Investing in Continual Enhancement of School Buildings in Japan

Overview

Country: Japan

Stakeholders: Ministry of Education, Culture, Sports, Science and Technology (MEXT), prefecture governments, local/municipal governments, schools, local communities, World Bank

Hazards: Earthquakes and tsunamis

Japan is a world leader in addressing safer school infrastructure and is included in three case studies: Module 2.1: Mapping the regulatory envirnoment; Step 3: Financial environment; and Module 5.1: Investing in continual enhancement of safer school buildings

Summary: Japan has a long history of seismic events that have caused significant loss of life and damage. The potential impacts of earthquakes and tsunamis on school buildings built before the 1981 Building Code put school children and teachers at an unacceptable risk.

This situation gave shape to the country-wide Program for Earthquake-Resistant School Buildings to improve the safety of schools infrastructure through seismic retrofitting and reconstruction activities.

Investments for the Program were heavily influenced by the high performance levels required for school buildings under the 1981 Building Code. As the experience of seismic events in Japan continued during the Program's implementation, additional non-structural considerations were highlighted. In light of this, new investment opportunities arose and were incorporated into the program incrementally.

CONTEXT

Safer schools program reduces risk from the 'Pacific Ring of Fire'

Japan is an industrialised and developed nation of 127 million people, located in the world's most seismically-active zone, the Circum-Pacific belt (known as the Pacific Ring of Fire). Annually, Japan experiences an average of 2000 earthquakes of intensities that people can detect, which has resulted in a good understanding of the risks posed to school infrastructure. With a large, advanced economy, Japan has dedicated significant public finances to support interventions to make schools safer.

The Program for Earthquake-Resistant School Buildings was launched in 2003 (the 'Program'), supported by The World Bank, and aimed to make all public elementary and junior high school buildings compliant with the 1981 Building Code.

OBJECTIVES

Investing in suitable interventions under the Program

The objective of the Program was to upgrade the earthquake-resistance of public elementary and junior high school structures built to pre-1981 Building Regulations through retrofitting and/or reconstruction activities. Public facilities are often used for community shelter and disaster management, particularly school facilities. This emergency shelter function requires a high performance level under the 1981 Building Code which specifies increased seismic design loads for regular school buildings and gymnasiums.

Program investments centred on structural enhancements through retrofitting and reconstruction in order to achieve compliance with the Building Code. These investments were efficient because of the high degree of uniformity in school buildings across Japan, enabling the creation of specific retrofitting guidance which could have been significantly more costly for bespoke or multiple variations in structural typology. Non-structural components of safer schools were gradually added to the Program as the experience of seismic events underlined their importance, such as securing non-structural members, increasing building lifespans, and improving the functional capacity of schools buildings as evacuation centres.

METHODOLOGY

Designing an investment program that reduces risk to earthquakes

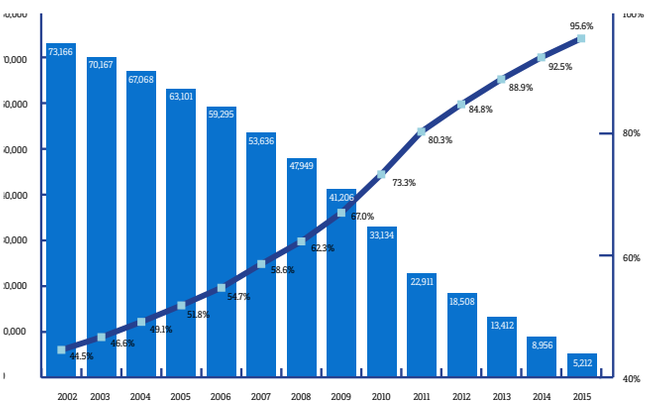
The Program was designed to ensure a targeted and robust process for addressing school structural safety in Japan. Initially this included the MEXT 'Guidelines for Promotion of Earthquake-resistant School Buildings' (the 'Guideline') in 2003 which set out how to prioritise vulnerable buildings, judge the urgency of retrofitting activities, and communicate what the basic principles of school retrofitting are and the steps to be taken to apply them.

Following this Guideline, the Program included:

1. Implementing a basic survey to assess the conditions of school facilities, confirm design drawings and documentations, collect data and information on hazards, confirm designation of evacuation centres, and identify the merger and abolishment plans for schools in each local government area.
2. Undertaking a prioritisation process to determine which school buildings require further detailed vulnerability assessment. This prioritisation criteria were based on the building typology, year of construction, and the number of stories.

3. Undertaking a detailed vulnerability assessment on the prioritised school buildings to understand the degree of deterioration, including structural strength, deterioration of strength due to aging, and impacts of local conditions.

Subsequent steps determined the urgency of remedial action, formulated annual work plans for retrofitting and reconstruction, and arranged to adequately finance work through the funding partnership between the national and local governments.



Source: MEXT 2015b

The program has increased the share of public schools whose main structures are earthquake resistant.

After the establishment of structural performance as a 'first priority', the Program broadened its focus to securing non-structural members and increasing building lifespans. This involved the MEXT commissioning a series of targeted studies, often from the experience of earthquakes. These studies informed policies and shaped the following investments:

- 'Study on promoting earthquake-resistant non-structural members of school facilities' (2009 to 2012) resulted in a policy emphasis earthquake resistance in non-structural members.
- 'Study on improvement of school facilities based on the Great East Japan earthquake experience' (2011) resulted in a policy emphasis on countermeasures for tsunamis, strengthening the functional capacity of schools buildings as evacuation centres, and energy supply measures.
- 'Special committee to examine measures against deterioration of school buildings' (2012/13) set out a policy for the rehabilitation for life-span extension of school facilities.
- 'Working group to examine measures to develop disaster-resilient school facilities' (2013 to 2016) resulted in a policy emphasis on reducing disaster risk to tsunamis, strengthening the functioning of school facilities as evacuation centres, emergency drills and disaster education.

CHALLENGES & OPPORTUNITIES

Implementation at a national scale

The relative similarity of school buildings and limited number of structural typologies enabled the development of specific survey methodologies for a country-wide assessment of schools infrastructure. The majority of school buildings consist of reinforced concrete and steel-framed structures, which made building assessments and retrofitting options easier to plan and develop guidance for. In specific cases for other typologies such as timber, masonry or steel-reinforced concrete, additional expertise was needed to provide the relevant tools and expertise to complete the surveying task.

During assessments and retrofitting work, the lack of technical staff at the local level meant that some local governments reported difficulty in accessing adequate local technical support from architectural and engineering firms. Given the scale of the work, some local governments had to outsource work to multiple firms at once, increasing the administrative burden. This was overcome by opening the bidding opportunities to firms outside their areas, even their prefectures.

OUTCOMES

Flexible investments and structural and functional vulnerability

Through the ongoing process of identifying, defining and prioritising investment opportunities that respond to school safety needs, the Program in Japan supported:

1. Investments that suitably addressed the structural requirements of school buildings, resulting in the number of earthquake-resistant schools rising from 44.5% at the beginning of the Program to an expected 98% at the end of the Program.
2. Investment flexibility that allowed the Program to broaden its focus to non-structural focus areas, resulting in more holistic school safety outcomes.

Learning

- Addressing structural issues as a first priority before broadening the approach - if and when more funding is available - is a sensible approach and particularly relevant to developing country contexts where resources are likely to be limited.
- Investment flexibility can improve safer school outcomes by responding to new focus areas that result from the experience of disasters and studies/technical advancements that occur during program implementation.

Find out more

Read: Making Schools Resilient at Scale, World Bank, 2016, www.goo.gl/CqTyyS

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