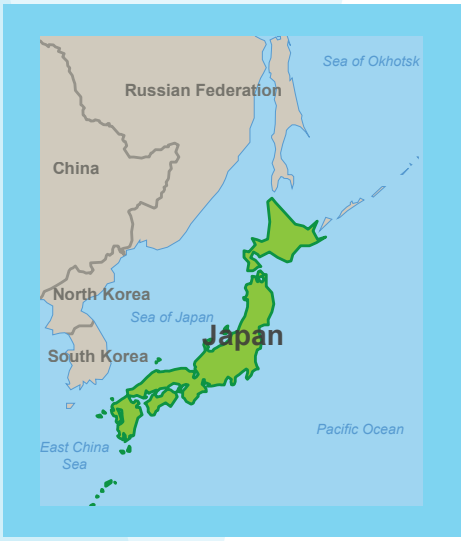
Global Alliance for Disaster Risk Reduction & Resilience in the Education Sector

GADRRRES Comprehensive School Safety Policy Case Studies Series



Japan

Pillar 1: Safe Learning Facilities

Organisations:

- *Ministry of Education, Sports, Science and Technology (MEXT)*
- *Japan Building Disaster Prevention Association (JBDPA)*

Schools Impacted:

- 52,000 public schools

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Guiding Local Governments to Strengthen Unsafe Schools in Japan

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Overview

Between 2002 and 2016, the percentage of earthquake-resistant elementary and junior high school buildings in Japan increased from just 44.5% to 98%. The rapid increase was the result of the Ministry of Education, Culture, Sports, Science and Technology (MEXT)'s Program for Earthquake-Resistant School Buildings. In 2003, MEXT published Guidelines for Promotion of Earthquake-Resistance School Building for local governments. Using the technical and planning guidance from the MEXT guidelines, as well as national subsidies available for school retrofit projects, municipal governments across the country began implementing school retrofits and reconstructions in their jurisdictions. By 2015, approximately 52,000 elementary and junior high schools had been either assessed as seismically safe, retrofitted to be seismically safe, or torn down and reconstructed.

Keywords: school assessments, seismic retrofit, earthquake-resistant school buildings

Hazards and Education Context

Sitting atop a subduction zone at the edges of four continental and oceanic tectonic plates, Japan experiences frequent earthquakes. The country records approximately 1,500 earthquakes each year; however, many of these are minor tremors or imperceptible. More destructive earthquakes are less frequent, occurring several times each century. The most recent destructive earthquake in Japan was the Great East Japan Earthquake of 2011, which had a magnitude of Mw9. The earthquake triggered a deadly tsunami and resulted in nearly 16,000 deaths.

With the high frequency of earthquakes, Japan began mandating anti-seismic construction practices decades before most other countries. Anti-seismic building standards were first incorporated into the building code in 1924 and were revised and improved after every major earthquake. Two major shifts in anti-seismic building standards took place after 1924. The first shift followed the 1968 Tokachi offshore earthquake, which damaged the modern reinforced concrete (RC) building stock. In 1971 the Ministry of Land, Infrastructure, Transport, and Tourism (MLIT), formerly the Ministry of Construction, heightened requirements for shear strength and established protocols for assessing and retrofitting the seismic safety of existing buildings. The second major shift occurred in 1981, when the MLIT heightened building standards to ensure the safety of building occupants even in high magnitude, rare earthquakes. Previously, national building standards had focused on smaller magnitude, but more frequent, earthquakes.

The 1981 revision was a major turning point for school safety. School buildings constructed after 1981 and subject to these standards were considered safe. However, all school buildings that had been built prior to 1981 and not been retrofitted were considered seismically unsafe.

Program Development Process

The national government began allocating subsidies to retrofit elementary and junior high schools located in high-risk earthquake regions in 1978. However, it was not until the Great Hanshin-Awaji earthquake of 1995 that the government began considering school building outside this high-risk zone. Following the Great Hanshin-Awaji earthquake, which damaged nearly 4,000 school facilities, the national government turned its attention to earthquake risk to school facilities nationwide, even in regions where earthquake risk was considered relatively low.

In 1995, MEXT partnered with the Architectural Institute of Japan (AIJ) to survey the damage to school buildings from the Great Hanshin-Awaji earthquakes. Unsurprisingly, the survey showed that school buildings constructed prior to 1981, when strict anti-seismic standards were put in place, were much weaker. The older school buildings were more heavily damaged than those constructed after 1981.

In response to the results of the damage survey, the national government expanded its school retrofitting subsidy program, making funds available to all pre-1981 public and private schools nationwide the same year. MEXT encouraged local governments to address the structural risks of pre-1981 schools by commissioning construction design architects to complete seismic diagnoses, a process in which the architect evaluated the anti-seismic structural capacity of the building using guidelines published by the Japan Building Disaster Prevention Association (JBDPA). Where seismic diagnosis indicated retrofit was necessary, a local government could take advantage of retrofit subsidies. However, many local governments did not comply. MEXT subsidies covered only about a third of the costs. Even with the availability of national subsidies for retrofit, local governments saw planning and implementing a seismic diagnosis and retrofit as complicated and expensive.

Seven years later, in 2002, MEXT conducted a new nationwide survey on the seismic safety of school buildings. They found that few local governments had completed seismic diagnosis, let alone retrofits, after the 1995 AIJ damage survey. Overall, only 44.5% of elementary and junior high school buildings nationwide fulfilled national seismic safety standards and could be considered earthquake resistant. MEXT realised that it needed a new strategy to better equip local governments to address their school building earthquake risk.

In late 2002, MEXT organised a working group of earthquake and planning experts, architects, and local government representatives to develop guidelines for the planning and implementation of school building retrofitting projects. The Guidelines for Promotion of Earthquake-Resistance School Building, which was published and distributed to local governments in 2003, describes the basic concepts of structural earthquake safety in schools, how to prioritise retrofitting projects, and methods for planning and implementing retrofitting projects.

These guidelines directed local governments to:

- Establish a steering committee consisting of relevant stakeholders in school safety and disaster prevention, including administrators, teachers, engineers, and academic experts. The steering committee would help stakeholders understand perspectives and gain knowledge from other professional fields.

- Conduct a baseline survey of school buildings inquiring about the condition of facilities, building design, presence of active fault, school

Problems:

- High earthquake risk.

- Seismically susceptible school building stock.

Goals:

- Strengthen all elementary and junior high school buildings in Japan to resist anticipated earthquakes.

Intervention:

- Development of guidelines for local governments to plan and implement assessment and retrofitting projects.

- National subsidy programme for school assessments and retrofits.

Major Impacts:

- Doubling of the percentage of seismically safe schools from 44.5% to 98% in four years.

Greatest Insights:

- National surveys to monitor program progress and develop additional guidance as needed.

What's Next:

- Increasing subsidies for the assessment and retrofit of private schools.

status as an evacuation centre, and plans for closure or merger.

- Prioritise school buildings for vulnerability assessment and/or seismic diagnosis based on the number of floors, year built, and other estimates of structural integrity.

- Conduct a vulnerability assessment in cases where prioritisation surveys indicate a building was structurally weak or dilapidated. The vulnerability assessment comprehensively assesses the level of building deterioration and if its calculated vulnerability score fell below a certain threshold, it had to be reconstructed. If the calculated vulnerability score was above that threshold, a seismic diagnosis must be conducted.

- Conduct a seismic diagnosis where prioritisation surveys find that a building is structurally average or where a vulnerability assessment resulted in a vulnerability score above the threshold requiring reconstruction. The seismic diagnosis produced two indices: a seismic index of structure and a horizontal load-carrying capacity index. These two indices were then associated with a low, medium, or high risk of collapse in earthquake, and determined the urgency of school retrofitting projects.

- Determine the urgency of projects using the results of the seismic diagnosis. Local governments were told to consider schools with high risk of collapse as cases with high urgency.

- Formulate an annual plan after reviewing the list of school facilities that require structural intervention in their jurisdiction. Local governments were told to consider extent of work, associated costs, and number of high-risk buildings that require urgent attention.

MEXT increased its support for the program at the same time. National subsidies, which MEXT provided in the form of subsidies to local governments, had originally covered approximately one-third of program costs – costs associated with vulnerability assessment, seismic diagnosis, retrofit planning and implementation – yet, new school disasters brought renewed concern.

After the 2008 Wenchuan earthquake in China, in which nearly 10,000 children were killed after school buildings collapsed on them, the Japanese government increased subsidies to cover two-thirds of the costs through the Act on Special Measures for Earthquake Disaster Countermeasures. MEXT also encouraged local governments to allocate tax revenue and issue bonds to further finance these projects.

Implementation

Though MEXT provided guidance for the planning and implementation of school retrofits, municipal governments were responsible for the implementation process because they had authority over the public school facilities subject to retrofit. Following the guidelines developed by MEXT, municipal governments established a steering committee and completed the recommended steps provided in the MEXT guidelines. Steering committees were in charge of coordinating the implementation process; they selected a seismic reinforcement plan, listed in guidelines provided by MEXT; prepared a detailed design of how reinforcement methods would be applied to each part of the building; developed a construction schedule with estimated costs; and implemented the construction work.

Given the scale and complexity of the work, local governments typically contracted this work to the private sector. Construction typically took between six months to several years depending on the extent of the retrofit or if a school was being entirely reconstructed. For longer-term projects, temporary facilities

needed to be built and used for school activities until the permanent structure was completed. For small-scale projects in which students remained on site during construction, the construction area was fenced off and stationed with security guards.

Prefectural governments typically played an important role as liaisons between the national government and municipal governments. The prefectural governments typically facilitated the application of national subsidies and reporting municipal progress to MEXT. To ensure the prefectural governments had the capacity to supervise municipal implementation of the Program for Earthquake-Resistant School Buildings, MEXT offered prefectural governors workshops that detailed the programme's guidelines and proper application, and facilitated trainings for prefectural government leaders by experts in academia, such as the JBDPA.

MEXT monitored program progress of municipalities primarily through the collection of survey data. Beginning in 2002, MEXT conducted the Status of Seismic Resistance of Public School Facilities, which was specific to the program. The survey collected basic data on seismic integrity of school building stock and also allowed local governments to indicate their retrofit program progress and define obstacles inhibiting proper program implementation, such as lack of local technical expertise or finances. The results of this survey helped MEXT develop additional resources for local governments to overcome these obstacles, often in the form of additional guidance documents or increased subsidies.

MEXT also conducted the School Basic Survey, which provided data on number of classrooms, students, and school facilities, and the Public School Facilities Survey, which collected quantitative information on school facilities such as building area and condition. Results of survey data collected by MEXT were publicly available, and names of local governments that were reticent or slow to implement retrofits were named in press releases in an effort to encourage local authorities to take action.

Policy-Enabling Factors and Remaining Challenges

By the end of 2015, over 95% of the public elementary and junior high school buildings in Japan were earthquake-resistant as a result of the guidelines and facilitating measures but in place by MEXT as part of the Program for Earthquake-Resistant School Buildings. As of 2016, this percentage was estimated at 98%. The remaining 2% of schools considered seismically unsafe have not been addressed due to planned closure or merger. The success of the program is due in large part to the availability of national subsidies, which reduced the financial burden school retrofitting placed on local governments. In addition, MEXT's development of comprehensive guidelines greatly facilitated program progress by providing local governments with detailed, step-by-step information for program planning and implementation. Furthermore, the collection of data through national surveys allowed MEXT to monitor program progress at the local level and develop solutions where local governments indicated obstacles in program implementation. This data, which was published by MEXT, also served as a mechanism for encouraging noncompliant jurisdictions to take action.

An ongoing challenge is the lower rate of private schools implementing school retrofits. In 2015, over 15% of private schools were awaiting needed retrofit or reconstruction due to lack of funds. Though national subsidies were available to private schools, municipal budgets were not responsible for covering the remaining costs, and private school budgets were not always sufficient to make up the difference. In response to this challenge, MEXT increased subisidies available for private schools and expects that the rate of private school retrofitting projects will soon increase.

Works Cited

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For further information about the MEXT and its safe school facilities policy, please see: http://www.mext.go.jp/a_menu/shotou/zyosei/english/index.htm

Child-centred DRR and CSS Bibliography at: https://www.mendeley.com/community/C-CDRRandCSS/

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Comprehensive School Safety (CSS) is a framework for advocacy and action aligning policies and plans across education and disaster management sectors at all level. It uses child-centred all-hazards risk assessment and context analysis as the evidence base for action in three overlapping areas: Safe Learning Facilities, School Disaster Management, and Risk Reduction and Resilience Education. For more information, see http://www.gadrrres.net/