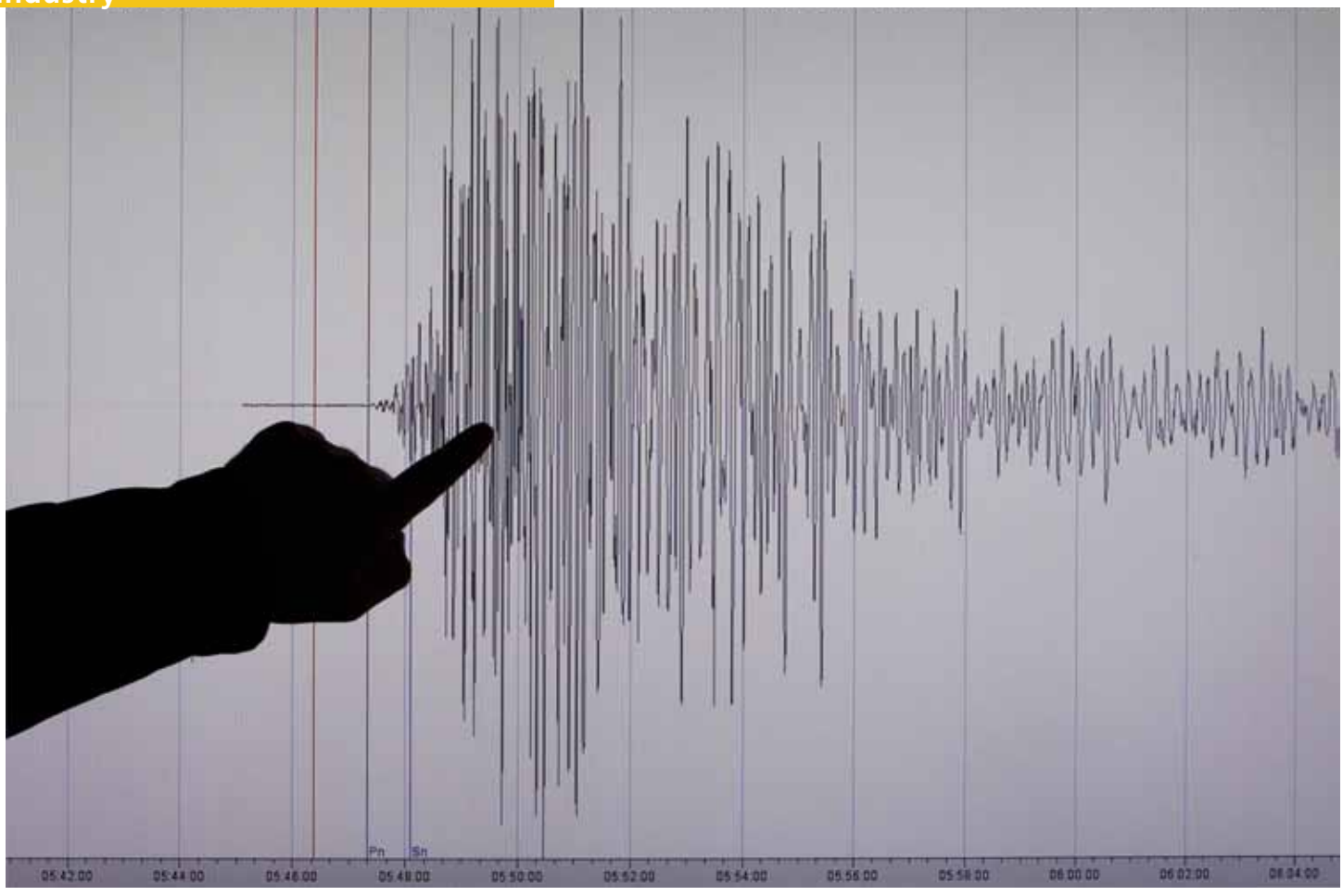

Seismic Spike

A rash of natural disasters and the development of Big Box Stores have boosted the demand for seismic resistant construction

In the United States, one of the major changes in warehouse seismic safety regulations has been the rising use of steel selective racks in areas accessible to the public. Since first being widely introduced about 25 years ago, the number of "big box" stores like Home Depot, Costco, Sam's Club or Lowe's has increased dramatically. Such stores, where products are displayed using storage racks in public areas - "warehouse style" - have further forced changes in seismic requirements. During an earthquake, occupant safety in these stores depends on the structural performance of the building and on the stability of the shelves and their contents. Seismic motions can cause racks to collapse, overturn, or goods can spill or topple off if racks are not properly designed, installed, maintained and loaded. The Occupational Safety and Health Administration (OSHA) mandated that warehouse employees be trained for safety procedures, but these measures are hard to implement in a facility open to general consumers. Therefore, the product on display must be secured to a degree that will keep everyone safe if the ground starts shaking.

Seismic force levels, an estimate of the largest possible earthquake in a given location based on geological calculations, were only considered in certain earthquake-prone locations. But major revisions to the International Building Code (IBC) have changed the requirements, which now mandate that every construction project, including warehouses, must include and

meet a seismic design category (structural and non-structural elements designed to prevent damage and loss of life in case of an earthquake), even those locations that have not required seismic installations in the past. The reason to fully protect all zones throughout the U.S is that areas considered less prone to earthquakes (low probability, high consequence) have not been built to resist seismic movement and are far less protected from disaster.

The need to build stronger, more stable structures has become painfully evident recently. In 2010, first Haiti then Chile were battered by magnitude 7 and 8.8 earthquakes respectively and in 2011 Japan by a magnitude 9. In the case of Japan, the triple strike of a magnitude 9 quake, ensuing tsunamis and nuclear plant malfunction, resulted in unimaginable destruction, in spite of the stringent seismic codes established. But the other two countries reflect the different outcomes that solid seismic codes can produce. The difference in destruction was not as much related to the intensity of the seismic movement, as it was to the durability of the structures these countries were able to build

In Chile, where they suffered the largest magnitude earthquake ever recorded in 1960 (a 9.5 magnitude), they have had stringent regulations and resources to implement them for years. Haiti, ranked no.149 in the UN's Human Development Index, did not have the infrastructure or financial means to prepare for that magnitude of seismic movement and counted its dead in the hundreds of thousands and the homeless in the millions, after the quake. So, even though the Haiti quake was less intense than the one in Chile, its lack of seismic resistant structures resulted in larger economic loss and death toll.

These developments have made the need to build seismic resistant structures more real than ever, starting first with its examination of seismic code applications. Although there are disaster elements beyond our control (when, where, how strong), stricter building codes for both external (buildings) and internal (non-structural) spaces in a facility's architectural designs, could mean the difference between life and death.

Nelson Campos, general manager for Mecalux in Chile believes the material handling industry has changed quite a bit in recent years. "Clients have become much more willing to comply with the seismic regulations since the last earthquake," Campos said. "They used to want to go with the most economical alternative, but now they try and find the safest option."

Manufacturers such as Interlake Mecalux strive for the highest level of safety when designing a seismic resistant facility and take many elements into consideration. To assess storage rack earthquake performance, it is important to determine the ground motions that occurred at the site, the design capacity of the rack, the actual loading of the rack, rack design details and any other extenuating conditions that would affect rack performance when an earthquake occurs. These factors include the magnitude of earthquake, the depth of the earthquake below the ground's surface, the distance the site is from the fault that generated the earthquake and the soil conditions at the site.

Interlake Mecalux engineer Greg Hajdus, pointed out that each seismic design is different depending on the client, the stored product, weight, dimensions, rack elevation and, most importantly, the location of the warehouse. "We have to have a specific zip code or an actual address in California to determine the considerations for the seismic design," explained Hajdus about the first step in the blueprint process. Larger beams or columns, larger base plates and more anchorage to secure the rack beams are some of the adjustments

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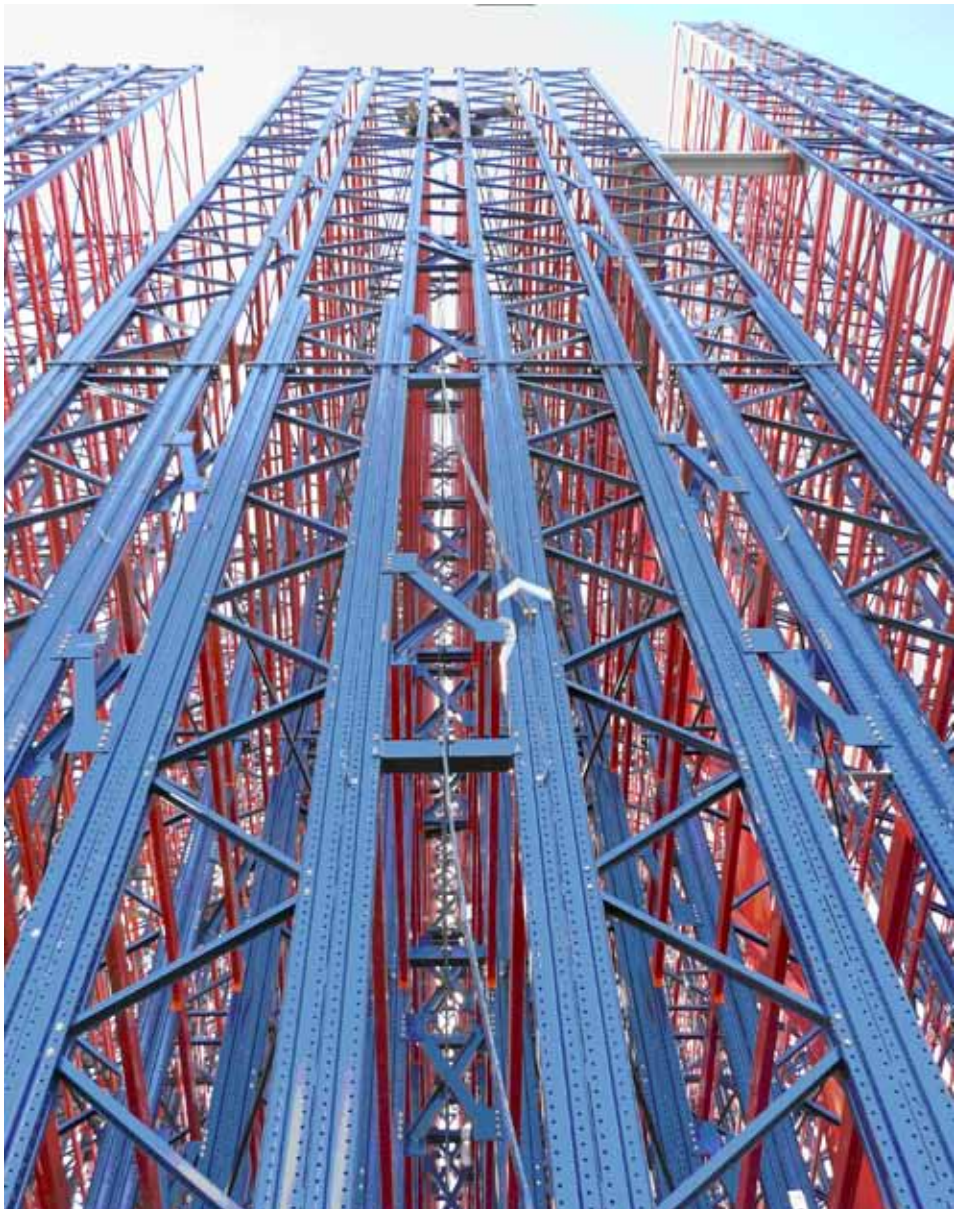
– Nelson Campos



Quake Superior: The seismically enhanced double-triple weld rack showcases the diagnal frame design that helps absorb the force of seismic tremors.

that are made. Also seismic bracing patterns are heavier and more condensed.

Through the systematic analysis of each project and based on the recommendations of the specific regulations of the sector, Interlake Mecalux provides the necessary solutions for its products to guarantee viability and functionality even in the most demanding seismic conditions.

The procedures currently used to compute seismic loads in rack vary depending upon whether the prevailing requirements are from the IBC (International building codes), the National Earthquake Hazards Reduction Program (NEHRP) recommended provisions or the RMI (Rack Manufacturer's Institute) standard. In some cases, there is more than one acceptable method of calculating seismic loads, but all final plans have to be signed, stamped and sealed by a seismic engineer.

With all these seismic safety measures in place and a constant desire to improve, we are now safer than ever, even when shopping at a "big box store" for 30 pounds of chicken and 40 bags of potato chips.

Anchor plates of larger dimensions and width provide greater resistance to traction.

Beams designed to withstand Flex-compression. Special diagonal frame design diffuses seismic occurrences.

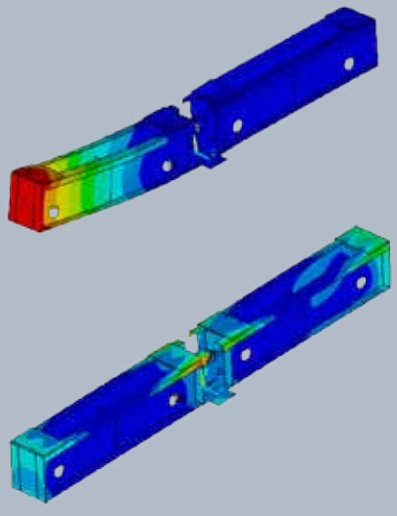
Double-triple weld end connectors prevent global and localized failure of the frame.

Special bracing system, horizontal and vertical, mounted upward from the floor throughout the entire frame. This dissipates the seismic energy generated by earthquakes.

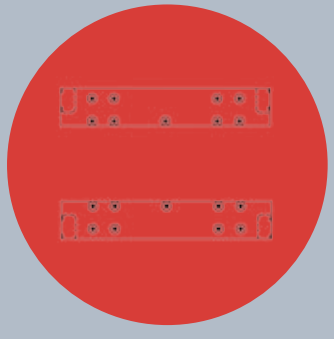
Seismic Resistance At Interlake Mecalux

All storage products in automated warehouses and special systems take seismic occurrences into consideration. Below are some examples of the tremor-resistant engineering used in Mecalux products to reinforce its steel shelving.

In specialized installations like Movirack, the mobile bases are designed around the probability of overturn during an earthquake, and utilize a stabilizing device to prevent components from tipping over. The extra thick plates are welded to the mobile bases over which the palletized shelving is installed, guaranteeing the mobile bases will not capsize. Mobile base without anti-tipping device (left), mobile base with anti-tipping device (right).



In the Clasimat Basic system, the anchorage of the machine is distributed according to the calculated probable maximum intensity of ground shift. Figure 2. shows the placement of seismic resistant anchors in the Clasimat Basic in a Seismic Zone 4.



In Unit Load automated warehouses, the stacker cranes also have stabilizing devices that prevent them from overturning. Figure 2. Placement of seismic resistant anchors in the Clasimat Basic in a Seismic Zone 4.