Disasters, either natural or manmade, occur worldwide. As a result, countless people are rendered homeless without any protection against the external environment. Different humanitarian organisations (NGO's) try to help these affected people by sending several disaster relief items. One of these items are temporary shelters. These disaster relief shelters should be extremely lightweight, durable and easy to set up. In the search for more appropriate shelters, several lightweight concepts will be analyzed.

Sheltering

The sheltering process is a well maintained process of rebuilding people's homes from the first critical emergency phase to the more permanent housing. These shelters will act as temporary homes for the affected people and should not only provide protection against the external weather conditions, but will also act as some kind of safe environment where the population can restore their dignity and privacy.

Shelter Design Parameters

In the whole process of sending shelters, several parameters need to be taken into account:

- *The total cost of the shelter.* This is the cost of the shelter itself, but also the cost to transport it. This is usually the most expensive part of the shelter, especially when transported by plain.
- *The transportability of the shelter.* The shelter should be stackable and satisfy to the dimensions of a pallet. The lighter and smaller the package, the cheaper the transportation cost will be.
- *The boundary conditions on site*. Each site is different in different ways. What is the type of soil, is it a urban or rural area, are there local materials available, what are the conditions of the roads, etc.
- *The climate type*. We can distinguish four different climate types: temperate, hot-dry, hot-humid and cold. Each climate type has its own set of parameters.
- *The social impact of the shelter*. A shelter should not only provide cover against heat, rain and cold, but should also provide a place of privacy and security.
- *The durability of the shelter*. Each shelter should be able to structurally withstand all the external forces working on it and this for a given lifespan.

Two case studies

This research will focus on two structural concepts which are applicable for disaster relief shelters: 'Clever Roof Shelter Kit' and 'Tensairity Shelter'. Each concept will focus on the following parameters: the level of technology, the total cost, the durability, the set-up time and the weight. While the clever roof will focus more on the low tech parameter, the Tensairity shelter will emphasize the durability parameter.

The clever roof shelter kit

The first products arriving on site at this moment is the basic shelter kit with added tarpaulins. This kit consists of: rope, a handsaw, nails, a shovel, a hoe, a machete, shears and a claw hammer. This research will try to improve the standard shelter kit which is used in large quantities by the NGO's. The greatness of this kit is because of its versatility. The tarp can be used in different occasions and can provide different functions. However, there are still some set-backs with this classic tarp. Usually the knowhow of how to span the tarp correctly isn't at hand on the affected site. And this is detrimental for the structural efficiency of the structure. This proposal will investigate several solutions where structural elements are provided, alongside the tarp, to correctly span this tarp. The total package incorporates all the materials needed to provide a simple light weight 'clever roof'.

Tensairity shelters

The structural concept Tensairity is the synergetic combination of an airbeam under low pressure, slender struts and some cables. The airbeam has a dual purpose in the system. Its first purpose is to make a physical separation between tension and compression. Secondly, the airbeam has a stabilizing effect on the slender strut against buckling. This whole brings forth a very lightweight structure which still has a decent load bearing capacity. Research in the field of Tensairity, has up to now mainly focused on beam components. But in the case of sheltering, an arch component will be more appropriate. Because the concept of Tensairity arches is fairly new, the feasibility still need to be tested through means of experimental testing and numerical simulations.

This research is funded by the European commission. Project number: 284931.