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The Great Eastern Earthquake and Lessons for Canada

By David W. Edgington

Japan's Sanriku coast in the north-east of the country has a well-documented history of significant seismic activity. The tri-fold disaster that recently hit Japan has put the country's recovery efforts to its greatest test since WWII. Reflecting on Japan's response to major earthquakes in 1995 and 2004 provides a glimpse into how the country has recovered and rebuilt through difficult times. With similar seismic activity predicted to hit the west coast of Canada in the future, how well-prepared is Canada and can we learn from Japan's experience?

The Great Eastern Japan Earthquake (higashi nihon dai shinsai) that hit Japan on March 11 was the greatest natural disaster in Japan's recorded history. At the time of this writing, the northeastern and eastern parts of Japan's main island (Honshu) are still coping with its aftermath. Although initial recovery and reconstruction is already underway, it will probably take years for the most hard-hit areas in the city of Sendai and surrounding coastal communities to fully recover from the devastation caused by the earthquake and the tsunami that followed. Some may never recover.

This review covers the estimates of damage and destruction of the Great Eastern Japan Earthquake, and focuses on the immediate emergency and rescue response compared to other recent earthquake in Japan, and then points to what can be learned from these events for the forthcoming earthquake in the Cascadia region of Canada.

The Great Eastern Earthquake was the biggest earthquake to hit Japan since officials began keeping records in the late 1800s struck off the country's northeast coast March 11 at 2:46 p.m. local time. It was at first designated a magnitude 8.9 and later raised to 9.0. The initial quake was followed by hundreds of aftershocks, some of them more than magnitude 6.0, and triggered a tsunami that swallowed homes, swept away cars and boats and forced people to scramble to higher ground. Japanese officials have reported that almost 8,500 people have died and almost 13,000 are missing.

The quake struck at a depth of 24 kilometres, about 125 kilometres off the northeastern coast of Japan. The massive wave it triggered swamped dikes in the Japan's northeast. leaving a massive trail of debris. The most affected cities and towns were metropolitan Sendai (one million population), Miyako city, Minami Sanriku village and Soma town-



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ship. Scores of other small towns and villages along the 300-kilometre stretch of coastline were shaken by violent tremors that also reached as far away as Tokyo, hundreds of kilometres from the quake's epicentre. The International Red Cross had said more than four million households were without power. Eight days after the event, about 343,000 Japanese households still did not have electricity, and about one million had no running water. While the affected area is known more for forestry, agriculture and fishing, some important industrial plants are located there. For instance, Shin-Etsu Handotai's Shirakawa plant, in Fukushima Prefecture. manufactured about 22% of total silicon wafer demand in the world in 2010, and is currently out of production. The World Bank has estimated that total damages would cost up to \$235 billion, and on top of this the government has to cope with problems of food contamination from the stricken Fukushima Daiichi Nuclear Power Plant.



Mapping out the Great Tohoku Earthquake that struck the east coast of Honshu on March 11, 2011. (Credit: Government of British Columbia)

LESSONS FROM JAPAN'S RESPONSE TO THE KOBE AND NIIGATA EARTHQUAKES

How well prepared was Japan for the 9.0 magnitude tremor that occurred off the coast from Miyagi, Iwate and Fukushima prefectures on March 11? The most useful benchmark is a comparison to earlier events.

Japan has experienced two other catastrophic earthquakes in the post-1945 period. In January 1995 the densely populated Japanese city of Kobe was also devastated by a major quake (7.0 on the Japanese scale), and it is interesting to reflect on just how prepared the country was when the much larger 9.0 magnitude tremor occurred off the coast from Mi-

yagi, lwate and Fujushima prefectures.

Total fatalities from the Kobe guake (called the Hanshin-Awaji Dai-shinsai) amounted to 6,279 and the cost of damage was around \$100 billion. The initial days following the quake in Kobe were a wake-up call for Japan in many ways. For one, the guake came just a few years before the widespread introduction of cell phones and the internet, and reports of the guake's magnitude, the mounting numbers of deaths and injured, and the desperate situation of the survivors were slow to reach the national government in Tokyo. Under then-existing protocols established by Japan's disaster-response legislation enacted in the early 1960s, local governments had to request emergency support and would only receive it if a state of emergency could be proved. This overly bureaucratic process and the lack of effective communication with Tokyo caused critical delays in Kobe, and the Self-Defense Forces (SDF) – Japan's equivalent of the US National Guard – were not sent in large numbers for four days and this delay led to many unnecessary deaths and suffering.

Local governments – both Kobe city and the surrounding Hyogo prefecture – were also censured, mainly for not taking immediate command over key emergency routes (to avoid traffic congestion), for the general shortage of water for fighting the post-earthquake firms, and for having no immediate means to call in firefighting units and ambulance services from nearby cities unaffected by the quake. In addition, Japan refused initially to allow international aid, and this was seen by domestic and overseas mass media as an act of vanity by a government unwilling to admit it could not manage the problem alone. Needless to say, the authorities' efforts were widely criticized as slow and badly synchronized.



Relief workers carrying food in Minami Sanriku, Japan (Credit: Audioaficionado.org)

Following Kobe, the nation's emergency relief effort was tested again in October 2004, when a series of quakes with magnitude 7.0 impacted the rural and mountainous region of Niigata prefecture on Japan's west coast (Niigata-ken Chuetsu Jishin). This time there were no wide-spread tsunamis, but a small number of deaths occurred due to collapsed buildings, and over 3,000 injuries were reported in Niigata prefecture. Over one hundred thousand people fled their homes. For the first time in its history, a Shinkansen (rapid 'bullet' line) train derailed while in service. Still, the response from Tokyo was much quicker and by the morning after the Saturday evening earthquake, the national government's Self-Defence Forces opened a disaster headquarters in the city of Ojiya to coordinate relief efforts, and used 300 SDF personnel, 21 helicopters, and 65 vehicles to transport food and water to evacuation sites. They also evacuated tens of thousands of residents to emergency shelters, and used helicopters to airlift stranded villagers from the isolated towns and hill-side hamlets. Members of the Tokyo Metropolitan Fire Brigade were also sent to assist with rescue operations. Nonetheless, a number of factors significantly impeded emergency response, including the many landslides that severed access to rural settlements, and the large number of sizable aftershocks. These two disasters these provided valuable lessons for the government's response to the Great Eastern Japan Earthquake in terms of the importance of good communications between local governments and Tokyo decision-makers, and the need to quickly mobilize search and rescue forces.

In the months and years following the large disaster events of 1995 and 2004, both national and local governments were involved in long-term reconstruction planning, with the geography of each location demanding a different set of responses; mainly involving urban renewal in Kobe and restoring an agricultural economy in the many dispersed mountain towns and villages in the `snow country' of Niigata. Because of the extensive landsliding, many communities there have had to face difficult decisions regarding possible relocation or abandonment of their village sites. In Kobe, the national government funded an international airport for the city on reclaimed land, and a number of other incentives in the emerging bio-technology sector to help the city recover its economic base. Population in the Kobe region dropped by 10 per cent after the quake and took a full 10 years to recover. Some districts have recorded only 80 per cent recovery.

After the 1995 Kobe and 2004 Niigata Chuestu earthquake disasters, the Japanese government improved its disaster reduction systems to focus equally on effective recovery and reconstruction processes as well as speedy disaster response to minimize deaths and damage. Before the Kobe earthquake, Japan's earthquake and disaster risk management depended primarily on structural engineering aspects and the need to have 'earthquake-proof' infrastructure. However, the Kobe earthquake revealed the importance of good communication and coordination, while the Niigata Chuetsu disaster stressed the vulnerability of isolated communities in Japan, the particular challenges of a declining agricultural economy and the large elderly population in the villages affected.

JAPAN – ISSUES REMAINING AND IMPLICATIONS FOR THE FUTURE

In terms of directing large numbers of search and rescue forces following the disaster then Japan has come a long way. We have seen a rapid mobilization by Japan's SDF who have played a critical role in the largest relief efforts in the post-war history. In order to gain the upper hand on the humanitarian relief of the survivors and injured, the government has sent around 100,000 personnel to the stricken area and accepted help from the US Navy as the US Department of Defense launched Operation Tomodachi (or friends). This stands in stark contrast with the Great Hanshin-Awaji Earthquake in 1995, when a relatively strong anti-military sentiment among both Prime Minister Muruyama and local leaders contributed to their delayed deployment for relief activities. The SDF has also played an important role in preventing a meltdown at the crippled nuclear power plant in Fukushima. In other respects the continued vulnerability of elderly survivors, many of whom were in hospitals and nursing homes represent a challenge common to all three Japanese disasters.

Clearly, for the long-term credibility of the Japanese government it is essential for the administration of Naoto Kan to be seen to be taking effective leadership in restoring communications, distributing food, gasoline, drinking water and medical supplies.



Prime Minister Naoto Kan leads a meeting at the Headquarters for Emergency Disaster Response for the 2011 Tohoku Earthquake and Nuclear Emergency Response Headquarters at the Prime Minister's Office. (Credit: Cabinet Public Relations Office, Government of Japan)

IMPLICATIONS FOR CANADA

So, to what degree are we prepared for an earthquake and tsunami in Vancouver and Victoria? The Great Eastern Earthquake in Japan is really a carbon copy of what we can expect on our coast, not necessarily this year, next year, or even 50 years from now, but we will get an earthquake of that magnitude—possibly even larger. In the Cascadia region similar sized earthquakes and tsunami occur average about once every 500 years. We had one in AD 1700 and many risk analysts predict a 30 per cent chance of another within the next 50 years. It is not a matter of if, but a matter of when.

A particular unique aspect of a great Cascadia earthquake is the strong likelihood that the three greater metropolitan areas of Portland, Seattle, and Vancouver will simultaneously feel the effects of strong and sustained ground shaking. This wide-spread ground shaking combined with accompanying elevation changes and the likely generation of a tsunami along the Pacific coast, will cause loss of life, property damage, and business interruption in vulnerable locations throughout southwestern British Columbia, Washington, Oregon, and northwestern California. The wide geographic distribution of damaging impacts will generate special challenges and severely stress the response and recovery resources of the three Pacific states and British Columbia. A combined international recovery involving the US as well as the Canadian federal governments will be necessary.

For Vancouver, it has been widely reported that at least 8,000 of our older buildings are at risk of catastrophic damage, including housing and hotels for low-income residents in the Downtown Eastside district, Yaletown and Chinatown. Low-lying land in Richmond, Delta and elsewhere could be inundated by a tsunami and land in these municipalities broken by liquefaction. The damage to the port facilities and airport in Vancouver is likely to be the most worrying impact on the local economy. In the case of Kobe, the local port was out of action for two years, and many small-scale factories making shoes, sake, roofing tiles and pearls never recovered fully. Extra bonds and taxation were involved in covering the \$100 billion infrastructure spending.

Many Japanese had only 15 to 25 minutes to flee to higher ground after the earthquake struck on March 11th. Still, the local tsunami and earthquake preparedness, which includes evacuation drills, escape routes and towering shelters, prevented countless deaths. Our disaster prevention and response is good in BC, and the province, municipalities and regional districts have dedicated Emergency Management Offices to analyze risk, issue mitigation programs, and plan for response, recovery and rebuilding. But the fear is that a large earthquake in the Cascadia region would likely overwhelm our local government capacity to respond adequately. In contrast, the new social network infrastructure – should it be working – will allow local volunteers to give assistance in the recovery phase to the most affected areas.

The role of the Canadian military will be extensive, as in Japan, and their task will be to work with the civilian authorities both at the provincial and local government level, including the restoration of health services, evacuations, communication, and management of logistics which is always a major undertaking. However, it is worth knowing that because the nearest major army contingent to the west coast is currently in Alberta, disaster rescue plans depend on individuals in the stricken zone having enough food and water to survive for three days if there is an earthquake. Clearly, this plan has not yet been implemented fully and there is a huge challenge to increase people's awareness of the consequences of a forthcoming disaster.

In all, the three disasters in Japan indicate that an 'ounce of prevention' is worth a 'full pound' of trouble after a major disaster event. At both the individual and community level there is a need to learn about the risks and hazards involved, draw up emergency plans, and be well-prepared at home, school and at work.

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