



ESTRUCTURAL JOINTS IN INCREMENTAL USER BUILT
CONSTRUCTION

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For: SIGUS Lab MIT, Prof. Reinhard Goethert

INTRODUCTION

Structural joints are an essential aspect of safety in user built constructions. When users build their own houses from scratch, they decide the type of structure and materials for incremental growth without many restrictions. On the contrary, when houses are designed and build predicting incremental growth its structural design guides the type of joints and materiales. In the case of Elemental, houses where designed to doble their area over time with design and materiales restrictions.

The purpose of this field research was to determine which types of estructural joints people choose to build on their own. More specifically, for the case of Elemental the goal is to determine if the design and material restrictions were followed. The sites to visit in Santiago were: Elemental Renca, Lo Espejo and Lo Barnachea. Other incremental housing projects similar to Elemental were visited in Santiago: Los Sauces, Comunidad Andalucía, Casas Chubi and los Torreones de la Reina.

Overall, it seems that the choice of materials for incremental growth is usually limited by the starter structure and varies between wood and steel structure. All the projects visited had survived very well the earthquake that stroke Santiago in 2010.

Another interesting aspect was that in most cases the incremental part of the house was not built incrementally beacuse families managed to find subsidies from the government to pay for that part of the house before moving in..

Elemental Projects:

1. Elemental Renca, 2005
2. Elemental Lo Esepjo, 2005
3. Elemental Lo Barnechea, 2010

Other Incremental Housing Projects:

4. Los Torreones de la Reina
5. Los Sauces
6. Comunidad Andalucía
7. Casas Chubi



Estructural Joints In Incremental User Built Construction



Elemental Renca

Arch. Elemental

Av. Brasil 6300, Santiago, Chile

Contact person: Mario Orellana phone +56 996348679

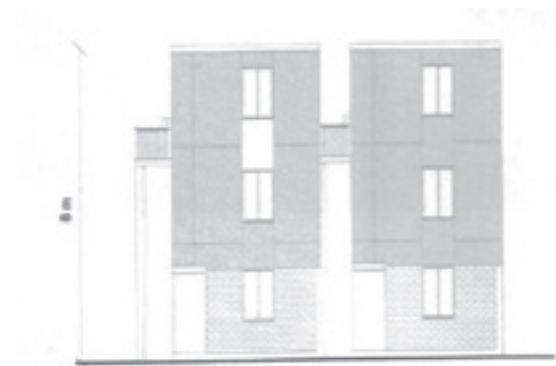
Elemental Renca
 Arch. Elemental, 2007
 Type: Incremental growth
 Previous settlement: Informal settlement very close.
 Unit size: 35 sqm + 32sqm (expansion) = 67sqm (final)
 Materials: Clay bricks, wood and steel beam
 Type of growth: ground floor house (ground expansion), second floor house (second and third floor expansion)

Elemental Renca was developed with “Un Techo para Chile” a local NGO that can be classified as an EGIS (Entidad Gestora de Inmobiliaria Social) which is in charged of bridging the housing needs of organized communities (Comité de Allegados and Comité de Campamento) and the government to facilitate housing subsidy.

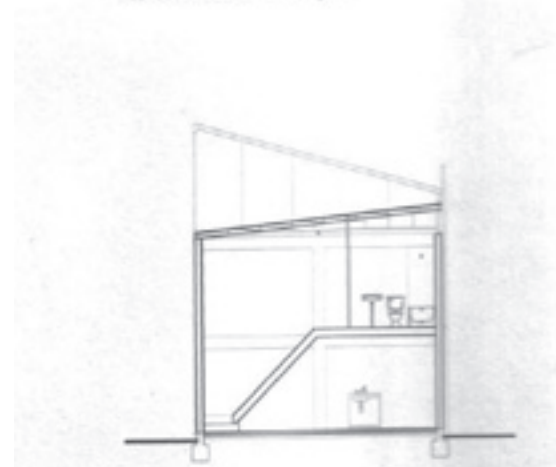
The government proposed to build new housing very far from Renca where the organized community was living, the community argued that it would threaten their livelihoods and families to move so far and raised money to buy a garbage dumpsite space within Renca. This case originated a new public policy named “Subsidio de Localización” (Localization Subsidy). The site was excavated and a landfill was made adjacent to the houses for a park, which has been abandoned. The houses are organized as row houses leaving alleys that have become the key open space for the families.

Each house was designed to grow incrementally inside within a structural shell. In reality, the organized community managed to find additional subsidy from private funding to build the complete house from the beginning. Nonetheless, the back and front yards have been occupied with additions not designed or predicted by the architects. The houses located on the main road have built small shops in their front yard space. Some families have used light steel structure because they considerer it safe and fast to build, other have used wood. No adiotional floors can be built because the structure and the tilted roof makes it very expansive and dangerous.

When interviwing Mario Orellana, he said “We passed from an emergency (situation) to an investent”



Fachada Frontal | Front Façade



Corte AA | Section AA



House type sections



Houses facades with additions



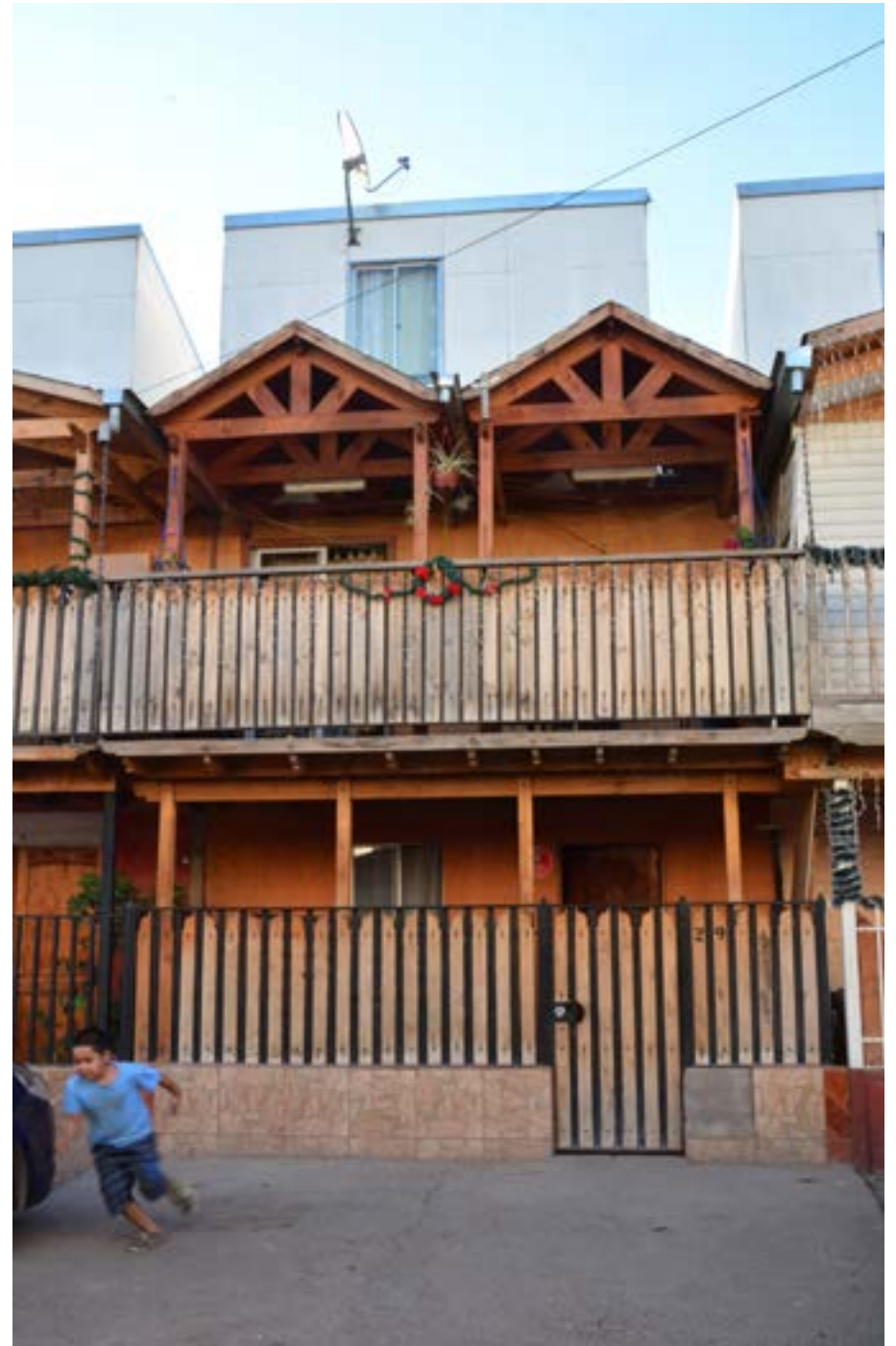
Expansions in backyards



Alleys. Expansions in frontyards



Shop additions



Frontyard additions



Frontyard additions



Frontyard additions



Sports fieldcourt



Solar panels



Small park in alley

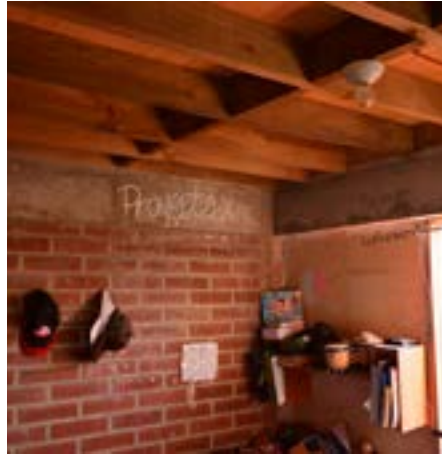


Backyard expansions

Mario Orellana's house (he has not changed the original house)



Steel beam and wooden floor



Wall structure: reinforced concrete and wood floor



Ground floor space



Staircase made with wood

Khaty's house (small changes inside divisions)



Khaty's family



Master bedroom with sliding door that opens into room



Staircase



Bathroom

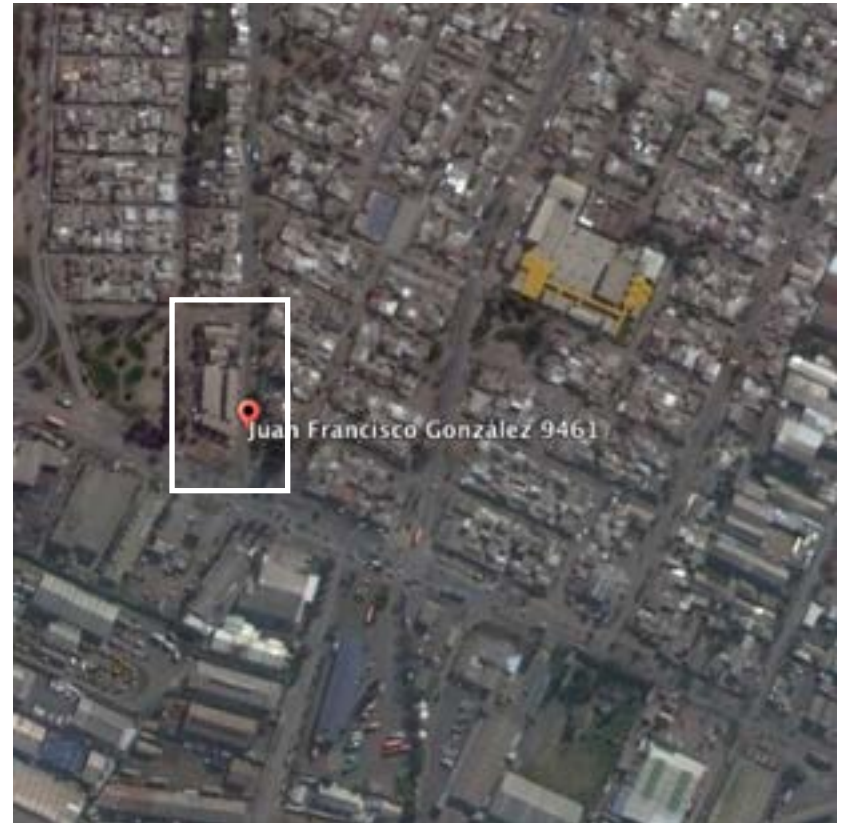


Additional room below tilted roof



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600m



Elemental Lo Espejo

Arch. Elemental

Juan Francisco González 9461, Lo Espejo, Santiago, Chile

Contact: Johanna +56965582417

Elemental Lo Espejo

Arch. Elemental, 2007

Type: Incremental growth

Previous settlement: Informal settlement very close.

Unit size: 36.2sqm // Final House: 60.5sqm (GF) and 72.5sqm (duplex)

Materials: Clay bricks, wood and steel beam

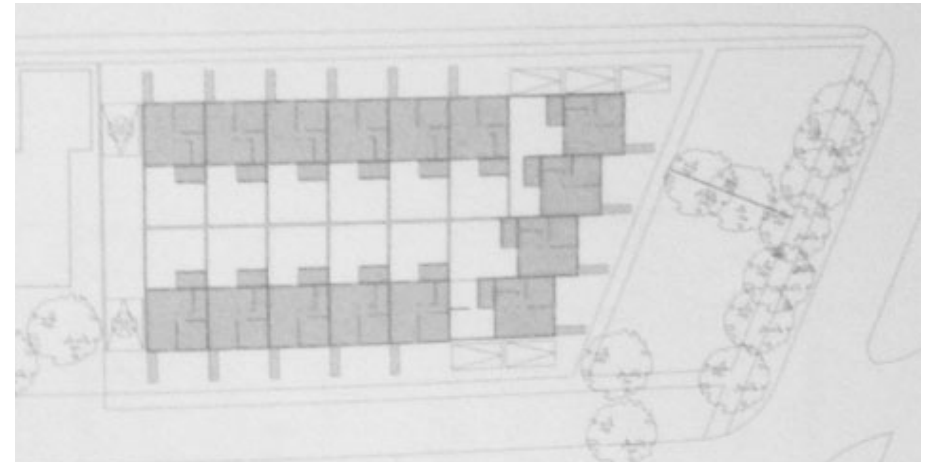
Type of growth: ground floor house (ground expansion), second floor house (second and third floor expansion)

The families of Lo Espejo used to live in Don Ramón an informal settlement (campamento) in the same area. This project was pilot project to relocate 30 houses in a small lot. The houses are row houses. One on the ground floor, with possible expansion on the ground, but very limited natural light and ventilation. The other, a duplex apartment accessed by outside stair that could grow to one side. In reality, the houses were finished before the families moved in because they received additional government subsidy.

During the house visits it was evident that the ground floor houses have little access to natural light and ventilation. Some families made significant changes in their houses. For example, Johanna changed the location of the staircase inside her house to expand and open the kitchen into the social space.



Houses as designed (from Elemental book)



Site Plan



Houses as built (from Elemental book)

Johanna's House (Duplex House)



Johanna's family



Children's room



Bathroom expanded after moving staircase



Expanded and open kitchen

Alicia's House (Duplex House)



Living room



Kitchen with original stair



Children's room



Children's room



Kitchen and dinning table



Lack of natural light in main social space



Frontyard covered with light roof



Small patio for light and ventilation



Inside courtyard occupied with ground floor expansions



Campamento (previous settlement)



Staircase



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Elemental Lo Barnechea

Arch. Elemental

Getsemaní 238, Lo Barnechea, Santiago.

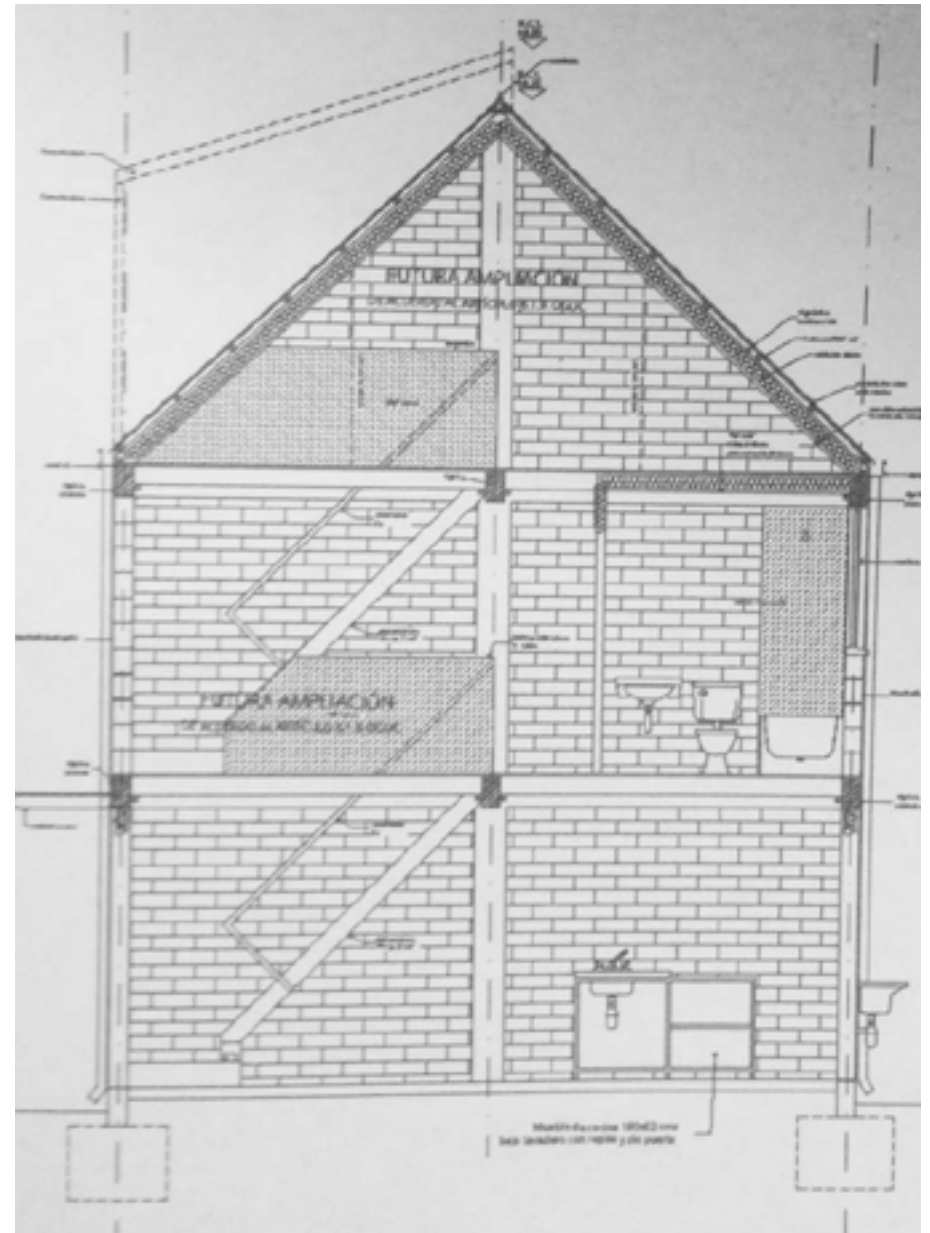
Contact: Alejandra phone +56985072732

Elemental Lo Barnechea,
 Arch. Elemental, 2007
 Type: Incremental growth inside structural shell
 Previous settlement: Informal settlement in the same site.
 Unit size: 44.5 smq (core), 27.7sqm (expansion) = 69.2 sqm
 Materials: Clay bricks, wood and steel beam
 Type of growth: second and third floors inside internal shell.

Elemental Lo Barnechea was built in a small site next to a larger housing project to relocate families living in informal settlements in the area. Lo Barnechea is a wealthy neighborhood in the northern side of Santiago, many of the people living in the Elemental houses work as house staff in the neighborhood and can walk to work. The row houses were placed in groups around shared open courtyards.

Each house was designed to grow incrementally with a shell, but as the other Elemental projects visited, the houses were finished with government subsidy before the families moved in. Each house has three floors, one bathroom and three bedrooms. They have informally expanded into their backyards or/and front yards.

During the visit, one family was demolishing a balcony they had added because the builder had made it out of steel that was too thin and it was on risk of going down. Our guide explained that the house footings were very small and could not support heavy structural additions.



House section (from Elemental's Book)



Steel Structure Expansion being demolished



Entrance to courtyard



Typical Street



Structural details of Expansions



Structural details of Expansions

Alejandra's House



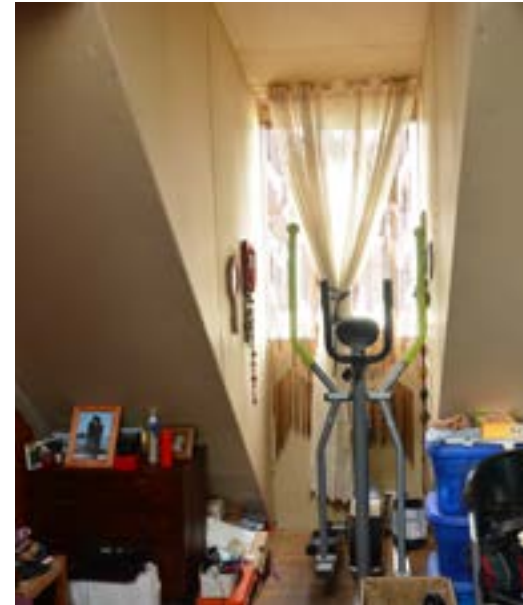
Alejandra and husband



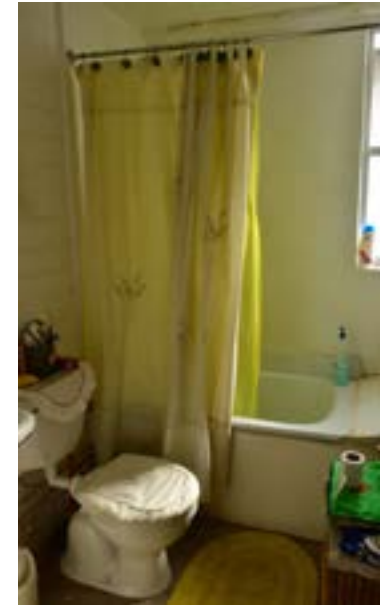
Dinning and living room



Staircase and Structure



Master bedroom (third floor)



Bathroom



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Casas Chubi, Villa El Valle

Arch. Victor Gubbins, 2005

Av. Tobalaba con El Valle, Santiago, Chile. Subway stop: Grecia

Coordinates: -33.4799881769, -70.5581553258

Casas Chubi, Villa El Valle

Arch. Victor Gubbins, 2005

Type: Incremental housing, single units paired houses.

Previous settlement: Toma de Peñaloén

Unit Size: 32.18 sqm (core) + 48.56sqm (expansion) =76.52 sqm

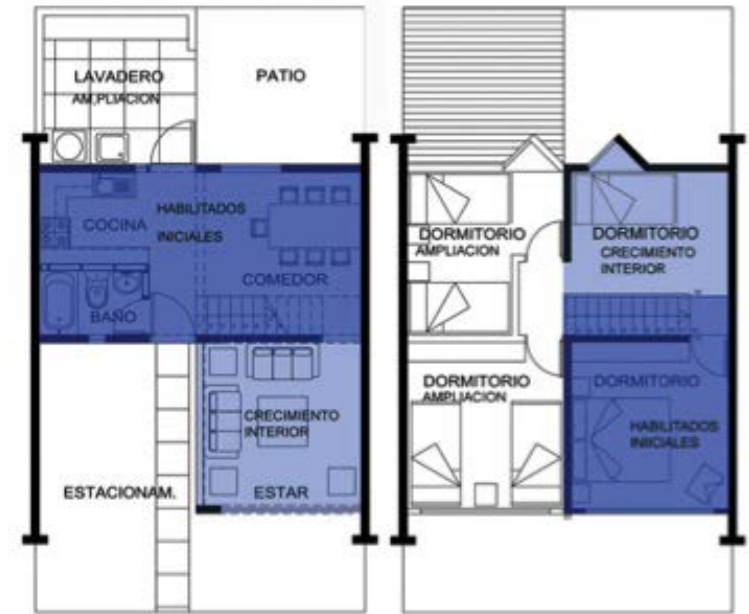
Materials: Reinforced Concrete for structure, bricks for sidewalls, wood and drywall for walls, tin sheet for roofs.

Type of growth: enclosure and finishes

“Casas Chubi” typology was developed for 4 sites in Santiago in the Peñaloén District on the east and southern side of Santiago. The families were previously settled at “Toma de Peñaloén” an informal settlement in the same area. They used to live in wooden shacks without access to basic services. The four sites are called: El Valle, Las Higueras, Las Torres y los Microbuseros. The closest metro station is “Grecia” from line 4. They can be directly accessed by “micros” (Transantiago). Each site has at least one public space, either a plaza or a sports facility.



Casas Chubi Sites



Typical House Plan, in blue initial house

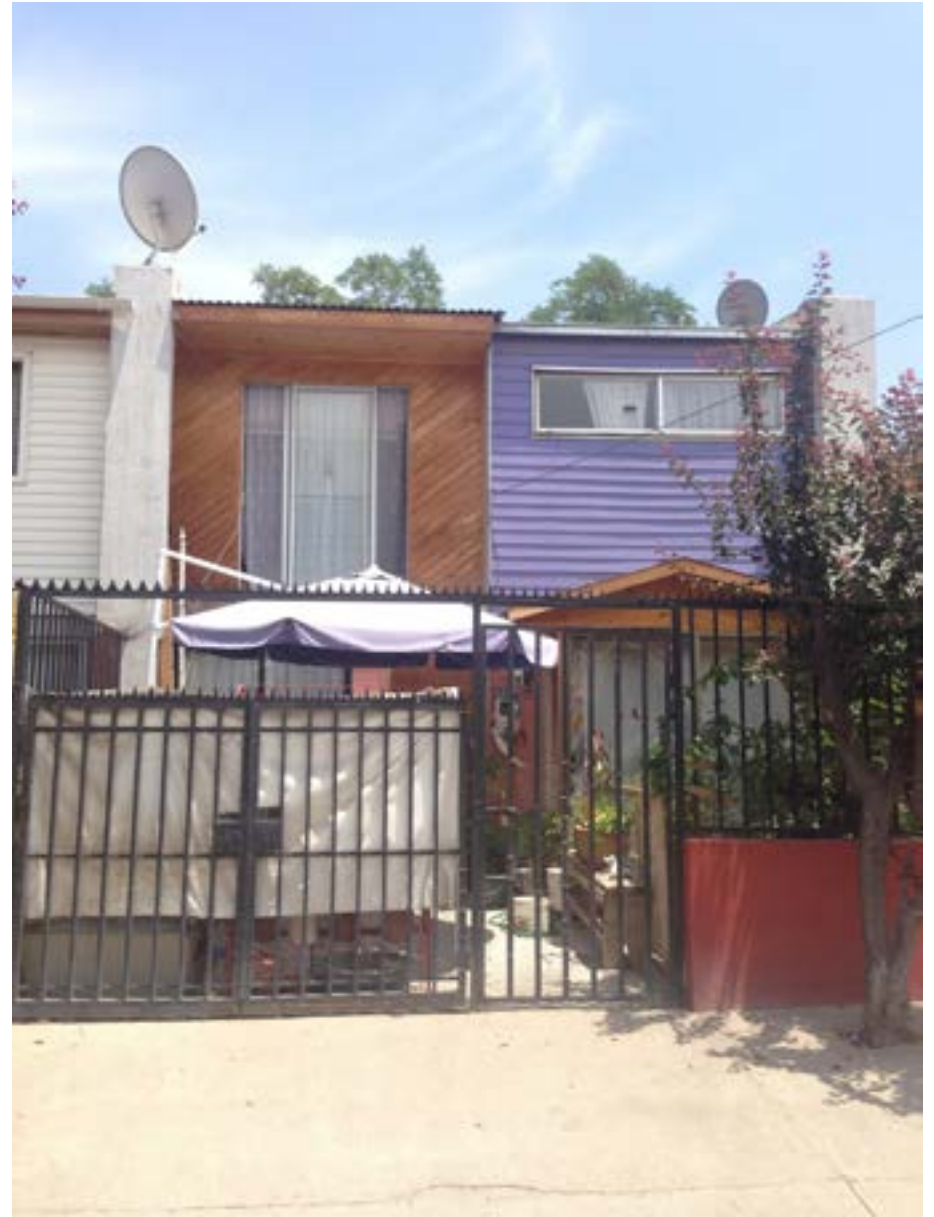
The design for incremental growth of this typology is based on a 3 by 3 meter modular plan. Each family received half a house of 32.18 sqm consisting of: kitchen, bathroom, common area and one room on the second floor with a staircase. The planned expansion can add 48.56 sqm for a total area of 76.52 sqm. The houses were designed to build within structural constraints that help control their incremental growth. A reinforced concrete load-bearing wall was built between each house. The second floor is made of wood beams supported by reinforced concrete columns and load-bearing walls. This strategy helps guide the self-construction phase because it limits the structural growth.



Incremental growth



Initial House



Expanded House

Each family received government subsidy for the initial house. After two years, if they had saved money, the government offered a subsidy to the owners so that they could build their house expansion. According to the interviews, some families had already finished theirs because they needed the extra space; others did not have the required amount of money to apply for the subsidy and remained only with the initial house. When visiting the site one could observe very few houses remained untouched. Most houses enclosed their front yard and some even opened a little shop.

Notes form talking to the tenants:

1. Some families invested in moving the toilet to the back of house or to the second floor, because it was uncomfortable to have it so close to the entrance and social space.
2. The second floor addition is built with the same wood beams and floor and walls are built using drywall.
3. All the houses remained standing after the 2010 earthquake.



Expanded House



The name "Chubi" comes from this colorful candy because of teh facade colors.



Expansion Structure



Use of front open space



Facade variations



Facade variations





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600m



600m

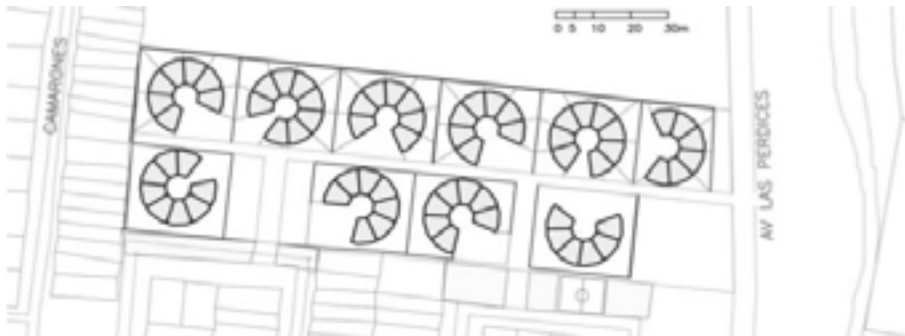
Los Torreones de la Reina

Arch. Fernando Castillo Velasco, 1998

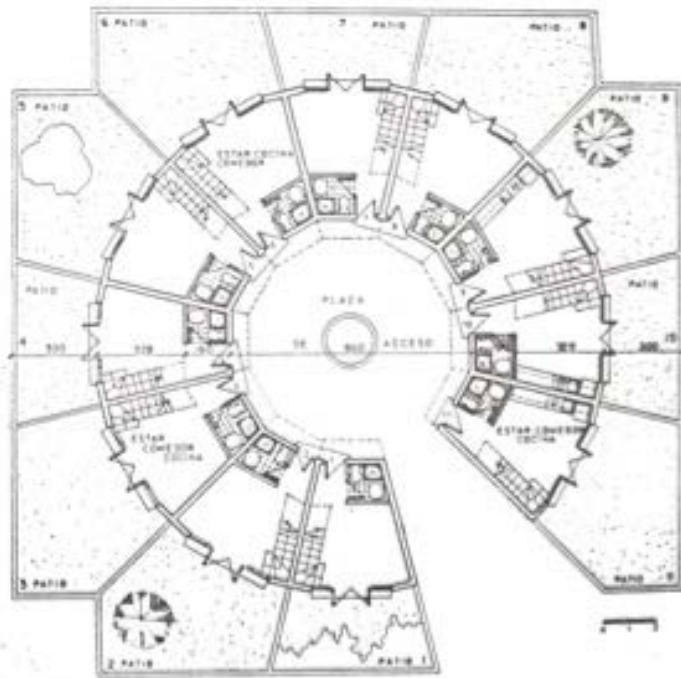
Address: Av. Las Perdices (behind La Reina Municipality). Subway stop: Egaña

Coordinates: 33°27'20.20"S 70°31'47.88"W

Los Torreones de la Reina
 Arch. Fernando Castillo Velasco, 1998
 Type: Incremental growth inside structural shell
 Previous settlement: Municipality of La Reina
 Unit size: 15.5 smq (core), 31sqm (expansion) = 46.5 sqm
 Materials: Clay bricks, wood and steel beam
 Type of growth: second floor inside internal shell.



Housing Group Plan



Housing Group Detail Plan

Los Torreones de la Reina were designed by the Arch. Fernando Castillo Velasco, Chilean architect and Politian who was elected four times as Mayor of La Reina Municipality. They are located behind the Municipality's building and were organized as a closed condominium organized in 8 groups (torreon) of 6 to 8 houses each, with a total of 71 housing units. Each group of houses is organized around a circular shared courtyard giving the shape of a cylindrical building.



Housing Unit Detail Plan

Each housing unit was paired with its neighbor around the circular courtyard. The shell was built as the core unit, which consisted of one open space on the ground floor with kitchen and bathroom. The ceiling was built about 9 meters above to allow for two more floors within the same shell. The structural strategy was to leave a steel beam to support a wooden floor structure for the second and third floors. Most of the houses visited had already build their upper floors.

During the visit to this housing project, it was interesting to see how each family has taken over their garden space to accommodate their different needs. It seems that the real incremental growth has happen within this additional ground space, where one can find: extra rooms, swimming pools or garages.



Entrance to housing units, courtyard



Wooden staircase inside a house



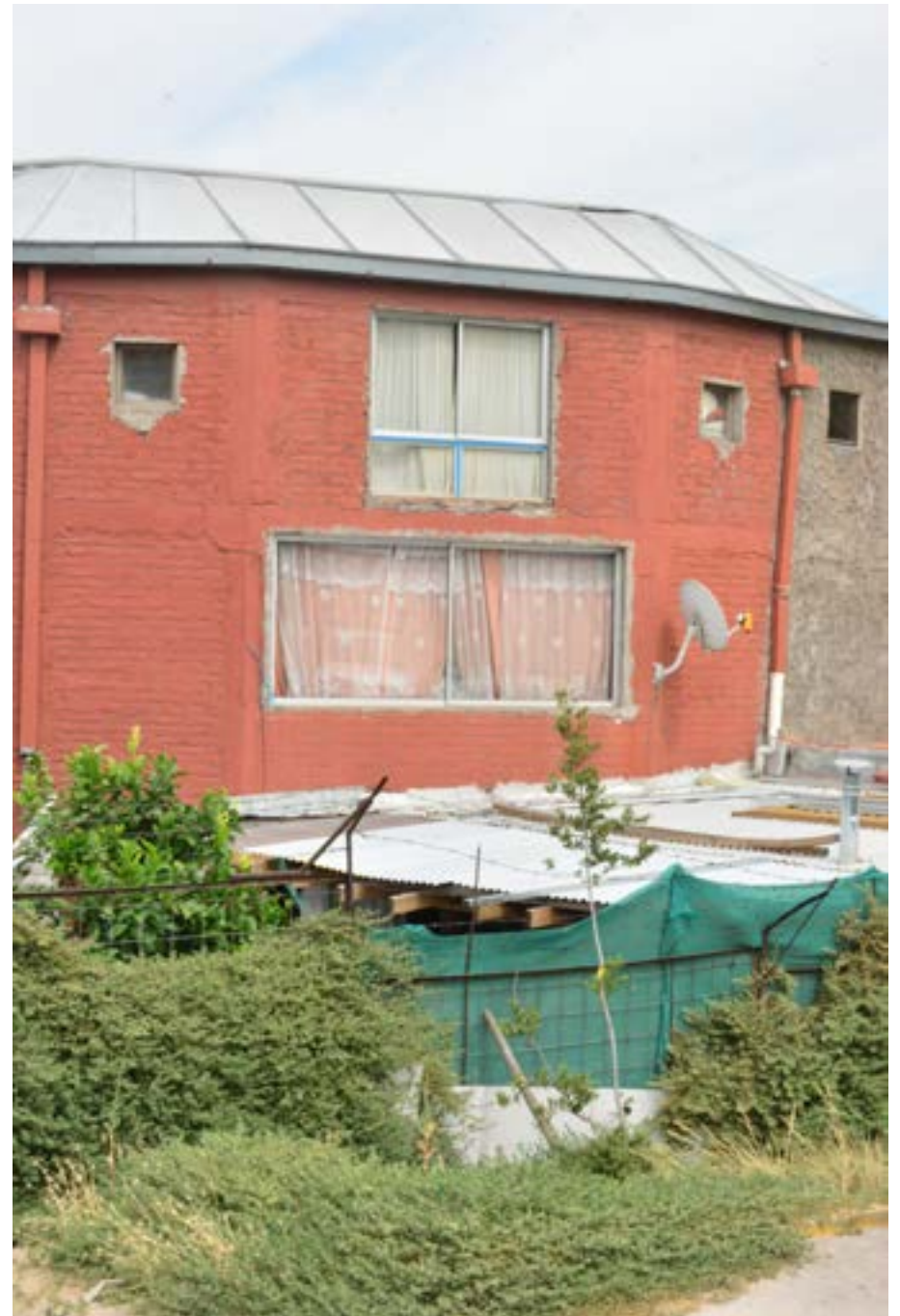
Expansion on ground floor open space



Expansion on ground floor open space



Expansion on ground floor open space



Expansion on ground floor open space



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Comunidad Andalucía

Arch. Fernando Castillo Velasco,
Address: Av. Lord Colchrane con Pedro Lagos, Santiago. Chile
Coordinates: 33°28'1.77"S 70°39'7.33"W

Villa Andalucía

Arch. Fernando Castillo Velasco, 1992

Type: incremental growth inside structural shell

Previous settlement: Cité Santa Sofía y Barrio Mata

Unit size: 2-floor type 36sqm (core) + 36sqm (expansion) =72sqm

3-floor type 30sqm (core) + 60sqm (expansion)= 90sqm

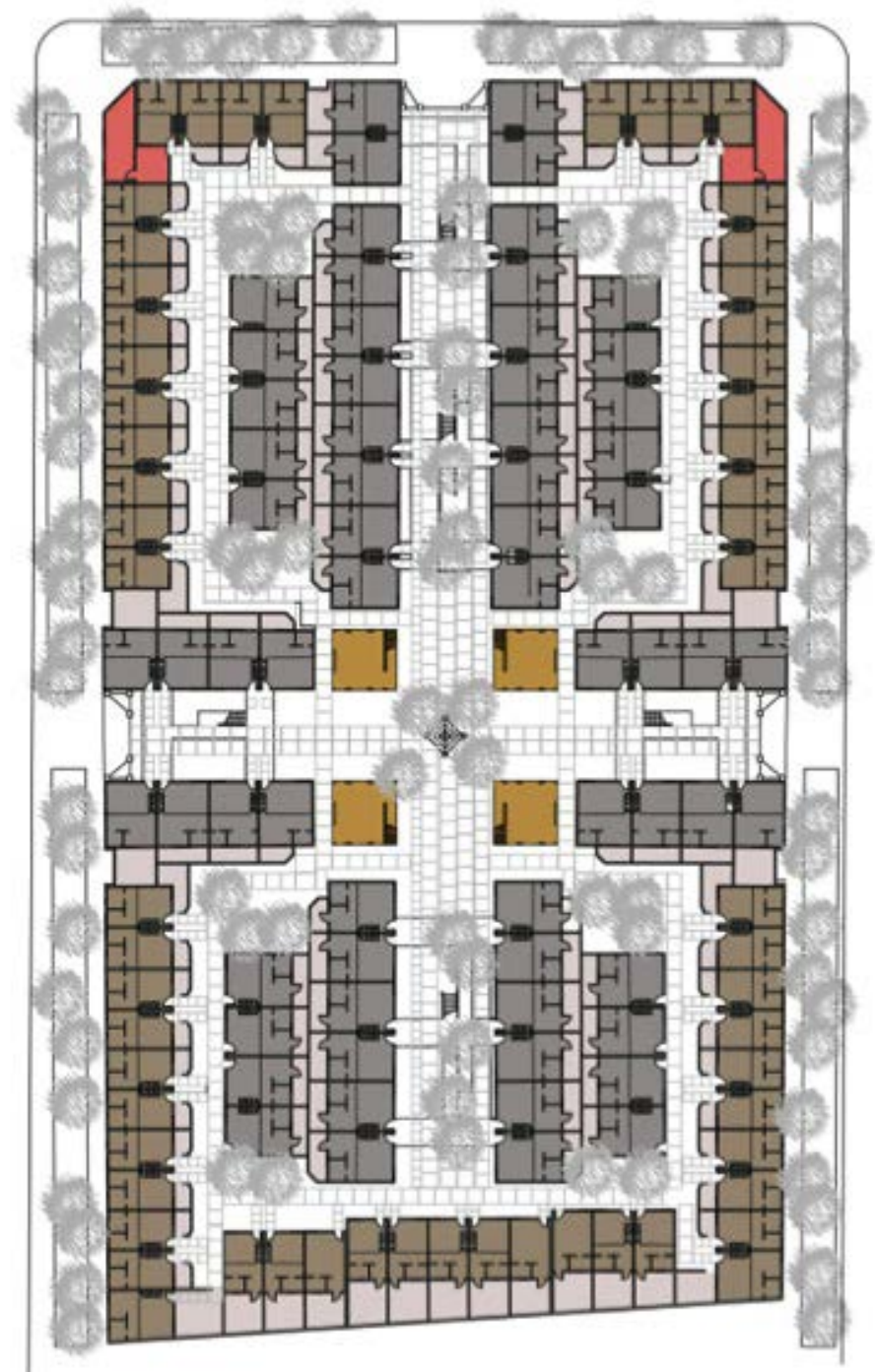
Materials: reinforced concrete structure, bricks (walls) and wood (floor)

Type of growth: second and third floor inside internal shell.

Villa Andalucía was designed as one enclosed urban block with 200 housing units, open spaces and shared facilities. The tenants were relocated to this place and given a house with the potential to grow up to two or three floors within a shell. They also have a small patio in the back, which has been used for informal expansions. The structural design included a steel beam to build the second and third floors using a wood platform as floor.

The complex is organized within one enclosed urban block with three entrances. The houses have access only from inside the complex. The corners of the block are reserved for shops that can be accessed from the outside.

The special quality about this housing complex is that being enclosed it has a strong sense of community. They are well organized, they have a community library and they share and maintain the open spaces together. They even applied for government subsidy recently to improve their shared facilities and repair houses. During the visit, it was evident the difference between the private open space in the back of the houses which has been filled with irregular additions in contrast with the front open spaces which remained untouched and well kept.



Compound siteplan



Steel beam for floor additions



Wooden staircase



View of open back space



Compound view



Shared Community Spaces



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Los Sauces

Arch. Francisco Vergara, Aldo Bravo, 1984

Address: Av, Vicuña Mackenna and Elisa Correa. Subway stop: Elisa Correa)

Coordinates: 33°34'7.26"S 70°35'4.43"W

Los Sauces

Arch. Francisco Vergara, Aldo Bravo, 1984

Type: incremental growth front and backyards.

Previous settlement: unknown

Unit size: 66 sqm

Materials: Reinforced concrete, bricks and wood.

Type of growth: second and third floor inside internal shell.

Los Sauces is located next to Elisa Correa Metro Station (Line 4). There are 843 houses organized in 12 macro blocks with an open courtyard in the center. The houses are row houses with an entrance from the street and access to the common courtyard from the backside. The common space can also be accessed through the corners of the urban block, which allows neighbors to park their cars inside. Each courtyard has a sports field and shared garden, which was not well kept.

The houses are designed in half floors and the incremental growth is within the shell. Nonetheless, some families have built additions in their backyards. Sometimes this additions bring problems to the community because they bloc the sun from their neighbors.

Los Sauces is very far from the the city center but in 2005 the Elisa Correa metro station made it easier to commute and it has brought a lot of commercial life to the area.



Elisa Correa Subway Station



Housing block continuous facade



Corner entrance to macro block



Small street between macro blocs



Small street between macro blocs



Facade variations according to incremental needs



Internal community space



Backyard informal expansions



Backyard informal expansions



Backyard informal expansions



Backyard informal expansions



Roof structure



Roof structure

