to the Secretary-General

Protecting students and schools from earthquakes:
The seven OECD principles for school seismic safety

Schools must provide safe environments for everyone on their premises.

But all too frequently, earthquakes strike countries, causing school buildings to collapse, and staff and students to be hurt or gravely injured. And, schools routinely collapse in earthquakes due to avoidable errors in design and construction, because existing technology is not applied and laws and regulations are not sufficiently enforced. Yet, knowledge exists to significantly lower the seismic risk to schools, preventing further injury and deaths on school grounds; this can be done at a realistic cost and in a reasonable time frame.

In response to this need, OECD approved a **Recommendation** inviting the member countries to establish and implement programmes that follow seven principles for school seismic safety.



- In 2005, the expert group's recommendations were transferred to an OECD Recommendation Concerning Guidelines on Earthquake Safety in Schools, approved by the Council on 21 July 2005.
- According to the **Recommendation of the Council Concerning Guidelines on Earthquake Safety in Schools**, member countries should "take steps to establish and implement programmes of school seismic safety based on the principles set forth in the […] Recommendation".
- The Recommendation contains principles and elements of an effective school seismic safety programme.
- Every five years the OECD monitors its member countries progress towards creating comprehensive and effective seismic safety programmes for schools.
- Five member countries completed the self-evaluation questionnaire that formed the 2010 Monitoring Report.
- The 2014 Monitoring Report included responses of the self-evaluation questionnaire from **15 countries**: including the 5 countries that reported in 2010 [Greece, Japan, Mexico, New Zealand and the United States (California)] and 10 additional countries that submitted the questionnaires for the first time [Australia, Belgium (French community), Chile, France, Hungary, Portugal, Slovak Republic, Slovenia, Spain and Turkey]. Austria, Denmark and Sweden also responded, affirming that their counties were located in areas with low seismic risk, so they did not fill out the self-evaluation questionnaire.

The 7 principles included in the recommendation

1. Seismic safety policy
2. Accountability
3. Building codes and enforcement
4. Training and qualification
5. Preparedness and planning
6. Community awareness and participation
7. Risk reduction in new and existing schools

Countries that participated in the 2014 Monitoring Report

5 countries reporting in 2010 resubmitted self-evaluation questionnaires

Greece
Japan
Mexico
New Zealand
United States (California)

10 additional countries submitted self-evaluation questionnaires for the first time

Australia
Belgium (French community)
Chile
France
Hungary
Portugal
Slovak Republic
Slovenia
Spain
Turkey

Structure of the publication

This publication is organised around the **7 principles** of the initial recommendation and the **country profiles** of the 15 countries that completed the self-evaluation questionnaire for the 2014 Monitoring Report.

- There are two pages dedicated to each principle: the first page defines the principle with an excerpt from the original 2005 Recommendation; the second page briefly explains how countries implement the principle and states the key findings from the 2014 Monitoring Report.
- The one-page country profile explains the seismic risk and implementation of the principles in more detail for the 15 countries of the 2014 Monitoring Report. These include Australia, Belgium (French community), Chile, France, Greece, Hungary, Japan, Mexico, New Zealand, Portugal, Slovak Republic, Slovenia, Spain, Turkey and United States (California).
- Following the country pages, the full text from the initial 2005 Recommendation is available as an annex.
- The publication concludes with an index of the organisations who are involved in seismic policies in each of the 15 countries based on the information from the 2014 Monitoring Report.

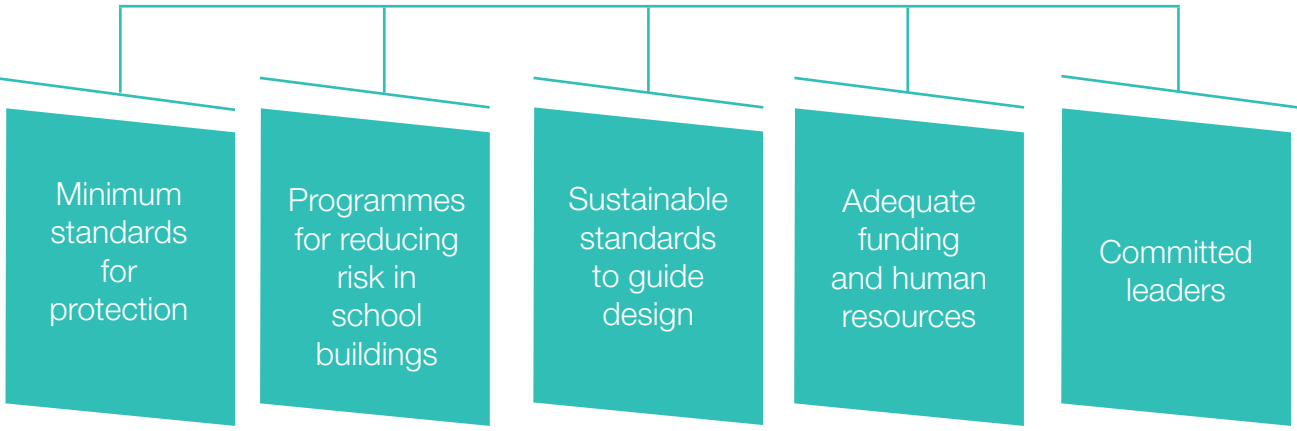
The 15 countries are classified by their seismic risk: red indicates high risk, orange indicates moderate risk and green indicates a country with low seismic risk.

High seismic risk countries	Moderate seismic risk countries	Low seismic risk countries
Chile	Australia	Belgium (French community)
Greece	Hungary	France
Japan	Mexico	Slovak Republic
New Zealand	Portugal	Spain
United States (California)	Slovenia	
	Turkey	

Principle 1: Seismic safety policy

Policies should be established by the competent authorities and should state **well-defined and measurable objectives**. Priorities and strategies for satisfying the objectives should be established by the appropriate authorities. The policy must be clear and should have adequate support and authority to enforce its scope and objectives and to carry out the plan over a specified number of years. The policy should:

- Recognise the need to ensure the safety of schoolchildren.
- Recognise the consequential need for the safety of school buildings.
- Establish minimum standards for protection of human life.
- Adopt sustainable standards to guide design for new and existing school infrastructure based on prescribed performance objectives, knowledge of the ground shaking severity in different regions, quantification of site specific hazards, and the ability of the community to educate, train and license its members to effectively achieve established objectives.
- Establish programmes for seismic risk reduction of school buildings and their components.
- Provide adequate funding and human resources for the protracted duration of the programme.
- Be supported by committed and competent leaders with sufficient legal and moral authority to ensure the effectiveness, sustainability and continuity of the programmes that derive from the policy.



Country analysis on principle 1: Seismic safety policy

National programmes prioritising & strengthening vulnerable schools

Chile
Greece
Japan
New Zealand
United States (California)
Australia
Mexico
Portugal
Turkey
Spain

Follow local/regional legislation

United States (California)

Follow international legislation

Slovenia
Belgium (French community)
Slovak Republic

Follow national legislation

Chile
Greece
Japan
New Zealand
Australia
Hungary
Mexico
Portugal
Slovenia
Turkey
France
Spain

Key Findings

Although reporting countries are at different phases of implementation, given the recent and significant investments by countries in strengthening school infrastructure, there has been limited assessment of the long-term sustainability and effectiveness of these programmes.

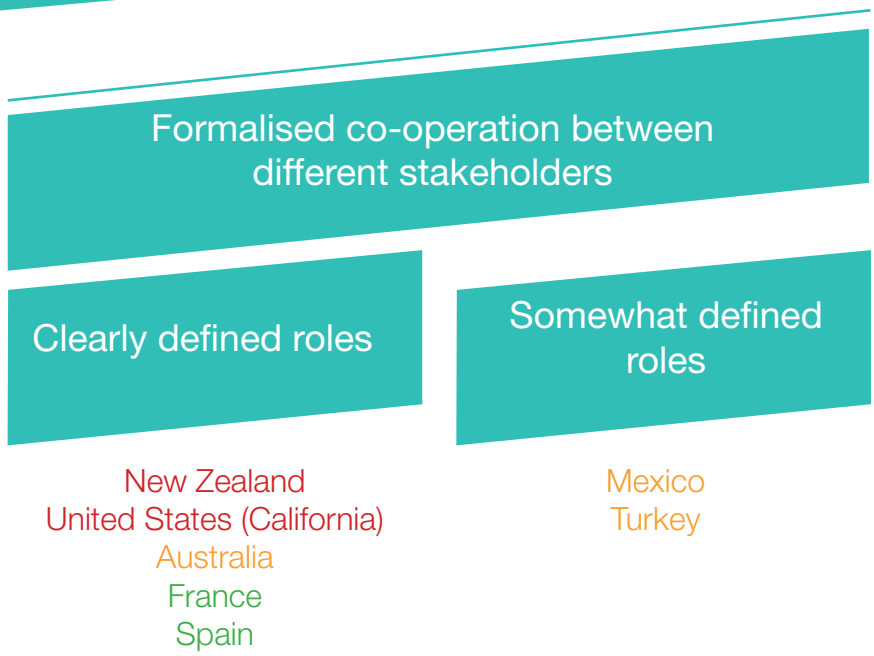
Principle 2: Accountability

There should be a basis for action with **clear lines of accountability of the different members of society** who are given responsibility for implementing earthquake safety programmes. To achieve the objectives of these programmes there should be:

- A clear definition of the roles and responsibilities of the various individuals, agencies and organisations involved in school seismic safety.
- A process for making all planning, design, regulation and enforcement decisions transparent.
- Qualification requirements for professionals engaged in the design of school facilities.
- An independent assessment of the proper design, construction and maintenance of school facilities including:
  - Conducting assessments of existing school facilities.
  - Reviewing and approving construction documents prepared for new structures and the retrofit of existing structures.
  - Inspecting and approving construction.
  - Qualifying personnel for design, plan review and inspection, materials testing and support functions.
- A clearly identified jurisdiction in terms of the area and the type of school systems and buildings affected.

Accountability measures for implementing seismic programmes

Country analysis on principle 2: accountability



Key Findings

All reporting countries identified a range of government-sanctioned stakeholders and agencies in education, civil protection and construction sectors involved in implementing school seismic safety policy; however, the structure/ organisation and effectiveness of co-ordination between the bodies who draft policy and the stakeholders who implement said policy remain unclear for most countries.

Principle 3: Building codes

The primary objective of school building codes and regulations should be to **protect the life of occupants of a school building**. Other objectives could include minimising damage to allow rapid occupancy of buildings after earthquakes. An effective school building code and enforcement element should establish:

- Clear building performance objectives based on:
  - Ground motion characteristics and geology of the region.
  - Collapse prevention and structural damage control criteria.
  - Secondary effects such as tsunamis, landslides and surface rupture.
  - Socio-economic impacts to the community.
- A process for periodic review and revision of codes and guidelines by knowledgeable individuals to reflect current understanding of good earthquake engineering practice.
- Enforcement procedures for school building code and construction regulations that take into account community needs & provision for:
  - Checking of design plans for school buildings by qualified reviewers.
  - Review and certification of constructed school facilities.
- A mechanism for ensuring that enforcement activities are not compromised by overt or subtle pressures due to project-specific cost, deadlines or other financial considerations.

Components of effective building codes

1. A mechanism to ensure that procedures are not compromised by financial setbacks or deadline pressures
2. A process for periodic review and revision of codes
3. Procedures for enforcing building codes and design plans
4. Clear building performance objectives based on:
   - ground motion activity and regional geology
   - collapse prevention and structural damage control criteria
   - secondary effect (tsunamis, landslides, ect.)
   - socio-economic impact to the community

Country analysis on principle 3: Building codes

Building codes beyond the minimum standards	Process in place to enforce building codes	Regular reviews of building codes
Chile	Greece	Japan
Greece	Japan	New Zealand
Japan	New Zealand	United States (California)
New Zealand	United States (California)	Australia
United States (California)	Australia	Mexico
Australia	Mexico	
Mexico	Portugal	
Portugal	Turkey	
Turkey		
Spain		

Key Findings

Most reporting countries issued building standards that go beyond the minimum standards required in general legislation and they are based on current international research and good practice; however, only some countries conduct a **regular review** of building codes and **code enforcement remains one of the biggest challenges**.

Principle 4: Training & qualification

Building safety relies on regulations and laws that require proper training and qualification of professionals, builders and technicians involved in the different aspects of the design and construction process. Training and licensing should be required for design professionals, code enforcement officials, plan checkers, inspectors and contractors.

- **Engineers and architects** should be properly trained and licensed by the competent authorities, and their training should include seismic design as well as elements specific to school design and construction.
- **Qualifications of contractors** should be considered in awarding construction projects. This could involve the establishment of training programmes on best constructions practices for contractors and trades.
- **Building officials, plan-check professionals and inspectors** should be certified through a process of adequate training and experience.

Country analysis on principle 4: Training & qualification

Tertiary qualification required for professionals

Chile
Greece
Japan
New Zealand
United States (California)
Australia
Portugal
Slovenia
Turkey
France

Required membership for professionals in recognised professional organisations

Chile
Japan
New Zealand
United States (California)
Australia
Portugal
Slovenia

Key Findings

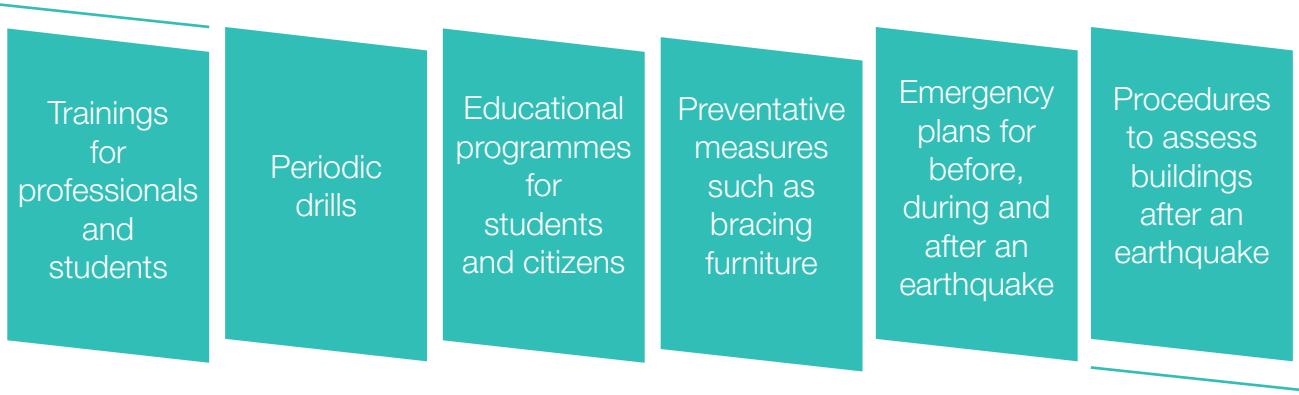
A tertiary-level qualification is required for most countries' professionals. Additionally, in some countries professionals must be registered members of recognised professional organisations or associations. While accredited academic and/or technical training courses for professionals in the field are widely available in all reporting countries, these courses are only mandatory for some professionals in California, and only in New Zealand do engineers have to pass tests every 5-6 years to prove their ongoing competencies.

Principle 5: Preparedness & planning

Effective programmes should include the following measures at education authority and school level to prepare employees and students.

- **Education:** Develop and implement educational programmes in schools and communities to make citizens aware of earthquake hazards and preparedness actions.
- **Risk reduction measures:** Undertake measures to improve the safety of the physical environment by bracing and anchoring furnishings, bookcases, and equipment and building components such as lights, heaters and water heaters.
- **Emergency plan:** Prepare and maintain plans that identify the actions, decisions and responsibilities needed before, during and following an earthquake; the organisation and responsibilities to carry out these plans, including determining whether to shelter or release students or to use school facilities as community shelters; and the equipment and supplies needed to carry out these decisions.
- **Safety assessments:** Establish standards, line of responsibility and procedures to assess the safety of buildings following earthquakes, and decide on evacuation, repair and re-occupancy procedures.
- **Training:** Provide training and materials for employees and students on earthquake hazards and actions to take to improve personal safety.
- **Drills:** Hold periodic drills simulating realistic conditions of earthquake events to reinforce training and to test the adequacy of plans and safety assessments.

Elements of effective earthquake planning programmes



Country analysis on principle 5: Preparedness & planning

Countries with earthquake disaster plans	Countries with immediate post-earthquake procedures
Chile	Chile
Greece	Greece
Japan	Japan
New Zealand	New Zealand
United States (California)	United States (California)
Australia	Mexico
Maxico	Slovenia
Portugal	Turkey
Slovenia	
Turkey	
France	
Spain	

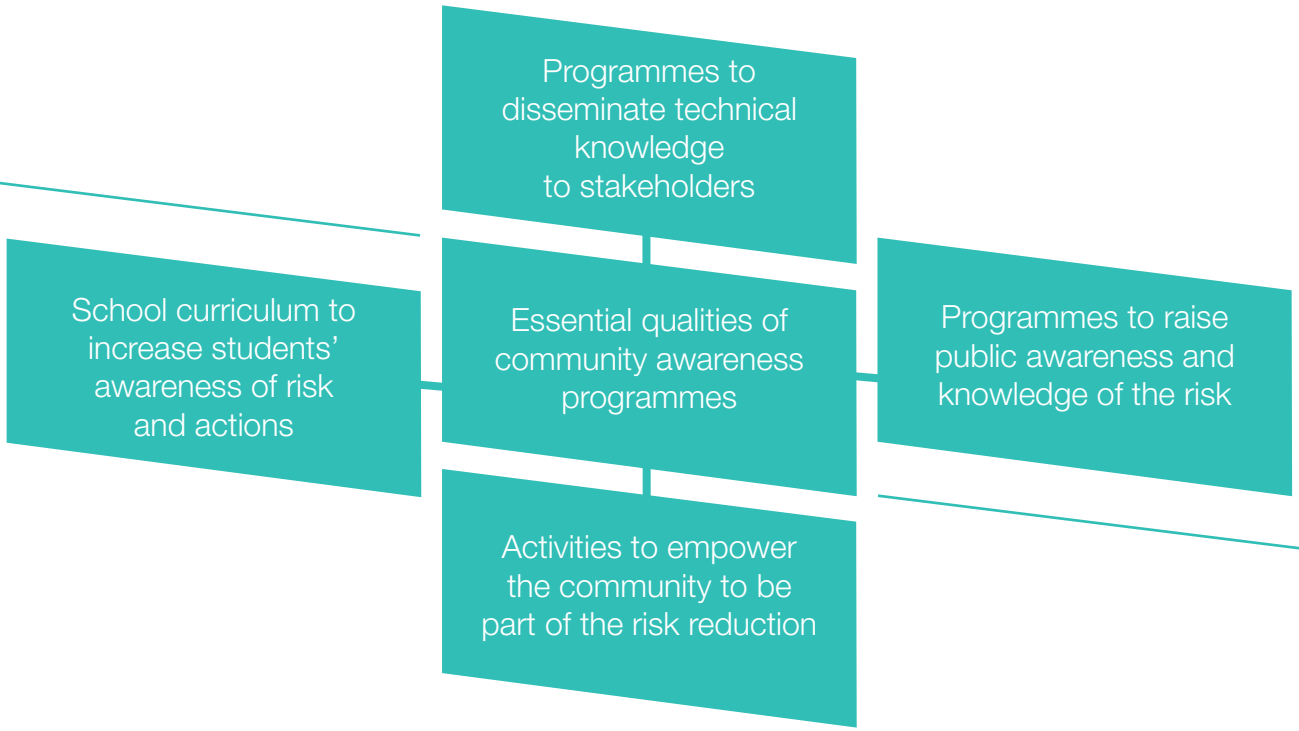
Key Findings

Almost all reporting countries have school disaster plans in their schools, including regular earthquake drills. Most countries also have put in place official post-earthquake procedures; however, post-event data surveys are not undertaken systematically in all countries.

Principle 6: Community awareness

Paramount to the success of a programme to improve the seismic safety of schools is the **understanding and involvement of the community.** All members of the community should understand the seismic hazard of the region, the vulnerability of existing school buildings, the consequences of not properly constructing new school buildings or improving the resistance of existing buildings, and the feasibility of improving seismic safety. In particular, those members of the community who are involved in the construction of school buildings need to understand why they are required to follow prescribed practices, and the consequences of their failing to do so. An effective community awareness effort will include:

- Programmes to raise public awareness and knowledge of the risk from earthquakes and other natural hazards.
- Educational programmes to transfer and disseminate technical knowledge and to explain risk in terms understandable to community stakeholders.
- Activities to empower the community to be part of, and contribute to, the reduction of seismic risk of schools.
- Use of school curricula to increase awareness of earthquake hazards and preparedness actions.



Country analysis on principle 6: Community awareness

Earthquake safety curriculum

Chile
Japan
New Zealand
United States (California)
Australia
Mexico
Portugal
Slovenia
Turkey
Slovak Republic

Countries that use widespread communication tools to disseminate information about earthquakes

Chile
Greece
Japan
New Zealand
United States (California)
Australia
Mexico
Portugal
Slovenia
Turkey

Training programmes for students, teachers and staff

Greece
New Zealand
Mexico
Portugal

Key Findings

In all reporting countries with heightened seismic risk, there is significant community awareness and participation in school earthquake safety-related issues, some of which can be attributed to concerted efforts by national governments.

Principle 7: Risk reduction

Verified procedures currently exist to ensure good seismic performance of school buildings and their contents, and the implementation of such procedures is feasible. The following components are needed in a **risk reduction** element for new facilities:

- Determination of seismic hazard in the region and development of seismic hazard maps.
- Development of performance criteria and codes suitable to the culture and economic conditions of the region with recognition of the fundamental societal importance of schools and the shelter function of school structures in post-disaster emergencies.
- Development of simple regulations, or best construction practices, for regions where such an approach may have an immediate impact on seismic safety (e.g. simple, low-cost education facilities in rural regions of developing countries).
- Training and education of professionals, technicians and the construction workforce.
- Target dates for implementation of construction standards recognising the different levels of current practice in different countries.
- Effective building codes and regulations, and rigorous enforcement of these regulations.

Components of risk reduction for new buildings:

1. Determine seismic risk by consulting seismic hazard maps
2. Develop building codes suitable to economy and culture of the region
3. Develop simple regulation for regions that have simple, low cost education facilities in rural regions
4. Train and educate industry professionals
5. Develop implementation deadlines for construction standards
6. Rigorously enforce building codes

Country analysis on principle 7: Risk reduction

Regional differentiation for earthquake policies	Published guidelines to reduce the risk of structural damage
Chile	Chile
Greece	Greece
Japan	Japan
New Zealand	New Zealand
United States (California)	United States (California)
Australia	Australia
Maxico	Mexico
Portugal	Portugal
Slovenia	Slovenia
Turkey	France
Belgium (French community)	
France	

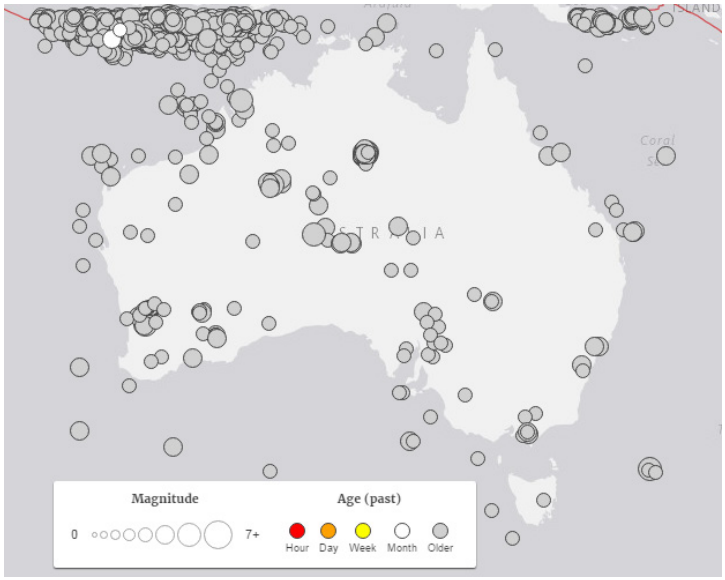
Key Findings

Seismic hazard maps with regional differentiation exist in all countries, but only a few routinely consult them when selecting a site for a new school. Technical guidelines to reduce the risk of structural damage are available in most countries.

Australia

Moderate seismic risk

In Australia **local governments** have put policies to ensure earthquake safety in schools. All regions require schools to set up **emergency plans for a range of natural disasters**, including earthquakes. Building codes are periodically reviewed and new scientific findings are consulted. The training, certification and licensing of designers and contractors are held to a very high standard.



Earthquakes of **4.5M** or greater from 1960-2017

Who is responsible for the 7 principles?

National level
3. Building codes
6. Community awareness
7. Risk reduction

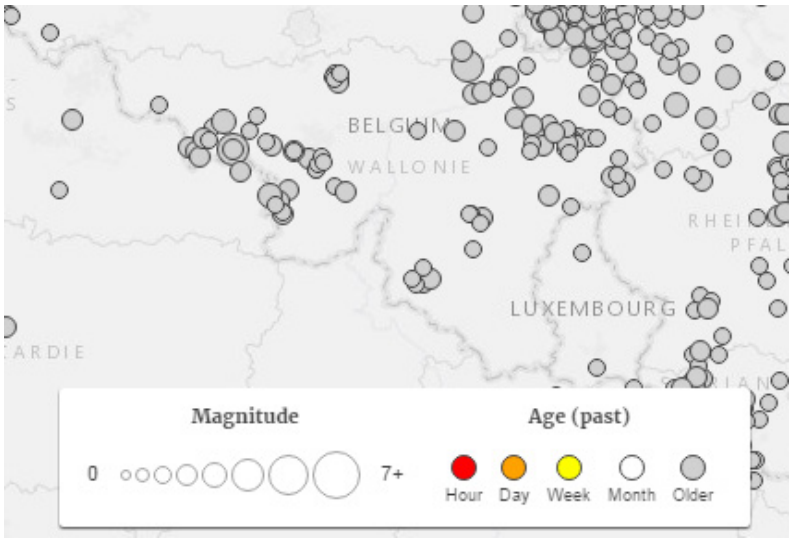
Local level
2. Accountability

Independent level
1. Seismic legislation
4. Training and qualification

Belgium
(French community)

Low seismic risk

Belgium (French community) is not a seismically active region and it **does not have any specific legislation** regarding earthquake safety. However, it abides by **Eurocode 8**, which defines norms regarding earthquake resistant construction for the European Union member countries. The government envisages analysing the impact of structural measures in high-risk zones for new buildings in the near future.



Earthquakes of **2.5M** or greater from 1960-2017

Who is responsible for the 7 principles?

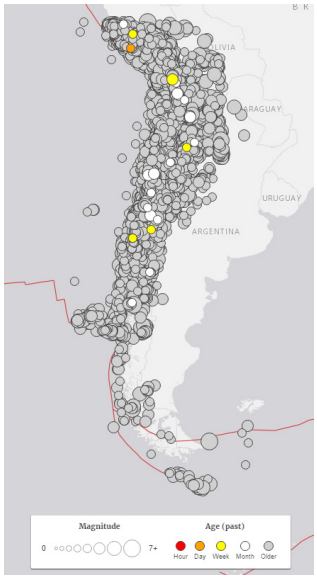
International level

1. Seismic legislation

Chile

High seismic risk

Chile has implemented **legislation that applies to all school buildings**. However, **effectiveness and enforcement** of these laws and building codes is unclear. In addition, there is not enough information on school seismic strengthening programmes. Chile is very effective in terms of its **comprehensive disaster plans** for schools, involving the school, fire fighters, policemen and health providers. Moreover, school awareness materials are provided to all citizens.



Earthquake of **4.5M** or greater from 1960-2017

Who is responsible for the 7 principles?

International level
4. Training and qualification

National level
1. Seismic legislation
2. Accountability
4. Training and qualification
5. Preparedness and planning
6. Community awareness

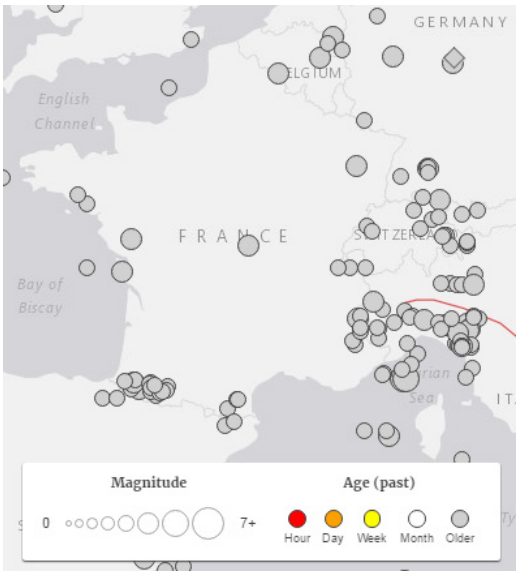
School level
5. Preparedness and planning
7. Risk reduction

Independent level
3 . Building codes
4. Training and qualification

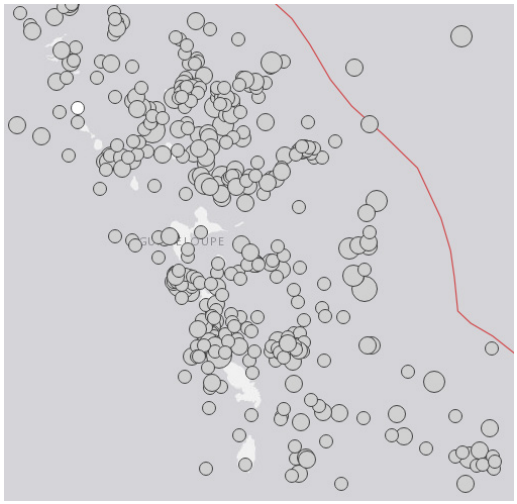
France

Low seismic risk

France regulates schools seismic safety through the **general construction safety guidelines** in the French Environmental Code. Regions with increased seismic activity have specific programmes in place. For example, in the "2007 Antilles Seismic Plan for Guadeloupe, Martinique, Saint-Martin and Saint-Barthelemy" hundreds of schools were identified as at risk and are currently being retrofitted and/or reconstructed. This programme is implemented by the Overseas Department's Directorate for the Environment, Land and Housing and is subsidised by the government.



French territories in the Caribbean



Earthquake of **4.5M** or greater from 1960-2017

Who is responsible for the 7 principles?

National level

1. Seismic legislation
2. Accountability
4. Training and qualification

Local level

1. Seismic legislation
2. Accountability
6. Community awareness
7. Risk reduction

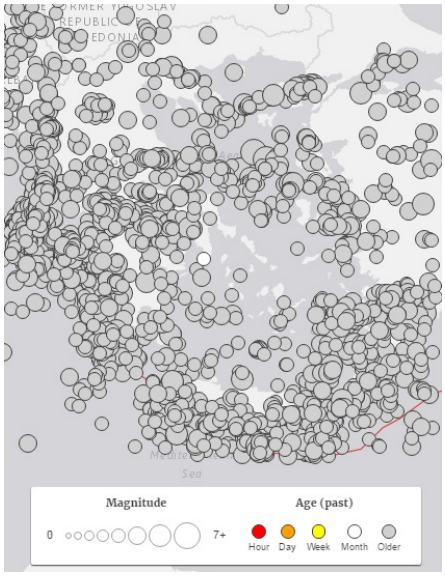
School level

5. Preparedness and planning

Greece

High Seismic Risk

Greece has put in place seismic legislation based on international regulations. It is **in the process of broadening its national agency** to monitor, enforce, and assess the implementation of the models. Greece has **strong community involvement** and national agencies help to further raise awareness. However, Greece faces challenges in assessing vulnerability of existing schools and prioritising the schools most in need. Greece should also develop a transparent process to enforce building codes.



Earthquakes of **4.5M** or greater from 1960-2017

Who is responsible for the 7 principles?

National level
1. Seismic legislation
2. Accountability
4. Training and qualification
5. Preparedness and planning
6. Community awareness

International level
4. Training and qualification

Local level
1. Seismic legislation

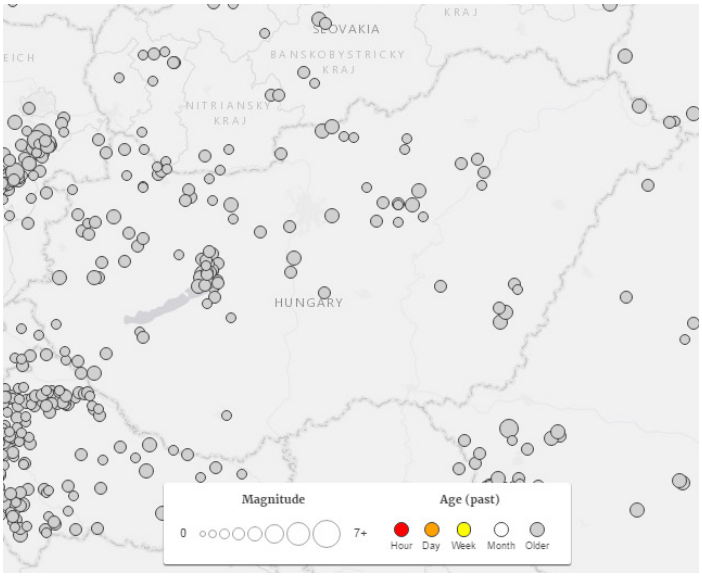
School Level
5. Preparedness and planning

Independent level
2. Accountability

Hungary

Moderate Seismic Risk

Hungary is located in a moderate seismic zone where a highly destructive earthquake (M 5.5 to 6.0) occurs every 40-50 years, while moderately damaging earthquakes occur every 15-20 years. Hungary implements the **Eurocode 8** seismic legislation and adopted a national norm and an **earthquake information system** with government support for students, teachers, researchers, media, architects and authorities. A model seismographic station has also been set up to help students and teachers better understand seismology and related practical questions.



Earthquakes of **2.5M** or greater from 1960-2017

Who is responsible for the 7 principles?

International level
1. Seismic legislation

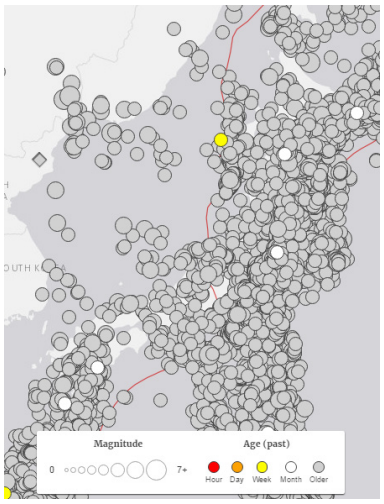
National level
1. Seismic legislation
6. Community awareness

School level
6. Community awareness

Japan

High Seismic Risk

Japan has a **wealth of experience and expertise** in this area. The country is very adapt at assessing the vulnerability of its' school buildings and establishing a funding mechanism to strengthen schools most at risk. In recent years these schools have received significant attention. Japan has **well-established building legislation, and funding legislation** in place that secures earthquake-proofing of school buildings. Japan is particularly **strong in the area of disaster prevention**, and there is a high level of community awareness and participation in the country.



Earthquakes of **4.5M** or greater from 1960-2017

Who is responsible for the 7 principles?

International level
1. Seismic legislation

Local level
2. Accountability
4. Training and qualification
6. Community awareness

National level
1. Seismic legislation
2. Accountability
3. Building codes
4. Training and qualification
5. Preparedness and planning
7. Risk reduction

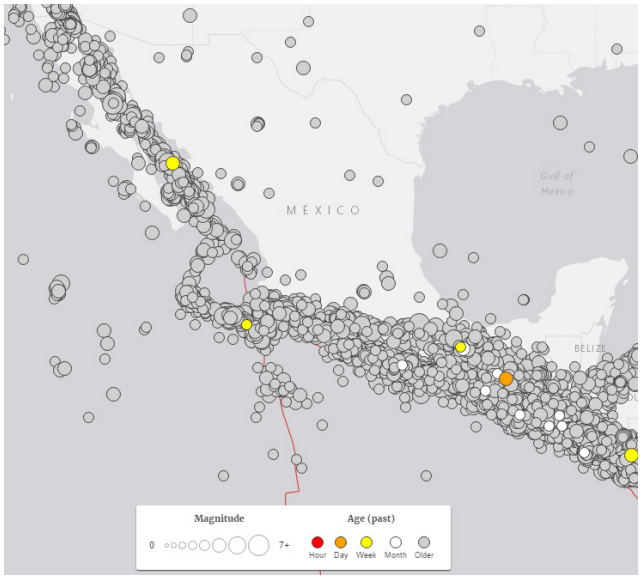
Independent level
4. Training and qualification
7. Risk reduction

School level
3. Building codes
6. Community awareness

Mexico

Moderate Seismic Risk

Since last reporting, Mexico has increased its efforts to implement the OECD recommendation. Over the past 4 years, the National Institute of Physical Infrastructure for Education (INIFED) has issued several **important standards** to ensure schools seismic safety. Moreover, a **national programme** was launched in 2013 to renovate 40,000 schools in need of repair, including those in need of seismic strengthening. However, with its complex legal frameworks, large school stock, and complex administrative structure, establishing effective communication channels between different administrative levels in the country and increasing its' enforcement capabilities remain one of the greatest challenges for INIFED.



Earthquake of **4.5M** or greater from 1960-2017

Who is Responsible for the 7 Principles?

National level

1. Seismic legislation
2. Accountability
4. Training and qualification
6. Community awareness
7. Risk reduction

Local level

2. Accountability
5. Preparedness and planning
6. Community awareness

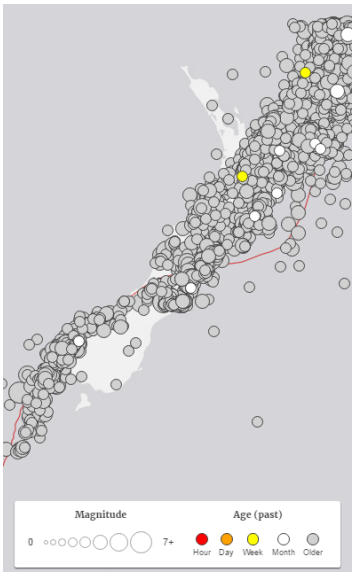
Independent level

6. Community awareness

New Zealand

High Seismic Risk

New Zealand has **significantly expanded its earthquake programmes** by developing legislation, codes, criteria and documentation that are regularly reviewed and based on the latest international research. **Highly qualified professionals** supervise all phases of design and construction and schools are involved in developing future training materials. After the Canterbury earthquake in 2010, the country introduced school seismic risks assessments. **Continuously reviewing seismic vulnerability** will ensure continued success regarding school safety in New Zealand.



Earthquakes of **4.5M** or greater from 1960-2017

Who is Responsible for the 7 Principles?

National level

1. Seismic legislation
2. Accountability
4. Training and qualification
5. Preparedness and planning
6. Community awareness
7. Risk reduction

School level

5. Preparedness and planning

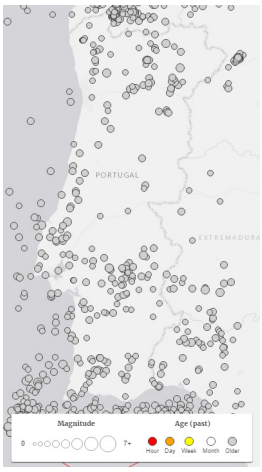
Independent level

3. Building codes
4. Training and qualification
6. Community awareness

Portugal

Moderate Seismic Risk

Portugal has established a framework with procedures in place to assure school safety in the event of an earthquake. This is a **shared responsibility** by the National Authority of Civil Protections (NACP), the Portuguese Institute of Sea and Atmosphere, the Fire Fighting Services, Educational Authorities, and Municipalities. However, the nature of collaboration between these institutions remains unclear. Since 2007, **135 schools have been upgraded** to follow seismic building codes as part of the Secondary School Building Modernisation Programme. However, since the financial crisis in 2011, **upgrades have slowed down.**



Earthquakes of **2.5M** or greater from 1960-2017

Who is Responsible for the 7 Principles?

International level
1. Seismic legislation

Local level
2. Accountability

Independent level
3. Building codes
4. Training and qualification

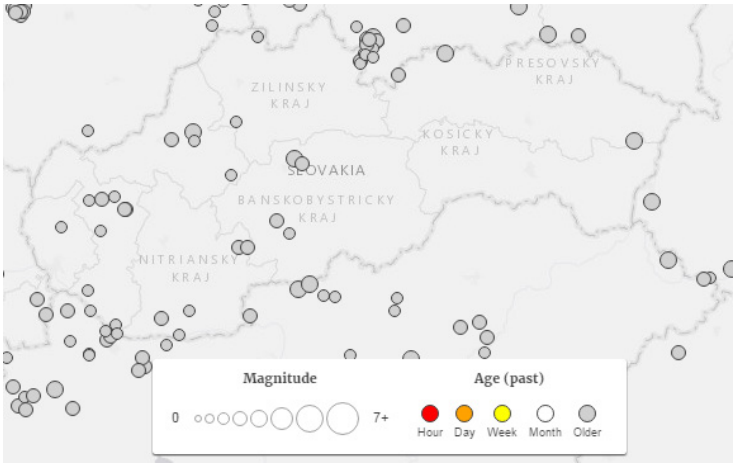
National level
1. Seismic legislation
2. Accountability
3. Building codes
6. Community awareness
7. Risk reduction

School level
5. Preparedness and planning

Slovak Republic

Low Seismic Risk

The Slovak Republic is located in an area with low seismic risk so **no national legislation** exists specifically for earthquakes. Instead, the government complies with **Eurocode 8** for seismic building standards and legislation. Nevertheless, schools carry out **trainings and awareness-raising activities** on how to behave in the event of an earthquake.



Earthquakes of **2.5M** or greater from 1960-2017

Who is Responsible for the 7 Principles?

International level

1. Seismic legislation

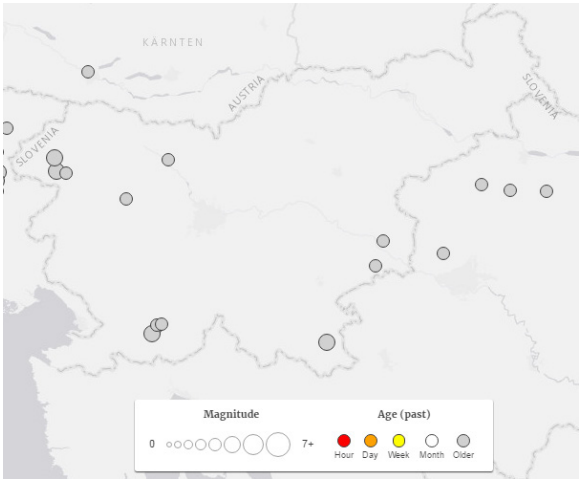
School level

6. Community awareness

Slovenia

Moderate Seismic Risk

Slovenia is a country with a moderate seismic risk. Its main legislation on seismic safety stems from the European Standard for Earthquake Resistance, Eurocode 8. A state-of-the-art seismic hazard map is incorporated in building code requirements and constitutes one of the most important criteria when selecting a site for a new school, besides the demographic criteria. Professionals engaged in the planning, design and construction of school facilities are required to have a tertiary-level qualification and must be members of recognised professional organisations. The Slovenian Chamber of Engineers (IZS) is responsible for recognising vocational qualifications for state-regulated professions. Official post-earthquake procedures are carried out by the Ministry of Education, Science and Sport, and earthquake drills are carried out in each school on an annual basis.



Earthquakes of **4.5M** or greater from 1960-2017

Who is Responsible for the 7 Principles?

International level
1. Seismic legislation
3. Building codes

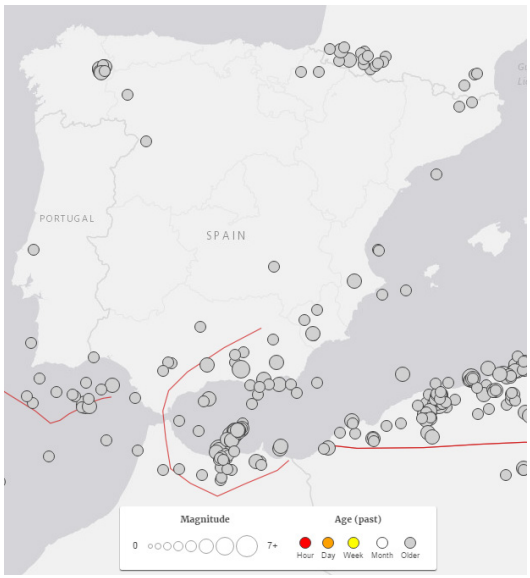
National level
1. Seismic legislation
3. Building codes
4. Training & qualification
5. Preparedness & planning
6. Community awareness
7. Risk reduction

Local level
1. Seismic legislation

Spain

Low Seismic Risk

Spain is **divided into three zones of seismic activity** and additional legislation of school disaster management plans largely depend on the level of risk. In the country's history, **no personal injury has been recorded** due to an earthquake. Some schools were damaged in the past, such as by an earthquake in the region of Murcia in 1818 and in 2011 in the same region which damaged one high school which was subsequently rebuilt.



Earthquakes of **4.5M** or greater from 1960-2017

Who is Responsible for the 7 Principles?

National level
1. Seismic legislation

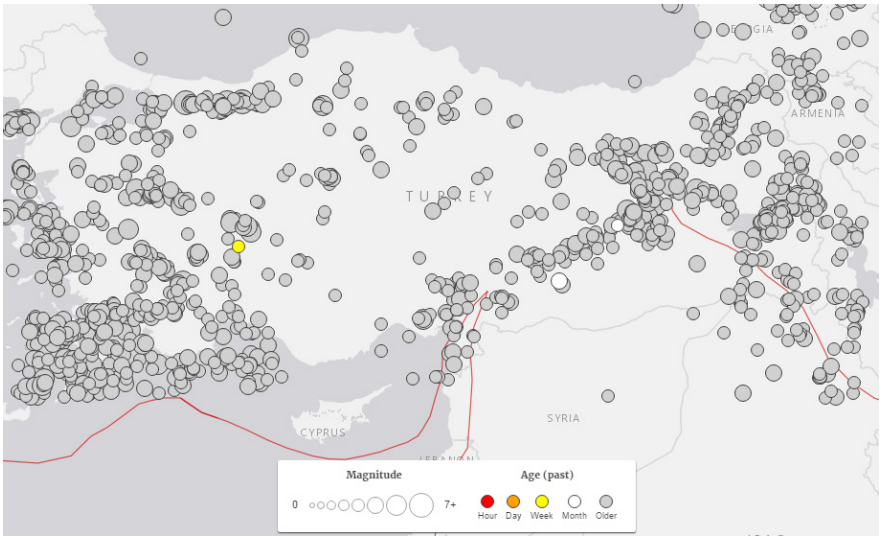
Local level
5. Preparedness and planning

Independent level
2. Accountability
4. Training and qualification

Turkey

Moderate Seismic Risk

Turkey introduced the **National Earthquake Strategy and Action Plan 2012-2013** after the "Don't Let Our Schools Collapse" campaign revealed that less than half of the schools that were sampled were safe. Turkey has established several **community participation programmes** such as the 10-year collaborative project between the Ministry of Education (MoNE) and the Turkish Red Crescent Co-operation, which organises training for local community leaders. Another project with a non-profit organisation, Risk RED, offers teachers e-learning courses on disaster risk mitigation.



Earthquakes of **4.5M** or greater from 1960-2017

Who is Responsible for the 7 Principles?

National level

1. Seismic legislation
2. Accountability awareness
6. Community awareness
7. Risk reduction

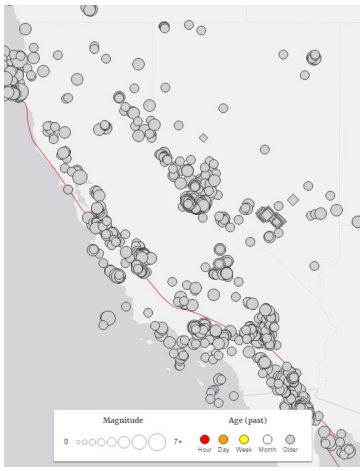
Independent level

3. Building codes
4. Training and qualification
6. Community awareness

United States (California)

High Seismic Risk

California has the **most comprehensive programme** with regularly **updated and accessible codes** reflecting international research and local needs. It is the only reporting country with an independent body that implements, monitors, enforces and evaluates legislation. California has **strong community involvement** but districts are now working to engage a range of stakeholders to further reduce earthquake risks.



Earthquakes of **4.5M** or greater from 1960-2017

Who is Responsible for the 7 Principles?

International level
5. Preparedness and planning

National level
3. Building codes
6. Community awareness
7. Risk reduction

Local level
1. Seismic legislation
2. Accountability
3. Building codes
4. Training and qualification
6. Community awareness
7. Risk reduction

School level
5. Preparedness and planning

Independent level
3. Building codes

The 2005 Recommendation

The following text is the 2005 Recommendation of the Council of OECD:

OECD RECOMMENDATION CONCERNING GUIDELINES ON EARTHQUAKE SAFETY IN SCHOOLS

THE COUNCIL
Having regard to article 5b) of the Convention establishing the Organisation for Economic Co-operation and Development of 14 December 1960,

Recognising that:

- all too frequently, earthquakes strike countries, causing collapse of school buildings and the injury or death of staff and students;
- the knowledge presently exists to significantly lower the seismic risk of schools and to help prevent further injury and death of school occupants during earthquakes, at reasonable cost and in a reasonable time frame;
- schools built world-wide routinely collapse in earthquakes due to avoidable errors in design and construction because existing technology is not applied and existing laws and regulations are not sufficiently enforced; unless action is taken immediately to address this problem, much greater loss of life and property will occur;
- a state requirement for compulsory education, while allowing the continued use of seismically unsafe buildings, is a dangerous practice;
- efforts to improve the seismic safety of schools and education systems require co-ordination at appropriate levels while acknowledging the need to provide flexibility and alternative means of achieving equivalent results depending on the level of seismic hazard, knowledge, technology and resources, and commensurate with indigenous capacity, need and level of sophistication.

On the proposal of the Programme on Educational Building (PEB) Governing Board and the Education Committee:

RECOMMENDS that Member countries take steps to establish and implement programmes of school seismic safety based on the principles set forth in Annex 1 to this Recommendation of which it forms an integral part. In so doing Member countries should take into account the major elements of such programmes as set out in Annex 2 to this Recommendation of which it forms an integral part.
INSTRUCTS the PEB Governing Board to review actions taken by Member countries as requested in pursuance to this Recommendation and report thereon through the Education Committee to the Council three years from the date of this Recommendation.
INVITES non-Member economies to take account of the terms of this Recommendation.

ANNEX 1
Principles for school seismic safety programmes

Programmes for seismic safety in schools should recognise the safety of children in schools as an important goal. Such programmes, to be established on an urgent basis to assure earthquake safety of new and existing schools, should be based on the following principles:

1. Establish clear and measurable objectives for school seismic safety, based on the level of risk, that can be implemented and supported by the affected residents of communities and agencies at the local government level, and provide adequate resources and realistic timelines to achieve these objectives.

2. Define the level of the earthquake hazard in order to facilitate the development and application of construction codes and standards under the responsibility, as appropriate, of national, state or local authorities. At a minimum, natural hazard zones should be established and, where possible, seismic hazard maps should be based on probabilistic analysis.

3. Set forth expectations or objectives that define the desired ability of school buildings to resist earthquakes. School buildings should be designed and constructed, or retrofitted, to prevent collapse, partial collapse or other failure that would endanger human life when subjected to specified levels of ground shaking and/or collateral seismic hazards such as surface fault rupture, landslide or inundation from tsunami waves or dam failure. However, some authorities may desire that school buildings have additional seismic resistance to the extent that damage is limited and the buildings can be occupied immediately after earthquakes and used for shelter or emergency operations.

4. Give priority to making new schools safe. Efforts to identify vulnerable existing schools; to establish standards for retrofitting or replacing dangerous buildings; and to develop a list of priority actions can be made over a short period of time. A longer timeframe will likely be needed to correct seismic weaknesses of existing school buildings.

5. Be established as long-term undertakings with a strong commitment to sustained effort rather than one-time action.

6. Adopt a multi-hazard approach to school safety, with earthquake mitigation strategies that complement disaster countermeasures for other hazards.

7. Employ advisory committees as needed to assure that policy and technical decisions are consistent, and to provide long-term independent support and evaluation for the seismic safety effort.

ANNEX 2
Major elements of effective school seismic safety programmes

An effective school seismic safety programme will include the major elements described below:

Seismic safety policy element

Policies should be established by the competent authorities and should state well-defined and measurable objective. Priorities and strategies for satisfying the objectives should be established by the appropriate authorities. The policy must be clear and should have adequate support and authority to enforce its scope and objectives and to carry out the plan over a specified number of years. The policy should:

- Recognise the need to ensure the safety of schoolchildren.
- Recognise the consequential need for the safety of school buildings.
- Establish minimum standards for protection of human life.
- Adopt sustainable standards to guide design for new and existing school
- infrastructure based on prescribed performance objectives, knowledge of the ground shaking severity in different regions, quantification of site specific hazards, and the ability of the community to educate, train and license its members to effectively achieve established objectives.
- Establish programmes for seismic risk reduction of school buildings and their components.
- Provide adequate funding and human resources for the protracted duration of the programme.
- Be supported by committed and competent leaders with sufficient legal and moral authority to ensure the effectiveness, sustainability and continuity of the programmes that derive from the policy.

Accountability element

There should be a basis for action with clear lines of accountability of the different members of society who are given responsibility for implementing earthquake safety programmes. To achieve the objectives of these programmes there should be:

- A clear definition of the roles and responsibilities of the various individuals, agencies and organisations involved in school seismic safety.
- A process for making all planning, design, regulation and enforcement decisions transparent.
- Qualification requirements for professionals engaged in the design of school facilities.
- An independent assessment of the proper design, construction and maintenance of school facilities including:
  - Conducting assessments of existing school facilities.
  - Reviewing and approving construction documents prepared for new structures and the retrofit of existing structures.

- Inspecting and approving construction.
- Qualifying personnel for design, plan review and inspection, materials testing and support functions.

- A clearly identified jurisdiction in terms of the area and the type of school systems and buildings affected.

Building codes and code enforcement element

The primary objective of school building codes and regulations should be to protect the life of occupants of a school building. Other objectives could include minimising damage to allow rapid occupancy of buildings after earthquakes. Building codes should govern the design of new and retrofitted school buildings. Design earthquake ground motions may be based on a probabilistic approach, a deterministic approach, or on a map of seismic zones. The competent authorities should determine the most appropriate design criteria, based on a review of their country's seismic hazard and other pertinent factors.

An effective school building code and enforcement element should establish:

- Clear building performance objectives based on:
  - Ground motion characteristics and geology of the region.
  - Collapse prevention and structural damage control criteria.
  - Secondary effects such as tsunamis, landslides and surface rupture.
  - Socio-economic impacts to the community.
- A process for periodic review and revision of codes and guidelines by knowledgeable individuals to reflect current understanding of good earthquake engineering practice.
- Enforcement procedures for school building code and construction regulations that take into account community needs but provide clear provision for:
  - Checking of design plans for school buildings by qualified reviewers.
  - Review and certification of constructed school facilities.
- A mechanism for ensuring the enforcement activities are not compromised by overt or subtle pressures due to project-specific cost, deadlines or other financial considerations.

The mere existence of a building code in a community can give the false impression that buildings are being constructed safely and that their seismic performance will be satisfactory. While extremely important, the writing and adoption of building codes and regulations can be an incomplete strategy if they are not enforced at every step of the design and construction process. Steps should be taken to ensure that proper implementation and enforcement of code regulations is done in a consistent manner and has equal priority to code development.

Training and qualification element

Building safety relies on regulations and laws that require proper training and qualification of professionals, builders and technicians involved in the different aspects of the design and construction process. Building safety training programmes should be carried out within the context of each individual country. Training programmes must accommodate governmental structure and division of responsibilities, perception of risk to the institution and its stakeholders, community values and economic conditions. Training and licensing should be required for design professionals, code enforcement officials, plan checkers, inspectors and contractors.

- **Engineers and architects** should be properly trained and licensed by the competent authorities, and their training should include seismic design as well as elements specific to school design and construction.
- **Qualifications of contractors** should be considered in awarding construction projects. This could involve the establishment of training programmes on best constructions practices for contractors and trades.
- **Building officials, plan-check professionals and inspectors** should be certified through a process of adequate training and experience.

Preparedness and planning element

Effective programmes should include the following measures at education authority and school level to reduce risks and to prepare employees and students to react in safe ways during emergencies.

- **Education**: Develop and implement educational programmes or curricula in schools and communities to make citizens aware of earthquake hazards and preparedness actions.
- **Risk reduction measures**: Undertake measures to improve the safety of the physical environment by bracing and anchoring furnishings, bookcases, and equipment and building components such as lights, heaters, and water heaters.
- **Emergency plan**: Prepare and maintain plans that identify the actions, decisions and responsibilities needed before, during and following an earthquake; the organisation and responsibilities to carry out these plans, including determining whether to shelter or release students or to use school facilities as community shelters; and the equipment and supplies needed to carry out these decisions.
- **Safety assessments**: Establish standards, line of responsibility and procedures to assess the safety of buildings following earthquakes, and decide on evacuation, repair and re-occupancy procedures.
- **Training**: provide training and materials for employees and students on earthquake hazards and actions to take to improve personal safety.
- **Drills**: Hold periodic drills simulating realistic conditions of earthquake events to reinforce training and to test the adequacy of plans and safety assessments.

Community awareness and participation element

Paramount to the success of a programme to improve the seismic safety of schools is the understanding and involvement of the community. All members of the community should understand the seismic hazard of the region, the vulnerability of existing school buildings, the consequences of not properly constructing new school buildings or improving the resistance of existing buildings, and the feasibility of improving seismic safety. In particular, those members of the community who are involved in the construction of school buildings need to understand why they are required to follow prescribed practices, and the consequences of their failing to do so. An effective community awareness effort will include:

- Programmes to raise public awareness and knowledge of the risk form earthquakes and other natural hazards.
- Educational programmes to transfer and disseminate technical knowledge and to explain risk in terms understandable to community stakeholders.
- Activities to empower the community to be part of, and contribute to, the reduction of seismic risk of schools.
- Use of school curricula to increase awareness of earthquake hazards and preparedness actions.

Risk reduction element for NEW facilities

Verified procedures currently exist to ensure good seismic performance of school buildings and their contents, and the implementation of such procedures is feasible.

The following components are needed in a risk reduction element for new facilities:

- Determination of seismic hazard in the region and development of seismic hazard maps.
- Development of performance criteria and codes suitable to the culture and economic conditions of the region with recognition of the fundamental societal importance of schools and the shelter function of school structures in post-disaster emergencies.
- Development of simple regulations, or best construction practices, for regions where such an approach may have an immediate impact on seismic safety (e.g. simple, low-cost education facilities in rural regions of developing countries)
- Training and education of professional, technicians and the construction workforce.
- Target dates for implementation of construction standards recognising the different levels of current practice in different countries.
- Effective building codes and regulations, and rigorous enforcement of these regulations.

Risk reduction element for existing facilities

To reduce the seismic risk of existing school buildings, it is important to understand why this risk exists and what actions can be taken by the community to eventually reduce the risk. Community values, economic conditions, financial possibilities and the type of building materials available in the region should be considered when developing and implementing a risk reduction plan.

Key ingredients for an effective risk reduction element for existing facilities include:

- Determination of the seismic hazard and preparation of hazard maps.
- Assessment of risk to existing schools and their contents.
- Evaluation of the consequences of not taking corrective action.
- Development and implementation of technical guidelines to improve performance of existing facilities during earthquakes (e.g. methods and procedures to estimate forces and displacements of the structure and predict damage, acceptable margins of safety or confidence, proper use of building materials, and monitoring the construction processes).
- Formulation of an action programme based on availability of funding, human resources and their qualifications, existing infrastructure and the operational structure of the community.
- Prioritisation and risk reduction plan implementation, considering financial and human resources and the role of school buildings in post-disaster emergency management.
- Monitoring of effectiveness of plan implementation.

Given the magnitude of the retrofitting task in many countries, responsible officials should establish time schedules and priorities to retrofit at least those facilities deemed to be at the highest risk. While several decades may be needed to complete implementation of a school seismic retrofit programme, work in the facilities at greatest risk can be undertaken on a priority basis over a much shorter period.

Index of organisations per country

Australia

Department of Education - disseminates information after an earthquake
Geoscience - makes seismic map to identify high risk regions
Department of Education and Child Development - disseminates information to schools in Southern Australia
Building Code of Australia - assists to building code development
Australian Energy Management Institute - gives schools seismic advice through website
Australian Institute of Architects - is responsible for national policy; registers architects a professional organisation
State Governments - assist in implementing policies

Belgium (French community)

Eurocode 8 - defines norms regarding earthquake resistant construction for the European Union member countries; specific section of Eurocode advising for seismic retrofitting

Chile

Integral Plan of School Safety (PISE) - creates seismic legislation and sponsors programmes for vulnerable schools
Ministry of Housing and Urbanism
National Office of Emergency of the Internal Affairs Ministry (ONEMI) - assists in implementing seismic policies
Office for National Emergency - helps make a University degree on school safety management
Ministry of Education - develops the Plan of School Safety
National Institute for Normalization (INN) - provides foundation for technical norms
The Architectural Directorate - registers architects, engineers and constructors
Metropolitan University of Education Science - help make a University degree on school safety management
School Safety Committee - evaluates schools after an earthquake
UNESCO - help make a University degree on school safety management

France

French Seismological Bureau - collects field data after an earthquake
Ministry of the Interior - is involved with the post earthquake procedure
Ministry of Culture - supervises architect profession
National Observatory for Safe School Buildings - creates an annual seismic report
Regional Authorities - is responsible for seismic safety implementation
Schools - develop individual safety plan

Greece

Buildings Infrastructure SA - reviews school designs and issues building permits, conducts inspections after an earthquake
Scientific Committee for Planning and Monitoring the Pre-Seismic Inspection of the Territory - reviews building codes
Ministry of Infrastructure - conducts schools inspections immediately after an earthquake
Eurocode 8 - defines norms regarding earthquake resistant construction for the European Union member countries; specific section of Eurocode advising for seismic retrofitting
EAK 2003 - categorises 3 seismic risk zones
Local municipalities - are responsible for immediate school inspections, repairs, and construction after earthquakes
Organisation of Anti-Seismic Design and Protections (OASP) - develops education material and administers teacher and staff training on material; helps implement seismic policy
Technical Chamber of Greece - registers architects and engineers

Hungary

Eurocode 8 - defines norms regarding earthquake resistant construction for the European Union member countries; specific section of Eurocode advising for seismic retrofitting

Japan

Ministry of Land, Infrastructure, Transport and Tourism - reviews and revises building codes and approves architects
National Institute of Educational Policy Research - publishes reports about how to earthquake proof buildings
Architectural Institute of Japan - publishes reports about how to earthquake proof buildings.
Local Governments - organise training courses for professional; approves risk inspectors
Ministry of Education, Culture, Sports, Science and Technology (MEXT) - implements seismic strengthening policies for school buildings, provides funding for regular revision of legislation

Mexico

National Institute for Physical Infrastructure for Education (INIFED) - develops legislation; implements construction/retrofit programmes for most vulnerable schools; aids with implementing policy
Mexican Institute for the Protection and Communitarian Assistance - assists marginalised groups living in high risk areas
Ministry of Public Education - broadcasts earthquake community awareness
Interior Ministry - provides civil protection through media channels
Association of Parents - develops earthquake curriculum
TOPOS - volunteer organisation that rescues people after earthquakes
CIRES - trains engineering students as part of their community service to development seismic technology
National Centre for Disaster Prevention (CENAPRED) - assists INIFED with retrofitting old schools and provides training courses for civil protection managers

New Zealand

Ministry of Education - sets standards for building codes
Ministry of Business Innovation and Employment (MBIE) - develops and monitors policy
School Board of Trustees (BOTS) - manages school property
Ministry of Civil Defense and Emergency Management (CDEM) - teacher support/ training for What's the Plan Stan Programme
Engineering Strategy - advises the Ministry of Education on structural evaluation
Association of Consulting Engineers of New Zealand - required professional organisation membership which reviews building codes
New Zealand Earthquake Commission (EQC) - introduces programmes to develop hazard awareness among students; organises field trips to the National Museum

Portugal

Institute for Structural Engineering, Territory and Construction (ICIST) - assists with seismic research
Parque Escolar - conducted research to define strengthening solutions for school buildings
National Authority for Civil Protection - implements policy
Portuguese Institute of Sea and Atmosphere - implements policy
Secondary School Building Modernisation Programme - developed seismic retrofitting programme
National Authority for Civil Protection - disseminates info to public
Architects Association - professional organisation
Chamber of Engineers - professional organisation
School Boards - develop school safety plan

Slovak Republic

Eurocode 8 - defines norms regarding earthquake resistant construction for the European Union member countries; specific section of Eurocode advising for seismic retrofitting
Life and Health Protection Curriculum

Slovenia

Administration for Civil Protection and Disaster Relief - provides information for citizens on seismic safety
Construction Institute ZRMK d.o.o - publishes building guidelines
Geodetic Institute of Slovenia - estimates the costs for improving seismic construction in schools
Mapping Authority of the Republic of Slovenia - carries out nationwide evaluations of school buildings
Slovenia Chamber of Architecture and Spatial Planning (ZAPS) - organises informational workshops for kids
Slovenia Chamber of Engineers - responsible for recognising qualifications for state regulated professions
Slovenia Environment Agency (ARSO) - drafts anti-seismic construction legislation; reports on seismic activity
Ministry of Education, Science and Sport - collects information on seismic vulnerability in schools and coordinates activities in schools after an earthquake

Spain

Board of Education - approves school safety plans

Turkey

Risk Red - provides eLearning courses for teachers on disaster risks and mitigation
National Education Foundation - assessed buildings and concluded less than half were safe
Ministry of National Education - makes evaluations after earthquakes
Turkish Red Crescent Co-operation - affiliated with the Red Cross, and develops earthquake curriculum
Chambers of Civil Engineers and Architects - provides professional certification
Ministry of Disaster and Emergency Management - created the National Earthquake Strategy and Action Plan which clearly defines roles and coordination between stakeholders

United States (California)

FEMA - provides earthquake curriculum
U.S Department of Education - 6 step planning tool for schools
U.S Geological Survey - helps develop building codes
District Engineers - supervisor construction
California Architects Board - licenses architects
California Geological Survey - assists in developing building codes
Department of General Services - inventoried public schools to prioritise those built before building codes were updated
Berkeley Unified School District - provides earthquake curriculum
International Code Council (ICC) - helps develop building codes
Building Seismic Safety Council (BSSC) - helps develop building codes
American Society of Engineers (ASCE) - helps develop building codes
District of State Architects (DSA) - professional organisation that oversees seismic mitigation programmes and all the different stages of the approval process

This publication is prepared by Learning Environments Evaluation Programme of OECD.

Our team at the OECD LEEP works with school leaders, researchers and policy makers to explore how investments in the learning environment, including the physical learning environment and technologies, translate into improved education, health, social and well-being outcomes. (CELE, www.oecd.org/edu/facilities)

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