EERI Reconnaissance

Preliminary Study of Earthquake's Effects on Chile's Wine Industry

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Chilean Wine Industry

- US$2 billion annual sales
- Approx. 1 billion liters
- 70% exported
- 80,000 full-time workers
- 12-20% of 2009 harvest lost

2010 Earthquake

- 3:30am, February 27, 2010
- $M_w = 8.8$
- Strong shaking in 70% of Chile's wine-producing areas
- Significant damage to:
  - Power, transport, communications
  - Wine processing equipment
  - Wine tanks, barrels, bottles
  - Winery structures

2010 Harvest

- 10% of 2010 crop harvested before earthquake
- Little equipment damage
- Power outages disrupted irrigation and picking
- Damage to roads impeded grape transport

Fermentation Tanks – Stainless Steel

- Significant losses due to failures of tanks up to 100,000 liters

Legged Tanks

Flat-base Tanks

Legged Fermentation Tanks

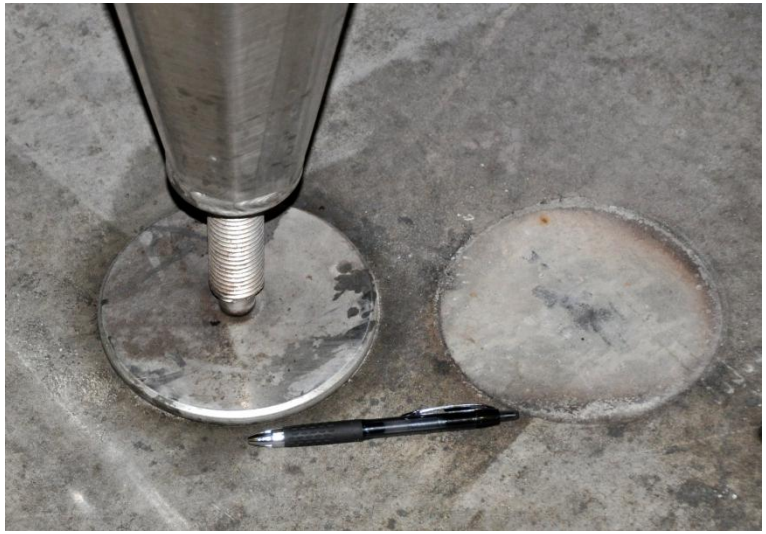
Anchored Tanks

- Anchorage performed well
- Most common failure mode was yielding at top of legs

Legged Fermentation Tanks

Unanchored Tanks

- Ability to slide reduced failures in tank legs or body
- Sliding requires clear area around tank



Legged Fermentation Tanks

Connection Failures

- Contents spilled from broken spigots

Leveling Screws

- Used where winery floor slopes to drain

Buckling at Top of Tanks

- Believed to be caused by suction following loss of contents

Flat Fermentation Tanks

- Outperformed legged tanks
- Occasional buckling at base
- Hold down failures edge distance was insufficient

Tanks – Other Materials

Concrete

- Little damage observed

Wood

- Susceptible to damage from falling objects

Wine Barrels – Racks

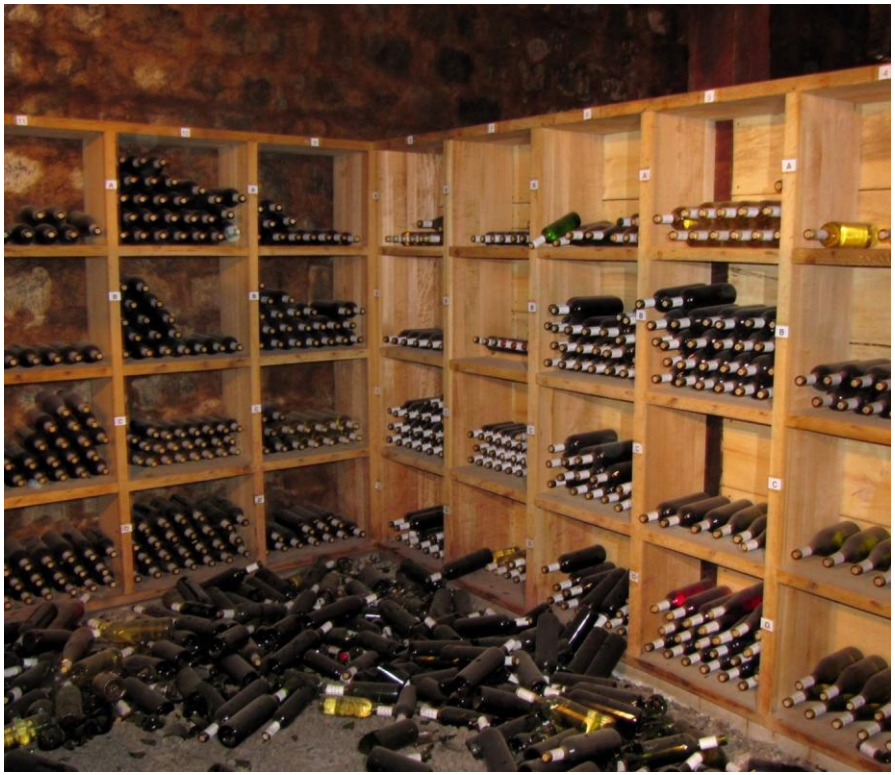
- Performance of barrels stacked on racks varied greatly

Wine Barrels – Traditional Stacks

- Significant losses from barrels falling from 3rd row onto solid surface
- Wood floors took damage instead of barrels

Bottles

- Bottles generally packed and stored without seismic restraints

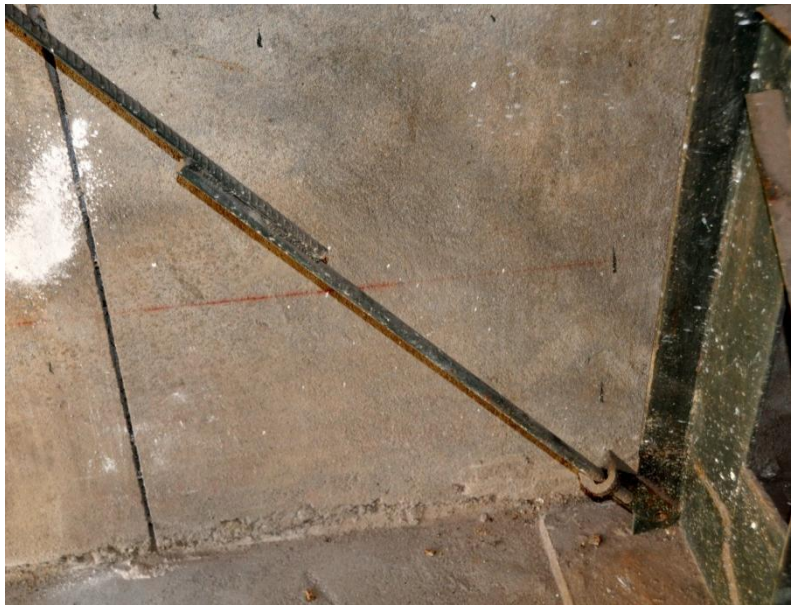


Structures - Old

Adobe and unreinforced masonry suffered heavy damage

Structures – Modern Warehouses

- Few significant failures
- Frequent non-critical damage to lateral systems



Thank You