Forum on Safe and Resilient Infrastructure

Proceedings Report

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Acknowledgments
This report summarizes the proceedings and highlights of the Forum on Safe and Resilient Infrastructure and Government Executive Meeting that took place in Manila, Philippines, in October 2013. The workshop was organized by the World Bank and the Philippine Department of Public Works and Highways, with support from the Australian Government and the Global Facility for Disaster Reduction and Recovery. The team is grateful for their generous support. This report was prepared by the World Bank Disaster Risk Management Team East Asia and the Pacific led by Jolanta Kryspin-Watson, with contributions from Artessa Saldivar-Sali, Abigail Baca, Catherine Vidar, Zuzana Stanton-Geddes, Christopher Ancheta and Abegyl Albano. The team expresses its gratitude to Ousmane Dione and Abhas Jha, Sector Managers, for their guidance and support.

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Cover photo: Cluster of houses built on a hill in the City of Baguio, Philippines. Photo: © Edwin Verin | Dreamstime.com

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Acronyms

DepEd	Department of Education
DOH	Department of Health
DOST	Department of Science and Technology
DPWH	Department of Public Works and Highways
DRM	disaster risk management
EU	European Union
GFDRR	Global Facility for Disaster Reduction and Recovery
HRMEP	Hazard Risk Mitigation and Emergency Preparedness Project (Romania)
ISMEP	Istanbul Seismic Mitigation and Emergency Preparedness Project (Turkey)
JICA	Japan International Cooperation Agency
MMDA	Metropolitan Manila Development Authority
MMEIRS	Metro Manila Earthquake Impact Reduction Study
MPSS	minimum performance standards and specifications
NDRRMC	National Disaster Risk Reduction and Management Council
NEDA	National Economic and Development Authority
NOAH	Nationwide Operational Assessment of Hazards Project
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PMO	project management office
QRF	quick response fund

Panoramic view of Manila, Philippines. Photo: © fivepointsix.com | Thinkstock.com

Summary

This report summarizes the proceedings and highlights from the Forum on Safe and Resilient Infrastructure and the Government Executive Meeting that took place in Manila, Philippines, in October 2013. The two-part event was organized by the World Bank and the Philippine Department of Public Works and Highways (DPWH), with support from the Australian government and the Global Facility for Disaster Reduction and Recovery (GFDRR). The forum and executive meeting were attended respectively by 116 and 41 participants—officials from national, provincial, and municipal agencies; representatives from local associations, development partners, and the private sector; national and international experts; and other practitioners.

The forum and the government executive meeting served as a venue for the government of Philippines to set policy and an initial strategy for a cross-sectoral Philippine program for building the resilience of public infrastructure and facilities, particularly schools. With the goal of sharing lessons and best practices applicable to the Philippine context, the forum showcased experiences of countries, including Turkey, Romania, Indonesia, Colombia, Japan, and the United States, that have implemented seismic retrofitting programs. The executive meeting served as a platform for presenting to Philippine policy makers and practitioners the initial findings and recommendations of the panel of experts, which was drawn from different spheres of the structural resilience practices. A proposed prioritization methodology for investment decisions on strengthening of critical assets and draft guidelines on structural retrofitting in the Philippines were also shared.

With the goal of sharing lessons and best practices applicable to the Philippine context, the forum showcased experiences of countries, including Turkey, Romania, Indonesia, Colombia, Japan, and the United States, that have implemented seismic retrofitting programs.

The forum and the meeting highlighted the fact that concrete action from decision makers can build resilience in public facilities and effectively reduce disaster risk. Exposure to hazards does not necessarily have to result in disasters if governments prioritize risk reduction investments and make informed decisions about disaster risk. Scarcity of resources and competing priorities should not lead policy makers to postpone difficult choices, because the costs of inaction—in terms of lives lost and economic damages—can be very high.

International experience can provide useful insight for decision makers in the Philippines to address key questions, challenges, and prioritization needs. The forum showed how many countries, both developed and developing, invest in countrywide earthquake risk management, initiate enabling legislative actions to support multi-hazard resilience in design and construction that go beyond building code revisions, and draw on the lessons learned from the impacts of previous earthquakes to reduce the vulnerability of communities, facilities, and infrastructure.

Prioritization of buildings is a critical part of risk assessment studies to ensure the optimal allocation of available funds during the implementation phase of an earthquake risk management program.

International experience offers the following three key lessons for setting up a policy framework for seismic upgrading programs: First, systematically upgrading certain structures is possible and can significantly reduce the number of fatalities and damages to assets and services. Second, upgrading can be truly cost-effective: past experience shows that five existing buildings can be upgraded for the cost of constructing one building. Third, upgrading can be multipurpose; for example, increasing schools' seismic resiliency also increases their typhoon and flood resiliency—important because schools are used for shelters—as well as their overall functionality.

In terms of devising and implementing a successful program, the following factors are important: First clear leadership, ownership, and accountability are crucial for championing, coordinating, and implementing a seismic upgrading program. Linked to this, institutional roles and responsibilities need to be clarified, since mandates for infrastructure or construction projects can often overlap between different line ministries and agencies. Second, maintaining and expanding public support for such programs is very important. Inevitably, upgrading or retrofitting causes service interruptions that may last for months, so public support for the works is crucial. Third, it is important to objectively evaluate the local construction industry's capacity—in terms both of quantity and quality. Firms chosen to implement retrofitting must have robust technical knowledge about how to carry out projects cost-effectively, according to careful prioritization, and with realistic management of expectations

With the understanding that large-scale investments in retrofitting critical public buildings have been successful, cost-effective means to reduce risk in other countries, DPWH initiated a technical assistance program with the World Bank to assess the vulnerability of Metro Manila schools. The forum highlighted some of the results of the prioritization. These show that *strengthening the most vulnerable 5 percent of school buildings (186 out of 3,821) can reduce the number of student fatalities by 25 percent (over 6,000 lives saved).*[1] *By strengthening the most vulnerable 40 percent of school buildings (1,466), potential student fatalities can be reduced by 80 percent (over 19,000 lives saved).* In other words, upgrading even a relatively small number of systematically selected structures can save a disproportionately large number of lives, and is very cost-effective in comparison to building new schools.[2]

The risk assessment developed a prioritization methodology to identify the highest-risk schools. Prioritization of buildings is a critical part of risk assessment studies to ensure the optimal allocation of available funds during the implementation phase of an earthquake risk management program. The prioritization methodology ranked each of the 3,821 school buildings in Metro Manila identified for the program and factored in key parameters such as construction type, construction date (age of the building), number of stories, and number of occupants. The prioritization methodology drew from that of earthquake risk management programs in other countries, such as the World Bank–supported Istanbul Seismic Mitigation and Emergency Preparedness Project (ISMEP) in Turkey that strengthened seismically vulnerable public buildings.

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1 This estimate is based on the Metro Manila Earthquake Impact Reduction Study (MMEIRS) magnitude 7.2 earthquake scenario along the West Valley fault. See Philippine Institute of Volcanology and Seismology (PHIVOLCS), Japan International Cooperation Agency (JICA), and Metropolitan Manila Development Authority (MMDA), *Earthquake Impact Reduction Study for Metropolitan Manila, Republic of the Philippines*, 2004.

2 Generally, experience shows that five to seven schools can be strengthened and renovated for the cost of one new building.

Ranking 3,821 school buildings according to their risk levels, the risk assessment distilled the following results (see figure 1)**:**

- 18 percent of all fatalities associated with the Metro Manila Earthquake Impact Reduction Study (MMEIS) scenario earthquake will occur in less than 3 percent of the assessed school buildings.
- 25 percent of all fatalities will occur in less than 5 percent of the assessed school buildings.
- 80 percent of all fatalities will occur in less than 40 percent of the assessed school buildings.

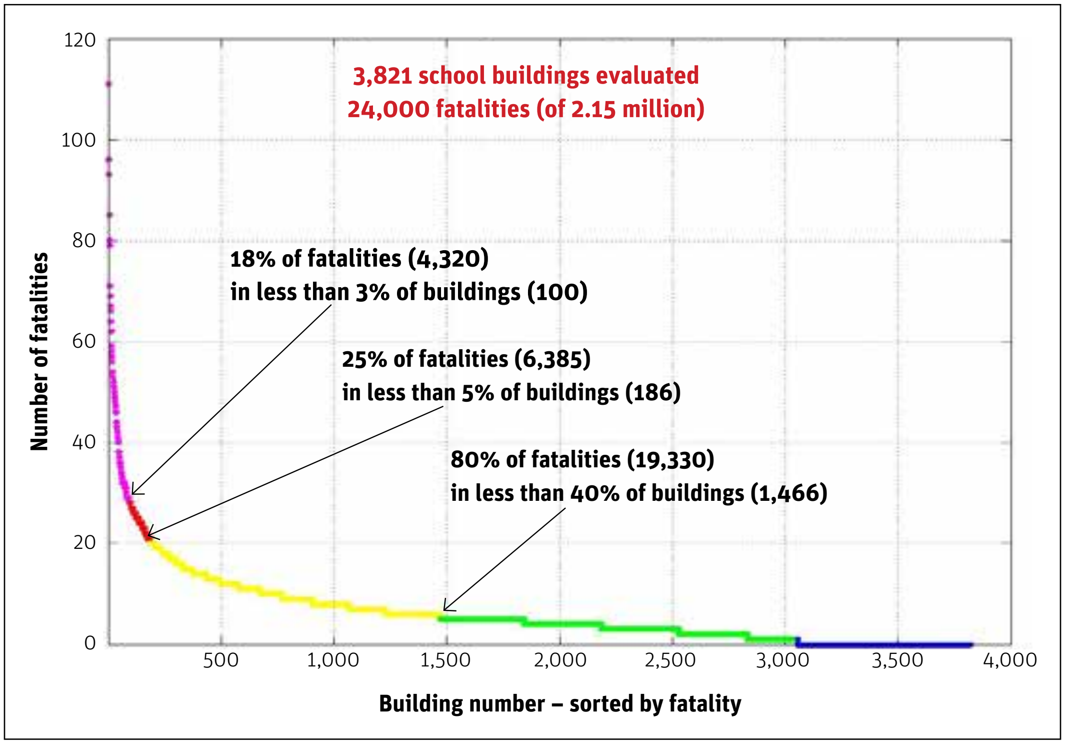
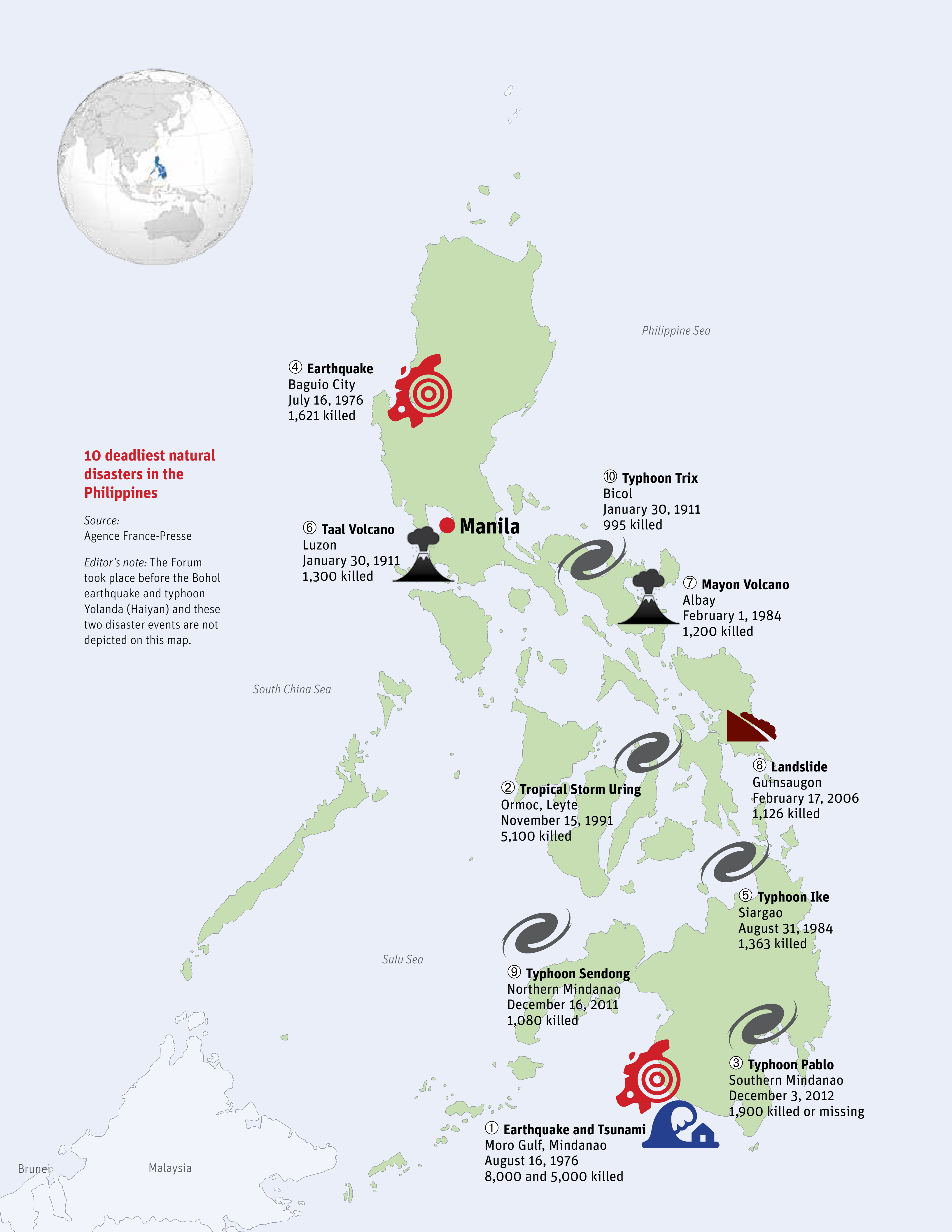


Figure S1. Estimated Metro Manila student fatality rates for a M7.2 West Valley Fault daytime earthquake scenario

Source: Kit Miyamoto, Miyamoto International; World Bank.

The following recommendations for how to implement a national program in the Philippines emerged from the presentations and discussions: (1) determine funding requirements and sources; (2) devise public awareness and education campaigns to build social awareness of disaster risks and of the need for upgrading critical infrastructure; (3) update the National Building Code, specifically addressing the gaps in provisions and requirements for existing structures; (4) improve the regulatory and institutional arrangements, and specifically include a project management office (PMO) and consultation processes; (5) build technical capacity in the design and construction industry, for example by requiring certification for earthquake engineering professionals and prequalification or certification for design firms, contractors, and others involved in the upgrading; and (6) establish a quality assurance system for both the design phase and the construction phase.

As a result of the forum, DWPH has committed to implementing the cornerstone phase of the Safe and Resilient Infrastructure Program in Metro Manila. This would involve upgrading approximately 200 of the most vulnerable public school buildings in Metro Manila, with a view to eventual scaling up to other sectors (for example, lifeline infrastructure) and geographic locations, and to institutionalizing quality assurance systems. The forum and the executive meeting were an important step in facilitating discussions among national stakeholders from different line ministries and agencies on the policy framework, technical aspects, and lessons learned from other countries, supporting in this way the shaping and future implementation of such a flagship program.



10 deadliest natural disasters in the Philippines

Source:
Agence France-Presse

Editor's note: The Forum took place before the Bohol earthquake and typhoon Yolanda (Haiyan) and these two disaster events are not depicted on this map.

Background

The Philippines ranks 8th among countries most exposed to multiple hazards, and 13th among those at high economic risk to natural disasters, with at least 85 percent of GDP in areas at risk.

Located in the Pacific Ring of Fire, the Philippines is among the top global disaster hot spots. It ranks 8th among countries most exposed to multiple hazards, and 13th among those at high economic risk to natural disasters, with at least 85 percent of GDP in areas at risk.[3] Earthquakes, volcanic eruptions, and other geological hazards threaten the country's sustainable development. The Philippines features an interrelated system of faults across the archipelago, including a 1,200 km fault zone that runs from northwestern Luzon to Mindanao and an active West Valley fault system that runs across Metro Manila.

Over the last five years, the Philippines has experienced severe weather events that resulted in considerable damages and losses. Four weather events alone—typhoons Ondoy, Pepeng, Sendong, and Pablo—have claimed over 3,000 lives, affected more than 10 million people, and caused economic damages and losses amounting to approximately US$5.7 billion.[4] Notably, these events also affected areas that historically have not been hit by strong typhoons, such as Mindanao.[5]

With rapid population growth, disaster risk in urban centers is increasing. Unplanned or poorly planned urbanization is the single largest driver of risk,[6] and in the Philippines, over 60 percent of the population is expected to live in cities in the near future, exposing more people and assets to multiple hazards. The inadequate construction quality of the built environment only adds to the ever-increasing risk to natural hazards that public facilities face.

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[3] M. Dilley, R. S. Chen, U. Deichmann, A. Lerner-Lam, M. Arnold, J. Agwe, P. Buys, O. Kjekstad, B. Lyon, and G. Yetman, *Natural Disaster Hotspots: A Global Risk Analysis* (Washington, DC: IBRD/World Bank and Columbia University, 2005).

[4] This figure is derived from official post-disaster needs assessments conducted for these events.

[5] Editor's note: The Forum took place before the Bohol earthquake and typhoon Yolanda (Haiyan). The 7.2 magnitude Bohol earthquake struck the Visayan Islands (Visayas) on October 15, 2013. The National Disaster Risk Reduction and Management Council (NDRRMC) reported 222 deaths, 73,002 damaged or destroyed houses, and damages of PhP2.26 billion to infrastructure and public buildings. Typhoon Yolanda made landfall in the Philippines on November 8, 2013. According to the Philippine government's "Reconstruction Assistance to Yolanda Plan", over 7,000 lives were lost, an estimated 12.2 million people were affected, and PhP571.1 billion (US$12.9 billion) in damages and losses were caused.

[6] Global Facility for Disaster Reduction and Recovery, *Managing Disaster Risks for a Resilient Future: A Strategy for the Global Facility for Disaster Reduction and Recovery 2013–2015* (Washington DC: GFDRR, 2012).

The high concentration of population and assets in Metro Manila increases its risk to natural hazards.

The policy framework for disaster risk reduction is reflected in the Philippine Disaster Risk Reduction and Management (DRRM) Act (Republic Act No. 10121) of 2010. The law emphasizes ex ante actions—i.e., preparedness, prevention, and mitigation—over emergency relief and response. The strategies for implementing the law are contained in the National DRRM Framework and Plan (2011–2028), which identifies the priority areas for engagement of the sectoral agencies of the government.

Metro Manila, in particular, is extremely exposed to multiple natural hazards. In addition to being transected by an active fault system, Metro Manila is located on a river delta, which makes it vulnerable to more intense ground-shaking impacts during earthquakes. The high concentration of population and assets in Metro Manila increases its risk to natural hazards. About 30 percent of the population of Metro Manila, or 210,000 households, live in hazardous areas.[7] Many critical public facilities, including school buildings and hospitals, are likewise built in danger zones and have structural deficiencies.

The probable maximum losses from a magnitude 7.2 earthquake along the West Valley fault—a scenario predicted in the 2004 Metro Manila Earthquake Impact Reduction Study (MMEIRS)[8]—are expected to be exponentially greater than those from any other type of natural hazard faced by the Philippines. MMEIRS, conducted from 2002 to 2004 by the Philippine Institute of Volcanology and Seismology (PHIVOLCS), Japan International Cooperation Agency (JICA), and the Metropolitan Manila Development Authority (MMDA), was a major initiative to improve the structural resilience of public assets and infrastructure in Metro Manila. The study evaluated seismic hazards, potential damages, and vulnerability of Metro Manila to various scenario earthquakes, and developed a master plan for earthquake risk management. Among the 105 identified priority actions in the master plan, 40 were selected as high-priority. These 40 actions included securing the emergency road network and strengthening buildings against earthquakes. Following the release of the MMEIRS report, the Department of Public Works and Highways (DPWH) embarked on a continuing program of retrofitting bridges in Metro Manila. However, in terms of risk reduction in the building stock, implementation has been more limited in the past 10 years.

With the understanding that large-scale investments in retrofitting critical public buildings have been successful and cost-effective ways to reduce risk in other countries, DPWH initiated a technical assistance program with the World Bank to assess the vulnerability of Metro Manila schools. A preliminary structural assessment was conducted that looked at important factors affecting the vulnerability of public buildings, including age of construction, number of stories, occupancy type, number of occupants, building type (including the lateral load resisting system), and level of exposure to hazards. A key component of the initiative was developing a prioritization methodology for upgrading and retrofitting critical assets. At the forum and executive meeting, the results of this assessment were presented, and its implications discussed among the participants.

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7 National Housing Authority, National Housing Survey, 2010.

8 Philippine Institute of Volcanology and Seismology (PHIVOLCS), Japan International Cooperation Agency (JICA), and Metropolitan Manila Development Authority (MMDA), *Earthquake Impact Reduction Study for Metropolitan Manila, Republic of the Philippines*, 2004.

Opening and Welcome Remarks

2006 Southern Leyte mudslide. Photo: commons.wikimedia.org

Keynote Address

Hon. Rogelio Singson, Secretary, Department of Public Works and Highways

Guests, resource persons, colleagues in government, including my colleagues in the Department of Public Works and Highways: good morning to everyone. On behalf of the Philippine government, allow me to thank our guests, especially the resource persons from Turkey, Indonesia, Japan, and Romania, for taking time to join us today. Allow me also to thank the World Bank for organizing the Forum on Safe and Resilient infrastructure.

What we hope to achieve in this forum is a country plan or road map for safer communities through disaster-resilient public infrastructure and facilities. By the term "resilient" we mean the ability of an infrastructure system to absorb a disturbance or disaster and still retain its structural capacity and its ability to perform its basic function.

Let me present key facts concerning the vulnerability of the Philippines to natural disasters. We are located in the most disaster-stricken region in the world. The Philippines is ranked eighth among countries most exposed to multiple hazards, meaning eighth in terms of number of people killed, number of people affected, and estimated damage. We are exposed to typhoons, flooding, earthquakes, landslides, droughts, and volcanic eruptions. I don't think we can add any more to this long list.

We need the whole government and the whole society to work in partnership to build our resilience to natural disasters.

Eighty-five percent of our GDP's economic activities here are in at-risk or hazardous areas. Metro Manila, our economic center, contributes 30 percent of the Philippine GDP; it has a population of 11.9 million and a population density higher than Seoul, Tokyo, or Jakarta, measured per person per hectare. But it is very vulnerable to flooding, typhoon, earthquake, and landslide, not to mention man-made disasters that we are experiencing all over the country.

Unfortunately, we cannot do much about our location, the physical characteristics of our country, or our national attributes. There are, however, specific decisions and actions that stakeholders can take collectively to reduce the vulnerability of our country, minimize loss of lives, and reduce damage to property. We need the whole government and the whole society to work in partnership to build our resilience to natural disasters. We hope that by inviting experts from other parts of the world to share knowledge and lessons learned, this forum will help us draw up a road map to make our public facilities and infrastructure resilient to natural disasters.

Significant reforms have been carried out in the last few years, as embodied in the Natural Disaster Risk Reduction Management Act of 2010 and the National Disaster Risk Reduction and Management Council (NDRRMC). President Aquino also created the Climate Change Commission; funded Project NOAH (Nationwide Operational Assessment of Hazards) for flood modelling, flood forecasting, and flood warning; funded completion of geo-hazard mapping for the whole country; continued funding for resettlement of informal settler families residing in high-risk and hazardous areas; and continues to provide funding for relocation sites and immediate relief and rehabilitation after a disaster.

On our part, DPWH continues to implement infrastructure projects to mitigate flooding and landslides in highly vulnerable areas. We have even started to upgrade our standards for school buildings so they can withstand winds of 250 km/h. However, we still need a more sustained program to develop structural resiliency in our infrastructure. We want to make sure that our schools remain safe and structurally sound to withstand any disaster. We want our hospitals to be structurally sound and operational after disasters. We want our national roads and bridges to continue to function as lifelines during and after disasters. We want our other public facilities, such as fire stations and police stations, to be built with high performance standards to ensure that these remain functional after a disaster.

Resilient infrastructures depend on structural and nonstructural measures and systems that in their totality allow continued operation or use of the structure in the event of a natural disaster. We need to ensure that policy makers and professionals have a new and higher level of awareness of what structural resiliency entails. This forum is a continuation of the government's enduring commitment to disaster risk management (DRM) and reduction. In the coming days, we will engage the various stakeholders in more in-depth discussions and consultations as we develop our country's vision and road map for a structural resiliency program. In the meantime, let us learn from the experiences of other countries and devise better disaster risk reduction and related programs for the country.

We need to come up with a clear road map for dealing with natural disasters. We need to create a much higher level of awareness, impart knowledge, build institutional capacity, and determine investment priorities. We eagerly await the insights of experts who will share their experiences in developing and sustaining structural upgrading programs for critical public infrastructures. We also want to hear their crucial practical recommendations to facilitate action and decision making. We want resilient and sustainable infrastructure in the Philippines. We want cost-effective measures for hazard mitigation for both new and rehabilitated buildings and other structures.

At this point let me again thank our resource persons for coming to the Philippines to share their experiences and knowledge. I encourage everyone to actively participate and contribute your insights as we move forward with our advocacy for structural resiliency in our infrastructures. By tomorrow as we end, we hope to have a draft road map for building structural resilience in the country's public facilities. It will be discussed in depth with various stakeholders before it is finalized. I assure you, as the agency responsible for the National Building Code and for the integrity of many public infrastructures, DPWH is keenly interested in the output of this forum and will consider its early adoption and phased implementation. We look forward to a productive discussion with all of you.

Keynote speakers and panelists opening the Forum on Safe and Resilience Infrastructure.

The recurrence of severe weather events could be understood as the new norm, meaning that society will have to prepare for them.

Partnership for Resilience: Supporting the Philippine Disaster Risk Management Agenda

Mr. Motoo Konishi, Philippines Country Director, World Bank

Secretary Rogelio Singson; partners in the Philippine government, civil society, and the development community; and international experts: Magandang umaga po!

I would like to begin by thanking Secretary Singson and the Department of Public Works and Highways for hosting this event. It is indeed a pleasure to support this concrete and significant step toward making the Philippines more resilient to the impacts of natural hazards. I am encouraged by your presence in this forum, which is a recognition of how urgent and important the disaster risk reduction agenda is for the Philippine government as well as for the whole country.

We all know the pervasive impact of disasters, especially on a country as vulnerable as the Philippines. Secretary Singson has already described the situation in the Philippines and the importance of the resilience agenda. Disasters limit the path to sustainable development, not only through the tragic loss of lives, livelihoods, and assets, but also through wider and long-term effects on the economy and society. One of the conclusions that emerged very clearly from the 2013 Philippine Development Report "Creating More and Better Jobs"[9] is that disasters (along with poor health and conflicts) are a huge factor in creating poverty. Data show that the poor may move into the lower-middle-income level, but they fall back into poverty because of disasters. Part of the reason why we're here and why this discussion is so urgent is the need to protect that bottom 40 percent that is so exposed to danger.

Over the past five years, we saw how a number of severe weather events resulted in considerable damages and losses to the country. Extreme events like Ondoy, Pepeng, Sendong, and Pablo have together claimed over 3,000 lives, affected more than 10 million people, and caused economic damages and losses of approximately US$5.7 billion. These events have also demonstrated how poverty and vulnerability to disasters are closely linked: the urban poor, who live in danger zones, and the rural workers in upland Mindanao have been hardest hit; the destruction of their homes and limited assets has pushed them further into poverty. The recurrence of severe weather events could be understood as the new norm, meaning that society will have to prepare for them. All the data suggest that we will be experiencing severe events in the Philippines over and over again. In 2004, PHIVOLCS, MMDA, and JICA undertook the Metro Manila Earthquake Impact Reduction Study to assess the potential impacts of earthquakes along the West Valley fault, running through Metro Manila. The study found that a magnitude 7.2 earthquake could have a devastating impact on Metro Manila, far greater than past disasters in the region: it estimated approximately 34,000 dead, 114,000 injured, and some 25 percent of the building stock collapsed or seriously affected, including 10 percent of the school buildings. These findings are not exaggerated, but based on scientific calculations of what would happen.

Back in 2004, the study called for the promotion of safer and more resilient infrastructure, particularly the ability of schools, hospitals, and other critical facilities to withstand earthquakes. This call for action is even more urgent today—since 2004, the population and the physical landscape have changed dramatically in Metro Manila, meaning the number of people and buildings is much higher. Despite past initiatives, no more than 10 percent of the country's schools, hospitals, and other public

[9] World Bank, *The Philippine Development Report: Creating More and Better Jobs* (Manila: World Bank, 2013).

buildings have upgraded their structure, so that a large share of the population is exposed to danger. The horror of the Sichuan earthquake in China in 2008 reminds us how important it is to prioritize the safety of children in schools.

In recent years, the Philippine government has significantly reduced its disaster vulnerability. The enactment of the Philippine Natural Disaster Risk Reduction Management Act in 2010, which marks a shift from emergency response and recovery to risk reduction and mitigation, has spurred action in the field of risk assessment and catastrophe risk modelling, at the sectoral as well as the community level. These efforts are already bearing fruit, with greater preparedness at every level of governance in the Philippines.

At the fall 2012 Annual Meetings of the World Bank Group, President Jim Yong Kim emphasized the need for "a culture of prevention." He stated that "no country can fully insulate itself from disaster risk, but every country can reduce its vulnerability," and stressed that "prevention can be far less costly than disaster relief and response."[10] This vision unites us and creates opportunities to work together to make the Philippines more resilient to the impacts of natural disasters. Disaster prevention, reduced vulnerability of public facilities, and immediate action to implement upgrading of infrastructures are the key recommendations that we must consider today in the Philippines and in this forum.

I would like to encourage the participants of this forum to see this event as a way to jump-start the action that will ensure structural resilience in the Philippines. This forum is an opportunity for decision makers to discuss a road map for a cross-sectoral program that will build the resilience of public infrastructure and facilities, especially schools and hospitals. The timing is vital, given that the Philippines is now embarking on major public investments in relevant sectors. I also encourage the participants to learn from the experiences of countries that have been implementing large-scale structural resilience improvement programs. This event brings examples from Turkey, Romania, Indonesia, Japan, the United States, and Latin America to inspire policy makers like yourselves to plan for the Philippines. These countries have not just improved physical structures, they have simultaneously established economic revitalization programs that mobilized the private sector and the construction industry, from design professionals to laborers, to ensure timely and sustained implementation of the program.

I would like to encourage the participants of this forum to see this event as a way to jump-start the action that will ensure structural resilience in the Philippines.

International experts will also share their knowledge about prioritizing investments, choosing methods of implementation, and identifying priority structures for immediate strengthening and upgrading in order to save the most lives. These contributions will show that exposure to hazards does not necessarily have to result in disasters.

I would like to congratulate the Philippine government, including Secretary Singson, the DPWH, and its people—for leadership in building resilience in this region. I believe that together we can make communities even stronger, more resilient, and safer. I would like all of you to actively participate in today's dialogue and to agree on concrete next steps to spur everyone into action.

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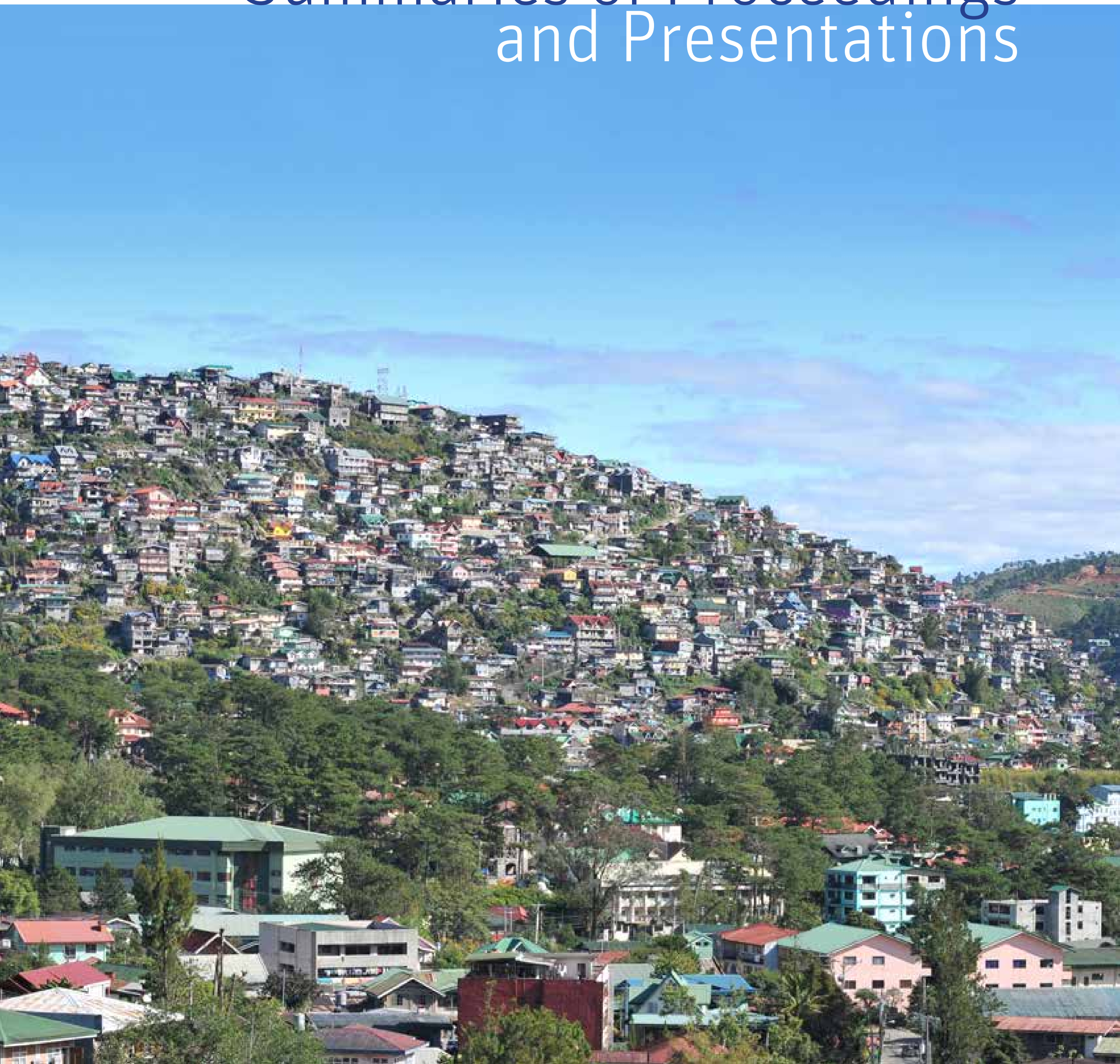
[10] World Bank, "Sendai Dialogue Advances Global Consensus on Disaster Risk Management," press release, October 10, 2012, http://www.worldbank.org/en/news/press-release/2012/10/10/sendai-dialogue-advances-global-consensus-on-disaster-risk-management.

Cluster of various houses built on a hill in the City of Baguio, Philippines. Photo: © Edwin Verin | Dreamstime.com

Summaries of Proceedings and Presentations



Forum Session 1

Putting in Place an Agenda for Structural Resilience

Session 1 provided the context and objectives for the discussions held in the course of the forum and executive meeting. International presenters highlighted the roles of the different sectors in increasing the resilience of infrastructure. The conversation culminated in a discussion of Turkey's pioneering retrofitting program for public facilities.

Chair: **Hon. Rogelio Singson**, Secretary, Department of Public Works and Highways
Co-chair: **Ousmane Dione**, Sector Manager, Sustainable Development Unit, World Bank

Safer Philippine Communities through Stronger Public Facilities

Mr. Abhas Jha, Sector Manager, Transport, Urban, and DRM, East Asia and the Pacific, World Bank

This presentation offers three key messages: (1) The Philippines is at great risk of natural disasters; (2) there are proven solutions for retrofitting of public facilities that can easily be adapted to the Philippine context; and (3) investing in retrofitting of 200 structures over the next three years will potentially save the lives of 7,000 children.

The threat posed by natural hazards is compounded by the concentration of populations in urban centers and by poor construction quality and weak enforcement of building codes. For Metro Manila, the threat from earthquake is particularly acute: according to the MMEIRS study, the approximate return period of West Valley fault earthquakes is 500 years, with no known event along this fault since the 1600s—which means that this area in the active phase.[11]

Risk is a function of three elements—hazard, exposure, and vulnerability—and there is comparatively little that countries can do about the first. But they can seek to minimize exposure (by keeping people out of harm's way) and vulnerability (by making structures safer). Addressing exposure in Metro Manila is challenging, however, since its population is projected to reach 14.8 million by 2025. Addressing vulnerability is similarly challenging; the magnitude 7.2 earthquake scenario analyzed in the MMEIRS study would result in the collapse of 4 out of 10 buildings.

Investing in public facilities—schools, hospitals, fire stations, and roads and bridges—is crucial in preparing for disaster. These facilities not only protect future generations; they provide shelter and make rescue and medical care possible in the event of a disaster.

Investing in public facilities—schools, hospitals, fire stations, and roads and bridges—is crucial in preparing for disaster. These facilities not only protect future generations; they provide shelter and make rescue and medical care possible in the event of a disaster.

In high-risk countries, strengthening existing school buildings is more cost-effective than entirely rebuilding them. In the Philippines, achieving stronger schools that protect schoolchildren is not difficult from an engineering standpoint. Nor is it expensive: in new classroom construction, the additional cost of shear walls is estimated at 5 percent of the total cost. Moreover, experience from Istanbul shows that that five to seven schools could be strengthened for the cost of building a single new school. As a result of Istanbul's program, schools are now the safest place for Istanbul children to be in the event of earthquake.

[11] PHIVOLCS, JICA, and MMDA, Earthquake Impact Reduction Study for Metro Manila.

Making infrastructure and public facilities safer requires regulation and action. The Philippines should update the National Structural Code to include requirements for the strengthening of existing buildings; provide focused training and certification programs for engineers; scrutinize the design screening mechanism; and improve supervision and enforcement of existing regulations, including inspection of construction practices and materials. Prioritization of investments to systematically upgrade existing and new structures is similarly critical.

Resilience in the Philippines: A Cross-Sectoral Effort

Dr. Benito Pacheco, Professor, University of the Philippines

The effort to strengthen Philippine public facilities needs to come from all sectors in order to truly safeguard our communities. It needs to take account of risk factors—hazard, exposure, and vulnerability—and be aware of which actors are concerned with each. Managing human hazards is the task of social scientists and business managers, while natural scientists and engineers are responsible for understanding natural hazards; managing exposure falls to local governments, health workers, social workers, and planners; and managing vulnerability falls to engineers (for built environment), farmers (food supply), health and social workers (communities), and economic managers (livelihoods). These roles and responsibilities are illustrated in figure 2.

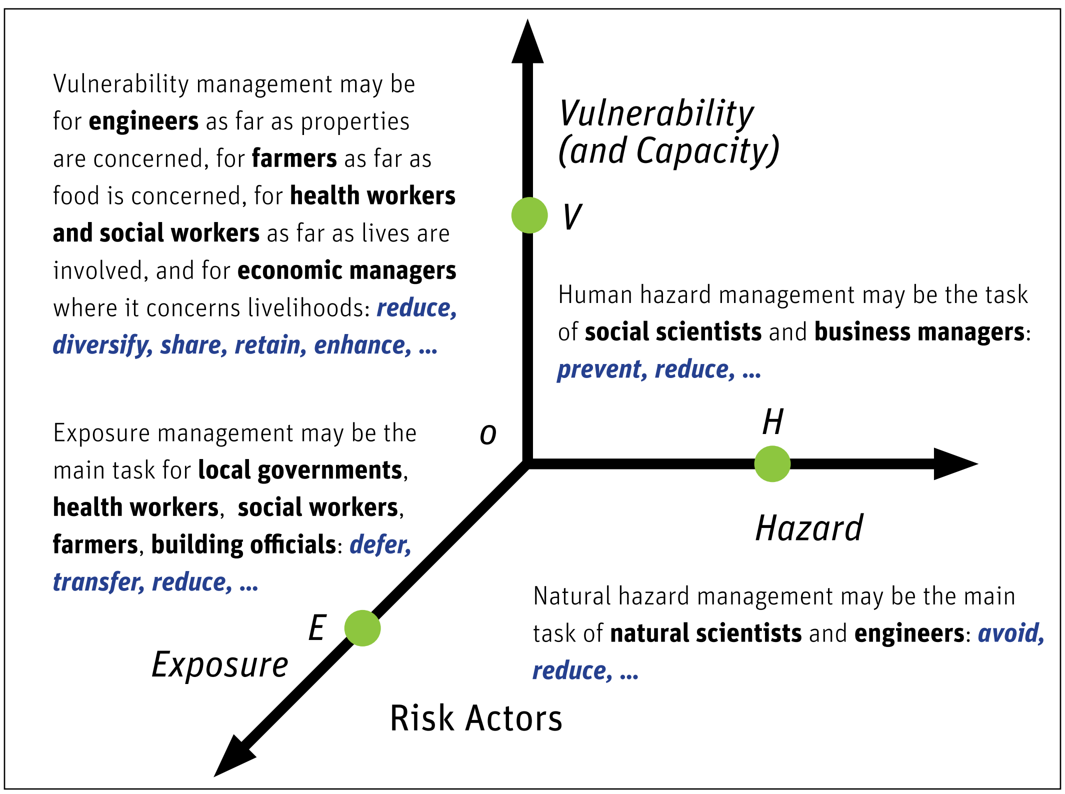


Figure 2. Risk factors and risk actors

Source: © Benito Pacheco, University of the Philippines. Used with permission.

Buildings may be vulnerable for a number of reasons, and accurately assessing each hazard during the design and construction phases might be difficult. Many buildings barely comply with the codes and standards applicable at the time they were built; government codes for new buildings aim to protect lives and not necessarily to prevent property damage; and buildings may suffer wear and tear without undergoing corresponding maintenance.

If resilience is understood as the ability of a system, community, or society to resist, absorb, accommodate, and recover from the effects of hazards in a timely and efficient manner, then achieving resilience in the Philippines must involve all sectors of society and the government.

Exposure as well as vulnerability contributes to disaster risk; indeed, the growth of population and assets in harm's way is now understood to be the single largest driver of disaster risk. According to the Intergovernmental Panel on Climate Change, "long-term trends in normalized losses have not been attributed to natural or anthropogenic climate change."[12]

With the passage of the Philippine Disaster Risk Reduction and Management Law (2010), Philippine disaster policy has shifted away from emergency response and recovery to risk reduction and mitigation. The Philippine DRM framework now envisions safer, adaptive, and disaster-resilient communities achieving sustainable development by mainstreaming disaster risk reduction and climate change adaptation in planning and implementation. To implement the DRM law, the National Disaster Risk Reduction and Management Council (NDRRC) was created. The NDRRC is chaired by the secretary of the Department of National Defense, while four other secretaries—of the Department of Science and Technology (DOST), Department of the Interior and Local Government, Department of Social Welfare and Development, and National Economic and Development Authority (NEDA)—serve as vice chairs.

Under the DRM plan for 2011–2028, the DPWH is in an excellent position to work with NEDA and DOST on structural resilience programs in transportation, education, health, and other sectors. If resilience is understood as the ability of a system, community, or society to resist, absorb, accommodate, and recover from the effects of hazards in a timely and efficient manner, then achieving resilience in the Philippines must involve all sectors of society and the government.

Earthquake Disaster Risk in Manila: Feasible Solutions to Save Lives in Schools and Hospitals

Dr. H. Kit Miyamoto, Senior Earthquake Engineer

The status of the Philippines as a natural hazards global hot spot—it ranks eighth among most exposed countries in the world, with 85 percent of GDP activity in at-risk areas[13]—is well known. Two major earthquakes, in Mindanao in 1976 and Luzon in 1990, damaged schools, but the impact was significantly lower than it could have been, because the earthquakes occurred in the evening, when school was not in session. A magnitude 7.2 earthquake occurring along the West Valley fault is explored in the 2004 MMEIRS report.[14] That report projects that such an earthquake, which could strike at any time, would kill 33,500 and injure 113,600.

Since the MMEIRS study was published, the population of Metro Manila has grown; the official 2013 population was 11.5 million, but the daytime figure is closer to 20 million. Thus the same scenario earthquake could today result in twice the number of deaths originally projected. The study also projected that 10 percent of schools would suffer heavy damage and/or collapse in the scenario earthquake. Given the current student population, this means that 210,000 students are now endangered, and that 24,000 casualties could be expected. The risk to schools is similar to that of Sichuan schools in 2008, when an earthquake killed 19,000 students (total deaths were 86,000), damaged 14,000 schools, and caused the collapse of over 7,000 classrooms.

[12] Intergovernmental Panel on Climate Change, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (Cambridge and New York: Cambridge University Press, 2012), 268.

[13] Dilley et al., *Natural Disaster Hotspots.*

[14] PHIVOLCS, JICA, and MMDA, *Earthquake Impact Reduction Study for Metro Manila.*

Any effort to improve the resilience of schools and hospitals needs to include seismic risk identification, prioritization, and cost analysis. To identify a building's seismic risk, we need to know the following: the number of levels, date of construction; type of construction; the location's soil type; the site's earthquake intensity; and the building's occupancy level. This information is used in prioritizing which buildings are most in need of retrofitting. Especially dangerous building types in Metro Manila have been identified; they include three-story, 1970s construction, near field, hard soil; two-story, 1980s construction, far field, liquefiable soil; and four-story, 1990s construction, far field, soft soil. Analysis of cost data from contractors working in Metro Manila shows that constructing new schools costs US$580 per m^2, whereas strengthening schools costs between US$120 and US$260 per m^2, depending on the number of stories.

Any effort to improve the resilience of schools and hospitals needs to include seismic risk identification, prioritization, and cost analysis.

In sum, the following conclusions are clear (see figure 3 below):

- *Certain structures can be systematically retrofitted to greatly reduce the number of fatalities.* By retrofitting the worst 5 percent of schools (186 out of 3,821 school buildings), the fatality risk will be significantly reduced for 25 percent of the total casualty population (equal to 6,385 people). By retrofitting the worst 40 percent (1,466 buildings), the fatality risk will be significantly reduced for 80 percent of the casualty population (over 19,000 lives saved).
- *Earthquake strengthening is extremely cost-effective.* Strengthening and renovating five buildings can be done for the cost of constructing one new building.
- *Earthquake strengthening will also increase the typhoon and flood resiliency of emergency shelters.*

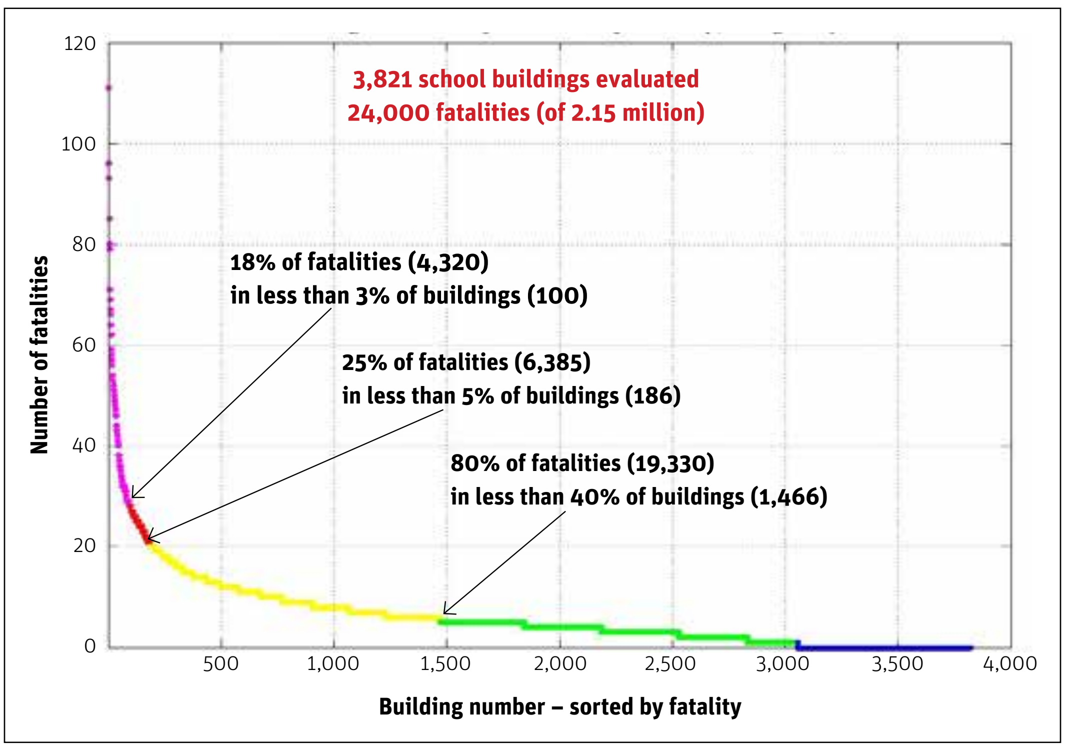


Figure 3. Estimated Metro Manila student fatality rates for a M7.2 West Valley Fault daytime earthquake scenario

Source: Kit Miyamoto, Miyamoto International; World Bank.

International Experience in Structural Retrofitting

Mr. Peter Yanev, Senior Structural Resilience Specialist

Important lessons about structural retrofitting can be learned from international experiences following the many earthquakes that have affected public facilities. California and Turkey offer particularly relevant lessons for the Philippines, though relevant lessons are also offered by other cities and countries.

The 1906 San Francisco earthquake was a major catalyst for the development of seismology and earthquake engineering, and led to the inclusion of earthquake regulations within the California Building Code. The moderate (magnitude 6.4) Long Beach earthquake in 1933 destroyed most of the city's schools—mostly new and built to then-current standards—and led to a law requiring special earthquake design for schools and later to the creation of a state bureau to regulate school design and construction. A similar bureau was established for hospitals following the 1971 San Fernando earthquake. Advances in reducing the earthquake risk to infrastructure (power facilities, roadways, and bridges) followed a similar pattern.

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Examples of best practices in structural retrofitting are offered by the following:

- *Istanbul, Turkey*. By the end of 2013, about 800 schools, hospitals, and other buildings have been evaluated and strengthened/reconstructed under the Istanbul Seismic Mitigation and Emergency Preparedness Project (ISMEP). Strengthening has proven very cost-effective for schools but less so for hospitals, where equipment, other nonstructural features, and business interruptions are very expensive. A typical school can be temporarily evacuated and strengthened in four to six months, whereas hospitals cannot be evacuated without major interruptions in service.
- *Berkeley, California*. Much like Manila, the Berkeley campus is transected by active faults and contains a mixture of old and new buildings. Structural strengthening of the oldest and most dangerous buildings began in 1978; in 1997, the university created the Seismic Action plan for Facilities Enhancement and Renewal (SAFER) as a comprehensive, long-term framework for strengthening or replacing vulnerable buildings. About 75 percent of the work under SAFER was completed by 2011.
- *Romania*. Under the Romania Hazard Risk Mitigation and Emergency Preparedness Project (HRMEP), several dozen key buildings throughout Romania were strengthened between 2003 and 2012. The project aimed to reduce risk while setting examples of state-of-the-art strengthening techniques for different types of public buildings.

Based on this experience, six key recommendations for safer infrastructure and public facilities in the Philippines can be made: (1) update the National Structural Code to include requirements for the strengthening of existing buildings; (2) make use of a plan-checking mechanism or agency; (3) improve enforcement and inspection of construction practices and materials; (4) provide focused training programs for engineers; (5) prioritize investments to upgrade critical physical assets; and (6) systematically upgrade both existing and new structures.

Countrywide earthquake risk management programs involve rapid risk assessments, followed by multiphased risk reduction programs that can take from a few years to decades to complete. The programs typically consist of three phases: Phase 1 is a risk audit of a specific sector (e.g., public schools); buildings are prioritized on the basis of established evaluation criteria for exposure and vulnerability. Phase 2 is a detailed cost-benefit analysis and prioritization of assets to strengthen and renovate. Phase 3 is the actual strengthening of prioritized buildings and upgrading of nonstructural features; this phase involves construction and accounts for about 90 percent of the total cost.

As the experiences of other countries indicate, successful and implementable solutions to seismic hazard do exist. Through targeted upgrading programs and construction of new public facilities and infrastructure to higher safety standards, basic services like education and health can be provided in a safe and sustainable way for all Filipinos.

Istanbul Seismic Risk Mitigation and Emergency Preparedness Program

Mr. Kazim Gokhan Elgin, Director, Istanbul Project, Coordination Unit

Turkey is exposed to three types of natural hazards:

1. *Earthquakes.* About 70 percent of the population lives in seismically active areas; 66 percent of the country is located on active fault zones. In the last century, 75 percent of damaged buildings and 64 percent of total disaster losses were due to earthquakes.
2. *Floods.* These occur mostly in coastal plains, and are exacerbated by deforestation, erosion, and poorly planned development. Floods account for 15 percent of total disaster losses.
3. *Landslides.* Roughly a quarter of the country is exposed to landslide hazard, and 16 percent of Turkey's total disaster losses are due to landslides.

Disaster management is a sustainable development issue, not just a matter of search and rescue. This was especially clear after the 1999 Marmara earthquake (magnitude 7.4), in which 17,480 lives were lost and 113,000 housing units and business premises were completely destroyed, at an estimated direct cost of US$10 billion to US$15 billion. After that event, communications failed; substandard buildings and infrastructure suffered damage or collapse; rescue efforts were chaotic; and a large resource gap for post-disaster needs (equal to about 5–7 percent of Turkey's gross national product) was revealed. Figure 4 summarizes what was learned as a result of this disaster.

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The Marmara earthquake drove a paradigm shift in Turkey: the country became more proactive and less reactive, began to focus on disaster mitigation more than on recovery, sought to manage risks rather than crises; and in general pursued more sustainable development. Evidence of this shift is the Istanbul Seismic Risk Mitigation and Emergency Preparedness Project, a €1.2 billion project jointly financed by the World Bank, European Investment Bank, Council of Europe Development Bank, and Islamic Development Bank. ISMEP has three main components:

- *Strengthening of emergency management capacity*, through strengthening of emergency communication systems, management information systems, and the Disaster and Emergency Directorate's institutional capacity, along with raising of public awareness and training.
- *Seismic risk mitigation for priority public buildings*, through retrofitting, reconstruction, and national disaster studies.
- *Enforcement of building codes*, through raising public awareness, developing a regulatory framework, encouraging voluntary accreditation and training of engineers, and streamlining of issuance procedures for building permits.

ISMEP was designed to be carried out in three phases (see figure 5 and figure 6 for more detail). As of fall 2013, ISMEP has completed the strengthening, reconstruction, and renovation of over 800

Figure 4. Lessons Learned from the Marmara earthquake

Source: © Kazim Gokhan Elgin, ISMEP; used with permission.

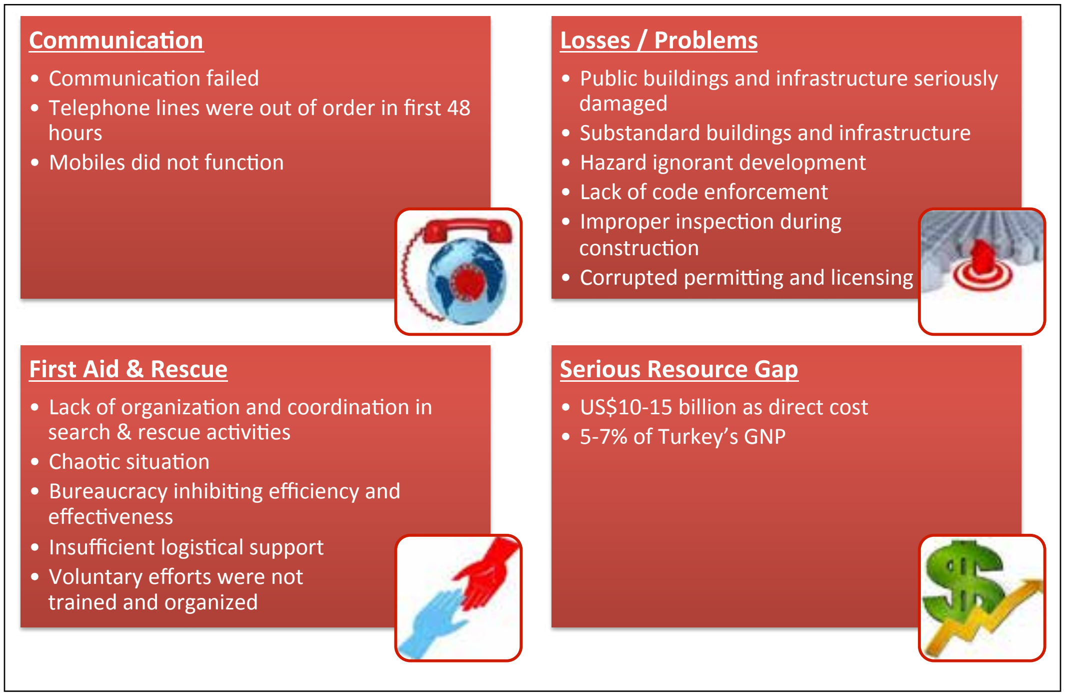
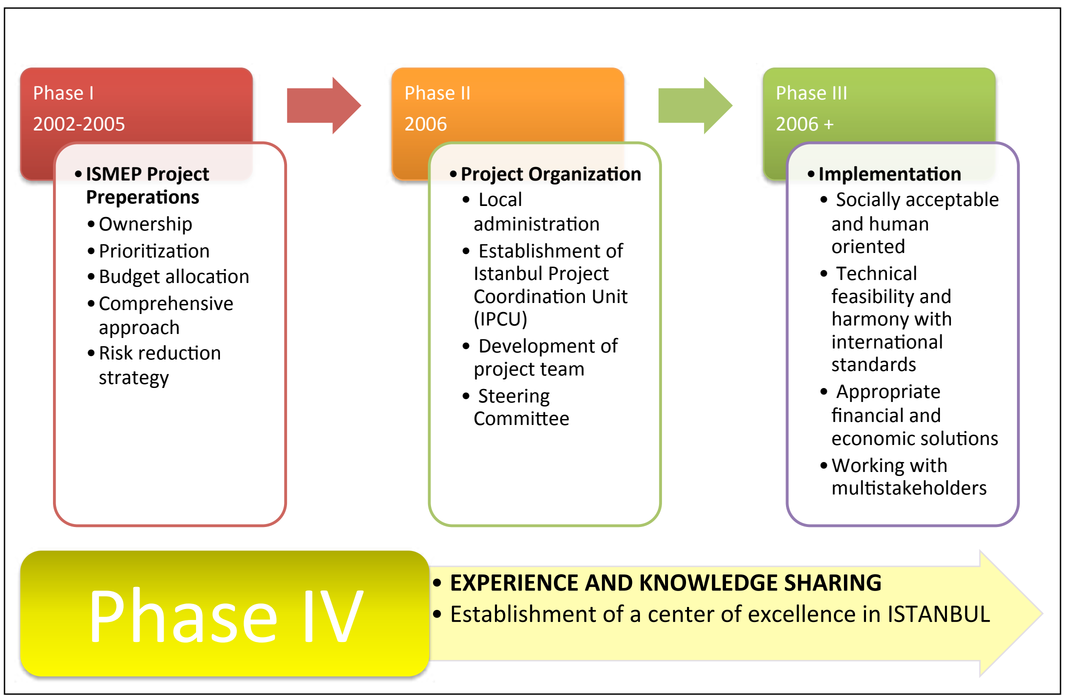


Figure 5. ISMEP project phases

Source: © Kazim Gokhan Elgin, ISMEP; used with permission.



schools, hospitals, and other buildings found to be at high earthquake risk. By the end of 2014, this figure will be above 1,100. ISMEP's work directly affects the safety of over 1.2 million students and their teachers, and the lives of 4 million of their family members. The development and implementation of ISMEP had contributed to the discussion of the key challenges in earthquake risk management and suggested useful strategies for addressing these challenges. Its scope and success make it an excellent example for other countries to study and follow.

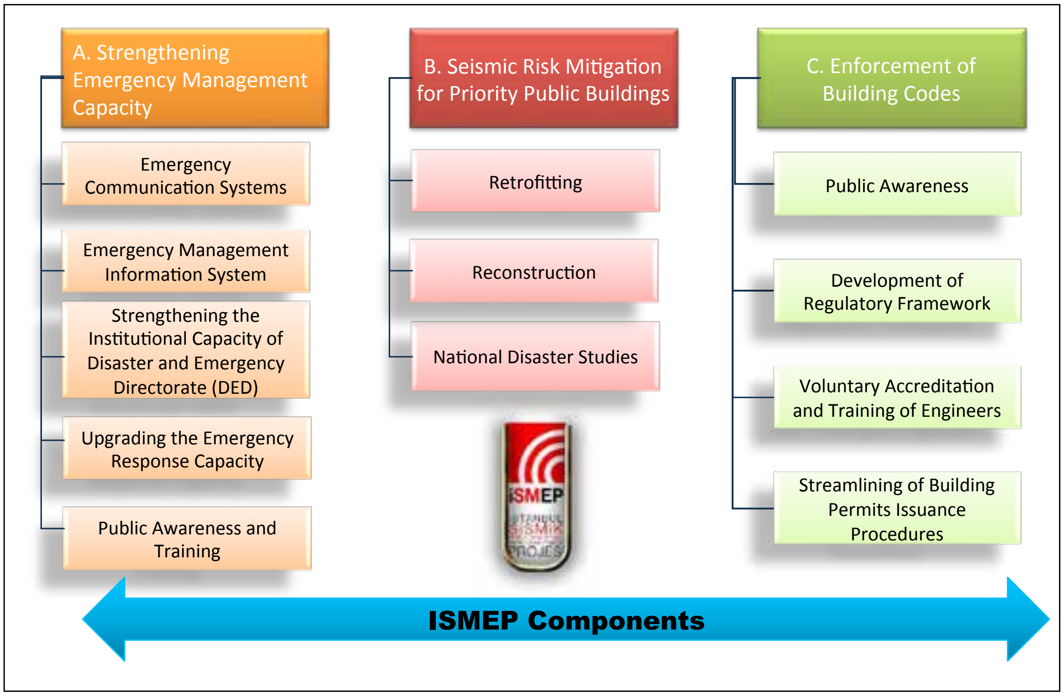


Figure 6. SMEP phase III: Implementation

Source: © Kazim Gokhan Elgin, ISMEP; used with permission.

Yalova, Turkey-August 28, 1999: The Azmit earthquake was a 7.6 magnitude earthquake that struck northwestern Turkey. The event lasted for 37 seconds, killing around 17,000 people and leaving approximately half a million people homeless. Photo: © sadikgulec | Thinkstock.com

Forum Session 2

International and Local Structural Resilience and Retrofitting Programs

Session 2 focused on gaining a deeper understanding of lessons learned from programs that have been implemented throughout the world, and on ways the Philippines could apply this knowledge and experience to its context. This session showcased experiences in building safe and resilient infrastructure from Romania, Indonesia, Japan, and Latin America as well as the Philippines.

Chair: **Chairman Francis Tolentino**, Metropolitan Manila Development Authority
Co-chair: **Dr. H. Kit Miyamoto**, Senior Earthquake Engineer

Romania Hazard Risk Mitigation and Emergency Preparedness Project: Earthquake Risk Reduction Component

Ms. Stela Petrescu, Director (Ret.), Project Management Unit, Ministry of Regional Development and Public Administration

Romania is among the most seismically vulnerable European countries. In the 20th century, it experienced 14 earthquakes of magnitude greater than 7.0. An earthquake in Bucharest in March 1977 killed 1,578, injured 11,300, and damaged or collapsed 32,900 housing units, 257 schools, and 47 hospitals. The estimated economic losses from this earthquake came to US$2 billion.

The 1977 disaster served as a catalyst for Romania to develop seismic risk reduction measures, improve emergency preparedness, and create a disaster mitigation/management system. A recent part of these efforts is Romania's Hazard Risk Mitigation and Emergency Preparedness Project. Conceived on an ex ante basis, it sought to proactively reduce the country's vulnerability to multiple natural hazards. The project has four components, each carried out by a different ministry: (1) strengthening of emergency management and risk financing capacity (Ministry of Administration and Interior); (2) earthquake risk reduction (Ministry of Regional Development and Tourism)—the focus of this paper; (3) flood and landslide risk reduction (Ministry of Environment); and (4) reduction of mining accident risk in the Tisa basin (National Agency for Mineral Resources).

The 1977 disaster served as a catalyst for Romania to develop seismic risk reduction measures, improve emergency preparedness, and create a disaster mitigation/ management system.

The earthquake risk reduction component of HRMEP aimed to reduce the seismic vulnerability of high-priority technical and social infrastructure in two ways: (1) through retrofitting key structures, high-priority public buildings, and buildings hosting public services involved in the emergency response and preparedness system; and (2) through institutional strengthening and capacity building in the seismic risk mitigation domain.

Retrofitting of key structures required several steps, including identifying at-risk structures, prioritizing those at highest risk, and implementing the actual retrofitting works. The project focused on emergency and disaster response facilities, emergency health facilities, education facilities, communication facilities, and essential public buildings. Some changes were made to the original plan as implementation proceeded; for instance, upon Romania's accession to the European Union (EU), designs had to be adapted to fit EU specifications. A total of 44 important public structures have now been retrofitted under HRMEP (figure 7).

TYPE OF FACILITIES	NUMBER OF FACILITIES (%)
EMERGENCY AND DISASTER RESPONSE FACILITIES (disaster control/command/rescue centers, firefighter stations, public order structures comment centers)	**17 / 38%**
EMERGENCY HEALTH FACILITIES (national and country level emergency hospitals)	**14 / 32%**
EDUCATIONAL FACILITIES (universities, child protection centers)	**10 / 23%**
ESSENTIAL PUBLIC BUILDINGS	**3 / 7 %**
TOTAL	**44 / 100%**

Figure 7. HRMEP Implementation phase: Results of the investment program

Source: © Stela Petrescu, Ministry of Regional Development and Public Administration. Used with permission.

Institutional strengthening and capacity building involved the following: a review of the building code, with a specific focus on the applicable earthquake design requirements; two pilot programs that made use of innovative and cost-effective methods for seismic retrofitting; an energy sector risk assessment study focused on the vulnerability of the gas, electricity, and oil lifeline facilities; and professional training of Romanian structural specialists.

In summary, the project was successful and had a positive social impact on the target population. Outputs from models created under HRMEP are available for use, meaning that models can be scaled up for similar projects.

Improving Earthquake Resilience in Latin America and the Caribbean

Mr. Niels Holm-Nielsen, Lead Disaster Risk Management Specialist, Latin America and the Caribbean, World Bank

This presentation addresses risk reduction investments to improve earthquake resilience in Latin America and the Caribbean, particularly in Colombia, Belize, Costa Rica, and Brazil.

Colombia. The Bogota Disaster Vulnerability Reduction Project focused on the safety of schools and hospitals. Since the project's inception in 2006, 250,000 students have benefitted from the 243 earthquake-resilient schools (costing US$579 million), and 4,000 children age five and under have benefitted from 29 retrofitted or newly constructed kindergartens. The program has trained 1,762 teachers in risk management and emergency response and has funded 18 seismic vulnerability studies and reinforcement designs for hospitals.

Belize. Under the Belize Climate Resilient Infrastructure Project, critical transportation infrastructure (road segments, drainage systems, and stream crossings that are susceptible to flooding and critical to the socioeconomic operation of the country) is retrofitted, rehabilitated, and reconstructed. A first step involved evaluating infrastructure to prioritize investments aimed at improving climate resilience.

The São Paulo Sustainable Transport Project offers a pioneering approach to disaster risk management in the transport sector in Brazil.

Costa Rica. A technical assistance program is in place to build institutional capacity in probabilistic risk assessment in the water and sanitation sector. An expected outcome of the program is support for policy makers deciding on water and sanitation infrastructure investments to reduce disaster risk in San Jose, Higuito, and San Isidro.

Brazil. The São Paulo Sustainable Transport Project offers a pioneering approach to disaster risk management in the transport sector in Brazil. The proposed framework aims to integrate geotechnical/meteorological monitoring and highway management and operation; doing so will both ensure the adoption of structural measures to reduce identified risks and also support the adoption of nonstructural procedures to better manage traffic in case of disaster.

Japanese Experience in Seismic Design and Retrofitting

Dr. Tatsuo Narafu, Senior Advisor, Japan International Cooperation Agency

The Japanese experience in seismic design and retrofitting offers useful lessons for other countries. This presentation focuses on what can be learned from (1) mega-earthquakes in Japan, (2) Japan's experience with retrofitting, and (3) a comparison of the structural design of apartment buildings in the Philippines and Japan. It also considers some important lessons from other countries.

In both the 1995 Hanshin Awaji (Kobe) earthquake and the 2011 Great East Japan earthquake, buildings that had been constructed to meet the current building code suffered little—their damage was within the expected range—while buildings built to meet older codes were much more badly damaged. Among the buildings that collapsed in the Kobe earthquake, only 3 percent of buildings constructed after 1981 collapsed, compared to 76 percent of buildings constructed before 1971 (see figure 8).

Seismic assessments and retrofitting designs should consider the effects of imperfect construction,since the majority of serious damage (e.g., total collapse) is due to imperfect construction works rather than strong seismic loads.

The Hanshin Awaji earthquake drew public attention to the importance of retrofitting older buildings to newer seismic standards, and in 1995, Japan passed the Act for Promoting Seismic Retrofitting of Existing Buildings. The law seeks to bring schools, hospitals, fire stations, and other important public buildings constructed before 1981 up to current standards. According to the most recent data, 79 percent of houses are considered earthquake resilient (data from 2008), along with 84.8 percent of schools, 61.4 percent of hospitals, and 73.0 percent of emergency hospitals (data from 2012).

There are also lessons to be learned from comparing the structural design of apartment buildings in the Philippines and Japan, though a study that looked at five-story apartment buildings in comparable metropolitan areas in both countries found that the comparison of seismic loads is in fact very complicated. More specifically, the study found the following:

- In Philippine design, structural members, especially columns, are smaller than in Japanese design.
- In Philippine design, the total structure is softer and more flexible than in Japanese.
- The design procedures are different for each country: in the Philippines, elastic behavior is calculated with specification requirements to ensure required ductility, while Japan uses pushover analysis.

Some important lessons from global experience with large earthquakes are as follows:

- Seismic assessments and retrofitting designs should consider the effects of imperfect construction, since the majority of serious damage (e.g., total collapse) is due to imperfect construction works rather than strong seismic loads.
- Retrofitting design must be suited to local conditions in the Philippines, because using designs from developed countries without local adaptation can prove dangerous, given the different design attributes.
- Seismic assessments should also consider nonstructural members as well as mechanical and electrical facilities, and attached structures such as sign boards should also be taken into account in seismic assessments.

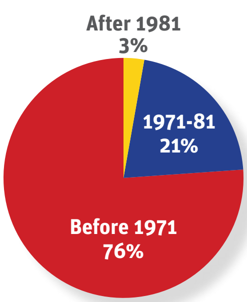


Figure 8. Percentage of buildings collapsing in Kobe earthquake, by construction date

Source: World Bank Institute. Knowledge Note 1-2. Cluster 1: Structural Measures. Building Performance. http://wbi.worldbank.org/wbi/Data/wbi/wbicms/files/drupal-acquia/wbi/drm_kn1-2.pdf.

Indonesia Safe Schools Program

Dr. Fauzan, Head, Disaster Mitigation Center, Universitas Andalas

The frequency and magnitude of extreme hazard events, including earthquakes, tsunamis, volcanoes, and landslides, are increasing. Around the world, these events have taken many lives and damaged many buildings, including schools. In Indonesia, about 40 million students go to school in areas at risk of earthquakes, and approximately 75 percent of schools are located in a disaster risk area.

Following the establishment of Indonesia's National Secretariat for Safe Schools in 2011, the Safe Schools Pilot Project was begun with funding from the World Bank. The project was designed in part to support the secretariat (along with the Ministry of Education and Culture and the National Agency for Disaster Management) in developing safe school guidelines.

The safe school guidelines involve both structural and nonstructural principles. Structural principles concern school rehabilitation and retrofitting to meet the standard for safe and resilient buildings. Nonstructural principles concern school communities' ability to identify potential risks and prepare for a response.

The safe school guidelines involve both structural and nonstructural principles. Structural principles concern school rehabilitation and retrofitting to meet the standard for safe and resilient buildings. Nonstructural principles concern school communities' ability to identify potential risks and prepare for a response.

Under the Safe School Pilot Project , the safe school guidelines were implemented in a total of 180 schools spread over three provinces that had recently experienced deaths and heavy damage to school buildings from earthquakes and tsunamis—West Java, West Sumatra, and West Nusa Tenggara. Schools were selected by the relevant District Education Office based on their need for rehabilitation, vulnerability to natural disasters, and location relative to the home base of the pilot project. The project trained both technical and social facilitators, the former in repair and retrofitting of school buildings, and the latter in early warning and disaster evacuation systems. The retrofitting methods were designed so that local workers could learn them easily and so that local materials available at low cost (e.g., chicken wire mesh—see figure 9) could be used. The retrofitting steps are shown in figure 10.

The expected outputs of the pilot were as follows:

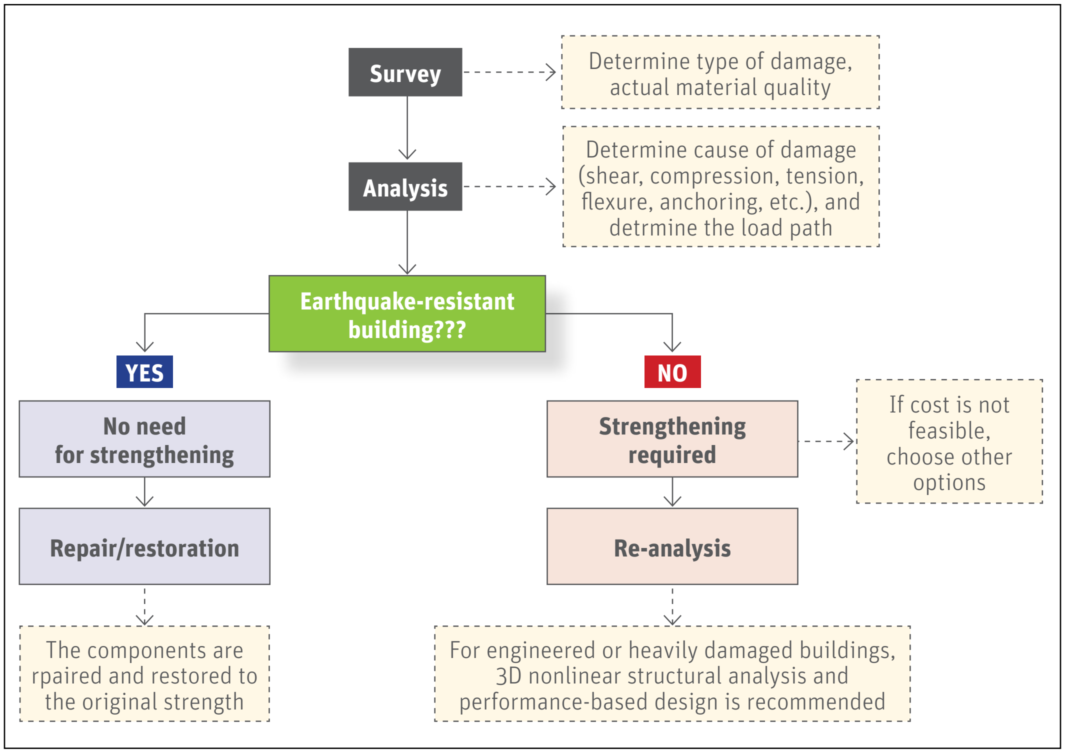
- Produce simple guidelines on school retrofitting to guide school rehabilitation design and construction.
- Establish school disaster preparedness teams.

Figure 9. An unreinforced masonry school building (left) has its walls strengthened with chicken wire mesh (right)

Source: © Dr. Fauzen, Disaster Study Center, Andalas University. Used with permission.

Figure 10. Safe Schools Program steps for retrofitting

Source: © Dr. Fauzen, Disaster Study Center, Andalas University. Used with permission.



- Develop a standard operating procedure for evacuation, including an evacuation map for each school, and regularly conduct the evacuation simulation.
- Produce various media for safe schools, including posters and books about disaster.

Philippine Safe Schools Campaign

Engr. Annabelle Pangan, Department of Education, the Philippines

This presentation describes existing policies, standards, programs, and projects relevant to increasing resilience in Philippine schools.

Many policies, standards, and requirements for designing and constructing school buildings and other facilities are included in the Department of Education (DepEd) physical facilities handbook. These requirements take into account DRM and hazard-resilient approaches and consider schools' vulnerability to different types of hazards and disasters. The manual establishes minimum performance standards and specifications (MPSS) for the school buildings' architectural and structural designs; electrical, plumbing, and sanitary designs; room quality (heat, noise, toxicity, etc.); and adherence to various national design and construction codes. The MPSS were developed in coordination with the DPWH and added to the manual in 2012.

Among the programs and projects under way to promote safe schools in the Philippines are the following:

- *School Building Program under Basic Educational Facilities Funds.* This program addresses classroom shortages by repairing or replacing old buildings and constructing new buildings.
- *Public-Private Partnership School Infrastructure Project.* This project adopts a build-lease-transfer arrangement to supplement current DepEd initiatives for classroom construction.

- *Replacement/reconstruction of school buildings under quick response funds (QRFs).* QRFs are lump sums included in the DepEd budget for the immediate repair, rehabilitation, reconstruction, or replacement of school buildings and facilities affected by calamities.
- *School Mapping Exercise.* The mapping is linked to the department's Basic Education Information System and contains basic school profiles necessary to determine the location of individual schools relative to hazards and their vulnerability to hazards.
- *Brigada Eskwela.* Under this annual program, volunteers in the community devote a week before the school year begins to preventive maintenance of school buildings.
- *Assessment of Structural Integrity of DepEd Structures.* This program identifies school buildings that are not safe for occupancy and recommends either demolition or repair/rehabilitation; the goal is to reduce vulnerability and extend the economic life of structures.
- *Schools Water and Electrical Facilities Assessment Project.* This program seeks to repair/rehabilitate schools' water and electrical facilities, since these are common causes of waterborne diseases and fire.
- *Constructors' Performance Evaluation System.* This system collects data on builders to safeguard the government's investments in infrastructure.

Many policies, standards, and requirements for designing and constructing school buildings and other facilities are included in the DepEd physical facilities handbook. These requirements take into account DRM and hazard-resilient approaches and consider schools' vulnerability to different types of hazards and disasters.

Hospitals Safe from Disasters: The Department of Health Safe Hospitals Program

Dr. Asuncion Anden, Department of Health

Hospitals can play a vital role following emergencies and disasters, and the Philippine Department of Health (DOH) is working to ensure that hospitals and hospital staffs are prepared to manage any emergencies and disasters that may arise. The DOH approach is based on that of the Hyogo Framework for Action, a global template for risk reduction. It makes use of the concept of safe hospitals as defined by the World Campaign for Safe Hospitals, which was begun in 2008 with the goal of reducing risks, protecting facilities, and saving lives.

A safe hospital is considered to have three components: (1) it has the capacity and the capability to remain functional and operational during and after a disaster; (2) its health services remain accessible during and after a disaster; and (3) it is physically and functionally resilient.

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The DOH Safe Hospitals Program, which was started and is now run by the Health Emergency Management staff of DOH, rests on three pillars that correspond to the three goals of the World Campaign for Safe Hospitals. These pillars are safe structure, functioning facilities, and prepared staff. (Figure 11 gives some details about what each of these pillars entails.) As a result of the program, all 71 DOH hospitals have a risk reduction program in place—each with a coordinator, a budget, and regularly scheduled activities for preparedness and response—as well as an emergency plan. All DOH hospitals and some other hospitals have been trained in preparedness and response.

Under the Safe Hospitals Program, hospital assessment tools have been developed and updated. In 2013, 200 hospitals in Luzon and Metro Manila were assessed. Also in that year, the DOH issued "Policies and Guidelines on Hospitals Safe from Disasters," an administrative order that specifies practices for reducing risk and managing hazards. The guidelines require risk assessment before new hospitals are constructed; strict adherence to building codes in construction, repair, or rehabilitation of hospitals; and inclusion in licensure of plans, structures, systems, and mechanisms for preparedness and response.

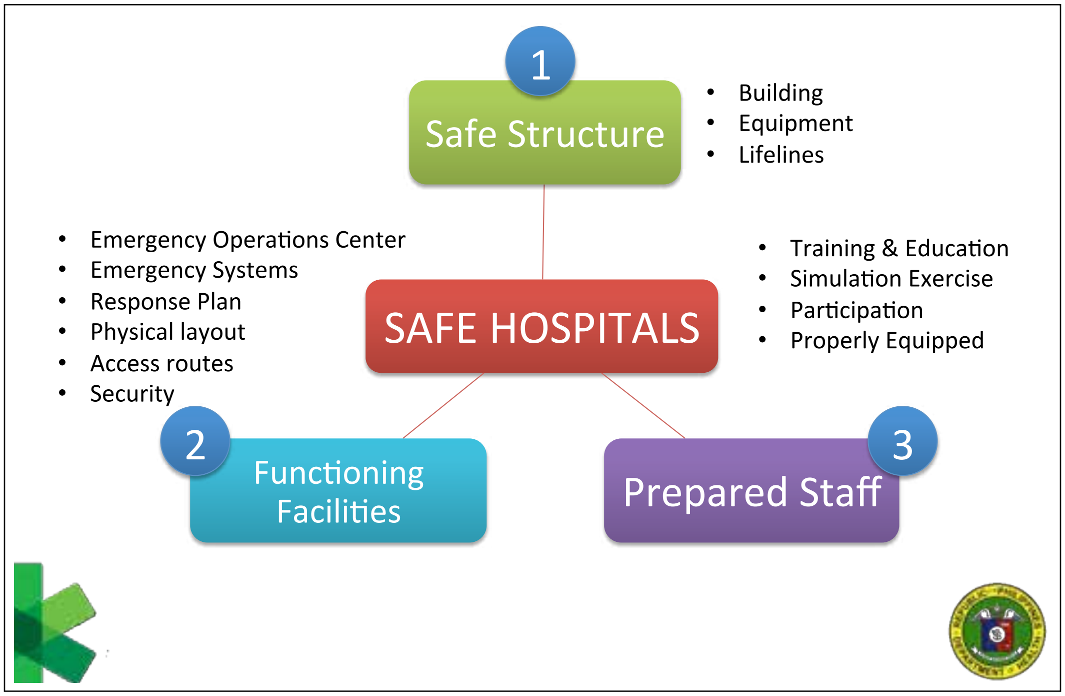

Figure 11. Elements of safe hospitals as defined by the DOH Safe Hospitals Program

Source: © Asuncion Anden, Philippine Department of Health. Used with permission.

Some future areas for collaboration include technical/scientific measures, financial investments for hospital infrastructure, and research and good practices. In general, the way forward for safe hospitals is to move from awareness raising through advocacy to building of capacity for safe and prepared facilities, where concrete actions save lives.

Synthesis and Open Discussion

Dr. H. Kit Miyamoto, Senior Earthquake Engineer

General observations included the following:

- Deaths are preventable—and inexcusable. Proven solutions for reducing risk and increasing resilience exist.
- Frequent disasters can motivate governments and communities to prioritize investment in strengthening infrastructure; however, investments should be made in advance of disaster.
- Approaches that emphasize preparedness can be cost-effective.
- Ensuring that infrastructure is safe and resilient is not only or primarily an engineering problem, but is also one of political will and institutional commitment.
- Infrastructure must be resilient to multiple hazards, even though reducing risks from multiple hazards can be a balancing act given the different needs and priorities.
- It is time to move away from the technical or engineer-focused concept of retrofitting to the concept of upgrading. In the case of the schools, this approach results in an enhanced learning environment, one that is safe as well as suited to modern learning standards. In the case of hospitals, this approach facilitates continued function and operation during and after disaster, and is part of ensuring a safe structure, functioning facilities, and prepared staff.

- Disasters limit the path to sustainable development; there is a clear relationship between disaster impacts and loss of poverty reduction gains.
- Ownership is a critical issue in the preparation phase; social acceptance from the public—gained in part through sharing of information—is a critical issue in the implementation phase.
- Retrofitting is far less disruptive than new construction and more likely to serve the goals of education and to promote continuation of life-saving services in hospitals.

Specific takeaways for Metro Manila included the following:

- Key institutions are already working to reduce natural disaster risks: DPWH has invested in enhancing roads and bridges, DepEd has a safe schools program, DOH has a safe hospitals program, and the NDRRMC has set policy targets.
- Strengthening 5 percent of schools can reduce 25 percent of the expected fatalities, and in this way save the lives of about 7,000 students.

It is time to move away from the technical or engineer-focused concept of retrofitting to the concept of upgrading. In the case of the schools, this approach results in an enhanced learning environment, one that is safe as well as suited to modern learning standards. In the case of hospitals, this approach facilitates continued function and operation during and after disaster, and is part of ensuring a safe structure, functioning facilities, and prepared staff.

Panelists discussing the relevance of international lessons learnt to the Philippine context.

Discussion with Session Speakers and Chairs

The discussion focused on the following challenges and approaches in upgrading programs:

- **Setting up a program: The case of Istanbul.** During the preparation stage of the ISMEP, ownership of relevant authorities was a critical issue. In the implementation stage, ownership remains important, but the key issue is public acceptance of the program. Public trust and support are closely linked to governance safeguards to prevent corruption and public funds mismanagement. While technical issues were important when establishing the ISMEP program, good governance structure was likewise critical. Among the challenges faced in establishing the program was sharing of information among the different stakeholders. In project preparation, different ministers from the central level, as well as representatives from local government, came together to discuss important issues. It is very important to have consultation mechanisms in place to allow exchange of information and experience.

Panoramic view of Makati City, Manila. Photo: © Thinkstock.com

- **Integrating principles of sustainability and resilience into the Philippine National Building Code.** Updating the National Building Code is not just a matter of including the best technical provisions. Certainly provisions should ensure that new buildings are designed in accordance with the right standards, while older buildings are properly maintained and upgraded as needed. But the implementation of the code is also crucial, and this involves different parties—including designers, engineers, contractors, and owners—who must dedicate the required amount of time and resources to meet the code. Advocacy plays an important role in ensuring that there is public agreement on the importance of safe and resilient structures. The public includes owners, investors, and government agencies at the national and local levels. As the caretaker of the National Building Code, DPWH seeks to raise the level of awareness of the whole society, so that practitioners, building owners, and others follow the requirements in full scope. Platforms like this one are important for creating a higher level of awareness.
- **Investing in retrofitting programs in Metro Manila.** MMDA is involved in disaster preparedness training in 878 public schools that are within the 5 km radius of the West Valley fault. DPWH will be investing in school retrofitting. The department is currently considering the first 200 structures in vulnerable areas.
- **Making decisions about retrofitting programs: The case of Istanbul.** There are many difficult decisions to be made regarding a project's technical, financial, and economic feasibility, as well as about retrofitting versus new construction. While people often prefer new construction, economically, this preference is not feasible. In Istanbul, incentives were offered to make this option more attractive. One advantage of retrofitting is its shorter timespan; it takes approximately five months, compared to one year for new construction. The short time span for retrofitting is an advantage, given the uncertainty about when an earthquake could occur. This uncertainty means that buildings' structural resilience should be strengthened as soon as

possible. The shorter time frame also reduces the overall cost of the project. From the social perspective, it is important that people affected by a retrofitting program understand the full process. For example, students who must transfer to another school should be informed about what they are likely to experience and problems that may arise. It is important to highlight the benefits beyond retrofitting—not just a safer school, but one with new bathrooms, equipment, etc. It is also important to invest in a publicity campaign to communicate all these aspects of a retrofitting program. Communication is very important. While "retrofit" is an engineering term that means "fit to the current building code," a more suitable term, and one that conveys more information, is "upgrade structurally." This term acknowledges that what was built in the past met the standards of the time, but because more or new information is now available, buildings need to be upgraded.

- **Clarifying the methodology for assessing hospitals.** The DOH follows an administrative order that defines the guidelines for safe and resilient hospitals. An assessment tool has been developed, and hospitals across the country are currently being assessed using this tool. The department focuses on denser urban areas, which have more health facilities and bigger populations using these facilities. For risk mapping, DOH uses available information and studies by technical agencies like PHIVOLCS and PAGASA (Philippine Atmospheric, Geophysical and Astronomical Services Administration); these also help to determine needs and validate the data that have been collected. The department can share information about hazards and also about the vulnerability of particular structures. One issue that is coming out of this assessment is that many structures, including many DOH and local government hospitals, were not built according to standards for resiliency and safety. Funds are needed to carry out the necessary upgrading of these structures.

Investing in retrofitting programs in Metro Manila. Photo: © Christine Gonsalves | Thinkstock.com

We must prepare for hazard events as soon as possible.

Closing Remarks

Undersecretary Eduardo del Rosario, Office of Civil Defense, National Disaster Risk Reduction and Management Council

We are all aware of what happened just recently in Pakistan—more than 500 were killed in an earthquake. We can easily see that the building structures in Pakistan are not resilient, and perhaps that is because Pakistan does not have a building code like that of the Philippines.

In the Philippines, our problem is the enforcement or implementation of the right type of building codes. Typhoon Pablo caused massive devastation to houses and government buildings in the Davao Oriental and Compostela Valley provinces. In Davao Oriental, about 90–95 percent of all structures were felled by the 200 km/h wind. Typhoon Labuyo, which hit Casiguran, Aurora, last August, partially damaged 40–50 percent of the total infrastructure. But when Batanes was hit by winds of 220–250 km/h, only 10 percent of infrastructure suffered damage.

Just 10 percent! Why? The buildings in Batanes were constructed in the 1870s and early 1900s, but these massive stone structures have a certain degree of resiliency. When I heard that the most powerful typhoon of the year globally, and the most powerful in Batanes in the last 25 years, had made landfall, I went to see for myself the massive devastation that was being reported. But when I arrived, I was surprised to see the comparative lack of damage. It was as if just a grade 1 or 2 typhoon had hit the area.

If we achieve a sound level of structural resiliency, then we will be prepared for and able to withstand severe winds and strong earthquakes. A 7.2 magnitude earthquake, such as the MMEIRS study describes, could be devastating, so a national program of retrofitting schools and hospitals is a step in the right direction. We must prepare for hazard events as soon as possible. We don't know when the big bang will happen, and I hope it will never happen. According to experts, it may happen in the next 50 years—or next year. But even if it doesn't happen for 100 or 500 years, we must prepare as soon as possible.

Tacloban City, Leyte – November 16, 2013: Super typhoon Yolanda (International name: Haiyan) destroyed countless homes, flooded cities and towns and left more than a 4,000 Filipinos dead and 1,100 missing after hitting the country on November 8, 2013.

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Government Executive Meeting

Opening of the Government Executive Meeting.

Reflecting on the international experience with structural resilience, the executive meeting focused on the next steps for a phased national safe and resilient infrastructure program. The expert panel and meeting attendees discussed implementation challenges, timelines, and institutional arrangements that need to be considered when devising a national program.

Chair: **Mr. Raul C. Asis**, Undersecretary, Department of Public Works and Highways

Co-chair: **Ms. Jolanta Kryspin-Watson**, Senior Disaster Risk Management Specialist, East Asia and the Pacific, World Bank

Synthesis from Day 1 Presentations and Introduction of Participants

Ms. Jolanta Kryspin-Watson, Senior Disaster Risk Management Specialist, World Bank

The examples from Istanbul, Colombia, Romania, Japan, and Indonesia were inspiring, and encourage stakeholders in the Philippines to push the resilience agenda even further. At this point, we hope to draft a preliminary road map for the government's next steps toward resilient infrastructure.

We came here agreeing that the impacts of disasters can be decreased, and that there are no excuses for failing to take concrete action to reduce disaster vulnerability. We learned yesterday about a number of approaches, both institutional and technical, that can help to achieve this goal.

Upgrading and retrofitting of structures to make them safer can be cost-effective. This is true for new structures, which can be made safer with little increase in the cost of construction, as well as existing structures. The presentations yesterday offered many examples of upgrading that improved functionality and increased safety. Retrofitting also has a "developmental effect," because upgrading schools and hospitals improves both their safety and functionality.

The examples from Istanbul, Colombia, Romania, Japan, and Indonesia were inspiring, and encourage stakeholders in the Philippines to push the resilience agenda even further.

It is clear that strengthening of public facilities is not just an engineering problem. Engineers know how to build safely; the key is political will and institutional commitment. At the same time, because upgrading of infrastructure needs to take multiple hazards into account, experts need to be at the site. But we can tackle multiple hazards simultaneously and work together on parallel tracks. It is time to replace technical and engineer-focused concepts of retrofitting with the concept of functional upgrading. For schools, this approach creates an environment that is both safe and more functional for modern learning standards. The goal for hospitals is to remain functional and operational during and after a disaster. Retrofitting/upgrading is far less disruptive and time-consuming than new construction. The critical issue in the preparation phase is ownership; in the implementation phase, it is acceptance from the public, so sharing of relevant information with the public is crucial, as are efforts to raise public awareness.

Another issue is that of building codes and regulations, which are regularly updated based on current experience and knowledge. Enforcement of these regulations is often a weak point, so quality assurance systems should be put in place to ensure regulations are being followed. Disasters take a toll on poverty reduction gains, and resilience to disaster is the clear path to sustainable development.

We saw yesterday that key institutions in the Philippines are already working to reduce natural disaster risk. Gains have been made in understanding the country's risk. DPWH has invested in roads and bridges, the Department of Education and the Department of Health are working to increase the resilience of their facilities, and the NDRRMC has set up policy targets. Thus the foundations for risk reduction programs are in already in place.

Yesterday we discussed a key finding of the World Bank study: strengthening just the top 5 percent of the most vulnerable schools in Metro Manila could reduce potential student deaths by 25 percent. That means that upgrading just 200 schools can save about 7,000 lives.

Secretary Singson has stated that the Philippine government is committed to upgrading schools, and that the department seeks to set a target of 5 percent of the most vulnerable schools for further implementation. This work will need to coordinated with and carried out by key agencies, at both the central and local level; the discrete program will need to grow into a long-term and sustainable institutional solution for safer infrastructure, and to scale up to other parts of the country.

Roadmap to Structural Resilience: Key Policy Recommendations

Dr. Benito Pacheco, Professor, University of the Philippines

This presentation includes a tentative road map to structural resilience, which can be understood as an evolving plan. It also offers policy recommendations for the medium and long term.

Many lessons have already been learned from past projects that have been supported by the World Bank and other development partners. These examples show that it is possible to leverage previous experience and methods that have proven effective. The government needs to be concerned with immediate projects, but must at the same time focus on long-term sustainable initiatives. Successful demonstration projects that increase the public's acceptance of long-term programs are valuable, linking the pilot and long-term stages.

The government needs to be concerned with immediate projects, but must at the same time focus on long-term sustainable initiatives. Successful demonstration projects that increase the public's acceptance of long-term programs are valuable, linking the pilot and long-term stages.

The following general recommendations can be made:

1. Clear leadership, ownership, and accountability are crucial to champion, coordinate, and implement a program like the one contemplated for the Philippines.
2. In the Philippines, as in other countries, there is typically a need to clarify institutional roles and responsibilities, because mandates for infrastructure or construction projects tend to be overlapping. The DPWH and DepEd are both concerned with public schools, for example, and the DOH and the Local Government Units both deal with hospitals. Many other national agencies and corresponding local agencies are responsible for different types of structures.
3. Maintaining and expanding public support for structural resilience programs is very important. Inevitably, upgrading or retrofitting causes service interruptions that may last for months, so public support for the works is crucial.
4. It is necessary to objectively evaluate the capacity—in terms both of quantity and quality—of our local construction industry, including the design profession. We may understand technically how to carry out these projects, but they must be carried out cost-effectively; there must be good use of resources, careful prioritization, and management of expectations.

Given these various challenges, the following medium- and long-term policy recommendations can be made:

1. Expand and improve public awareness and education campaigns to build social awareness of disaster risks and of the need for upgrading critical infrastructure.
2. Update the National Building Code, specifically addressing the gaps in provisions and requirements for existing structures.
3. Improve the regulatory and institutional arrangements.
4. Build capacity in the design profession and construction industry in the Philippines, for example by requiring certification for earthquake engineering professionals and prequalification or certification for design firms, contractors, and others involved in the upgrading.
5. Establish a project management office (PMO) in order to avoid duplication of efforts, keep costs down, and ensure greater consistency across projects. The PMO could eventually become a long-term body that could draw on what had been learned from the experiences of the pilot. During the forum, it was mentioned that the government has selected a number of buildings for upgrading, based on urgent needs, and that to support the upgrading, it has chosen highly

qualified staff—in engineering, procurement, and (for the PMO) evaluation. And that is really a step toward institutionalization of a national program.

6. In terms of the sequencing of concrete steps: first, clearly determine funding requirements and sources, with the goal of procuring comprehensive funding that would be consistent throughout the implementation; and second, establish a quality assurance system for both the design phase and the construction phase.

Next Steps for Disaster-Resilient Schools and Hospitals

Dr. Kit Miyamoto, Senior Earthquake Engineer

The presentations from the previous day offer the following three lessons regarding upgrading:

1. Systematically upgrading certain structures is possible and greatly reduces fatalities.
2. Upgrading can be truly cost-effective: five existing buildings can be upgraded for the cost of constructing one building.
3. Upgrading can be multipurpose; for example, increasing schools' seismic resiliency also increases their typhoon and flood resiliency—important because schools are used for shelters—as well their overall functionality.

There are a number of vulnerable buildings located across Metro Manila, not only along the fault line but also where the soil is soft or where the quality of construction is poor. In the event of a daytime magnitude 7.2 earthquake, a projected 24,404 students would be killed in Metro Manila (see figure 12).

As discussed during the forum, the assessment sorted 3,821 school buildings in which fatalities would occur, from highest to lowest expected death rate. The analysis suggests that the highest death rates—20 or more students per schools—are concentrated in 5 percent of buildings. This means that 25 percent of the fatalities would occur in only 5 percent of the buildings. It means that the worst buildings cause almost 18 percent of fatalities, or around 4,320 deaths (see Figure 3).

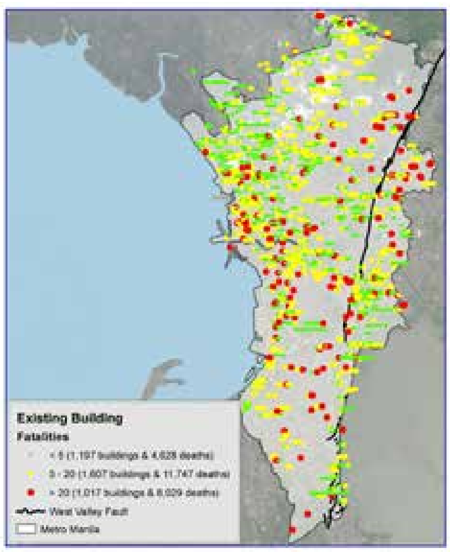

Figure 12. Projected fatalities for existing school buildings in Metro Manila.

Source: Kit Miyamoto, Miyamoto International; World Bank.

Upgrading 1,466 buildings, or 40 percent of the total building stock, could reduce potential student fatalities by 80 percent and save over 19,000 lives. Clearly, seismic upgrading can be very effective if properly targeted. Based on this type of assessment, Metro Manila should seek to upgrade 100 to 200 buildings for disaster risk reduction and functionality within two years; this would reduce student fatalities by 20 percent and enhance the disaster shelter safety of 17,000 school community members. Meeting this goal should be a cornerstone of a countrywide program (not part of a pilot that may be forgotten after completion), and it will require these five steps:

1. *Collection of current school building data*. Data collection should be coordinated with PHIVOLCS, DepEd, and DOH, with actual collection carried out by universities, technical agencies, and practicing engineers. (Timeline: two months.)
2. *Establishment of a project management office.* The PMO would oversee project execution and have implementation responsibility and authority. Once established, it would start the procurement process for design and construction. PMO's dedicated leadership and teamwork will be crucial for the program's success. (Timeline: two months.)

3. *Consultation on the draft earthquake upgrade guidelines.* An expert panel drawn from DPWH, University of the Philippines, professional associations, and other relevant organizations should modify and adapt the draft guidelines. A short training course for project engineers in implementing guidelines should also be developed. (Timeline: four months.)
4. *Establishment of a quality control system for engineering design and construction.* The quality control system would be under the PMO and would approve designs and construction plans. (Timeline: two months.)
5. *Implementation.* Implementation includes the following: updating existing risk data to determine which 100–200 building should be prioritized (timeline: 1 month); conducting a detailed assessment of 200 to 300 buildings, including estimating the cost of the work (6 months or longer); developing working drawings (12 months); and carrying out the actual construction (18 months). In terms of the implementation, the Philippine engineering community is best placed to take ownership of this task.

Synthesis and Roundtable Discussion

Experts discussing challenges and approaches to structural upgrading programs.

Ms. Jolanta Kryspin-Watson, Senior Disaster Risk Management Specialist, World Bank

Both presentations today make clear that we are talking about a cornerstone program and not little activities here and there, or pilots that will never be scaled up. Both emphasize the importance of streamlined and concentrated effort on implementation and of a single responsible authority. These are lessons learned from other programs that the World Bank has been involved in.

Discussion with Panel Speakers

The discussion focused on the following challenges and approaches to structural upgrading programs:

- **Determining the number of school buildings to be upgraded**. Currently, it is not clear which are the 100 most vulnerable structures in Metro Manila. DPWH is committed to taking action immediately on buildings in urgent need of retrofitting, and will then follow up with a more comprehensive program targeting another 100 to 200 buildings. This vision also depends on the timeline to complete 200 buildings. Even if the worst 100, 200, or 300 schools are being considered, there are still 4,000 schools in total in need of upgrading. This huge challenge requires a step-by-step approach. As discussed, it is not only school buildings that need upgrading but other types of buildings and facilities as well.

- **Clarifying the focus on schools.** A combination of factors makes schools a good starting point for a structural upgrading program: Schools are the simplest buildings to strengthen structurally. Moreover, improving schools' functionality has a positive impact on development. Finally, schools are often used as shelters during typhoons and other emergencies. This means that upgrading school classrooms will add to the resiliency of emergency shelters. Authorities need to prioritize among facilities, as projects that involve a variety of building types can be complicated. Prioritization of facilities needs to take into account not only technical aspects but also public expectations and other factors. A program to upgrade schools can be used to demonstrate the effect of upgrading. Based on the demonstration, other facilities should be gradually upgraded. For example, daycare centers are often more vulnerable than schools.

Panelists discussing implementation of national upgrading programs.

- **Ensuring flexibility and timelines in upgrading programs: The case of Istanbul:** During planning and managing of the ISMEP project, many details continued to change. There were a number of roundtable meetings to discuss these changes, which had to do in part with the results of progress evaluations. In order to manage expectations, the PMO's management system and the timeline established for the project needed to be realistic and to take such changes into account. For ISMEP, time was allocated to devise communications guidelines that would explain the works proposed to the public. For instance, programs need to set aside time for discussions with the public to explain why a specific school is being upgraded rather than another. They should also include the time needed to develop a training course for engineers.
- **Determining the size of the program.** Past experience suggests that the right project scale is important. In previous projects undertaken by the DepEd in the Philippines, major construction firms worked with engineering firms in Manila to design and build schools. After the earthquake of 1990, a lot of bridges in central Luzon were retrofitted, and lessons could be drawn from these projects, too, to determine the right size of the program. The seismic retrofit of a one- or two-story building is not very difficult and does not need to be done by a large industry group.
- **Integrating capacity-building and training into the program.** International and national experience shows that training of trainers is very important, especially capacity building among local municipal engineers who would be involved in upgrading programs in their respective provinces. Training of trainers can be carried out during a program's pilot phase.

- **Determining the role of the PMO: The case of Istanbul.** Having a single agency responsible for leading a program allows it to steadily gain the necessary experience. Each year, as ISMEP dealt with different building types and different standards, the PMO gained new experience. In the second and third years of the project, the project team members' self-confidence and trust increased with each subproject completed. Even a large city can benefit from having a single PMO in charge: metropolitan cities have different kinds of schools for different uses, and the PMO can gradually gain experience to deal with this variety. The PMO can also ensure coordination of the different agencies involved, which helps to keep the project on track, and it can communicate necessary steps to the public.
- **Involving private industry.** There are a number of ways for private industry to participate in such a program. Businesses can (1) consult with the PMO; (2) participate in the design phase; (3) be involved in the evaluation of the design, both for permitting and approval of the construction documents, calculations, and specifications; (4) be involved in the construction itself as general contractors; (5) be involved in the inspection of the materials; and (6) manage a specific building within the overall project. In general, participation of small businesses can help generate more knowledgeable and competent certified engineers and contractors, who would actively seek a role in ongoing efforts by government to seismically upgrade facilities. At the same time, the involvement of more small businesses and small contracts can be a little more complex than the involvement of fewer larger firms. In Romania for example, the project involved 84 buildings, and over 40 designers worked on 2 buildings. A small company of 10 engineers was normally able to handle about 20 buildings.
- **Determining the size of the technical team.** The size of the city and the scale of the program can guide the size of the team needed. In Turkey, strengthening schemes were categorized and then matched to the appropriate buildings. This helped determine the size of the teams needed and allowed the program to progress quickly.
- **Managing the bidding process.** In the tendering process, it is important to select the right consultant both for the design and the construction. Sufficient time needs to be allocated for this step, especially if there are any special regulations that apply to such a selection. In Turkey, the competitive bidding process—collecting and reviewing the prequalification packages from the different consultants, collecting the bids, creating a short list, and making the decision—can be very time-consuming. A similarly lengthy process is required for the construction and the construction supervision.
- **Ensuring institutional commitment.** In the Philippines, resilient infrastructure is one of the outcomes that the NDRRMC aims to achieve in the next 20 years, and it is also a goal of the NDRRMC's prevention and mitigation subcommittee. Thus a long-term vision and an institutional commitment already exist.
- **Institutional coordination and partnerships.** In the Philippines, coordination is needed between the line ministries (DPWH, DOH, DepEd, etc.) and the technical agencies (PHIVOLC, PAGASA, etc.). In terms of partnerships, DPWH plans to enter into a memorandum of agreement with the University of the Philippines and several professional organizations.
- **Justifying investments for upgrading.** The cost of the damage from a disaster can be quantified, but so can the benefits and impacts of an upgrading program. For the economic assessment of the investment, risk is considered along with the cost of avoiding losses, based on historical loss data. Some governments, including Japan and the state of California in the United States, have priced "life" into the formula for the economic losses. When devising the ISMEP program, Istanbul also carried out economic analysis for increasing public safety.

Taking actions now is preparing for the future.

Closing Remarks

Undersecretary Raul C. Asis, Department of Public Works and Highways

To start, let me convey a message form Secretary Singson, who would like to assure the participants that DPWH stands firm in its commitment to fund and implement works strengthening the resilience of critical infrastructure.

To support implementation and initiate the first round of upgrading, the DPWH needs specific systems. Most of these are in place, but some require modification. For example, the preliminary population screening for the project requires a rapid assessment tool, but that alone might not be enough to provide all the necessary information for prioritization. External help is needed in the form of technical assistance from another national government agency or institution to determine a set of relevant criteria for the 200-structure project. DPWH needs also help with the preliminary and detailed engineering.

DPWH has already standardized the buildings in terms of their ability to withstand seismic impact. In terms of the ability to withstand winds, because of Typhoon Pablo, the standard is set for winds over 250 km/h. Given that we have standard designs, we can import other parameters, such as school characteristics or school location with respect to the existing fault lines. Building templates may be available, so we might not need a lot of resources in actual design.

Concerning procurement: DPWH would fund this project locally if it is implemented within next 14 months. In this case, it would fall under the purview of RA 9194, the new procurement law. We have relevant experience, and capacity to manage the implementation of this program.

Regarding implementation: while DPWH is carrying out engineering prioritization, training is needed for those who will be supervising the project, since they might be called on to perform tasks with unfamiliar specifications, and the department does not currently have people with the necessary experience. External help will be needed for this. The department has a good monitoring system that can be used for the project. Monitoring and evaluation is very important for identifying problems, particularly during implementation, so issues can be addressed and corrected, rather than ignored or repeated.

In terms of the institutional arrangement, DPWH can go ahead with the project with a unit potentially composed of two and five cabinet secretaries. If the priority is schools, then DepEd and DPWH should be involved, as well as other agencies, including the PMO. This is where the University of the Philippines could play a role, as well as other professional organizations included in the memorandum of agreement.

To conclude, taking actions now is preparing for the future. The Philippine road map leads to infrastructural efficiency for present and future generations. On behalf of DPWH and Secretary Rogelio Singson, we thank the World Bank for sharing its knowledge and expertise in resiliency, and we especially thank all those who came from other countries to share their lessons with us.

Annex 1

Agenda: Forum on Safe and Resilient Infrastructure

October 1, 2013

8:00–8:30 AM Registration

8:30–9:15 **Opening Ceremony: Keynote Address and Overview of the Program**

Keynote Address
Hon. Rogelio Singson, *Secretary, Department of Public Works and Highways*

Partnership for Resilience: Supporting the Philippine Disaster Risk Management Agenda
Mr. Motoo Konishi, *Philippines Country Director, World Bank*

9:15–10:10 **SESSION 1: PUTTING IN PLACE AN AGENDA FOR STRUCTURAL RESILIENCE**
Chair: **Hon. Rogelio Singson**, *Secretary, Department of Public Works and Highways*
Co-chair: **Mr. Ousmane Dione**, *Sector Manager, Philippines Sustainable Development, World Bank*

Safer Philippine Communities through Stronger Public Facilities
Mr. Abhas Jha, *Sector Manager, Transport, Urban, and DRM, East Asia and the Pacific, World Bank*

Resilience in the Philippines: A Cross-Sectoral Effort
Presenter: **Dr. Benito Pacheco**, *Professor, University of the Philippines*

Earthquake Disaster Risk in Manila: Feasible Solutions to Save Lives in Schools and Hospitals
Dr. H. Kit Miyamoto, *Senior Earthquake Engineer*

10:10–10:25 Break

10:25–12:00 **International Experience in Structural Retrofitting**
Mr. Peter Yanev, *Senior Structural Resilience Specialist*

Istanbul Seismic Risk Mitigation and Emergency Preparedness Program
Mr. Kazim Gokhan Elgin, *Director, Istanbul Project Coordination Unit*

12:00–1:00 PM	Lunch
1:00–2:40	**SESSION 2, PART A: INTERNATIONAL STRUCTURAL RESILIENCE AND RETROFITTING PROGRAMS** Chair: **Hon. Francis Tolentino**, *Chairman, Metropolitan Manila Development Authority* Co-chair: **Dr. H. Kit Miyamoto**, *Senior Earthquake Engineer* **Romania Hazard Risk Mitigation and Emergency Preparedness Project: Earthquake Risk Reduction Component** **Ms. Stela Petrescu**, *Director (Ret.), Project Management Unit, Ministry of Regional Development and Public Administration* **Japanese Experience in Seismic Design and Retrofitting** **Dr. Tatsuo Narafu**, *Senior Advisor, Japan International Cooperation Agency* **Improving Earthquake Resilience in Latin America** **Mr. Niels Holm-Nielsen**, *Lead Disaster Risk Management Specialist, World Bank*
2:40–3:00	Break
3:00–4:30	**SESSION 2, PART B: INTERNATIONAL STRUCTURAL RESILIENCE AND RETROFITTING PROGRAMS** **Indonesia Safe Schools Program** **Dr. Fauzan, Head**, *Disaster Mitigation Center, Universitas Andalas* **Philippine Safe Schools Campaign** **Engr. Annabelle Pangan**, Department of Education **Hospitals Safe from Disaster: The Department of Health Safe Hospitals Program** **Dr. Asuncion Anden**, Department of Health **Open Forum and Synthesis** **Dr. H. Kit Miyamoto**
4:30–4:45	**Closing Remarks** **Undersecretary Eduardo del Rosario**, Office of Civil Defense, National Disaster Risk Reduction and Management Council

Annex 2

Agenda: Government Executive Meeting on Safe and Resilient Infrastructure

October 2, 2013

Chair: Undersecretary Raul C. Asis, Department of Public Works and Highways

Co-chair: Ms. Jolanta Kryspin-Watson, Senior Disaster Risk Management Specialist, World Bank

9:30–9:40 AM **Introduction of the Participants**

9:40–9:55 **Roadmap to Structural Resilience: Key Policy Recommendations**
Dr. Benito Pacheco, *Professor, University of the Philippines*

9:55–10:10 **Next Steps for Disaster-Resilient Schools and Hospitals**
Dr. H. Kit Miyamoto, *Senior Earthquake Specialist*

10:10–11:30 **Roundtable Discussion: Options for a Phased Structural Resilience Program in the Philippines**

11:30–11:40 **Synthesis/Highlights of the Forum**
Ms. Jolanta Kryspin-Watson, *Senior Disaster Risk Management Specialist, World Bank*

11:40–12:00 **Way Forward and Closing Remarks**
The Philippines' Roadmap for Safe and Resilient Infrastructure
Undersecretary Raul C. Asis, *Department of Public Works and Highways*

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