Precast Concrete Housing Solutions (PCHS)

Submitted By: Summary Architecture



Organization Profile

Organization Name: Summary Architecture

Organization Type: Private sector

Website: https://summary.pt/en/

Practice Details

Country(ies): Portugal

City(ies): Arouca, Ovar, Ílhavo, Vale de Cambra, Lisboa

Start Year: 2019 **Ongoing:** Yes **End Year:** N/A

Main Adequate Housing Components:



Housing Thematic Areas:

- Social Housing
- Housing & Climate Mitigation
- Housing Data & Monitoring
- Technology & Digital Solutions in Housing

Relevant SDGs:



UN-HABITAT

Problem & Context

Portugal's housing crisis results from market liberalization, tourism expansion, and insufficient public policy. Rising property prices and rents—fueled by foreign investment, short-term rentals, have limited access to affordable housing. With social housing representing less than 3% of the total stock and wages stagnating, many households face displacement. Policies such as the "Golden Visa" have encouraged speculation, while weak rent regulation and low public investment deepened inequalities. The absence of a long-term housing strategy and poor coordination between national and municipal levels hinder effective governance. Prefabrication construction methods offer faster, more cost-efficient, and sustainable housing solutions, enabling large-scale delivery and reducing environmental impact. Integrating such technologies into public policy could expand affordable housing access and promote territorial and social balance.

Solution Developed

The main objective is to propose a rapidly implemented solution that is replicable on a large scale, generates little construction waste, and is primarily factory-produced, given the shortage of construction workers. Its presents an accurate and efficient answer to the contemporary need for simplify and accelerate the building processes.

Thus, the aim is to quickly respond to the lack of social housing, demand that has increased with the pandemic and has been further pressured by increased immigration and rising housing prices. The efficiency of the system is directly linked to the speed of housing production and the reduction in the waiting time of populations for decent and healthy housing.

The effectiveness of the solution is based on the evolutionary system, which each module leaves the factory completely or partially ready, including all interior and exterior finishings, insulations, window frames installations and also fixed furniture pieces. This approach of production of all components in factory environment, allowed a faster and highly controlled construction process, avoiding construction problems, unforeseen events, on-site concreting, thus reducing waste production.

Implementation

The prototype system is the result of a research and development project with partnership between 20 companies specialized in different areas, from concrete prefabrication, incorporation of biomaterials in construction, technology and industrial automation. Thus, in a situation like this, the architecture role is not just about to design but mainly to coordinate based on data-driven design, in order to take advantage of the know-how of each company to enhance every feature of the solution. The prototype was developed to meet a specific demand from a city council in northern Portugal: a two-bedroom house (which could be expanded to three bedrooms in the future), to be used by people involved in a family organic farming project.

The most important task: to build it as quickly and cost-effectively as possible. The solution was developed five times faster than the average in Portugal, without compromising the building's structural quality.

Enablers & Obstacles

Municipalities of Portugal were directly involved in contacting the office to develop projects within the scope of the recovery and resilience plan, the PRR. One of the main obstacles encountered concerns the public procurement regime for projects. Nevertheless, there is still some "prejudice" against architectural projects that use prefabrication as a resource, still associated with post-war imagery. However, the project design seeks to deconstruct this myth.

Results & Impact

In a longer-term the impacts of the Evolutionary Precast Concrete Solutions are the reducing construction costs - by larging the scale production, reducing material waste and shortening construction timelines –. That can attract private investment in the production of affordable housing.

In addition, the application of biomaterial in the production of modules promotes the circular economy and social inclusion of communities involved in the regional production of rice and agricultural waste processing, for example. Furthermore, in the case of applying rice husks with concrete, it provides a high thermo-acoustic performance and energy efficiency of the home, reducing dependence on heating/cooling equipment and the entire chain involved.

In terms of the urban policies, the modularity enables rapid expansion of the dwellings stock, reducing deficits and easing pressure on rental and property prices. Also, the addition or partial replacement of Portland cement with rice husk can decreases the use of high-cost, high-carbon cement.

Now, 24 dwellings made with evolutionary precast solutions were delivered and 64 are under construction. It's worth noting that, in addition to the homes delivered using the same system, four kindergartens and a sports center were also built. Another kindergarten and sports center are currently under construction. At least 88 families were benefited with new dwellings and a wide range of other families were benefited with the social facilities.

Replication & Scale Up

The evolutionary design solution was repeatable, across Portugal in seven projects with 87 dwellings so far. The successful is enabled by data-driven concept processes that improves efficiency when designing for different sites and contexts, making the project more adaptable and optimizing the outcomes. Furthermore, the design based on information enhances the

modular systems to diverse typologies and regulations. Also, the Partnerships with local industry and factory-produced elements, ensuring speed, quality control, and cost reduction.

The replicable framework of evolutionary precast solution by modular design can be easily scaled-up and the project can be exported by joint-venture models, to ensure design quality and local monitoring. Also has the flexibility to adapt to different geographic contexts, housing requirements, and building codes, whether in Europe or abroad. The know-how acquired through the incorporation of biomaterials into the process enhances the incorporation of other biomaterials available in each location, strengthening the local circular economy and aligning with global sustainability benchmarks.

Policy Uptake

This housing practice is a new or innovative practice that is not yet adequately or fully integrated into formal policy frameworks.

Since 2023, the prefabricated and modular solutions were integrated in national legislation for public projects. Despite the recent integration of the subject in the legislation, a broader incorporation into public housing promotion policies is necessary, allowing for the effective advancement of replicability and large-scale production.

Furthermore, there is still some prejudice against prefabricated solutions, still stemming from the post-war period. The trend, with the increase in new prefabricated projects, is to reverse the perception of this solution.

Lessons & Takeaways

There is still some way to go in incorporating biomaterials into the composition of prefabricated elements and reducing the system's carbon footprint.

However, the circular economy and end-of-life solutions for scalable precast concrete solutions need to be improved, leveraging modularity in a sustainable deconstruction and reuse process for new projects.

Furthermore, there is a need to expand quantitative and qualitative monitoring of post-occupancy projects to improve proposed design solutions and support data-driven design.