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Port Strategy » Archive » 2009 » December » News extra » Crane study shakes things up

News extra

Crane study shakes things up

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Concerns around the vulnerability of container cranes to even moderate earthquakes has triggered a US-based seismic performance study which is due to take place this week.

Prof Glenn Rix: Crane operations critical to "post disaster recovery" as well as port viability

It is especially pertinent, says Glenn Rix, professor of Civil Engineering at Georgia Institute of Technology, because cranes' continued operation after an earthquake is critical to the continued viability of the port as well as post-disaster recovery for the region in which it is located - and replacement of a failed crane structure can take more than a year.

"For example, during the 1995 Kobe, Japan, earthquake, a considerable fraction of the container cranes at the Port of Kobe either collapsed or were damaged beyond repair, leading to significant economic losses for the port and the surrounding region," he says.

Despite their importance, the seismic performance of cranes has not been studied in the United States until now.

Reginald DesRoches and Roberto T Leon of Georgia Tech explain further: "Cranes are usually designed as rigid frames with little or no seismic detailing." Further, they typically are designed to carry heavy goods, while resisting large environmental and berthing loads. As the research professors add, all this "results in large seismic forces being transferred to these structures."

Earthquake causes a range of crane damages. These run from derailing (which only takes days to remedy) to localised structural damage to the crane (which takes months to repair) and most severely, collapse - which necessitates replacement.

Georgia Tech has designed a one-tenth scale model of a container crane that is being tested on a large scale shake table at the University at Buffalo. The objective of the test is to measure the response of the crane from small levels of shaking to those large enough to cause the test-crane to collapse.

When damage occurs in the test crane, repairs similar to those used in the field will be made to the structure – and then the cranes will be tested again to determine how well the repairs perform during subsequent earthquakes. The upcoming test will be the largest ever performed in the United States and the first shake table test in the world to test a container crane model all the way to collapse.

The information from the test will be used to verify computer models, assess the expected performance of existing container cranes and, if necessary, design retrofit measures as well as developing improved design standards.

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