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## **Housing Recovery Lessons From Chile**

### **Introduction**

At 3:34 a.m. local time on Saturday, February 27, 2010, a great earthquake of magnitude (M) 8.8 struck the south central region of Chile. The earthquake occurred on the interface between the Nazca and the South American plates, with a rupture zone extending over an area approximately 500 km long and 100 km wide (see Figure 1). Over 12 million people (about 75% of the population of Chile) experienced intensity VII or stronger shaking. In the first month following the main shock there were 1300 aftershocks, with 19 in the range of M 6.0–6.9. The earthquake produced a tsunami that caused major damage over more than 500 km of coastline [Moehle and Frost 2012]. The earthquake and tsunami together resulted in 526 deaths (with 31 persons still missing). The earthquake damaged highways, bridges, railroads, ports and airports as well as 40 hospitals and over 4000 schools [MINVU 2010, 2011]. Estimates by engineers suggest that approximately 50 to 100 multistory reinforced concrete buildings were severely damaged and 4 collapsed partially or totally. Lifeline infrastructure generally performed well, given the magnitude of the event, but failure of some elements led to power outages affecting much of the population for days. However, given Chile's long history of frequent earthquakes, rigorous building codes and standards for infrastructure operability served to limit damage and save lives.

The earthquake was Chile's largest disaster in terms of property and economic loss. The total estimated loss of US\$30 billion (18% of Gross National Product) is composed of US\$21 billion to physical assets (including buildings,

housing, roads, and schools) and US\$9 billion in business and indirect losses. An estimated US\$7 billion to US\$8 billion of the loss will be paid for with insurance and the remainder by government or private individuals (AACH 2012; Siembieda, Johnson, and Franco 2012).

Chile is a country with stable institutions and a prosperous economy, but like many emerging and developed economies, it is a nation with income inequality and many marginal structures (particularly adobe housing) at high risk in earthquakes. The government, through the Ministry of Housing and Urban Development (MINVU) has a long tradition of improving housing conditions for low-income families and working to eliminate informal housing. This history is a crucial element in the government's capacity to respond to the housing needs after the earthquake in February 2010, and serves as a basis for expanded planning efforts developed as part of the recovery process.

Insert Figure 1 about here

There are important lessons for planners and governments to be learned from the Chilean approach to reconstructing housing and infrastructure in a four-year time frame. While all disaster recovery is complex and locally specific, the literature on disaster recovery suggests that successful aid delivery has three critical components that are necessary for equity, mitigation and sustainable development: 1) adaptable government programs, 2) locally targeted agendas, and 3) community participation and capacity building (Berke, Karetez, and Wenger 1993; Nigg 1995; Quarantelli 1999; Alesch 2005; Ingram, Franco, Rumbaitis-del Rio, and Khazai 2006). Chile's recovery programs included all of these components.

As this case study will show, the flexibility of its housing assistance programs was critical to the delivery of 220,000 units in a relatively short time frame. However, the study will also show the limited role of participatory planning in time compressed programs and the need to create opportunities for ongoing local planning and capacity building.

This paper is based on qualitative data analysis of extensive interviews with more than 75 individuals conducted during two trips to Chile: five days in February and 15 days in October of 2012. The trips were organized by the Ministry of Housing and Urban Development (MINVU) and funded by the United Nations Development Program (UNDP). Interviews were conducted with an equal number of individuals in three groups: 1) those with positions in the current or previous government at national, regional and local offices; 2) those providing construction, materials and technical assistance, and academics studying the recovery; and 3) community leaders and families who received government housing subsidies. Efforts were made to balance political affiliations and viewpoints in the range of people interviewed.

### **Housing Program Decisions and Implementation**

Overall, the earthquake damaged 370,000 housing units. The Chilean government is rebuilding or repairing 222,000 units (60%) for low- and middle-income families, while the remainders have been financed through insurance and private funds (AACH 2012; ONEMI 2010; Siembieda, Johnson, and Franco 2012; SVS 2012). Of the 222,000 targeted for government assistance, 109,000 involved repairs of damaged homes and 113,000 required rebuilding (MINVU 2010, 2011). Within a

few months after the earthquake, a national reconstruction plan was developed which required special legislation and funding through various business taxes and (non-affected) property tax increases. The plan covered major sectors including infrastructure, hospitals, schools, heritage sites, etc. Housing, a central element of the plan, is managed by the MINVU. The Ministry, whose mission is to improve the quality of housing for vulnerable populations, felt that the earthquake and tsunami overturned four years of housing program efforts to reduce the already existing housing deficit (Perez 2012).

In the immediate aftermath of the earthquake, however, emergency response was in the hands of an outgoing administration and the scale of the losses had to be understood by an incoming government. After 20 years of rule by a center-left coalition (Concertación), Sebastián Piñera (of the center-right coalition Alianza) assumed the Presidency on March 11, two weeks after the earthquake. The transition is important to recovery planning. The new government wanted to show they could do things better, and organized for a national effort. Three key individuals were brought into the MINVU within days of the earthquake: Andres Iacobelli, as undersecretary and architect of the reconstruction program; Pablo Ivelic, as coordinator of housing reconstruction; and Pablo Allard, as coordinator of urban design and historic preservation. Together they evaluated conditions in the disaster zone and began assembling data on damage and the number of families affected, estimating a need for US\$2.5 billion in housing as the administration took office.

### **Critical Decisions**

Many important decisions were made by government officials in the first months after the earthquake and the housing recovery program was in the planning phase at the same time that emergency (temporary) housing were under construction. The MINVU leadership decisions provided a balance of strong central government leadership with significant efforts to engage local communities and involve citizens in housing decisions (MINVU 2012a). The *first* decision was to use government funding for recovery. With a robust economy and widespread political support, the primary budgetary sources for the recovery included taxes on copper mining, tobacco, and non-affected high value properties: some additional funding was generated from international donations, and reallocation among various government budgets (MINVU 2010, 2011).

Given the structure of the Chilean government, with strong ministries and regional staff offices, the *second* critical decision was to use the existing ministries and their programs and budget lines for the recovery effort. The government consciously chose not to create a “super-minister” or special agency for reconstruction. Instead, MINVU was given charge of the reconstruction of cities and housing, and Public Works took on roads and other infrastructure. These were the largest recovery domains, but other ministries, such as Health and Education, managed programs in their areas as well. A committee of Ministers (Comité Interministerial de Ciudad y Territorio) coordinated reconstruction policies at a national level, and worked with Governors (Intendentes) to coordinate the intervention at a local level. The committee met monthly with the President on the reconstruction planning.

In order to design recovery-focused programs, the government needed data on the extent of the damage and social conditions. Baseline data on damage was collected by the Oficina Nacional de Emergencia del Ministerio del Interior y Seguridad Pública (ONEMI) in coordination with local municipalities. Typically agencies collect data for their own use, so the formats are not necessarily coordinated with those of other agencies. Damage data collection is one area in which a single government super-coordinator would have been useful and more efficient. MINVU took whatever surveys on damage were available from local governments and overlaid these with census data, social conditions, and building typologies to develop preliminary estimates of housing need.

*A third* critical decision made by MINVU was to identify what portion of the population should be beneficiaries of a government recovery program. They chose the lowest three quintiles—60% of the population. It was hard to match income and need to actual conditions. Even a middle-class person with a job who had lost their home would need help. Thus the program was generously aimed at low- and middle-income populations who did not own a second home, and whose annual income was below US\$12,000 per family per year, and whose home value was less than US\$88,000. Essentially, anyone with housing damage who did not own a second home could apply for a subsidy.

*A fourth* decision was that MINVU gave mayors six months to create a Registry of Disaster Victims—names attached to each damaged building, with information on whether the building needed repair or replacement. The registry served as the basis for all housing subsidies, and it gave a critical responsibility to

local government to represent the needs in their communities. This kept the municipalities in the loop and served to link the municipalities with the regional and national programs.

The *fifth* and perhaps most critical decision was to subsidize housing demand rather than direct supply. A “supply-side” subsidy entails government contracting with large local or international companies to build thousands of units on green-field sites. The “demand-side” subsidy was focused on keeping families in place. It meant putting emergency shelters on individual home sites and planning for rebuilding on those same sites. Practically speaking, this meant that the housing reconstruction program would be scattered over thousands of towns and rural regions, on individually owned sites. The decision was not popular with the Santiago based building industry, or with many politicians, as it was seen as slow and cumbersome. However, by two years into the recovery, it was clear that this was the single most important decision made. The use of existing home sites kept people in their communities, with access to their jobs and family members, and the recovery was on their land, where they could monitor the construction. This decision applied to the great majority of disaster-impacted families. The approach supported local builders and kept monies in the communities.

Three additional decisions were part of the overall housing recovery program development, and further exemplify the balance between a strong government role and citizen involvement. First, the Ministry established strict construction norms for all new housing—with particular focus on materials, structure, thermal capacity, and habitability (in terms of minimum unit size).



Essentially every builder had to have their model units certified by Ministry engineers before it could be presented to a family or community. Second, funding for technical assistance, inspection, quality control, and oversight was built into the subsidies and this went to local architects, local governments, and Ministry offices. Finally, although housing recovery programs were tailored to specific types of damage and specific social conditions, one key principle was that all families would be able to choose from a variety of building types and contractors. For families, the capacity to choose a model home gave them an active role in their own recovery process.

### **Program Options**

Over 70% of the homes to be rebuilt or repaired were on sites where the beneficiaries lived. This meant that a major issue was developing a process for rebuilding individual homes over thousands of kilometers and in rural and urban localities. For owners eligible for subsidy, a variety of options were available: funds to repair existing houses, funds to acquire a new house, new houses on the owners' land, houses on new sites, or units in new social-housing developments. Owners could complete modest repairs on damaged houses with subsidy funds used to purchase materials from a local source. Owners could use contractors for more complex repairs with subsidy funds. Repair funds were disbursed in three increments (30%, 30%, and 40%) with inspections to insure that funds were used for construction (MINVU 2012a, 2012b).

Insert Table 1 about here

Owners needing full reconstruction could select models from precertified contractors, do their own construction or buy an existing house. For those selecting contractor-built homes, community residents were allowed to choose from models based on presentations from several predominantly local builders, some of whom offered prefabricated homes and some of whom offered site built homes, all of which were precertified for engineering standards by the Ministry. Once the community voted, the builder received the contract for that community. Such contracts provided some advantages of scale for the builders in remote regions and at the same time encouraged competition among builders. The typical subsidy for each house is about US\$18,000 to US\$20,000 (more than most families earning \$10 to \$12,000 per year could afford without the subsidy). Additional funds were added for extra site-work, water, or sewer systems (MINVU 2011, 2012a). All the units were approximately 50 m<sup>2</sup> with three bedrooms, designed so that families could add rooms or special finishes after the house was completed.

Insert Figure 2 about here

Families without land—those in damaged social condominiums, renters, and those doubled-up in single units—were accommodated in temporary camps, while new social condominium projects or new single family house developments were designed and completed. Social condominiums were designed on sites selected for pre-organized groups of families, that is, families who signed up to participate in the project. Additional new developments and acquisition subsidies were designed for non-land owners such as renters or families who had shared space in damaged

homes. These families became homeowners in recovery, and each family could choose condominiums or new-site houses, according to their needs.

These projects typically improved on previous housing quality in terms of unit size (from older units that were 27–38 m<sup>2</sup> to new units at 50 m<sup>2</sup>), services, and site amenities. In cities such as Talca, where 30% of the housing stock was severely damaged, additional subsidies enabled builders to increase density on inner-city sites in an attempt to counteract the rush to build on the periphery. The variety of program options demonstrates a serious commitment to housing choice and at the same time, to recognition of the variety of needs and family circumstances (MINVU 2012b).

### **Implementation**

*Regional Management of Housing Subsidies:* The regional offices of the Ministry, Servicio de Vivienda y Urbanismo (the SERVIU), which are normally tasked with implementing Ministry policies, worked with the mayors in their region to understand the social, legal and technical problems after the earthquake and to process all applications for housing subsidies. In total, the Housing Reconstruction Program, through the regional SERVIU offices, would allocate over 220,000 subsidies (half for repair and half for new construction).

The regional SERVIU offices were the government's main point of contact for local victims and they were not only helping families with applications for subsidies (which could include paperwork to clarify land tenancy), they were also looking for existing homes to buy or rent, negotiating land purchases, attempting to limit land speculators, attempting to limit duplicate or fraudulent applications, and reaching

out to local financial and construction companies (Fodón 2012). The leaders of the local SERVIU had a particularly difficult job trying to provide services and manage unrealistic expectations by victims and politicians.

Additionally, the SERVIU offices recognized that in some urban areas, the demand was “double the size of the problem” in the sense that often two families shared a damaged house or there were renters in the damaged units (Ayala 2012). For example, in central Talca the registry included 1200 owner-site families, 1800 renters (plus 3700 in need of home repairs as well as an existing housing deficit suggesting a need for another 1600 urban units). Such information led the Ministry to develop special subsidies for increasing housing density in urban settings.

Both the local SERVIU offices and the program planners at the Ministry met with local and national building contractors, to bring them into the process early in the planning stage. The Chamber of Contractors (Cámara Chilena de la Construcción [CChC]) was initially opposed to the owner-site programs. In fact, given the economy and the demand for contractors in the northern mining regions, the on-site program opened opportunities for small local builders and expansion-potential for companies that had already worked with SERVIU on rural subsidy and social housing programs, and for companies developing prefabricated housing.

For example, Mingatek (later renamed Sinergia), a manufactured housing producer, moved their small company from the south of Chile to Linares (a town located midway between the O’Higgins and Biobío regions) in May 2010 to take advantage of the post-earthquake demand. They met with Ministry officials to create designs that would meet regulations and developed five model houses for different

site conditions. In two years they have built the company to produce 50 houses per month with 100 employees in the plant and 170 in the company. Three medium sized builders (Iraira Ltd, Hurtado y Carrasco, and S&C LC.), who each had previous experience with SERVIU rural projects, all had to restructure their businesses to meet the demands of the owner-site reconstruction program. Each of them chose to develop a house kit of construction materials that would fit on one truck, and hire local labor. While all found the transition slow, all report significant growth for their companies. At the same time, micro-contractors who previously built one or two houses per year also were able to compete for local projects and grew their businesses as well.

At the national level, the MINVU housing reconstruction team focused on tailoring the programs to meet the variety of needs. Pablo Ivelic created pilot programs in each region as test cases for managing the subsidy-application paperwork, certifying land ownership, providing access to water and sewer, as well as providing families with a mechanism for choosing contractors and house designs. Ivelic reported that these processes were frustratingly slow at the beginning but became more efficient over time.

*Social Condominiums Program:* Although the majority of the housing effort would be on repair and rebuilding on owner-sites, about 20,000 units of social condominiums needed repair or rebuilding and these presented unique problems. Social condominiums are similar to public housing in the U.S. with the main difference being that in Chile the residents own the units.

Families living in social condominiums are in the lowest-income bracket in the country. Many of the damaged units were older buildings in poor condition with small (28 m<sup>2</sup>) units. When the Ministry evaluated the cost of earthquake repairs plus the cost of bringing the units up to current standards, they decided to build an additional 30,000 units in new developments (beyond the 8,000 which were severely damaged). The new developments for displaced non-land owners—families who were renters, or who shared housing with other families including both single family homes and condominiums, all at the 50-m<sup>2</sup> standard—bringing the total to 38,000 new units (MINVU 2012b).

The inhabitants of damaged social condominiums could not shelter on site, and in some cases, families in tsunami-impacted coastal communities had no safe site to return to. For the 4,350 families without alternatives, the government built 107 emergency camps, which were supported with access to schools, day care, job training, health clinics, and other government social services. The process of assembling (or clearing) sites, preparing for the infrastructure, developing designs, and working with families took almost two years. A unique feature of social housing in Chile is that families are organized by community leaders into groups for the purpose of applying for social housing as a group with their individual vouchers. Needless to say, the family organizing process took time and effort. In addition, some families in older condominiums may have sold or rented their units, thus adding complexity to the process of organizing families into groups for new social condominiums.

For the Ministry, this meant that only a small percentage of the social condominiums and new developments would be ready for occupancy by the second winter after the earthquake. In order to provide an alternative (especially for the elderly and families with small children), the Ministry devised a rent-subsidy program—allowing camp dwellers to opt out of the camps and rent a housing unit with government assistance until their new unit was complete. The numbers of families in various emergency camps who took advantage of the option ranged from 17% to 55%, but it was important that people felt empowered by the choice.

*Heritage Preservation:* Adobe houses comprised 27% of the homes damaged in the earthquake. While some were merely old and poorly built, others were located in zones that were previously designated Zones of Historic Conservation. In some cities and towns without the historic designation, the new master plans identified and delineated specific “historic areas” so that residences could be allocated an additional amount of special heritage subsidy [MINVU 2010, 2011]. These included villages with continuous facades and or covered sidewalks. In all, approximately 5,000 units were designated as having historic value.

In the town of Lolol (Region VI), architects and engineers devised a structural system with wood framing inside adobe finishes, while others used a straw-bale method of construction, maintaining the façades and covered sidewalks. These were not pure historic reconstructions but they allowed families to rebuild safely and preserve the town image, which was seen as crucial to maintaining their attraction as tourist destinations.

Although the National Monuments Council (Consejo Nacional de Monumentos) exists for historic landmarks designation, there was no institutional framework or funds for repairing or rebuilding damaged historic homes. The homes in the national registry of historic buildings each needed approvals from the National Council, but at the same time the local SERVIU offices did not know how to handle approvals for adobe buildings for which no building code existed and which did not meet SERVIU rules, budget limits, and minimum size requirements. New regulations, checklists and approval processes had to be adapted for heritage projects.

*Completion Rates:* One year after the earthquake, 60% of the subsidies were allocated, 35% of the housing was in construction and 5% was complete. By the second anniversary in February 2012, 100% of the subsidies were allocated, 67% was in construction and 37% had completed construction—although the majority of the projects completed were home repairs, with only 10% new construction.

The construction component of the housing recovery program took time to ramp-up and the decision to build on-site replacement housing made it both more complex and less visible than new developments because the reconstruction is blended into the existing urban fabric. By October 2012, the percentage of units with construction started has increased to 84% and the percentage completed to 54% (MINVU 2012b). The reconstruction program will be 95% complete by the fourth anniversary of the earthquake in February 2014.

### **Integration of Urban Planning with Housing Reconstruction**



The earthquake and tsunami affected 3 metropolitan areas, 5 cities with over 100,000 inhabitants, 45 cities with over 5,000 inhabitants and over 900 rural and coastal towns and communities (MINVU 2010, 2011). In coastal cities, new master plans were needed for tsunami protection, infrastructure and urban relocations. At the time of the earthquake, Chilean cities had basic zoning plan requirements, but little more. Given the need to incorporate risk mitigation with land use conditions and infrastructure investment, the opportunity to develop master plans for impacted cities was led by Pablo Allard at MINVU but coordinated with local efforts.

For example, when a local industry, a cellulose plant in Constitución, wanted to give the city a plan, MINVU devised a method to use their help and develop a model for other cities. They created a new planning instrument, the Planes Maestros de Reconstrucción Estratégica Sustentable (PRES, Strategic and Sustainable Reconstruction Plan) for Constitución. The work was completed in 90 days with an interdisciplinary team and financed by the company. The plan had to be endorsed by the Municipal Council but the plan was referential, not binding. Plans for many other cities followed, including Juan Fernández Island, Curicó, and Talca (the only plan not endorsed by the Municipal Council). Funding from Chilean corporations and NGOs allowed local architects and urban designers to develop the plans, some with the assistance of teams of international volunteer professionals and students. Because the plans were developed by private consultants and paid for with donations, the process moved quickly without competitive bid requirements.

The Governor of the Biobío region developed another planning program at the same time. Jacqueline Van Rysselberghe organized a process to develop

reconstruction plans for 18 towns on the coastline following the PRES model, using in-house staff. To develop the Planes de Reconstrucción de Borde Costero (PRBC), she took advantage of private donations to pay for risk assessment and tsunami consultants to assist the planning effort. In total, 27 master plans were developed (9 PRES and 18 PRBC). The government funded an additional 110 Planes de Regeneración Urbana (PRU) master plans for groups of small towns with assistance from the United Nations Development Program (UNDP). On a local level, the plans helped guide redevelopment. On a national level, the Ministry was able to use the plans to prioritize proposed projects for government funding, based on economic and social need (Allard 2012).

In all cases, the planners revised and updated the zoning plans to incorporate risk assessment studies, bringing the concept of resilience into the planning process. This was particularly important on the coast. Although the master plans were referential and non-binding, they created a moral imperative for change in the municipalities. In Dichato and similar coastal towns, MINVU did not want to finance homes to be rebuilt in the high-hazard areas, so the town plans and land use protocols for tsunami mitigation and buffer zones integrated planning and with housing reconstruction. Some allowances were made for elevated concrete housing behind the buffer zone (about forty meters back from the seawall, beyond the estimated level for inundation), acknowledging that fishermen needed reasonable access to their boats and livelihoods.

### **New Urban Planning**

While Chile has a long tradition in the provision of social housing, its urban planning system is weak. According to Minister Rodrigo Pérez (2012) there is no fully articulated policy, many actors, and little or no cooperation between government, municipalities, and the private sector. There are no metropolitan systems (Santiago, for instance, has 32 different municipalities), and it can take years to approve local plans. It is within this context that the Ministry attempted to build a degree of coordination into the institutional framework of post-earthquake planning.

The post-earthquake master plans were both proactive (in terms of hazard mitigation) and coordinated (in terms of targeting and encouraging specific types of short- and long-term development); and introduced the concept of resilience to cities and towns that had previously used only zoning as a planning instrument. They were not locally generated so the opportunity to build local capacity was lost in the haste to complete the process.

*The Dichato Case:* There were 18 coastal cities and towns in the Biobío Region that suffered extensive tsunami damage and the planning efforts brought new thinking on land use as part of the housing and community recovery (MINVU 2010, 2011). In Dichato, just north of Talcahuano (see Figure 1) with a population of about 4,000, some 600 families (and 200 renter households) were displaced by the earthquake and tsunami, which destroyed over 1,300 homes. The town was particularly hard hit because of its geographic position and wave direction. The planning effort involved detailed risk analysis and the design of numerous mitigation elements, including a tsunami wall on the beachfront backed by a

mitigation park with hills and trees. The park's size and layout were designed to reduce tsunami energy (from an event equivalent to the one of February 2010) by 35%. Properties along the waterfront would be expropriated for the park, new roads, and other significant infrastructure. This new zone ran 3-4 km along the shore and was 6-8 blocks deep (see Figure 3). Housing could not be built until other infrastructure was completed, including the reinforcement of the river channel. These projects required funding from the Ministry of Public Works. Other ministries funded corollary projects. For example, Ministry of Education funding was used to move a school out of the hazard zone.

INSERT FIGURE 3 ABOUT HERE

Only commercial activities would be allowed in the first zone behind the park; a second zone would allow elevated housing; and regular housing would only be permitted behind the elevated housing. While these restrictions are currently in place for all subsidized (i.e., government-built) housing, they will become mandatory when the zoning plan is updated. However, given the public investment in infrastructure, the plan is effectively in place.

Needless to say, local people were not uniformly supportive of the changes. Those with homes or second homes in the expropriation zone did not want to lose their beachfront property. Fishermen and tourist-serving businesses were concerned about losing waterfront access and income. Families were divided over whether they wanted to return to living in town or move to higher ground. Many citizens were deeply opposed to the tsunami park. They believe it is too big, and they are concerned about the lack of maintenance in the future. A tsunami park as

public space is new to the Chilean culture, where small town plazas are more typical of public open space.

Although the government intends to create a maintenance entity located in the park, modeled after a park management organization for a large Santiago park, the local community is skeptical. The only open spaces they have experienced are the troublesome open spaces in large social housing developments. They cannot imagine that the park will be free of vandals or crime. These are legitimate concerns, which could be addressed through increased concessions and public uses to give local merchants and civic groups a sense of ownership and control in the public spaces. The government-led planning effort is based on sound design principals, but additional steps are needed to bring local governments and community groups into long-term relationships that recognize local input.

*The Talca case:* Talca is a mid-sized city of 220,000 people and capital of the Maule region. Thirty percent of the city was severely damaged, because the center-city neighborhoods were filled with old adobe structures. While Dichato had the worst damage, Talca was second in terms of overall earthquake impacts.

Talca had more than double the number of families in need because of the high number of renters in central neighborhoods. In some areas, it did not seem logical to simply rebuild 50-m<sup>2</sup> single-family homes on high-value land. In addition, given the need by displaced renters, new developments on the periphery of the city were inevitable. To counteract this trend, the Ministry created a program to add density to the city, by providing a subsidy to builders to develop infill center city sites with proximity to shopping, health care, and other services. Earthquake

victims in the registry would have first priority to purchase the condominiums (equivalent to a single family home voucher), but the builder would receive an additional loan of US\$4,800 per unit to cover the costs of urban construction. After a certain period, unsold condos would be made available on the market for people who qualify for regular subsidy programs.

While the intention is laudable, it is not clear that the builder subsidies and complementary zoning is enough to regenerate central neighborhoods. The program will certainly increase density, but greater public intervention may be needed to really transform the areas. Unlike Dichato, where the mitigation park and new infrastructure (necessitated by hazard reduction) reshaped the commercial core of the town, the Talca neighborhoods will not be reshaped by higher density housing on scattered sites. These neighborhoods will need better urban design for high-density development, and more investment in public amenities as well as economic development to revitalize the communities; and that will require more planning tools than are presently available in Chile.

Ultimately, more urban planning tools (such as redevelopment authorities and enterprise zones) and planning capacity are needed at the local level,. These and other contemporary planning instruments could create a variety of opportunities to:

- Acquire land for concentrations of commerce or mid-rise housing;
- Develop community services and amenities for revitalization;
- Encourage community involvement and participation.

This applies not only to Talca, but also to Curicó, Chillán, Constitución, and other mid-sized cities that have urban problems requiring urban-scale solutions. In

these settings, housing is not necessarily the only tool needed to reconstruct the community.

### **Conclusion**

In Chile, the housing recovery program has helped the great majority of earthquake victims to restart their lives in a reasonable time frame. The plan was coordinated with other national recovery efforts in infrastructure, health care and schools, and benefited from strong leadership at the national level. The political commitment by the newly elected government was critical to funding and managing the overall process. In addition, the leadership by young professional engineers, architects, and urban planners in the Ministry and among the regional SERVIU staffs, and technical assistants was exemplary. These individuals combined best professional and technical practices with creative thinking to craft flexible and targeted programs that were manageable and accountable by government standards. They worked within existing programs and institutions, but they stretched or rewrote the rules to accommodate the varied conditions they encountered among the damaged housing and family circumstances. Ultimately, the flexibility in both program development and implementation was critical to its success. Of course, a good economy and good political timing (the transition to a new administration) were helpful, providing the capacity to finance the programs and the opportunity to bring in new leaders and new thinking into existing government programs.

Of the three criteria for successful recovery aid, Chile was most successful in *adapting government programs* to provide housing and infrastructure in disaster-

impacted regions. The central government attempted to create a *locally tailored agenda* with a number of policies. Mayors were engaged in identifying housing needs, programs were designed to replace units on owner sites, and citizens participated in decisions on their own housing unit, but neither the local governments nor the citizens were engaged in the post-disaster planning for their own communities. Equally important, social and economic planning was largely left out of the rebuilding program, which meant that housing reconstruction efforts in cities like Talca did not resolve the loss of economic opportunity and neighborhood cohesion caused by the earthquake.

Finally, a key challenge in recovery is balancing the need for both speed and deliberation (Olshansky and Johnson 2010). In Chile, the goal of completing recovery in four years meant that there were limited opportunities for the third successful recovery criteria, *citizen participation and local capacity building*. The urban planning efforts for many towns were done by professionals and coordinated by MINVU staff to provide guidance for reconstruction and hazard mitigation. In the process, MINVU recognized that they needed national and local regulations to develop local planning capacity and engagement.

Other nations have had similar recovery challenges. Many countries have varying degrees of success using national government funding and/or insurance for the rebuilding of housing and infrastructure, but few are good at engaging citizens in the planning and setting a local agenda that includes adapting to new social and economic conditions. The interaction between the welfare of households, employment, business, education, health care, institutional and environmental



recovery requires not only flexible and adaptable government funding for reconstruction but also opportunities for citizens to shape the future of their communities (Comerio 2014; Mukherji 2011; Olshansky and Johnson 2010; Olshansky et. al. 2005; Preuss 1998).

To that end, Chile will have to take advantage of the lessons learned in the earthquake recovery program to develop better planning and participatory design tools. In addition, Chile will need political and practical changes at the national and municipal levels to create a national urban policy. Historically, the national government, through the ministries, has invested in improving the physical conditions for housing, infrastructure, schools, hospitals, and other public services. Going forward, MINVU will need to think beyond housing supply and consider the role of urban planning and citizen participation. This will require significant professional development, coordination across traditional disciplines, and political changes—all necessary next steps. Thus, to go beyond measuring the success of disaster recovery through specific rebuilding programs, it is also important to evaluate whether reconstruction will enhance community resilience and develop community engagement (Comerio, 1998, 2005, 2012). The most important legacy of the 2010 earthquake may be a new phase in national urban policy, which develops a larger planning framework at the local level where citizens can participate in the planning process.

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**TABLES AND FIGURES**

Problem ► ▼ Approach	Repairable Units Land Owner	Non-repairable units Land owner	Non Land owner
Self Led	12,000 Bank of Materials	5,000 Acquisition 1,000 Do It Yourself	17,000 Acquisition Subsidy
State Led	12,000 Social Condo Repair Buildings	8,000 Social Condo Demo/Rebuild	30,000 New Development
Third Party Intermediary	85,000 Repair Subsidy	48,000 Pre-certified Houses	4,000 Urban Densification

Table 1. Breakdown of number of units for repair and rebuilding program options (MINVU 2012b)



Figure 1. Map of earthquake impacted area (J. Franklin and A. Gabbatt, *The Guardian* 28 Feb. 2010)

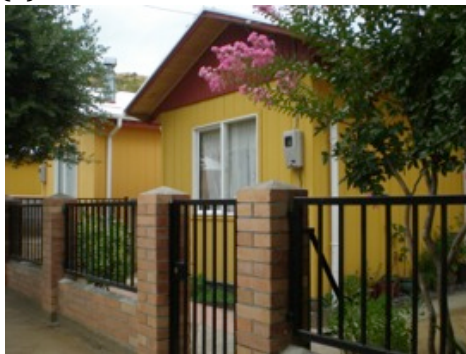
<http://www.theguardian.com/world/2010/feb/28/hundreds-feared-dead-chile-earthquake>



(a) site built wood house



(b) site built masonry house



(c) prefabricated house



(d) elevated concrete house

Figure 2. Varieties of rebuilt houses. (Photos: Mary Comerio)

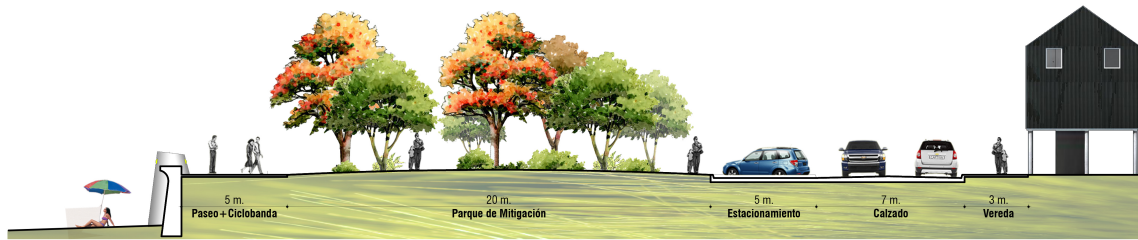


Figure 3. Dichato map and schematic section of Tsunami-mitigation Park (MINVU 2010).