

# Planning and Designing Post Disaster Transitional Housing: The Case of the Abruzzo (Italy) Earthquake

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## Abstract

The paper illustrates the planning and design strategies of a post-disaster transitional housing project, which complies with the planner's objectives, user needs, production system and the civil protection policies. The study arises from the analysis of the Abruzzo earthquake which occurred on April 6th, 2009: after a brief introduction on the characteristics of the disaster, the applied management of the Civil Defence's national system is illustrated and some critical statements are reported, particularly as regards the reconstruction phase and the emergency houses. The study illustrates the results of research on the procurement tools for the supply of prefabricated emergency housing units, developed for the Italian National Department of Civil Defence within the national project RELUIS (Seismic Engineering University Laboratories Network) from the Department of Construction and Mathematical Methods in Architecture (University of Naples) and the Department of Architectural Technology and Design "Pierluigi Spadolini" (University of Florence). A design proposal of a emergency housing unit developed on the basis of the procurement tool is also described; the project is the winning result of a large design competition on the emergency housing unit for the reconstruction in Abruzzo. A prototype of the unit is planned, to demonstrate the technical feasibility. The aspects pointed out are the evolutive realization of housing support in the reconstruction phase, the multi-functionality of technology systems of transitional housing, the adaptability and flexibility of the technological supply during the course of a housing emergency, the sustainability and reversibility of the design proposal and the construction process. Furthermore the study illustrates the experience carried out with a small community in Abruzzo aiming for the application of innovative methods and the practice of the reconstruction process. Considering the specific Italian context and the preliminary assessment of the case of Abruzzo, the paper aims to demonstrate the need for a transitional reconstruction phase, focussing on the results of research, both on methodological aspects and design solutions, and on a participated experience in a real reconstruction scenario for a small community in Abruzzo.

**Keywords:** emergency, housing, reconstruction, design, procurement

## **1. Introduction: short description of the effects of the earthquake**

On 6th April 2009 a violent earthquake struck the town of L'Aquila in Abruzzo (Italy) and the surrounding areas. The earthquake involved the Aquila fault situated in a valley lying between two parallel mountain ranges and the intensity and the way it occurred make it similar to the earthquake which struck the same area in 1703. The descriptions of that earthquake come to mind now as a warning and provide fundamentally important historical facts for determining the frequency of earthquakes in that geographical area.

The recent earthquake has caused the greatest damage in the small towns situated within the fault area, in particular Onna and Castelnuovo, and in the historical town centre of L'Aquila (Fanale L., Lepidi M., Gattulli V., Potenza F., 2009). An assessment of the effects in terms of macro-seismic intensity was critically important due to the "extreme variability of the types of buildings present in the different towns, the presence of buildings in a pre-existing state of serious deterioration and the often considerable difference in the damage between the historical town centres and the recently developed parts." (Galli P, Camassi R., 2009). The total population evacuated as a result of the damage to the buildings was approximately 65,000 people and on 3<sup>rd</sup> November 2009, about 7 months after the disastrous earthquake, 75,949 inspections had been made of the damage and fitness for habitation of private buildings and 2,340 for public buildings.

## **2. The civil defence prompt action model**

### **2.1 Centralized decision-making and financial flows**

As the civil defence experts have been saying for some time now, each disastrous event is an individual case, due to the nature of the disaster and the geographical area hit, the typological, morphological and technical characteristics of the towns, the social and demographic aspects of the population and the productive and economic structure of the territory. With regard to housing intervention, the response of Abruzzo was a special case especially for the prompt action measures provided by the national government and the Civil Defence department. The most significant aspect was the centralization of decision-making and financial management. The Government's main concern was to promulgate special laws for the funding of the rescue and reconstruction work; it should also be remembered that a national and international solidarity campaign enabled large sums of money to be collected for the affected populations, channelling it through a limited number of institutional bodies. For urgent repairs to housing the Government has authorized an expenditure of 400 million Euros for 2009 and 300 million Euros for 2010. The total sum of the cash donations amounts to over 75 million Euros, approximately 53 million Euros of which have been given directly to the National Civil Defence department while the donations handled by the Local Authorities and coordinated by the Department amount to 22 million Euros. International donations have already been made by Kazakhstan and other donations will arrive from Australia, Canada, France, Germany, Japan, Russia and from the World Monument Fund, which are formalizing the agreements to contribute to the salvage activity for the recovery of a part of the cultural heritage of L'Aquila. As well as cash

donations there are also donations of equipment and vehicles. The Civil Defence Department points out that the funds collected will not be used to reduce the Government's commitment, but will be added to the allocations already promised.

## **2.2 Housing intervention**

The civil defence system took immediate action with the participation of the mobile columns of the Italian regions which have been assigned precise sectors of the territory. An operations coordination centre was immediately set up in L'Aquila to organize all the activities under the management of the head of the Civil Defence Department, Guido Bertolaso, the undersecretary with special powers conferred on him directly by the national government.

In addition to the rescue operations to save human lives, recover bodies and valuable assets (the artistic heritage in particular) and the safety measures adopted for monuments and the principal logistic buildings, particularly with the contribution of the Fire Services, the Civil Defence department provided assistance for the homeless population: the majority of the people were given hotel accommodation in the surrounding area, in particular in hotels on the coast which were already equipped for tourism; others were accommodated in tent camps erected by the civil defence department in selected rescue areas, mostly in areas close to the towns. The national Civil Defence Department has managed the housing intervention issue with the primary aim to reduce to a minimum the stay in temporary accommodation and to house people in new, permanent housing (CASE) and in temporary houses (MAP), eliminating the intermediate phase of container accommodation. The percentage of families who preferred accommodation provided under the CASE plan, according to the survey of the housing requirements for those with an uninhabitable house or in the Aquila "Red Zone" is 64%.

The time limitation for residence in the tent camps was also determined by the weather conditions in the territory, at altitudes of over 500 metres above sea level: the summer period after the earthquake allowed the homeless people to live in the camps in fairly decent conditions, but with the arrival of the autumn and winter season the Civil Defence Department planned the decommissioning of the camps and evacuated the population; at the end of October almost all the tent camps were dismantled and the last one was closed in early December. The people who had not yet been given accommodation in the new houses were transferred to hotels, barracks or rented accommodation.

Table 2: Evolution of accommodation for the population (source: official Civil Defence Department website)

	23 April 09	5 November 09	30 December 09
hotels , private houses and barracks	27,850	21,400	17,566
shelter areas (tents)	35,565	1,447	0
tot	63,415	22,847	17,566
CASE	0	3,900	11,221
MAP	0	480	1,425
tot	0	4,380	12,646
total	63,415	23,116	30,139

### 2.2.1 The CASE project: sustainable, environmentally compatible earthquake-proof complexes

The CASE project houses are for the residents of L’Aquila whose homes have been destroyed or are uninhabitable. They are located in 19 areas around the town of L’Aquila chosen after the positive opinion of the Services Conference of 24<sup>th</sup> July 2009 and in the light of the new geological, geotechnical e seismic investigations. The first houses were delivered on 29<sup>th</sup> September 2009 and the programme foresees completion by the end of February 2010. The CASE project consists of 183 buildings, for a total of approximately 4,600 apartments, of varying sizes according to the composition of the family units and fully furnished. They will accommodate over 17,000 people in groups of 25 – 30 apartments in each building, on two or three floors. The buildings rest on bases supported by columns on which earthquake-proof devices have been installed. If a tremor occurs they isolate the platforms from the ground and use various materials from concrete to lamellar wood; moreover they are designed with the most advanced sustainability criteria, with energy consumption 30-40% lower than the legal limits, installation of 7,000 m<sup>2</sup> of solar panels and 35,000 m<sup>2</sup> of photovoltaic panels on the roofs of each building and rainwater storage tanks. According to the Civil Defence department, when reconstruction is finally complete, the quarters may be used for student accommodation or to receive tourists or according to the community’s wishes. The amount spent for the CASE project amounts to 35 million Euros; a further approximately 6.5 million Euros will be spent on the associated urbanization work, to be defined by the Mayor of L’Aquila.

### 2.2.2 MAP (Moduli Abitativi Provvisori): temporary housing modules

The MAP temporary housing modules accommodate people whose homes have been destroyed or are uninhabitable in the “earthquake crater”, i.e. in the 57 municipalities in the area surrounding L’Aquila. The MAP will be able to accommodate over 6,000 people. They will be provided also for the residents of the Aquila districts E, F or in the “Red Zone” to cope with the requests which emerged from the survey of the housing requirement. Around 2,300 MAP temporary housing modules

have been built in the earthquake crater, 2,000 of which are modules provided by the programme, 277 MAP were donated by organisations, companies and associations and another 1,125 modules are planned for L'Aquila. Sturdy and safe, of various sizes and according to the characteristics of the family unit, in some cases they are built of solid, natural wood, in others they have structures with insulated panels. Three types of modules will be built:

- MAP 40, approximately 40m<sup>2</sup>, for one person
- MAP 50, approximately 50m<sup>2</sup>, for 2-3 people
- MAP 70, approximately 70m<sup>2</sup>, for 4-6 people

The supply tender for a single MAP is for 760 Euros per m<sup>2</sup>. The total amount of the donations made to the local authorities, about 22 million Euros, has been set aside for the building of the MAP and other buildings for the communities affected by the earthquake, who live outside L'Aquila.

As well as housing, temporary school buildings (MUSP, Moduli ad Uso Scolastico Provvisori) have been erected. The MUSP temporarily replace the schools damaged or destroyed by the earthquake. They are prefabricated buildings, suitable for the zones where they are to be built, even at an altitude of 1,500 metres. The MUSP accommodate a total of 6,000 children and adolescents subdivided into crèches, playschools, primary schools, lower secondary schools, a trade school, a technical high school, a provincial boarding school and a conservatory.

### **2.3 A first evaluation of the results**

Despite the undoubted positive results achieved with the action model promoted by the national Government and managed by the Civil Defence department – the capacity to concentrate and raise financial resources, the effectiveness of the measures, the coordination of the activities, the availability of permanent housing only 6 months after the event, the dismantlement of the provisional tent camps etc. – there was criticism of their work, above all as regards the reconstruction process, as testified by the reports and newspaper interviews which started to appear a few months after the event.

These included the lack of involvement of the local institutions and in particular the municipalities affected by the earthquake: if on the one hand the centralized management enabled resources to be channelled and allocated directly for the post-disaster reconstruction work, on the other had there are complaints that this work was done without the necessary involvement of the local authorities in the decisions concerning layout and the future, both economic and productive development of the towns, villages and of the territory in general, so there is a call for a vision targeted towards the re-launch of strategic infrastructures, for the encouragement of excellence, including the university, tourism, handicrafts and small businesses . Reconstruction began substantially without listening to the local needs, via the politicians and starting from the grass roots level. The national institutions' attitude has often been seen as a propaganda tool for Government policy.

The same applies for the principal cultural players - the professional category associations such as architects, town planners, engineers and the universities complain about the absence of a cultural debate on the development of reconstruction. Although rapid, the reconstruction initiatives were not planned according to the development needs of the territory nor were they integrated with the existing towns. The new residential districts occupied new areas and made use of further land resources; they are unevenly spread all over the territory, with no town planning context and are not connected with the infrastructures or services. The cost per square metre of the housing is considered to be too high, in view of the results obtained, considering that the price per square metre is similar to that of a house in the historical city centre of L'Aquila.

An even more serious wound is the feeling of exclusion suffered by the communities and individual inhabitants struck by the earthquake. They have not been given a chance to join in the re-planning of their habitat according to the specific needs and connotations of the context. To enable the population to go back and live in their own territory there should be the conditions for a "light" transitional period to guarantee dignified temporary accommodation for everyone, awaiting the "major" permanent reconstruction .

### **3. Temporary housing after the disaster and before reconstruction**

From the first reports of the reconstruction process it appears that a transition phase between the first rescue operations and the final reconstruction is considered necessary in order for consistent town and regional planning models to be developed, connected with well-considered hypotheses of economic and productive development.

The national Civil Defence Department decided to commission research for the purpose of identifying a new instrument for regulating the supply and demand of temporary housing systems to be used in case of an emergency. This order came before the seismic event in Abruzzo occurred and the results of the research were made available a few months before the earthquake, although the Civil Defence department could not make immediate use of it. The supply of temporary houses was therefore managed using technical specifications of a type previously described and which the Civil Defence department already had at its disposal.

Moreover the need for a transition phase had been considered by some national cultural institutions which straight after the earthquake promoted a planning competition in order to look for ideas for the reconstruction process in Abruzzo.

#### **3.1 The Civil Defence performance specification**

*(text drawn from the Research Report)*

The Performance Specification was developed within a research convention, sponsored by the national Civil Defence Department, stipulated between the RELUIS Consortium (University

Laboratories Network of Seismic Engineering), which includes the Department of Construction and Mathematical Methods in Architecture of Naples University and the "Pierluigi Spadolini" Department of Architectural Technologies and Design of Florence University.

### **3.1.1 Aims and objectives**

Concerning the problem of the hotel accommodation available for the population displaced as a result of a disaster and in the context of a long-term programme for increasing the emergency intervention equipment in the case of an emergency, the Civil Defence Department decided to acquire Technical specifications, to define the characteristics and the minimum performance levels required of civil defence temporary housing units to be used as accommodation for a population struck by a calamity.

The technical specification, absolutely in general and separately from the types of buildings available on the market, aims therefore to define the characteristics of civil defence prefabricated modular buildings, overcoming the descriptive viewpoint of the technical specification for the supply of a "civil defence container", of which the most recent civil defence emergencies have highlighted the strong points, but also its intrinsic weaknesses.

The technical specification identifies strict "performance specifications" referred to the structural and functional characteristics of the prefabricated modules, so as to guarantee a high product quality. Moreover, these specifications provide a grid of the objective conditions for which to evaluate the businessmen's offers on the production market, capable of supplying goods potentially able to fulfil the established requirements. At the same time, in a wider perspective, the Department's intention is to encourage technological innovation in the sector, in terms of the process and the finished product, through the special enhancement that will be given to the most advanced solutions in terms of environmental sustainability.

In detail, irrespective of the technology and type of construction chosen, the technical specification defines the minimum requirements for the housing units intended for short to medium term temporary housing (1 week - 12 months) for the populations affected by calamitous events. The this is temporary housing that, installed in a time span that goes from 72 hours to a maximum of 7 days after the event, must allow the activities that are necessary for the recovery of "normal" living conditions. These buildings must therefore be rapidly transportable, easy to assemble and place on site, at the same time ensuring performance levels in terms of safety, comfort and environmental sustainability, in line with the standards defined by current scientific and technological progress.

The Civil Defence department's requirements as regards the characteristics of the "modular units" described in the performance technical specification are presented in summary in the following table.

Table 3: Macro requirements and limits of acceptability

<i>MACRO-REQUIREMENTS</i>	<i>MAX ACCEPTABILITY LIMITS</i>
<i>Service life</i>	<i>10 years</i>
<i>Dimensions and usability of the areas</i>	<i>according to current legislation</i>
<i>Safety</i>	<i>according to current legislation</i>
<i>Well-being</i>	<i>according to current legislation</i>
<i>Modularity / Flexibility (by family unit composition)</i>	<i>1-2 people</i> <i>3-4 people</i> <i>5-6 or more people</i>
<i>Transport time , assembly and placing on site (turnkey delivery)</i>	<i>7 days</i>
<i>Installation/Assembly (skilled workers –necessary equipment)</i>	<i>2 people – 5t crane</i>
<i>Impact / Environmental sustainability</i>	<i>strategies for the best adaptation to the context</i>
<i>Recoverability</i>	<i>100% (of the module and the foundation)</i>
<i>Maintenance</i>	<i>programmed, with easy supply of the parts subject to wear and tear</i>
<i>Dismantlement</i>	<i>100% recyclable or reusable elementary parts</i>
<i>Supply cost</i>	<i>minimum, in relation to the requirements</i>

### 3.1.2 Methodology

Experiences of emergencies in the last decade and the scenarios relative to the most challenging emergencies at the national level (prevalently seismic events) advise, regarding the temporary accommodation of the population, the adoption of a range of options which guarantee the provision of supplies, differentiation, flexibility and an abundance of solutions.

The technical specification is methodologically based on a performance-based approach. The decision to adopt such a model is linked to the need to reconcile the objective of fixing an adequate technical target for the modules to be purchased for civil defence purposes with that of allowing the free market to indicate more than one technical solution able to meet the required standards, so that :

- The identification of a “benchmark” solution, among the acceptable solutions, deriving from a cost-benefit analysis , on the basis of pre-established and objective criteria.
- The use of several solutions, all of them satisfactory from the “performance” point of view, in the case of a request for a number of housing modules that exceeds the production and installation capacity of the “benchmark solution.”

On the other hand, the definition of the characteristics of the prefabricated civil defence modules is well suited to a performance-based approach, owing to the intrinsic characteristics of such products, manufactured in a technological and industrial sector, for adaptation to an urban (even if temporary) system, for which it is possible to demand that their performance should correspond to the clients' quality requirements, according to established criteria. The evaluation of quality is therefore based on the performance levels of the product in relation to the demands and expectations of the users and, in this sense, the present technical specification is an instrument which guarantees the technical performance of the products to be purchased. Furthermore, a performance-based approach has been definitively adopted in the field of technical standards for buildings, with reference to the European codes and to the current Consolidation Act on Construction, as well as the context of planning standards for fire safety with performance methods (Fire Safety Engineering - FSE), that establish guidelines for the implementation of the engineering approach to fire safety.

To define the structure of this technical specification, the building system has been broken down into its elementary, correlated and independent parts, analyzing its constituent aspects, with a systemic conception, in which the relevance of each requirement should also be evaluated for its effects on the others, highlighting the connections and principal interactions. The technical specification contains the minimum requirements for the housing units intended for temporary, short to medium term accommodation of populations affected by disastrous events. The producer is responsible for an assessment of their performance; using the methods and forms presented in this document; he must declare that these requirements have been met and certify the characteristics of his product. In the light of the general objectives expressed, a review has been made of the series of requirements and of the conventional legal parameters, in order to accurately fulfil both the specific requirements in terms of functionality and flexibility of the construction systems, and also to consider the sustainability of the resources that will become part of the production cycle of the emergency housing systems. The performance levels indicated are not those of permanent housing to which current laws and standards refer, but are appropriate for the type of product described in the technical specification, i.e. a temporary structure able to meet a contingent need in the short to medium term. This performance adjustment corresponds to the need to obtain a correct cost/quality ratio, but it also guarantees levels of habitability which exceed the precarious conditions that are commonly associated with container modules. Another aspect considered in measuring performances is their correspondence to the supply of housing systems of this type currently on the market, so as to guarantee the feasibility of the possible solutions with the modern technology that the production system is able to use.

### **3.2 The project competition after the Abruzzo earthquake “An idea for reconstruction: proposals for the emergency”**

Following the earthquake which devastated the region of Abruzzo on 6th April 2009, the architecture reviews presS/Tletter and The Plan with the support of the InArch, l'Istituto Nazionale di Architettura, and the cooperation of Collettivo 99, a young architects' association in L'Aquila, launched a project competition “ An idea for reconstruction: proposals for the emergency.” The aim of the initiative was to develop proposals for a temporary habitat in emergency situations, with particular reference to the recent earthquake in Abruzzo. The objective was to ask for a reflection on the temporary structures to be erected in the territory struck by the disaster, and which could be dismantled and reutilized in other

emergency situations or easily recycled, becoming a part of the new urban fabric.

204 proposals were received and published on the website [www.presttletter.com](http://www.presttletter.com) in an especially created column. The jury in the first phase selected the 10 projects as finalists and the jury in the second phase, composed of Mario Cucinella, Odile Decq, Hans Ibelings, Lucio Passarelli, Nicola Leonardi and Luigi Prestinenza Puglisi, drew up the final classification which shows that the winner was the MIA project by the TAD Group (R. Bologna with S. Borgianni, C. Massaccesi, V. Serrani, L. Boddi).

### **3.2.1 The MIA Project**

The project proposal, based on concreteness and feasibility, aims to tackle the problem of the temporary habitat in emergency situations bearing in mind the mechanisms of the intervention process and of system logic: it is not limited to a specific moment of temporary housing, but takes into consideration a longer time span involving the passage from the immediate emergency housing phase and the re-appropriation of permanent housing. It attempts to reconnect the technological resources and materials used not only for a single object but for the whole town. MIA is a temporary housing system made up of two parts, the infrastructure module and the housing module; together they constitute the functional unit which underlies the configuration of a temporary housing settlement. Particular attention is given to the quality of housing, with a protected outside appurtenance to complete the confined private space and the creation of an organized series of open and semi-open spaces of an urban type in which the aggregation models of the functional units of the system generate a different degree of appropriation of the space (from private to public). From the point of view of the environmental compatibility of MIA, as well as controlling the fundamental parameters, it guarantees reduced energy consumption and is reversible in that it can be repositioned, and its main or secondary components reused. A hypothesis compatible with the case of Abruzzo is to reuse the housing system as residences or temporary services for tourism; the infrastructural module can be used for alternative uses other than for emergencies in which a temporary essential installation is required. MIA is designed with dimensional modularity criteria and can be made using easily transportable prefabricated components which can be assembled dry.

#### **3.2.1.1 The infrastructural module**

The infrastructural module, thus named because it is the connection between the housing system and the settlement's primary infrastructural system, consists of a raised walkway and a roof; this protected space is the first, rapid response to the population's need for assistance: a roof and a floor between which, sheltered from the weather and discomfort (rain, sun, humidity, dust, water, mud) the necessary activities can be carried out in the first phase of shelter, survival and safety. The infrastructural module provides certain essential services: it is waterproof; it gives protection from the sun's rays; protection from direct contact with the ground; structural safety. The module being raised above the ground creates a space that can be used to complete the utilities system: the housing module can be connected to the electricity grid, the feeder pipes and wastewater pipes for sanitary fixtures can be temporarily placed in this space without being put underground. The placing of the infrastructural module on the ground does not involve any permanent work nor cementing over the ground: the lightness of the building (in the hypothesis of a steel structure) enables the infrastructural module to

be placed on a minimally compact soil using materials in current use to distribute the load over the ground. The infrastructural module has a roof fitted with photovoltaic panels and/or solar panels in order to limit energy consumption; moreover rainwater can be collected at the base of the module for domestic use.

### 3.2.1.2 The housing module

The functional and distributive solution of the accommodation is rational and simple: according to modularity criteria, the housing module increases longitudinally the number of bedrooms and living-dining-kitchen areas according to the size of the family unit; the service block is always combined with a plant-engineering skylight, but there is no restriction on the position of the unit inside the module. Apart from the confined minimum space, the temporary accommodation also comprises a protected external area (covered and raised about ground) which is private, into which the residential activities can expand. From the construction point of view (the system can be built of wood, a natural material that can be recycled) the housing module is extremely simple in that certain essential attributes (waterproofing, protection against solar irradiation, protection from direct contact with the ground, structural safety) are assigned to the infrastructural module. The housing module can be the interchangeable element in the settlement if the infrastructural module is to contain the current housing solutions which are nowadays used in the different temporal phases: from the tent to the container and the prefabricated house.



Figure 1: Model of the transitional housing unit MIA

## 3.3 The design laboratory of Castelnuovo as a participatory planning instrument

The aim of the laboratory is to identify scenarios of the reconstruction of the town of Castelnuovo, a hamlet in the Municipality of San Pio delle Camere (AQ), struck by the earthquake of 6<sup>th</sup> April 2009. The programme develops in cooperation with the "Pierluigi Spadolini" Department of Architectural Technologies and Design of Florence University and the town of Castelnuovo, which after the earthquake, established the "Rebuild Castelnuovo" association, in order to find solutions for temporary settlements and post-earthquake reconstruction programmes. Cooperation is extended to

other university institutions, in particular the Department of Structural, Water and Land Engineering of the University of L'Aquila. The programme orientation, on the basis of the preparatory cognitive data and the general requirements, is based both on planning the temporary settlements in the allotted areas, with the typology design of the housing units, and on a study of possible scenarios for the reconstruction of the town and for the stable resettlement of the population in the territory. The hypotheses that will be examined in the context of the project laboratory may concern the reinstatement of the original site of Castelnuovo, bearing in mind the problems of geological consolidation and that of the damaged buildings. The possible scenarios will be presented in the form of a *masterplan* which describes the functional areas and the infrastructural network of the Castelnuovo urban development. Project developments include services and the residential system in its different forms: individual and collective, permanent and temporary residence. The research activities are carried out in the form of a project laboratory which will involve multidisciplinary university authorities (academic staff, experts, undergraduates), the Civil Defence Department and the people from the town of Castelnuovo, in order to present the needs of the inhabitants and train local experts for the management of the territory. An interesting aspect arising in the course of collaboration is the inhabitants' request to build autonomously complementary work on the existing temporary houses (MAP) supplied by the Civil Defence's national department: i.e. roofing and flooring of external spaces and entrance, fences, new colours for the external walls of the houses etc., in order to customize their private spaces. This request emphasizes how the temporary housing settlement is unfit for the user's needs and the characteristics of the private and semiprivate environment, as on the contrary proposed by the typological model defined for the design competition previously described. For this reason the department TAD has been requested to produce a "building standard of the temporary housing settlement" aiming to indicate the admissible typological solutions and the possible technical arrangement.

#### **4. General conclusion**

Also the Abruzzo's earthquake, as well as previous experiences in Italy, demonstrates that post disaster intervention each time requests a specific approach, unlikely repeatable in all conditions. At least in Italy, where re-construction is characterized by high complexity, the phase of transition from the disaster to the recovering of the existing settlement, appears unavoidable. Observing what is happened so far in the case of Abruzzo's earthquake and on the basis of the results of the research developed the following considerations are pointed out.

- the need of involving in decision making processes the local authorities at various level (regional, provincial and municipal) and the cultural institutions, which play the role of stakeholders for as regards the real needs and the requirements related to the architectural design and urban planning, is a necessity but an opportunity as well. The collaboration between Civil Defence and university and cultural institution in general terms can lead to more participated and quality-efficient results; the Civil Defence could keep the role of management and control of operations and financial flows guaranteeing the efficacy of the process.
- The action of preventing and programming the phase of transition between disaster and reconstruction must be strengthened. This means, on one hand, the arrangement in the

municipalities subject to a risk, of areas for temporary settlements which should be selected in advance and provided with permanent infrastructural services, in a way that these areas and services can be a resource not only in the case of a disaster but also in ordinary time; on the other hand, it needs to obtain the availability on behalf of the market of many temporary housing systems which the production system is really able to offer with the characteristics and technical requirements defined by the Civil Defence.

- The construction and dissemination of tools (performance prescription, typological models etc.) of pre-qualification of the supply of temporary housing systems in a fundamental aspect of the process of management of the phases of transition and recovering of existing settlement, because it allows, on one hand, to update the housing solutions to the technological evolution and the change of needs and, on the other hand, to enlarge the participation to the industrial sector and building production.
- The provision of a technical structure, a centre of competence should be very useful in the phase of transition and start-up of the re-construction process; the role of connection between Civil Defence and the local authorities, of coordinating decision making processes, of setting the general strategies from which technical solutions arise could be assigned to that body.

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