

Contact:

Karen E. Philbrick, Ph.D.
MTI Executive Director
408.924.7562
karen.philbrick@sjsu.edu

US High-Speed Rail Can Learn from Japan's Successful Earthquake Early Warning System

Mineta Transportation Institute: Detailed training also critical

San Jose, CA – May 10, 2016 – As California and other states move forward with high-speed rail plans, some have questioned the system's ability to withstand earthquakes. This is especially critical in California, an active quake zone. A recent peer-reviewed research report from the [Mineta Transportation Institute](#) says that valuable lessons are easily adapted from Japan's successes with its early earthquake warning (EEW) systems. [Great East Japan Earthquake, JR East Mitigation Successes, and Lessons for California High-Speed Rail](#). This was most recently demonstrated during the series of violent quakes that shook Japan in mid-April, 2016. The principal investigators were Frances Edwards, PhD, and Daniel Goodrich, MPA, working with an academic and professional research team.

Japan Rail developed systems to mitigate the damage to its facilities and personnel, including an early earthquake warning system, retrofitting existing facilities for seismic safety, developing more seismically resistant designs for new facilities, and holding earthquake response training and exercises for company staff and passengers.

“These systems demonstrated their value in the Great East Japan Earthquake of 2011 and have been further developed based on that experience,” said Dr. Edwards. “Researchers in California are developing an EEW system for the state, and the private sector has a few seismic sensors in place. These technologies could contribute to the safety of the California High-Speed Rail Authority's developing system, which could emulate Japan's best practices.”

The JR East EEW system stops the train, prompting a response from passengers and staff. Detailed staff training in Japan was largely responsible for the subsequent lifesaving activities that moved passengers and staff out of harm's way. There were no passenger or crew deaths on any JR East trains, including the bullet trains, during the 2011 triple disaster. For this report, the types of training and exercise activities used in Japan are evaluated for applicability to California rail systems.

That disaster's impact and its three-fold aspects (earthquake, tsunami, and nuclear event) also provided valuable information for the California High-Speed Rail Authority's (CHSRA) system. The insights are being leveraged and adapted to build greater safety for passengers and crew.

Scientist and specialist for the seismic detection “P Wave Sensor” system, Mr. Shunta Noda, who helped develop the early earthquake warning system for the high-speed rail in Kyushu, is part of Japan's Railway Technical Research Institute. He and his team are currently working in collaboration with the USGS in Menlo Park to expedite the development of this innovative new earthquake early warning technology for California. Noda contributed information for MTI's report and is helping to develop the California earthquake early warning technology.

The MTI report explains the physics of seismic events before delving into the evolution of warning systems. It also describes the extensive training that JR East provides for its employees so they can assist during a disaster.

JR East provided MTI's research team with reports that are rarely available to Western researchers on EEW system performance; seismic resistance and resilience research related to columns, piers and bridges; and staff training. The authors conducted extensive EEW research through the Berkeley Seismic Laboratory, at the sites of existing installed EEW systems, and structural engineering research on seismic resistance through private engineering activities.

JR East's Earthquake Early Warning System was invented and deployed by the Railway Technical Research Institute, which is subsidized by JR companies such as JR East, West, Central, and four smaller companies.

For a free, no-registration download, go to <http://transweb.sjsu.edu/project/1225.html>

Tweet this: @MinetaTrans report: Japan's 2011 quake has lessons in early warnings for #high-speed rail. Free download. <http://ow.ly/M26Bs>

ABOUT THE THE RESEARCH TEAM

Frances L. Edwards, PhD, CEM is deputy director of the National Transportation Safety and Security Center at Mineta Transportation Institute, professor of political science, and director of the MPA program at San Jose State University.

Daniel Goodrich, MPA, CEM, is a research associate with the Mineta Transportation Institute at San Jose State University and a lecturer in the Master of Science in Transportation Management programs.

Margaret Hellweg, Dr.rer.nat., is operations manager at the University of California Berkeley Seismological Laboratory.

Jennifer Strauss, PhD, is external relations officer for the Berkeley Seismological Laboratory, serving as the head of the Earthquake Research Affiliate Program.

Martin Eskijian, MS, PE, is an engineer specializing in structural dynamics, reservoir engineering, and structural engineering/code development for marine oil and LNG terminals.

Omar Jaradat, PhD, PE is a registered civil engineer with Moffatt Nichol specializing in earthquake engineering, soil-structure interaction and non-linear structural analysis.

ABOUT THE MINETA TRANSPORTATION INSTITUTE

The Mineta Transportation Institute (MTI) conducts research, education, and technology transfer programs regarding surface transportation policy and management issues, especially related to transit. Congress established MTI in 1991 as part of the Intermodal Surface Transportation Efficiency Act. MTI won national re-designation competitions in 2002, 2006 and 2012. The Institute is funded through the US Department of Transportation, the US Department of Homeland Security, the California Department of Transportation, and public and private grants. The internationally respected members of the MTI Board of Trustees represent all major surface transportation modes. MTI, the lead institute for the nine-university Mineta National Transit Research Consortium, is affiliated with San Jose (CA) State University's Lucas College and Graduate School of Business. Visit transweb.sjsu.edu

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