

Serrinha is one of the favelas of Florianopolis, a rich city on the Atlantic coast to the south of Sao Paulo in Brazil. While the economy of this area is rather flourishing during the summer months due to tourism, the number of residents decreases considerably during the winter and consequently the demand for labour: it is for this reason that many people in financial difficulty come here in search for a decent and stable employment but soon find themselves disappointed and forced to live in unhealthy places at the minimum affordable cost.

The main intent is to create in people a **“culture of living”**, making them understand that the welfare of the individual systems first of all from belonging to a community, to which the individual dwelling is reconsidered within a flexible, organismic urban system in which everyone has their own space and privacy. The IBGE, the national statistical institute, conducted a survey among Brazilian citizens which showed that **<< the peoples main demand is the provision of infrastructure and services, not so much a new dwelling >>** and it is precisely for this reason that we felt that the best option was to hypothesise a co-operation between the public and private sectors, since the government already spends considerable sums of money to invest in retrospective operations in the favelas. Our work aims to act upstream of the problem : the public sector will establish infrastructures in places that are suitable for building, where there is no risk , so as to avoid additional onerous funding needed successively to account for illegal structures, as happens today. The public and private sectors dialogue together in the project: the public investment is necessary as it comprises both material and conceptual impulse to change the traditional way of living in the favelas. This investment can be recovered by a fee of minimum lease that the private sector pays. In contrast to the undisciplined growth of Serrinha, which occurs by means of reckless deforestation and illegal occupation of land, a regulating criterion was sought for which, thanks to the repetition of a module, would give rise to public and private spaces in order to create an ordered and efficient structure. This criterion refers to the Le

Corbusier principle of the “bottle holder”: a main building in which housing cells can successively be inserted. The basic unit is a **skeleton infrastructure** of 3 modules by 4, with a central court being property of the municipality, comprising of floors, connections to plant and public utility networks, in which independent cells housing can be created by private individuals. The **module** size chosen is 4 x 4 meters excluding wall thickness, the minimum space that could accommodate the right amount of standard furniture, taking into account the minimum distances between them and the needs of a medium-low budget household. The infrastructure can thus accommodate different forms and sizes of apartments , starting from the minimum (lavatory/facility cell and night/living cell), up to larger ones , gradually increasing the number of cells occupied with the expansion of the simple **rules**: each module must have a minimum of 2 views to ensure good ventilation and lighting, the facility blocks must be placed in prearranged cells so as to be aligned vertically throughout the infrastructure, the 2 central modules are dedicated to the common courtyard where staircases and facility systems can be arranged installed.

This system solves two major problems: the lack of areas pertaining externally to the apartments and social gathering places. In fact, following the necessary rules, the infrastructure blocks would never be fully saturated, but would leave some empty cells. The module of 16 square meters and the compositional courtyard criterion gives flexibility in the infrastructure mesh such as to allow the insertion of **blocks for public use**. If the morphology of the terrain permits, the infrastructure 3x4 can in turn be aggregated with others forming more complex solutions.

The main objective for the creation of the basic infrastructure was that of being as **lightweight** as possible, so as not to impose too much on unstable ground. It rests on the specific reinforced concrete type foundation that allows minimising the impact on the ground and without destroying the layers of vegetation and, most importantly, are adapted to any slope gradient.

Cement was chosen as the construction material because it is easily available and convenient for construction, which the population is accustomed to for years. The supporting frame is made up of pillars and beams of laminated pine wood produced on site. The horizontal elements have a wooden structure, a thin screed for stiffening and a paving still in wood. The coverage, which is detached from the last floor, uses bamboo frame beams on which metal sheet coverage is housed.

The morphology of the infrastructure comes from a careful study of its **section**, designed in such a way as to ensure a good hygrothermal comfort without the aid of cooling and/or heating, which would be excessive for a mild climate like that of the island. The ground floors are raised from the ground so as to let fresh air through, which will be directed into the court, to escape from the space below the raised roof. The overhanging roof and wooden brise soleil become an instrument of protection from the sun rays.

Once a certain number of modules have been rented, the user proceeds to their buffering, which occurs through the combination of **panels**: those on the outside are made with recycled plastic bottles (with the function of isolation) embedded in hemp-lime, while internal ones are largely composed of plastered bamboo, that is a technique of creating a lattice of bamboo canes reinforced by layers of mortar. The idea of modular panels arises from the need to design housing that is **flexible and expandable** over time with simple procedures. The typical family is in fact extremely variable over time (an average of 4 people but in some cases even doubling) and generally does not occupy the same dwelling for more than 10 years. It is for this reason that the dry mounting of the panels takes place by scrolling and interlocking them; the single element has a tripartite structure so as to be drained easily if you want to open doors or windows at a later time. The production of these panels triggers an **internal economy** from which the company can draw benefit: assorted waste and sustainable building would be encouraged by the prospect an

economic return, and at the same time would reduce the need to import the construction materials from other countries, benefitting from the utilisation of local products.

The project also includes a possible merging of the infrastructure units at the **urban level**. When the cities' topography increases in gradient, roads comply by running straight along the steepest routes where houses are implanted laterally, with their larger side facing the valley. The project involves a hierarchy of roads: the main one, which provides access to Serrinha and essentially parallel to the contour lines, is a linkage road (vehicular and pedestrian) and serves for the main connecting roads; the secondary roads, i.e. less parallel to the contour lines used only for communication and pedestrian; and finally the roads that cut through the contour lines, hardly passable by car, make up the core of the infrastructure network, coming to connect the individual infrastructure blocks and allowing only pedestrian linkages.

¹ Da: *La bella favela*, di Rocco cotroneo, settimanale Sette n°46 del 13-11-2013.

2. da: Inventory of Carbon & Energy (ICE), prof. G. Hammond & C. Jones, Department of Mechanical Engineering, University of Bath.

Business plan The collaboration between the public and the private sectors results in a first public participation to provide a secure and connected infrastructure and a second private one in which the users, according to their needs, lease the necessary number of cells, taking care to pat them and develop the systems. So the users expenditure divides in two components: a monthly one (66 RS for each cell leased) to repay the public infrastructure to be paid for 30 years, after which the infrastructure will become the property of individual users, and the other one for the cost of the structure, that may be paid immediately or by a bank loan depending on the family's availability (approximately 240 RS per month for 15 years). There is also the possibility

that the government remains the owner of the infrastructure, case in which the monthly rate would be considerably cut down.

Here it is an example of a single infrastructure, 4 apartments (2 per floor) for 4 people each:

	Incidence %	RS (Reais Brazilian) Cost	Euro Cost
Infrastructure			
Fondation	10.3	56.800,41	18.260,28
Frame	14.7	81.367,91	26.158,27
Horizontal partitions	39.9	219.996,11	70.724,66
Stairs	1.4	7.863,42	2.527,94
Roof	2.5	13.625,82	4.380,45
Total		379.653,68	122.051,59
Structure			
Systems	14	77.286,69	24.846,23
Walls	17.2	95.107,39	30.575,26
Total		172.394,08	55.421,49
Total	100	552.047,76	177.473,10

Families for infrastructure: 4

Cells for family: 4

Maximum habitable cells for infrastructure: 16

Minimum salary for family: 1,356 RS (source: University of Santa Catarina, Florianopolis)

- It is considered that 1/5 of the minimum salary will be spent to repay the infrastructure and another 1/5 to pay the structure.

1/5 of the minimum salary: 271.2 RS

- **Infrastructure cost**

Fixed time to pay the infrastructure: 30 years

Cell's monthly cost: 66 RS

Apartment's monthly cost (4 cell): 264 RS

Every year the rent will increase by 2,26% (quote taken from an average of the last 15 years of the italian indices)

- **Structure cost**

Structure's monthly cost: RS 240

Time to pay the structure: 15 years