Creative Ideas for fast, durable and affordable reconstruction which sets the base for disaster mitigation

Executive Summary

This Project sketch focuses on combining disaster reconstruction with preparation for the mitigation of the next disaster which unfortunately is expected to happen.
It proposes a novel solution to provide solid and durable emergency shelters within days of a catastrophe, shelters that actually are the core of a new house at affordable cost. Instead of spending money, time and efforts on distributing tents and plastic sheets, it proposes to start immediately with the erection of core units made of small ferrocement panels. It is a technology used in house construction in several countries, system that actually gives a pleasing appearance in addition to its technical and financial advantages.
The EcoSur network is prepared for cooperation and know-how transfer with governments and civil society organizations to implement the proposal.

Situation at the time of the emergency

Experience shows that it is extremely difficult to move fast from an emergency situation to reconstruction. The transition phase between them generally takes several months and often years. During this time the social and economic situation of the distressed population worsens step by step. Living in tents and plastic shelters changes not only their physical wellbeing, but places many other strains on them. The situation of living in a shelter that does not provide security for life and goods prevents people from going about their normal activities, including going to work and earning an income.

- Temporary installations should not just provide shelter from the climate, but also provide security and a reasonable degree of privacy.
- They should be available within days or few weeks after the phenomena that caused the emergency
- They should be reusable, either as the core unit for a new house or made of reusable materials to be integrated into a house
- They should be affordable

Experience further shows that in order to be able to respond to those demands it needs an organization that has prepared beforehand, ideally a government in coordination with the civil society. The establishment and periodical training of civil defense units must be combined with mechanisms to dispatch emergency shelter or materials that comply with the above, and the possibility of fast local production of such shelters or materials.

Planning the Intervention	Implementation	Lessons learnt and comments
Process, Management and social organization		
The goal is to provide a fast and durable safe core unit that can be incorporated into a full construction or reconstruction later on. It obviously has to present high resistance to the environmental, climatic and social hazards in the location. Generally the beneficiaries need a safe place for their belongings and for themselves as fast as possible. In many places theft and even looting is common after a disaster, safety not only from the climate but also from other people is most often a high concern of the suffering families. The approach towards the affected population has to be clear; they must be aware of the fact that it is only an emergency measure that will provide an emergency shelter, a base from which they can expand later to a full house with their own effort or possibly with the aid of some project. The unit consists of a number of elements that can be assembled in different ways to accommodate the specific size and conditions of the plot. From start on it is possible to take into account the plans for the future extension.	If the action has to be fast and during an emergency situation, it has to be based on organizational and infrastructural scenarios that were prepared beforehand. When this is not the case, as it is unfortunately the rule, a local partner with solid structure must be identified. Experience shows that in the first days and weeks of an emergency the affected people are eager to commit themselves to mutual help and improvised leadership develops. If this momentum can be directed into an action that produces shelter, it is very likely that an action can count on popular participation in decision-making and labor; however an experienced core-team for management and construction has to be on site in order to guide the action. The task is to establish a production workshop to produce wall panels and roofing tiles. All aspects of the technology are simple and can be performed in less than perfect situations with a high degree of perfection and efficiency.	Emergency shelters often come too late, because no preparations were made before the emergency, in spite of the fact that many of those situations are recurring (hurricanes, floods) on regular intervals. The emergency aid itself often becomes an emergency, if not a disaster and popular discontent a first tangible result. Large allocations of funds are spent on temporary actions that will not resolve the problem, just to gain some time while the search for solutions is pursued. Ideally the emergency shelter should be produced beforehand and stored at a place from where it can be dispatched. Personnel for logistical support and technicians to assemble the units have to be trained and periodically retrained. The shelter units should be easy to transport and easy to store over prolonged periods of time, therefore metals, timber and other organic materials are not suitable. Concrete has some of those advantages; however the panels must be lightweight.
Land, site development and livelihoods		
In any disaster situation a decision has to be made whether to rebuild or repair at the same location or whether relocation to another site is needed. Relocation tends to take much time, suitable properties are seldom available, with the exception of countries where the state owns most of the land . Planning an urban intervention takes time and construction should not start before all overall decisions have been taken. However, in most cases reconstruction will take place in the same plot and the immediate need might simply be one safe room added to a damaged house.	The core unit has to be flexible in its size in order to adapt to the specific situation of the plot. Mainly in urban areas there are usually only small plots that are still partially occupied by debris or by parts of the damaged house than can be repaired or rebuilt. In the case of relocation, it is important that the core unit can be erected on provisional foundations or placed in a way that does not impede later small readjustments. The unit has to allow flexibility to grow into a full house, for urban areas this includes vertical growth. All sites must be evaluated for their risk potential and measures taken to lower the vulnerability.	The core unit proposed has been used in applications on different terrains and under different conditions. It is based on a modulation of 40 cm and allows flexibility. The system has been developed in Cuba around 1980 and several town developments were built in one- and two storey houses. 25 years later they are still in good repair. A technical adaptation to smaller scale was done in Nicaragua in 1992 and several rural schools and other buildings used the technology with success. They are all standing strong after several hurricanes and earthquakes. The system is successfully implemented in Cuba after the hurricanes 2008 and in Haiti after the earthquake 2010

Planning the Intervention	Implementation	Lessons learnt and comments
Technical solutions		
The potential beneficiaries will likely aspire to a house stronger and longer lasting than their old one. Generally all over the world this is conceived to be a cement based structure. However, the climatic, environmental, cultural and social conditions often point to solutions different from concrete units. The core unit or emergency shelter therefore has to give the option to be integrated into a house that could be completed later in many shapes and with many different materials. If the emergency shelter is solid, the rest of the house can be added in local materials that do not give the same feeling of security, as is generally the case with clay based buildings.	The solution presented is made of Ferro cement panels that can be produced on site and assembled by hand. They are visually attractive and relatively light weight, but solid. The energy consumption for production, transport and building (embodied energy) is lower than any other solid and fast solution. It is also lower than most construction, except for traditional clay based walls without cement plaster. They have a high resistance to the impact of earthquakes and strong winds and are not degraded by water (floods). As other cement based structures, they do not insulate well against cold or heat.	Sofonias Nicaragua has built several public buildings with this technology between 1991 and 1993 and in 2011 they do not present any cracks or other damages in spite of a total absence of any maintenance during this time (rural public schools). The design of the core unit is a simple room with a one side pitch roof, made for easy addition of more rooms with any material (adobe, bricks, blocks, timber or more of the same elements). The technology has been redesigned for small scale semi-industrial production and is being implemented in different housing schemes in Nicaragua, Salvador and Cuba, operated by semi-skilled personnel. It has caused much interest in the Haiti reconstruction.
Time frames		
The ideal scenario is to have a stockpile of elements ready and a group of trained builders. The concrete walling elements and roofing tiles can be stored outside during years without suffering damage. Mobile production units are available in Central America and can be transported to any site in short time span This must be combined with training of the personnel at all stages, on site manager, social worker, production foreman and masons. They will have to team up with local leaders to organize the community, and with workers and helpers to produce elements and erect buildings.	Local production can start within days of the arrival of the equipment. Cement, sand and steel rods have to be shipped to the site, water and if possible a covered workspace are precondition. The first elements can be used within less than one week if additives are used, or within two to three weeks without additives. Training is fast and after a couple of days the team reaches normal production speed. At the same time the construction brigades have to be trained, ideally every team consists of one mason and three helpers, who could well be volunteers from the community (beneficiaries ?)	Sofonias Nicaragua has implemented several training sessions and the time frame presented in this case study is based on real-time experience. The demands on the technical level of the workmen are low; a skilled mason will be able to direct a work group after his first exposure to the technology. Six workers (four semi- skilled plus two helpers) produce the elements for one unit per day, a group of four build the unit in 3 days, including roof and floor. This is based on two production equipments and the overall combined output is as follows : A total of 7 skilled people (masons) and 11 helpers will produce and build on average one core unit per day.
Financial aspects		
In order to be prepared for an emergency action, some costs have to be incurred previously. Production units have to be imported, and possibly a stockpile of wire mesh and additives in order to start production immediately. Sofonias Nicaragua has prepared an action plan that would guarantee the setup to go into production immediately .	It is not possible to budget production and building costs without analyzing the specific situation. The solution proposed is likely more expensive than a traditional emergency action of plastic combined with metal sheeting. However it is also certainly lower cost than other solid or semi-solid solution. If the community is well organized, labor costs for transporting the panels from the on site workshop to the actual construction could be low or minimal.	In Nicaragua at the moment a simple but solid traditional construction costs between 120 and 200 USD per m2. This does not include finishing nor electricity or sanitary installations. SofoNic builds with this system for 90 to 110 USD per m2 under similar conditions at a commercial level. There is a great potential that the emergency workshop could later serve reconstruction projects and the local market, providing livelihoods for several people.

Summary

Proposing light-weight concrete shelter units is viewed contradictory by many people. However, the embodied energy in those walls is lower than that of almost any solid material. Even clay walls built according to the instructions of many organizations concerned with earthquake resistant shelter are likely to have more embodied energy, as often the adobe is plastered with a cement-rich mortar and a chicken wire-mesh, which is similar to a layer of ferro cement !

This project sketch is based on 30 years of experience in disaster reconstruction and disaster prevention work. The EcoSur network has been building houses with rural cooperatives and with urban "working poor" and we have developed alternatives to lower the ecological footprint and the financial cost.
After the 2008 hurricanes in Cuba this system was chosen by the Cuban authorities and its implementation through the EcoSur network financed by several international relief agencies. In Haiti so far three production units have been installed to produce panels for a variety of projects.
In order to be able to assess the feasibility and present a comprehensive action plan with budget,, a fact finding mission could be made immediately.
The EcoSur network can draw on different partners in Cuba, Nicaragua and Ecuador and could start implementation within days of decisions taken.

Concept of the growing house

Producing walling elements

Building after 15 years and two earthquakes

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