

Resilience Reconnaissance | Business Continuity and Economic Recovery

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Introduction

Resilience is the ability for an entity to withstand, adapt and recover from a series of unexpected shocks and stressors. In the case of community earthquake resilience, the performance of many interconnected services and functions must be considered beyond the performance of the physical infrastructure typically surveyed in the immediate aftermath of an earthquake. These community services include government, housing, healthcare, education and business, among others, while the functions include shelter and public safety. As is discussed in “Development of a Framework for Resilience Reconnaissance” (Tremayne et al. 2017), community resilience is a concept that spans the dimensions of space, perspective and time. As the effects from a disaster can be felt individually, locally, regionally, etc., the resilience of a community must be evaluated across a similar breadth. Resilience is not specific to an individual class or group of people; it must be observed and understood from the perspectives of a wide range of stakeholders. The final, and often overlooked factor is time. Recovery and renewal are not static processes; they must be measured at various points during the recovery process to paint an accurate picture of the complex concept of resilience.

The EERI/CIGIDEN Learning From Earthquakes (LFE) Study Program aimed to assess the resilience of communities affected during the Maule 2010 earthquake by evaluating the state of housing, education, healthcare and business nearly seven years after the event. While the five-day program only offered snapshot during a single moment in time, interviews with those affected can offer a rich glimpse into past and ongoing recovery processes. In some cases, the information can be compared with the initial findings from 2010.

The intent of this particular report is to summarize the effects of the Maule 2010 earthquake on business continuity on a local level; it does not include analysis of economic performance on a large scale. Due to limited time constraints, the sole source of information was interviews with business owners and/or managers who were selected at random based on availability. The amount of information collected varies significantly in the case studies presented below. The first interview took place at a winery so the group was able to spend significantly more time at the location and the manager interviewed was fluent in English, so translation time was not a factor. The second interview took place while the manager was busy with customers and deliveries so the information stream was sporadic, making it difficult to follow up on initial questions with any depth.

The interviews were an attempt to gather information about the following topics related to business continuity:

1. The baseline condition for the business needs to be established in order to properly evaluate the impact of the earthquake. While owners/managers may not be forthcoming or aware of economic data in informal interviews, some indicator is needed to benchmark post-earthquake business performance. These indicators may be as formal as actual revenue data or annual sales, or as informal as the number of staff.

2. The physical impact of the earthquake must be assessed, including descriptions of repair cost (if available) and downtime. Temporary or permanent relocation, availability of local contractors and materials, and losses to building contents (inventory damage, components key to business continuity) also need to be understood.
3. The impact needs to be evaluated on a human level. This includes information related to staffing shortages, insufficient work to retain employees, presence of a consistent clientele, etc.
4. Establishing the performance of similar businesses is also important, as it will help to highlight trends or flag exceptions where they exist.

Case Study 1 | Colchagua Valley Winery

This internationally-owned boutique winery is situated in the Colchagua Valley (Figure 1). The winery has additional locations in Argentina, Spain and France. While this particular winery was largely spared, most wineries in the Colchagua Valley suffered serious economic losses as did those in the neighboring valleys.



Figure 1: Colchagua Valley Winery and associated vineyard

Nearly all of the sales (95%) from this winery are to international buyers. Tourism is a small part of their business model. This winery saw little economic impact from the earthquake due to its limited damage, large export business, and the fact that most of the other local wineries suffered significant losses and were likely unavailable for tours. A new high-end private dining facility was recently completed and from all indications the business appears to be prospering.

The most common failure seen throughout the region was local buckling of fermentation tanks, due to crippling of the support legs which precipitated stress concentrations in the tank walls. In this winery there was no significant damage to the structure nor equipment: the fermentation room houses approximately eight large stainless steel fermentation tanks aligned against the wall on three sides of the room. The tanks are supported on tapered steel tubes with thick stainless base plates (Figure 2). These particular tanks are not bolted down to the slab on grade, which is uncommon. During the earthquake the tanks rocked and “walked” up to 2 feet from their initial position, but did not impact each other despite relatively close spacing (approx. 1 to 2 feet). The slab slopes from the center of the room toward the wall for drainage, which may have helped prevent more movement of the tanks during the event.



Figure 2: Fermentation tank; unbolted tank foot

The winery's cold storage houses a large number of barrels for aging. The barrels are situated in stacks between 1 and 3 barrels high, and approximately 15-20 barrels long. The lower-most barrels sit on an approximately 4 inch by 6 inch concrete beam that is supported by 6 inch tall slightly tapered concrete feet between each barrel and on either end to elevate the barrels. A horizontal rectangular steel tube frame sat on top of the first row of barrels to receive the upper rows. Small rocks (some no larger than a golf ball) are placed in the angle formed by the circular barrel and the steel frame in an attempt to wedge the barrel to prevent rolling (Figure 3). The effectiveness of this is unknown, but appears to be unreliable, as some rocks could be removed with little effort and would likely fall out with any sustained shaking. In some cases, the rock wedge system has been upgraded to a folded steel plate support which appears significantly more robust. The rows of stacked barrels are not braced in the transverse direction in any way, relying only on their significant self-weight to prevent overturning.



Figure 3: Wine barrels in cold storage; rocks bracing barrel on frame

Given the lack of anchorage for the fermentation tanks and wine barrels, it appears that this winery was extremely lucky to avoid the significant damage seen elsewhere in the region. The winery sits on the side of a rock outcrop, so it is assumed that there was little to no amplification in shaking intensity from local site effects which may partially explain the lack of damage.

Case Study 2 | Local market in Santa Cruz

This small, local market is situated directly across the street from a large, eight-building social housing community with approximately 16 units per building in the outskirts of Santa Cruz. This community saw particularly significant damage during Maule 2010 earthquake, including some isolated structural collapses that claimed a number of lives. This market is run by two brothers, their mother and a cousin and was opened in 2006. The shopkeeper interviewed, one of the brothers, lived nearby during the earthquake. Once the shaking stopped, he and his mother rushed to the market to provide their neighbors with flashlights and candles so that they could survey the damage and search for missing people. This suggests that the physical structure of his business did not suffer any significant physical damage (Figure 4). In the aftermath of the earthquake, many temporary houses were built in the lot across from the market which provided a steady stream of clients into the store. This increase in business, which continued with the construction of the permanent social housing, prompted the family to hire their cousin for additional help. To date, he estimates that his clientele has increased by 50% since the earthquake.



Figure 4: Outside of local market

Conclusions

- Due to the limited number of interviews held, the findings presented above (excellent business continuity, lack of damage, etc.) should not be taken as indicative of any larger set of businesses or business performance in general. There were undoubtedly a significant number of businesses that were negatively impacted by the earthquake, including many that were forced to close.
- The interviews were held with no pre-planning, and the owners/managers interviewed had no time to prepare or gather their thoughts prior to the interview. With the event seven years in the past, specific indicators used to evaluate economic performance are not readily recalled, and reflections often resort to generalities and estimates.

- Additional owners/managers approached were either not in business during the event, or had joined the business since 2010 and as a result were largely unaware of the impact. This is a challenge that could be overcome by maintaining communication through successive reconnaissance trips and/or interviews, though this was not possible for this particular study program.

References:

Tremayne, H., M. Mieler, D. Martinelli, R. Olshansky, J. Berger (2017). Development of a Framework for Resiliency Reconnaissance, *Proceedings 16th World Conference on Earthquake Engineering*, Santiago de Chile, Chile.