ENABLING CLIMATE AND DISASTER RESILIENT RAILS

Railway station platform in New Alipur, Kolkata. India's national railway system is the fourth largest in the world. Photo credit: S. B. Stock, Shutterstock

AT A GLANCE

Region: Global

Risks:
Floods and earthquakes

DRAWING ON LESSONS FROM JAPANESE BEST PRACTICES IN RESILIENT RAIL DEVELOPMENT AND OPERATIONS.

By providing high-level practical guidance around climate and natural hazard resilience in urban rail projects, as well as Just-in-Time support, the Japan Program has supported governments in India, Peru and Ecuador in strengthening the resilience of their complex rail systems.

While there has been significant work recently on how to understand the impacts of rising global temperatures, water encroachment on coastal regions, increasingly severe storm surges, and other effects of climate change on road infrastructure, there is very little existing guidance on climate adaptation and disaster resilience for rail projects. Within the World Bank, there are 19 ongoing lending operations on intercity railways with a total commitment of US$7.5 billion as well as seven urban rail projects with a total commitment of US$2 billion. Recognizing that there is limited existing guidance on disaster and climate resilience for rail projects, the **Japan-World Bank Program for Mainstreaming Disaster Risk Management in Developing Countries** supported the development of a global knowledge program on climate and disaster resilient rails in order to fill this knowledge gap, drawing from Japanese and global experience and expertise in addressing these issues at home.

To address the knowledge gap, technical teams began by synthesizing good practice in considering resilience in all phases of rail project development into methodological guidance by producing a series of technical working papers and guidance notes on key issues of resilience in the urban rail context. This data then informed the "Climate and Natural Hazard Resilience in Urban Rail Projects" chapter of the World Bank's global Urban Rail Project Development Handbook, a flagship report and strategic document informing the preparation of all World Bank urban rail operations. Japanese best practices were leveraged in the development of this chapter. For example, the 2011 Great East Japan Earthquake saw damage to 325 kilometers of railway, mostly as a result of the subsequent tsunami. A majority of railway facilities had already completed seismic reinforcement including revised seismic codes and stricter safety standards. The

handbook, published in the World Bank's Open Knowledge Repository, presents high-level practical guidance for policymakers to practitioners, and has been converted into an e-learning course available to the public at the World Bank's Open Learning Campus.

Japan's experience in the context of earthquake protection and resilience proved invaluable as Ecuador and Peru embarked on their first metro rail projects, Quito Metro Line 1 and Lima Metro Line 2 respectively. Peru and Ecuador are in the Pacific "Ring of Fire", an area where 90 percent of the world's earthquakes occur. With their populations concentrated in cities, coupled with their exposure to seismic hazard, Peru and Ecuador face one of the greatest disaster risks in the world. For example, in April 2016, a 7.8 magnitude earthquake occurred in Ecuador, the most destructive in recent history, killing 676 people, injuring 6,274, displacing 80,000, and causing an estimated US$3.3 billion in damages.

Looking to the future with the goal of saving lives and minimizing damages, the governments of Ecuador and Peru sought operational support in developing seismic resilient designs and standards for their inaugural metro projects, which was the focus at the Just-in-Time Knowledge Exchange Workshop on Seismic Resilience and Underground Metro Structures in July 2017 in Lima. Attended by Japanese transport and engineering experts as well as project teams from Peru and Ecuador, Japanese experts shared good practices on seismic standards, early warning systems and emergency preparedness and response planning while also reviewing the engineering designs of the underground structures to enhance seismic resilience. In addition to the workshop, Japanese experts reviewed the design of emergency exits and seismic standards of the Lima Metro Line 2 project and made recommendations. These knowledge exchange opportunities armed Peruvian and Ecuadorian government officials and practitioners with increased knowledge and capacity to develop and implement their resilient rails projects. More specifically, each government also opted to adapt established seismic norms for underground structures to their projects thereby creating a more resilient system from the outset.

Dedicated Freight Corridor Corporation of India Limited (DFCCIL), a Government of India enterprise, also sought to enhance the climate resilience of its ongoing Eastern Dedicated Freight Corridor (EDFC) Project, a US$ 2.1 billion program financed by the World Bank. Studies show that increasing intensity and frequency of natural hazards due to factors, such as climate change, impacts from weather-related shocks are likely to increase. India's rail network, which is one of the most extensive in the world, transporting as many as 8 billion passengers annually and 1.1 billion tons of freight, is vulnerable to these shocks.

The first step for the technical team was to conduct a study on how to increase disaster resilience of the Eastern Dedicated Freight Corridor (EDFC). The report, Strengthening Climate Resilience of EDFC, provides recommendations for appropriate early warning systems and measures for strengthening operational emergency preparedness and weather hazard resilience. Next, Japanese resilience experts shared their experiences through a stakeholder workshop and provided guidance to DFCCIL on how to integrate critical climate change parameters such as temperature variations, floods and fog; resilience-enhancing measures in design, planning and operations and maintenance; as well as rail early warning systems for earthquakes; and processes of setting regulations for rainfall that inform such warning systems. DFCCIL now considers climate resilience risks in the design of its freight corridors and has initiated dialogue with the Indian Meteorological Department for advance sharing of hydromet information that will help to streamline and improve operations of DFCCIL.

RESULTS HIGHLIGHTS

Knowledge deepened and capacity increased

Japanese experiences and knowledge are shared as case studies and lessons learned from past disasters in the "Climate and Natural Hazard Resilience in Urban Rail Projects" chapter of the World Bank's Urban Rail Project Development Handbook, a flagship report informing the preparation of all World Bank urban rail operations. For example, in India, findings from this report have been incorporated into the analysis, discussion and recommendations for the resilient rails investments for the EDFC, specifically addressing resilience enhancing measures in design, planning, and operations and maintenance, as well as early warning systems for earthquakes.

A cross-sectoral approach promotes resilience

DFCCIL now considers climate resilience risks in the design of freight corridors and have initiated dialogue across sectors for advance sharing of hydromet information that will help improve overall operations.

LESSON LEARNED

A holistic approach to urban rail systems

One of the key takeaways from the knowledge exchange opportunities was that resilience thinking should extend beyond specific climate-related and other natural hazards to encompass the ability of urban rail systems, and the cities within which they operate, to prepare and plan for, absorb, recover from, or adapt to any adverse events during the system's operational life. International experience suggests that investments in measures that enhance the resilience of urban rail systems pay off in the face of hazards and can enhance efficiency and safety of the rail system during normal operations.

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