

Facing Emergencies: Design Strategies

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ABSTRACT

Some of nowadays problems have, due to general misunderstanding, been relegated out of our thoughts, as if they concerned us only remotely. One of these is the relationship between architecture – architectural design – and emergencies. But can the world of designers still find itself almost unprepared, as if taken by surprise, for a phenomenon that involves tens of millions of persons?

Each year, due to earthquakes, war and emergencies of various kinds, temporary camps are set up all over the world, facilities which often turn out to be anything but temporary. Emergencies can no longer, in fact, be considered extraordinary, linked to uncommon, unforeseen and unpredictable events.

Starting from these key considerations, the proposed essay – part of a research project on the subject of emergency housing conducted by professors of Architectural Composition at the DICEA, Faculty of Engineering, Sapienza University of Rome – will argue that, on the contrary, emergencies are very often predictable, manageable, and subject to planning aimed at reducing to a minimum the hardship of the people involved.

Analyzing selected fast, economical, comfortable, repeatable but versatile, solid, and last but not least, urbanistically, architecturally and aesthetically valid proposals dealing with emergencies, the authors outline a strategy focused on considering emergency housing an experimental topic of architecture, highly oriented toward finding an indispensable synthesis between structural researches, technical issues and the configuration of space

The essay deals with the subject of combining different materials – traditional (bamboo), innovative (teflon, polypropylene), recycled (containers) or usually considered inappropriate for construction (cardboard, pallets, rubble) – and modern prefabrication techniques, also digital, in order to propose a conception of systems for assembly, stiffening and eventually reach appropriate structural shapes.

Keywords: *Emergencies, design strategies, structural shapes, systems*

THINKING IN A DIFFERENT WAY

Each year, due to earthquakes, war and emergencies of various kinds, temporary camps are set up all over the world, facilities which often turn out to be anything but temporary. But even this parallel universe can be – at least in part – subjected to methods of planning and standardizing, rather than being ignored; if nothing else, because millions of people live in these places and will continue to live in them. And these people are not merely looking for shelter, but are continuing to seek, in spite of everything, the values of security, domesticity, family life, privacy and perhaps even an aesthetic quality in living.

The question is deciding how to respond – as we must – to this demand for living quarters in urbanist and architectural terms. Tackling the theme of how to deal with the sudden need to

build, as quickly as possible, decent living quarters means first of all realizing that the overall problem can be studied apart from individual cases of emergency.

It means accepting the normality of a problem that is both elementary (providing simple living quarters) and complex (involving many persons). It means finding solutions for responding to emergencies that are fast, economical, comfortable, repeatable but versatile, solid, and last but not least, aesthetically valid, as regards both architecture and the urban context. It means finding a way to preserve the very roots of inhabiting, of participating in an urban and social grid despite the obvious temporariness of the housing. It means thinking in a different way.

The barycentre of our thoughts should not be merely the permanence of architectural construction and the significance of its image. Faced with an emergency, the role of the designer changes, assumes other distinguishing features. The central theme of a project is no longer its ability to withstand the passage of time and the changing whims of fashion. Nor is it the creation and preservation of an image within a context that is undergoing rapid transformation.

Design for living “on the Edge of Survival”

An emergency project must operate among apparently irreconcilable contingencies. It proposes to furnish immediate shelter for communities overwhelmed by an unexpected event. But at the same time, to create the conditions for constructing, even temporarily, a section of the city, or a neighbourhood, at least a centre providing the inhabitants with a place where they can reconstruct their own cultural identity. But here things become more difficult. We do not know with statistical certainty that such an emergency will arise. We know with a certain approximation its dimensions, but we cannot know when it will happen, and hence its specific nature.

What can be done then? Wait for an emergency to arise, and then consider the specific problems of each situation in terms of the hardship imposed, the multiplicity of contexts, variability of climatic conditions, fluctuating availability of economic and material resources? Or let the reasons of the market prevail by demanding universal, standardized solutions for mass production, and as such valid on a broad scale, for “inhabiting the global city”? Or lastly, seek an intermediate way, based on the concept of adapting one or more general models to each particular case?

Although profoundly different, the projects for providing living quarters in emergency conditions [1] [2] are linked by an evolutionary thread that runs through some of the main strategies: perfecting, through new technologies and materials, well-tested prototypes; developing innovative structural concepts and ‘suitable’ spatial configurations, that is, different possible declinations of a construction know-how that traverses time and nations [3] [4].

The first design response, requested by those involved in humanitarian operations, who experience directly the dramatic scope of the catastrophe, concerns immediate action. It consists of shelters to be assembled instantaneously and lived in at once, as a valid alternative to the usual distribution of military tents. Emblematic for its concreteness is, in this regard, the temporary habitation model set up by the Croiz Roja Peruana and IFRC in the regions of Peru struck by the disastrous earthquake of August 2007.

Using locally available materials – bamboo mats and sheets of plastic over a structure built of wooden poles – over six thousand huts were constructed, providing shelter for nearly two thousand families. Always Spartan and primitive in form, these constructions represent a warning to designers of the importance of given decisive, effective and prompt responses to ensure physical survival in unbearable conditions and to bear witness to the value of involving the population struck by catastrophe in rebuilding, not only their own houses but above all the community’s identity, also through reference to local traditions. The project for a space in which

to live temporarily thus requires, in the first place, the capacity for combining economy and rapid operations schedules, in both transporting and assembling dwelling places. But it also requires planning on an operational scale that frequently assumes the dimensions of a small city, and thus comports other themes in addition to the purely architectural one, such as that of the outdoor space belonging to the dwelling place, of relationships with neighbours, of common spaces, and of community functions.

Constructions to meet emergencies create settlements comparable to little towns, in which to live realistically, sometimes for long periods of time. The criteria of economy and fast construction influence the project, orienting the selection of materials toward items locally available at very low cost, and direct technical decisions toward systems of dry assembly of simple components, standardized as far as possible, and hence manageable, interchangeable and reusable. Traditional solutions utilizing bamboo, one of the most renewable materials on earth, along with clay, sand and straw, are flanked by innovative options such as those utilizing honeycomb panels made of polypropylene, sheets of teflon or elements made of reinforced fibreglass, or experimental materials such as waterproof corrugated cardboard, or hypotheses of reutilizing existing components such as pallets and containers. A wide range of different materials is selected for the performance they offer. Their utilization is subordinated to the designing of systems for assembly, stiffening and then the most appropriate structural shape.

The urgency of the problem calls for a pragmatic design approach oriented toward finding an indispensable synthesis between structural aspects, technical aspects and the configuration of space.

In constructing for emergencies, the terms form and function are linked in a deeper relationship, no longer of subordination, but of simultaneity or identity. "Form and function do not follow each other, they are actually interchangeable terms". Adopting this simple principle, both structural and compositional at the same time, Pablo Castro and Jennifer Lee (OBRA architects, New York) impose a strict interpretation of architecture for emergencies as a form of extreme artistic expression that intercedes concretely on reality to improve the living conditions of those who find themselves unwillingly living "on the Edge of Survival".

To ensure that immediate action, decided and precise, is also aware such action must spring from a rigorous, shared disciplinary concept.

The prototype for global temporary housing designed by OBRA architects, called Red+Housing, displayed in the entrance courtyard of the National Art Museum of Beijing in 2009, is an example of the concrete application of precise rules of operation. Each design decision has been assessed considering its possible consequences. The project – which "aspires to universal applicability" – is designed to be used, with simple modifications, in different situations and different countries.



Figure 5. RED+HOUSING, OBRA Architects. Construction phases of the prototype of the project.



Figure 6. Interior and exterior view of the prototype built in the courtyard of the National Art Museum of China, Beijing, 2009.

The cruciform layout, for instance, is ideal for establishing a condition of planimetric indifference, allowing a wide range of possibilities, including extending the house's space to the outside, and hence versatility for different uses. The precision of modern digital prefabrication ensures production economy, easy transport and rapid construction. The residential unit, either single or multi-family, resembles a three-dimensional puzzle, being composed of a limited number of bamboo plywood panels, differing in shape depending on their utilization: flooring, side walls, main fronts, or interior partitions. While the two-dimensional shape of the primary elements facilitates transport, the predisposed jointing system simplifies and accelerates raising of the vertical structure. In the barrel vaults of the roof, the structural specificity of the material employed becomes evident. "With the same force with which a bow propels an arrow into the sky" strips of bamboo plywood support the waterproof outer shell, whose bright red colour reflects the iconic and domestic nature of these basic living units.

The same search for synthesis between material requisites and the strength of a conformation in this way of building with bamboo panels and strips is found in the cardboard tube system invented, tested, applied and perfected by Shigeru Ban in the numerous works that mark a long and significant professional career, which is also emblematic for commitment to ethical ideals. “I found that what I wanted to do, and what I was able to do, coincided” [5]. Motivated by this personal challenge to use intuition to supersede the boundaries of the commonplace, Shigeru Ban has gone so far as to test paper, an element of Japanese artistic tradition, as a building material, demonstrating how it can also possess structural qualities [6].

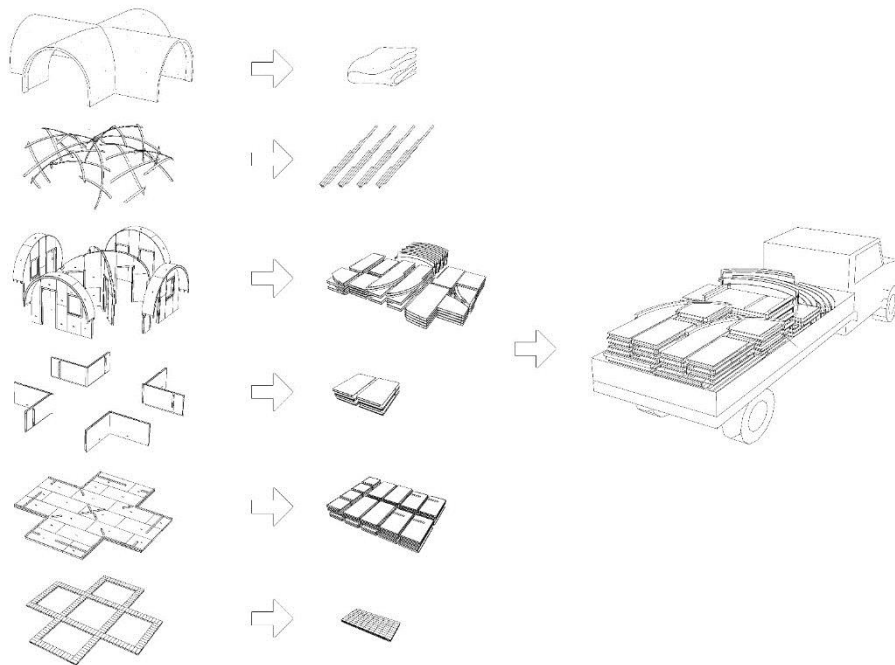


Figure 3. RED+HOUSING, OBRA Architects. Exploded axonometric drawing and disassembly of the housing components for transportation.

But the originality does not lie merely in the utilization of a material inappropriate for structural use – cardboard tubes suitably combined – so much as in the concept of a building that is elementary, and hence easily transmissible, temporary but not ephemeral and, above all, versatile and subject to evolution. Fast to build, fast to disassemble and recycle, PaperLog houses are still today the simplest and most radical project of Shigeru Ban. For their assembly method, simple enough to be done by anyone, and for their economy, they were used as emergency shelters at Kobe, Japan, after the earthquake of 1995, at Kaynasli, Turkey, in 1999 and at Bhuj, India, in 2001. In each of these places, minor differences in the materials and details served to interpret different housing traditions and different concepts of form.

In his most recent experiments, still on paper, Ban gives proof of personal sensitivity in perceiving the primary needs and necessities of mankind. For example, when he faces the problem of the loss of privacy of the homeless lodged in the great public buildings remaining still standing, pending the organization of aid and the construction of temporary living quarters, some kits composed of wall panels, tubes and joints in cardboard, sheets of PVC, along with instructions for self-assembly.

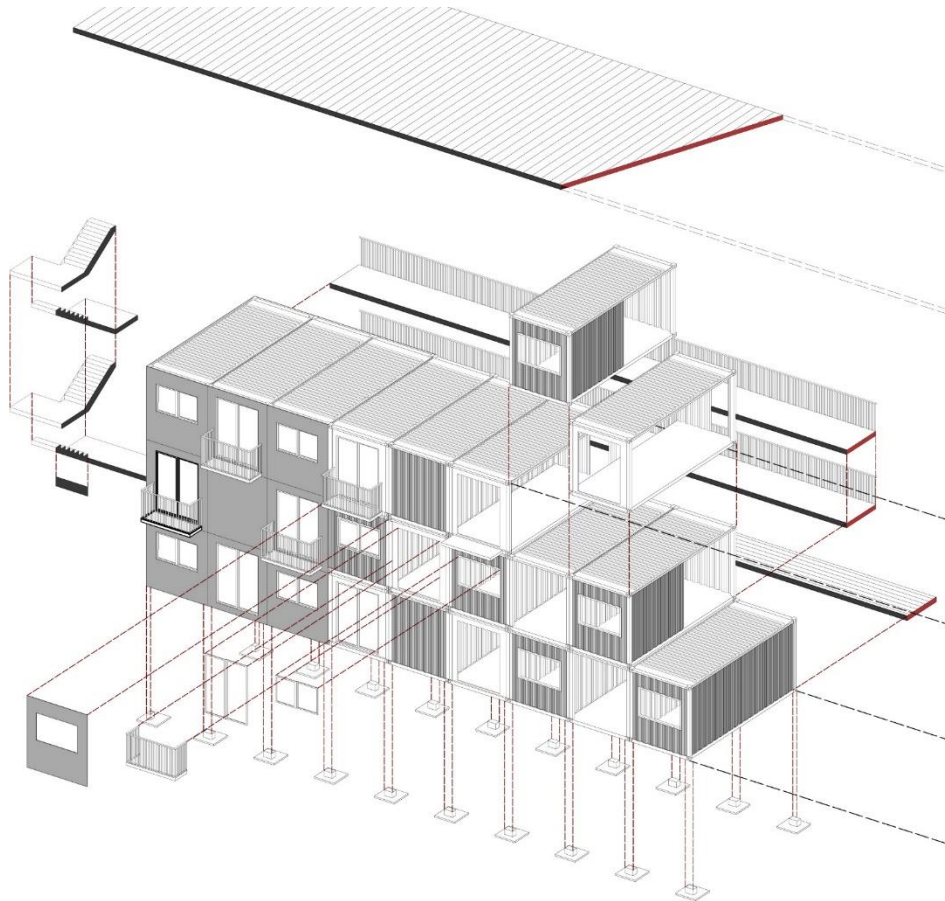


Figure 4. Onagawa Container Temporary Housing, Shigeru Ban Voluntary Architects' Network. Exploded drawing of the housing system's components (*drawing by L. Usai*).

Paper House for Niigata earthquake refugees of 2004 and the Paper Partition System used at Fukuoka in 2005 and Onagawa in 2011 are small design contributions, useful tools for allowing the homeless to carve out, within undifferentiated collective spaces, areas of privacy for each family, as well as common rooms for children to play in, study halls and areas for medical assistance.

The Japanese architect is continuing his research on emergency housing by proposing the Multistorey Container Temporary Housing, a complex consisting of 188 temporary homes for earthquake refugees, recently built on a baseball field at Onagawa, Province of Miyagi, Japan.

To shorten construction time, existing containers for transport were used, placed one on top of another up to a maximum of three levels. To lighten the compactness of the blocks and to limit their number, the elements are arranged like a checkerboard within a frame, with open spaces left between each unit. The apartments are designed in different sizes, each occupying one or two bays dictated by the standard size of the containers (20 feet). Inside each container are the bedrooms and bathrooms; the kitchens and living rooms, instead, are placed in the empty spaces between the containers, enclosed by glazing. This alternation of fullness and voids, of openings for the windows and of different colors makes the appearance of the new multi-level buildings less monotonous.

The goal of minimizing volumes for transport and storage while simultaneously reducing assembly steps is shared by other projects engaged in research on the best "form of house" and on providing minimum living quarters as a rapid response in the first hours after a disaster.

The recent living quarters project called EXO Shelter Unit, developed by the Reaction Housing System and advertised as a global strategy, instantaneous and sustainable in case of

emergency, is designed to shorten the waiting period as much as possible. A project of the designer Michael McDaniel, this unit is divided into two parts: a rectangular platform as base, made of steel with wooden flooring, and an upper shell, consisting of a polypropylene compound over a reinforced aluminum structure, shaped and sized to be stacked, or rather piled on upon another and so to shipped in high quantities by truck or by sea. The shell, with its fast, simple assembly, contains folding beds in its sides.

The versatility of the system is delegated to a series of optional accessories and equipment that make the elementary structure suitable not only for living quarters but also for other uses. It can be expanded by connecting it with other modules, to be grouped in temporary quarters around public social spaces.

Other projects are apparently based on a predominant formal solution, such as the dome configuration. This is an evolution of the natural bond between structural concept and spatial configuration. As Fuller taught, the dome is the most suitable form of delimiting space as regards the relationship between useful surfaces and size of the shell.

Among the numerous experimental projects advanced over the years, the U-Dome temporary housing system employed by the humanitarian association World Shelters for Humanitarian Needs, produced in California, the Dome Shelters, similar to the modules of the Dome Village (a facility for the homeless built in 1993 in Los Angeles and now dismantled), and the Shelter System's Relief Dome Tents, used in Haiti in 2010, reinterpret the structural system of Fuller's geodesic dome using products borrowed from other research sectors, most notably the plastic materials industry, the textile and aerospace sectors.

New materials, light and strong, with low cost and long life, generate new technical solutions. Honeycomb panels in polypropylene, for instance, form the shell and the origami beams of the U-Dome; high-tech composite panels are used for the portable refuge called Dome Shelters. The Shelter System's dome/tent is made of multi-laminar tear-proof, fireproof, waterproof fabric, resistant to UV rays, along with PVC tubes and resin joints.

The multiplicity of strategies, composition approaches and technical/structural principles that are theoretically possible reflect the dichotomies between shelter and home, between the precarious and the domestic, between local identity and global dimension, between each and all. If on the one hand the principle of 'reutilize at all costs' appears hard to apply on a vast scale, on the other we must acknowledge that the most visionary design tendencies among these experiments produce symbolic objects effective as communication, and hence useful as tools for stimulating debate and encouraging reflection, and for expressing the contradictions of the world we live in by forcefully denouncing the strident contrast between the superfluous for some and the bare necessity for many.



Figure 5. The U-Dome temporary housing system by World Shelters in front the Palazzo dell'Arte of the Milan Triennale.

In this research scenario, more artistic than architectural, the Pallet House of the New York studio I-Beam Design is outstanding for its concrete proposals. In contradiction to its name, the project has a broader interest than that of defining a single habitation. Once again, it is the designing of a construction system based on reutilization of the wooden pallet, a modular industrial product used the world over and plentifully available in emergency situations since it forms the support for large-scale supplies of medicines, clothing, food and other kinds of emergency aid.



Figure 6. Pallet House, I-Beam Design. Elevations and exterior view of the prototype built in Parco Sempione in Milan.

The different living units designed starting from 1999 and subsequently realized as prototypes for workshops and exhibitions document how the ordinary pallet can become the structural component for a versatile housing system used to define variable spatial configurations, depending on the specific needs and preferences of the inhabitants; adaptable to different climates, merely by inserting in the air gaps insulating materials such as mud, clay, wood, straw, debris, insulating plates or panels; subject to evolution, that is, allowing subsequent conversion of the emergency shelter into medium or long-term housing by lining the wooden skeleton with local materials of greater duration and inserting installations in the hollows of the pallets.

A challenge for the architecture

The shared objective of these proposals is that of enabling reversible processes of occupying a territory. Modular habitation systems, at low cost, able to satisfy varying requisites

as well as functional and formal preferences; standardized or standardizable systems able to meet the needs of institutions appointed to take action in a very short time in emergency contexts, by transforming refugee camps and shelters into little ‘instant cities’.

In practice, it is also a question of devising solutions on a grand scale. The debate on temporary emergency housing must abandon the occasional hypothesis and the sterile sociological survey. It must instead seek a valid response to an immense unsatisfied demand, confronting the subject in concrete terms (new materials, recyclable materials, reversible building systems, etc.) as well as economical, functional and formal aspects, and last but not least, satisfying contemporary aesthetic canons.

Developing projects able to deal with the problem of emergency housing scientifically by constructing physical spaces that meet the requisites of mobility, lightness and reduced size, is a challenge that architecture cannot and must not ignore.

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