

DESIGN CRITERIA FOR TEMPORARY SHELTERS FOR DISASTER MITIGATION IN INDIA

Krutika Gulahane, V.A. Gokhale, Dr. B.N. College of Architecture, Pune
Gokhale.va@gmail.com

Abstract

Creation of a sustainable architecture for earthquake prone areas is a matter of serious concern. The architectural development must respond to the climate and to the living patterns of the inhabitants. This crucial issue often gets ignored in the enthusiasm or speed of rehabilitation programs and a totally alien built environment is often created for the local people. Such built forms must be constructed by using materials which are not only economical but also provide required earthquake resistance in addition to facilitate ease in constructional operations. Providing temporary shelters is a complicated process. It requires an in depth study of special requirements of the victims in both physical and psychological terms. The structures need to be suitable for a specified period of time in addition to conforming to construction norms. It has been observed that in many cases shelters provided were truly of temporary nature and lacked the structural integrity and materials to withstand the forces of nature over any extended period of time. On the other hand, many turned out into permanent unplanned colonies. It has become imperative to establish a criteria with a multidisciplinary approach with reference to seismicity of the area in question, architectural parameters, psychological aspects, socio-economic, socio-cultural and constructional aspects such as availability of material and resources at the affected areas for design and construction of shelters. Such criteria must be focused on the development of holistic living environments for victims inclusive of housing infrastructure as well as resource management.

Keywords: Design, Criteria, Tsunami, Tamilnadu.

Introduction

Several types of natural disaster (particularly earthquakes and hurricanes) create a sudden and massive demand for alternative housing as a result of the widespread destruction of vernacular buildings that they cause (Arnold Christopher, Elsseser, E. 1982). There is a lack of data on emergency housing problems and the effectiveness of solutions in the aftermath of disasters. But still a considerable portion of international aid money (to which must be added what countries spend on their own homeless) is disbursed on emergency shelter, even though donated shelter usually does not comprise more than 20 per cent of total housing provision. The problem of shelter is universal and is most acute in Third World countries. In these, reconstruction tends to begin immediately, irrespective of government schemes. But this should not encourage governments to indulge in sweeping and immediate reconstruction planning, as carefully formulated indigenous solutions are likely to be the most effective and rapid ones, and will probably suit local needs best. Disasters can lead to solutions to the shelter problem as complex as they are costly (Raymond Murphy, 2006). A wide variety of types of shelter have been employed in disasters, largely because there is no agreed international policy on what to supply. Sadly, past efforts by the international relief community to solve the problem of the abrupt increases in homelessness which disasters cause have all too often been based on inaccurate assessments of needs: shelters that are highly inappropriate in style or culturally unacceptable

have been supplied, as well as forms that were irrelevant to the needs of the displaced population. A shelter should be considered as a process and not an objective. Housing is often evolutionary, developing as the needs, objectives or prospects of its occupants develop; and therefore emergency shelter is also subject to processes of evolution, change and mutation over time.

Creation of a sustainable architecture for disaster prone areas is a matter of serious concern. In such circumstances the architectural development must respond to the climatic condition and the living pattern of the inhabitants (V. Sridhar, 2005). Rehabilitation programs are often worked out in hurry without giving due importance to these crucial issues. This has resulted in a totally different built environment for the local people as is observed in Nagapattinam and Cuddalore districts of Tamilnadu (Fig.1).



Fig.1. Empty Temporary Shelters in Pichvaram, Tamilnadu.



Fig.2. A Small Sized Temporary Shelter Without Adequate Provision for Light and Ventilation.

Many temporary shelters designed without considering the severe heat, and space requirement failed to serve the purpose (Fig. 2). A box like temporary house made of Ferro Crete walls (walls constructed with steel mesh and cement concrete) and very thin roof resulted in inside temperatures rising to 30o C to 50o C, which is much more than the desirable temperature. Absence of adequate openings for light and ventilation created highly uncomfortable and unhygienic indoor environment (Gokhale Vasudha A., 2002). Tamil fishermen community, which is largely conservative, used to live in a joint family system, having 6 to 8 family members on an average (T. Krishna, 2002). They refused to live in small 2.5 M x 3.0 M size temporary shelters, because the space was not enough to provide shelter for the whole family. The survival of victims in the absence of space for cooking and washing became difficult. Many open tent-like shelters failed to provide a feeling of security to the victims who were under a state of trauma. It has been observed that many rehabilitation projects consisted of shelters made of locally available materials like coconut mats and thatch roof in addition to modern materials like polythene or Galvanized iron sheets. They proved successful in providing the required physical comfort because of the insulation provided with the use of coconut- thatched roof.

Sudden-impact disasters lead to three possible housing situations, none of which is entirely exclusive of the others, homes may have survived in usable form, and temporary lodging may be needed until permanent construction can house the victims or permanent reconstruction may be rapid enough to be the initial solution (Yogesh Chhabra, 2005). In developing countries, if not elsewhere, survivors tend to have clear preferences' regarding where to lodge after a disaster has destroyed their homes. These are, in order: the ones of friends or relatives, improvised shelters, converted buildings (such as schools and barracks) and official shelters.

Transitional Settlement

'Transitional settlement' is a new term, defined through the shelter project peer review process to mean 'settlement and shelter resulting from conflict and natural disasters, ranging from emergency response to durable solutions' (Lloyd Kahn, 2008). These guidelines consider the transitional settlement of displaced populations only. The term 'shelter sector' has been applied to the practice of responding to the settlement and shelter needs of refugees only, as covered by the mandate of UNHCR. The 'transitional settlement sector' therefore encompasses the 'shelter sector' as well as the response to similar needs of non-refugees, such as internally displaced persons (IDPs). There are a number of reasons why the term 'transitional settlement' is more appropriate than the term 'shelter sector' to describe operational activities. There is a need to broaden the focus of shelter responses, to take into account their collective impact as settlement responses: for example, their impact on local security. In the past, shelter response concentrated on family needs, at the expense of the collective needs of community and stakeholder groups, such as female-headed households (FHHs). The word 'transitional' emphasizes the position of emergency shelter and settlement response within the wider continuum of relief, reconstruction/rehabilitation, and development. Donors, co-coordinators, implementers, and governments need a consistent terminology to describe similar circumstances, from emergencies to durable solutions and development. A common, consistent, and comprehensive terminology is crucial in order to assess, monitor, evaluate, design, manage, and hand over temporary shelter responses. Temporary buildings systems can be simply divided into three specific types listed below.

- **Portable buildings** are those that are transported whole and intact. Sometimes they include the method for transport within their own structure (wheels, hull) and can be towed or carried. However, the dividing line between building and vehicle then becomes blurred; a few can be described as self-powered.
- **Re locatable buildings** are those that are transported in parts but are assembled at the site almost instantly into usable built form. These are almost always carried but in a few limited cases may have part of their transportation system incorporated into their structure. The main advantages of this type are that it can provide space almost as quickly as the portable building without the restriction in size imposed by transportation.
- **Demountable buildings** are those that are transported in a number of parts for assembly on site. They are much more flexible in size and layout and are usually transported in a relatively compact condition. They have some of the limitations that the site operations bring to a conventional building and, depending on the size, complexity, and ingenuity of the system, are not as instantly available.

Impacts of Transitional Settlement

The influx of large numbers of displaced people into an area, and any TS response to their needs, will have consequences beyond the displaced population itself. Both the local and displaced populations can expect transitional settlement to have an impact on their lives in many ways:

- Protection and security
- Survival and health
- Social needs, such as privacy and dignity
- Livelihoods
- Natural-resource management
- Communal service infrastructure.

It is essential for organizations responsible for implementing temporary shelter programs to be aware of these consequences, in order to reduce the negative effects and increase the positive effects of their work. For instance, temporary shelter responses, which match the cultural expectations of the displaced population, are less likely to fracture social structures, or to disrupt existing communities within the displaced population. Friction between or within families, or conflicts between clans or ethnic groups, may be reduced through appropriate temporary shelter responses. Adapting generic guidelines for the transitional settlement of displaced populations to local and cultural circumstances must be based on sound assessment, monitoring, and evaluation matters. Each of the impacts of transitional settlement has potential consequences outside the sector. The quality and appropriateness of shelter within transitional settlement have a major impact on health: for example, smoke produced by cooking on stoves or open fires is the fourth greatest risk to health and disease worldwide where emergency shelter must be utilized.

Transitional shelter can serve any of the following functions:

- Temporary housing during periods of risk to accommodation
- Protection against the elements (either hot or cold climate)
- Protection of ownership or occupancy rights
- Emotional security and the need for privacy; storage of salvaged property.
- The nodal point for receiving relief or starting reconstruction.

Stages of Post-disaster Housing

In disaster research, the terms housing and sheltering are often used interchangeably, with little distinction between the terms. Quarantelli (2001) makes a distinction between these terms in his definition of the four stages of post-disaster housing. He suggests that the division between housing and sheltering after a disaster is made on the basis that during sheltering, normal daily activities are put on hold, whereas housing involves the resumption of household responsibilities and activities, i.e. food preparation, laundry, socializing, work, school and recreation. Quarantelli uses the following definitions, which show that there are in fact four stages in post disaster reconstruction:

Emergency Shelter: A place where a family stays during the height of the emergency. This can be a public facility or the home of a friend or family member. Since the stay is so short there is no provision of food or other services.

Temporary Shelter: A place where a family resides immediately following the disaster for an expected short stay. This can be a tent, a self-built shelter, a public facility, the home of family or friends, or a second home. The length of stay dictates the need for food, possibly medical provision and other services.

Temporary Housing: A place where a family resides temporarily and resumes their household responsibilities and daily activities. This can be a prefabricated temporary house, a winterized tent, a self-built shelter, a mobile home, an apartment, or the home of family member or friend.

Permanent Housing: The place where a family will reside permanently after the disaster. This refers to the family returning to their rebuilt home or moving into new permanent quarters in the community.

The assumption for this work is that the emergency shelter will largely be temporary shelter (units). This is probably more the case for refugee situations and wide spread flooding disasters but may necessarily be the case for earthquakes and cyclones and perhaps also tsunamis. In these situations victims often elected to set up temporary shelters close to their original homes. Moreover, this thesis also assumes that the disaster will be in the context of a developing country rather than a developed country.

Response Strategies for ‘Shelter’

Response to large scale destruction of built environment due to natural or human made hazards involves re-sheltering displaced people and provision of life sustaining services. In post disaster situations, shelter is provided in 3 ways:

1. Emergency shelters – like temporary tents
2. Transitional shelters – like durable tents, temporary houses
3. Permanent shelters – permanent houses with infrastructural facilities

It starts with rapid shelter response termed as ‘emergency shelter’. The next increment comes in the form of transitional shelter, which involves relatively broad based discussions with various stakeholders and advances to more permanent and durable shelters, which is a multidisciplinary task.

Emergency Shelter

The imperative with emergency shelter is the speed at which it is to be made available; too slow simply means increased risk to life. At its most rudimentary level, emergency shelter might be plastic sheeting or blankets, which are distributed together with other non-food related items (NFS). Accommodation in existing mass shelters (schools, religious places, public buildings) or family tents is other forms of emergency shelter provision.

Transitional Shelter

The next increment of shelter response is transitional shelter; a vital habitable space, which has enough durability to last until a more durable shelter and settlement solution, is reached. The aim is to deliver a habitable and durable covered living space, which helps affected families get back to the normal way of living (restoration of livelihood). This type of response requires adequate consultation with various stakeholders and has to be part of a larger sheltering strategy. Therefore this needs investment of time for negotiation and discussions.

Permanent Shelter

The strategy for permanent shelters is formulated based on needs assessment. The assessment becomes a communication channel between affected population and aid agencies. Communications are improved by the use of tools for information gathering and analysis.

The ‘Best-fit’ Temporary Accommodation

The decision to plan is best taken in advance of the disaster. A government may make the decision to plan or not to plan. If they decide not to plan, they will wait for the disaster to strike and then they will be forced to make quick decisions regarding a reconstruction strategy. If they make the ideal decision to plan in advance, they must consider the various types of temporary accommodation available in conjunction with the other planning variables. These variables are revisited until a feasible strategy can be deduced. Even in the ideal situation with systematic planning and decision-making in advance of the disaster when and if a disaster occurs, the organization must reassess the strategy to see if it fits with the situation presented by the particular disaster. If it fits they may proceed with the strategy directly. If it does not fit, they must reconsider the planning variables. The planning variables on the left of the diagram will not be altered by the disaster. However, the planning variables on the right will change depending on the particular disaster situation. It is these variables that must be reassessed after the disaster.

Schedule of Operations

Using the schedule of operations as a tool for planning and management communication can be made easier by visualizing it in the form of a diagram. The diagram illustrates how populations move between different temporary shelter options; it thus allows the deadlines of different programs to be compared. It also illustrates the importance of monitoring. The diagram illustrates how displaced populations choose different temporary shelter options in response to the occurrence of certain events:

Event A: the disaster occurs, and a population movement follows. The displaced population chooses a number of temporary shelter options.

Event B: Planned camps are opened after the initial period, and the population in the self-settled camps is transferred to the planned camps.

Event C: population movement accompanies the closure of the collective centers to host families.

Event D: During the care and maintenance phase, a monsoon occurs and some families move to rural self-settlement to begin farming.

Event E: The majority of the displaced population is repatriated. For others, durable solutions are reached by settling them in the host country or a third country.

Grouped in Planned Camps

Planned camps are places where displaced populations find accommodation on purpose-built sites, and a full services infrastructure is provided, including water supply, food distribution, non-food item distribution, education, and health care, usually exclusively for the population of the site. Camps replicate an entire support system, rather than simply adding the components of existing settlement that are missing for a displaced population. As a result, establishing camps involves factors such as the following:

- Strategic planning
- Options for phasing, development, and expansion
- The selection of sites
- Cross-cutting factors, such as gender and age
- Camp management
- Cross-sectoral issues, such as water and health

Planned camps are considered to be the option of last resort by organizations, for several reasons: they are seen as drawing displaced away from other temporary shelter options; as promoting dependency; as requiring disproportionate support compared with other options; as more difficult to withdraw from than other options; and as posing more of a challenge to efforts to achieve durable solutions for the population. However, these problems can often be mitigated. It is possible that planned camps are the most appropriate temporary shelter option for a given population and situation.

Vulnerabilities

Camps may increase the vulnerability of displaced persons to security threats, both external and internal. Registration and screening are required from the outset, to identify combatants among the civilian population. It is important to assess the security threat, particularly because the local population may become a target if the displaced population has not travelled very far from the source of their displacement.

Livelihoods

The organizational structure of aid delivery to camp settlements, and the mechanisms for it, affects both communications with local populations and the displaced community's prospects for

self-sufficiency. It is very rare, however, to find organized settlements where displaced persons have no formal or informal interaction with local populations and economies, and where settlements have no internal economies to generate a degree of self-sufficiency. At the other extreme, it is also rare to find circumstances where local economic conditions and available land allow whole migrant populations to re-settle sustainably in a self-sufficient manner, on a permanent or transitional basis. In reality, most camp settlements fall between these extremes. The support offered to the displaced population should not raise their standard of living beyond that of the local population, who may be living in circumstances far below international standards for displaced populations. Standards should be developed that are appropriate to local circumstances, based firmly upon international standards. Support should be offered to both local and displaced populations to prevent tensions and support positive relations. Livelihoods can be supported, for example, by involving the displaced and local populations in all construction activities and by facilitating their access to local markets.

Essential Criteria

The following steps below are recommended in planning transitional shelters following a disaster to optimize the needs with reference to the availability of land and other resources.

- Rapid Assessment of relocation and resettlement issues
- Analysis of data obtained in order to determine size type and form of the transitional shelters and settlements.
- Site selection
- Developing layout plans
- Designing transitional shelters

Rapid Assessment of Relocation and Resettlement Issues

A rapid assessment (preferably carried out within 10 days) is necessary to support and facilitate decisions and to incorporate the wishes of the displaced persons regarding possible relocation options. The objectives of the assessment would be to find out;

- Opinions of displaced persons (living in camps and with host families)
- Socio- economic profiles of camp inhabitants.
- Experiences and needs of the families who are hosting the affected communities.
- Assessment of the knowledge and access to information among the displaced persons to relocation/resettlement issues.

Analysis of data obtained in order to determine size type and form of the transitional shelters and settlements

The data obtained from the above assessment should be analyzed in terms of political, socio-cultural, economic, technological and numerical terms so that the size, type and form of the settlement and transitional shelters can be determined. Conventional analysis tools such as PEST (Political, Economic, Social and Technical), SWOT (Strengths, Weaknesses, Opportunities and Threats) and STEEPLE (Social, Technological, Economic, Environmental, Political, Legal and Ethical) maybe used to analyze the data on socio-cultural, economic and technological issues. Statistical analysis maybe used to analyze the numerical issues (e.g. to arrive at number of households, number of families, their size, gender, age groups, number of persons with special needs etc.).

Practical Action's Experience

Practical Action used the questionnaire below to identify people who needed assistance. Then it could provide its own technical expertise on how to adhere to the set criteria/standards, or facilitate to find other service providers who could assist with meeting the transitional shelter standards.

Criteria to be considered in the selection of sites for transitional shelters

The proposed site should be undisturbed by all natural and man-made hazards. Transitional settlements and shelters would need to be designed with protection provided against identified hazards for at least about a year after erection. Examples for some of the likely hazards are busy roads, areas of open water, unsafe buildings, disused septic tanks or refuse dumps, air and water contamination by factories etc. The provisions to supply clean portable water (including rainwater harvesting) should be in accordance with minimum international standards. The surface water drainage systems in place to minimize flooding hazards and/or effects of unfavorable weather conditions or is there a way to make use of existing natural drainage systems. The shelters should be arranged in clusters to facilitate community activities and minimize the risk of socio-cultural sensitivity and sudden alienation from their familiar environments. If the temporary re-settlement takes place in an area completely unfamiliar to the intended inhabitants, the access points and boundaries around the settlement are clearly demarcated to make the residents mentally and physically secure.

Criteria in developing layout plans for transitional shelter sites

The extent of the site must be sufficient for delineation of major and minor routes across the site, public communal areas (i.e. play, meeting areas) and private spaces around shelters. Where the number of houses in the settlement exceeds 40 units, there should be provision for a community hall. It is advisable to locate the community hall closer to the administration unit, if facilities such as television, radios and newspapers are provided. The size of community hall should at least be 400 square feet for 40 housing units.

There should be a common space located within easy access and minimum disturbance to all the housing units and closer to the main entrance and administration office.

The proposals should be developed for refuse, sewage and wastewater removal and disposal. Provisions should be made for educational, health or recreational facilities or for access to such facilities.

There should be possibilities and space to support livelihood activities of the intended inhabitants i.e. grazing of livestock, cultivation, and storage of equipment, and workshop / fabrication areas.

The shelters should be positioned to minimize the clearance of trees and maximize shading and protection from high winds. Measures should be taken to minimize disturbance from noise, congestion and to minimize unfavorable environmental impacts to the neighborhood.

Sufficient thought should be given to assure service facilities such as grocery shops, markets etc. This space would provide required light and ventilation to the front room of shelter units and help the 'day-to-day social interaction' among the residents.

Residents have access to their shelters at least by a handcart. People with disabilities have undisturbed access to their shelter units. The roads and paths have to be prepared in such a way

that steep slopes are avoided as much as possible. It has to be ensured that the residents with disabilities are able to manage mobility on their own as much as possible, so that they too can interact socially according to their preference. In allocating the plots to them, their preferences and needs have to be given priority.

Reduce the risk of fire and facilitate air movement in large settlements avoiding development of stagnant air pockets along the long access paths.

Layout should provide them an arrangement somewhat closer to their previous lifestyle, thus contributing to a better psychological status.

Proposal

- Designed Disaster Shelters (DDS) are to be kept at state-level Resource centers from where they are transported to the site.
- (DDS) are to be erected with locally available manpower/equipments.
- (DDS) are to be erected according to site conditions, space requirements.
- Space can be increased /decreased as required.
- In emergency phase with given walling and roofing material which is replaced in later stage with climatically/ socially/ economically responsive material.
- Other facilities provided in later stages.
- After a specific period shelters are to dismantled and reused.

<p style="text-align: center;">A Checklist for Assessment of Risk Areas</p>	<p style="text-align: center;">A Checklist for Essential Issues to be Covered in an Assessment</p>
<ul style="list-style-type: none"> • Livelihoods patterns and their dynamics. • Resources and assets of the people in the community. • Availability of water. • Availability and supply of food. • Availability of fodder for livestock. • The formal institutional structure and accessibility. • Health and education services as well as their accessibility and availability to people. • Quality and effectiveness of health services. • Shelter opportunities and constraints in the area. • Means of Communication in the area. • Employment opportunities available in the community. • Available skills of people, which can provide alternative employment. • Social Networks, which can provide safety to the people during vulnerable times. • Management practices, government policies towards relief and development activities in the area. • The work of social organizations. 	<ul style="list-style-type: none"> • Household Information of the Communities. • Livelihood Patterns. • Natural Resource analysis. • Institutional Structure. • Community/Social Support Structures. • Overall Development .Concerns and Priorities. • Hazard Analysis. • Risk Analysis. • Vulnerability and Capacity Analysis. • Existing Preparedness and Emergency Management. Plans and Strengths. • Community Coping Mechanism. • Gender Issues and Concerns.

DISASTER MANAGEMENT PLAN

SHELTERS

Varying requirements with reference to



Very Flimsy

Less sense of security

Very heavy

Difficult to erect/ Transport

Small

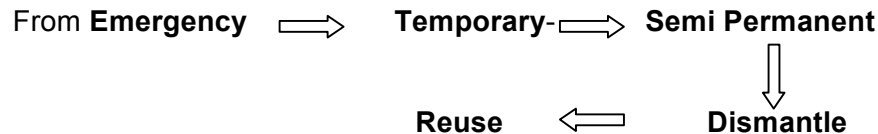
Unable to accommodate required number of people

Large

Difficulty in transportation/erection

REQUIREMENTS IDENTIFIED

Transition required they must be able to change according to specific requirement



Salient Features

- Modular units for easy staking and transportation
- Facilitates different sized units to accommodate different size of group/family.
- Can accommodate different walling roofing material
- Flexibility in planning - Can have different layout
- Easy to dismantle and erect.
- Climate responsive
- Provision of various required amenities as per phase wise requirements.

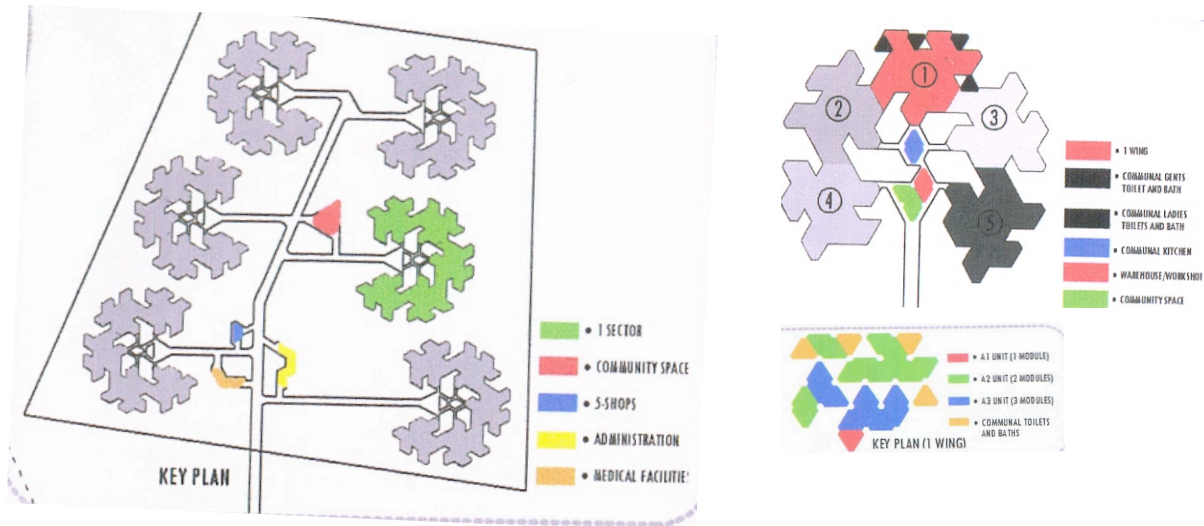


Fig. 3. Emergency Phase

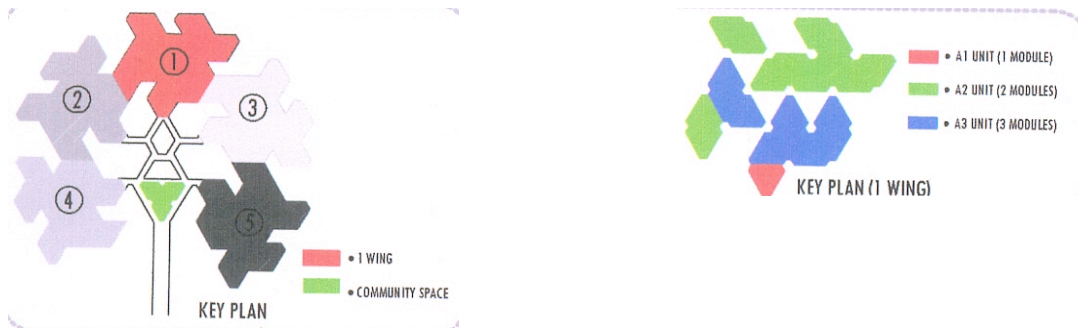


Fig. 4. Post-Emergency Phase

Conclusion

Following a major disaster, various government and non-government bodies' act quickly to reduce risk, rebuild communities and restore permanence. To address the complex situation many decisions are taken hastily which result in reactive policies and subsequent increase of people's long-term vulnerability. It has been observed that un-thoughtful large-scale relocation of affected population resulted in social, economic and environmental problems that threaten the well being of affected communities. Post-disaster reconstruction programs should address the critical social, economic and institutional factors to make such development sustainable. A well-planned post-disaster rehabilitation program comprises a system which addresses particular requirements of the separate short-term and long-term phases of rebuilding.

Post-disaster needs vary according to the assessed phase. For instance, immediate post-impact needs focus on search and rescue, first aid, and the provision of food and water and a short term emergency shelters. In later period however, response activities have to emphasize on

establishing temporary shelters and epidemiological surveillance systems among the encamped population. Through time, relief and recovery shift to restoring communications, transportation, and other lifeline systems.

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Author's Biography



Dr. Vasudha Ashutosh Gokhale pursued her Doctoral degree from IIT Roorkee. She is in research in the areas of Disaster Management particularly in “Earthquake Resistant Architecture” and “Sustainable Architecture”. She is a panel member of a number of national and international academic bodies. She was invited as guest professor at the University of Melbourne in Australia and Victoria University of Wellington New Zealand in 2006 and 2007.

She is associated with IIT Kanpur, and CEPT Ahmadabad. Gold Medalist at B.Arch from MACT Bhopal, and M.Arch from University of Roorkee, she has been awarded with Best teacher Award by MASA in 2008, Award for Excellent Contribution in Academics By IIA Pune Chapter in 2008-9, Best Teacher Award of University of Pune 2009 and “Maharshi Karve Award for Excellence”. She has more than 65 published research papers and is currently Professor & Head Research Cell Dr. B.N. College of Architecture Pune.