Developing Alternative Temporary Shelter (ATS) Solutions as Interim Coping Mechanism for the Displaced among Urban Poor Communities

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紛争や大規模災害によって長期にわたる避難生活を強いられる人は世界中で膨大な数にのぼり、2016年だけで3000万人も増えた。彼らが安心して暮らせる避難所や仮設住宅の建設はどうあるべきかを、都市・地域計画の観点から探る。

Abstract

Each year, floods force thousands of urban poor families living in informal settlements along the Tullahan River into the role of internally displaced persons (IDPs) evacuating in covered courts, community halls, churches and schools. Oftentimes, these places lack the space and facilities needed by the evacuees, which lead to significant health, privacy, and safety issues.

To help communities and local government units address these issues, contingency plans and emergency evacuation centers of twelve partner communities in Malabon, Valenzuela, and Quezon City were assessed along with local capacities through a combination of scientific and participatory approaches including: focus group discussions, interviews, community surveys, and ocular inspections. The study yielded the need to develop context- appropriate alternative temporary shelter (ATS) models to address the massive supply-demand gap. Collaboration between stakeholders from public-private-people sectors facilitated the development of home-grown ATS solutions to meet these needs.

This paper focuses on the process by which the "ATS menu of options" was conceptualized and developed by combining local technical expertise with community-based knowledge and capacities in a bid to uphold human dignity during disasters. It also points toward strategies that will significantly improve evacuation shelter planning in urban areas where there is scarcity of space.

Keywords disaster response; evacuation; temporary shelter; community-based disaster management, participatory design and development

Introduction

The Global Report on Internal Displacement (GRID) 2017 indicates that 31.1 million new displacements were recorded in 125 countries and territories in 2016. Majority of these take place in environments characterized by high exposure to natural and human-made hazards, high levels of socioeconomic vulnerability, and low coping capacity of both institutions and infrastructure. Of this number, 24.2 million is brought about by sudden onset natural hazards while 6.9 million forced displacements were triggered by armed conflicts. With displacement due to sudden-onset natural hazards outnumbering displacements associated with conflict and violence by more than three to one, climate and weather-related disasters account for 97 per cent; roughly 23.5 million, of all disaster-related displacements. Majority of these reported weather-related displacements is related to flooding (Norwegian Refugee Council and IDMC, 2017).

The GRID 2017 report also noted that East Asia and the Pacific accounted for 68 per cent of the global total with 16.4 million incidents disaster-related displacements. China and the Philippines account for a disproportionate share of the world's disaster-related displacement. In 2016 alone, around 7.4 million Chinese IDPs and 5.9 million Filipino IDPs were added owing to the flooding of the Yangtze and as a result of typhoons Nock-Ten *(Nina)* and Haima *(Lawin)* respectively.

Probabilistic risk models for disasters indicate that nine of the ten countries with the highest displacement risk are in South and Southeast Asia. Astride both the Typhoon Belt and the Asia-Pacific Ring of Fire, the Philippines feature a "high degree of ecological degradation and socio-economic vulnerability due to the large number of people and economic assets exposed to multiple recurring hazards such as cyclones, floods, earthquakes and landslides," making it among the most-vulnerable to climate change (IDCM, 2013 p.7). Based on an analysis of more than 40 social, economic, and environmental factors, the country ranked fifth among countries with largest modeled Average Annual Displacement. Over half a million Filipinos are at risk of displacement. The capital metropolis of Manila is ranked by the Climate Change Vulnerability Index (CCVI) as the second-most vulnerable to climate change of the world's 20 "high growth cities" (Maplecroft 2013 quoted in IDMC 2014, p.42).

Of the world's 31 megacities (that is, cities with 10 million inhabitants or more), the urban agglomeration of Metro Manila ranked fourth largest in terms of population with an estimate of 24.3 million in an area of 690 square miles (1,790 square kilometers) and a population density of 35,100 per square mile (13,600 per square kilometer); the highest density among the top six built-up urban areas (Demographia, 2018). According to the National Economic Development Authority (2017), as of 2015, three out of the 33 highly-urbanized cities (cities having a population of more than one million) in the country, are located in Metro Manila; namely: (a) Quezon City (2.94 million), (b) Manila City (1.78 million); and Caloocan City (1.58 million). More than 20 per cent of its population is either under or near the poverty line (PSA, 2015), with an estimated one-third of its population living in slums.

This area, which now constitutes a vast urbanized drainage basin formed atop a semi-alluvial floodplain formed by sediment flow from the Meycauayan and Malabon-Tullahan river basins in the north and the Marikina river basin in the east (Bankoff, 2003), Metro Manila has also experienced catastrophic disasters in recent times– Typhoon Ketsana (Ondoy) in 2009 with $11 billion damage/ 464 deaths, Habagat in 2012 (monsoon rains enhanced by Typhoon Haikui) with $3 billion damage/ 109 deaths to wit (Rappler, 2013). Bankoff (2003) attributed flooding in Metro Manila as a result of natural causes such as flat terrain, rainfall intensity and high tides in Manila Bay compounded with the unintended consequences of rapid urbanization that led to the encroachment of structures along the banks of waterways that lace its way around the plains, along with the reduction of the capacity of rivers and streams to hold runoff due to siltation from denuded watersheds, as well as the gradual disappearance of *esteros* which severely impacted the area's natural ability to dissipate floodwaters.

Since the 1990s, floodwater depths continued to rise especially in the northern cities of Caloocan, Malabon, Navotas and Valenzuela. Collectively referred to as CAMANAVA, with its flat lands ranging 0.3 to 3 meters above sea level, the area is considered one of the most flood-prone in Metro Manila. Rising floodwater depths in these areas have resulted to hundreds of thousands of families regularly requiring evacuation to higher ground (Bankoff, 2003). In 2014, Pornasdoro et al. conducted a GIS-based flood-risk assessment of barangays in Metro Manila and found that, by 2020, half of the barangays in Malabon and Navotas cities, 28 per cent of barangays in Valenzuela, 11.3 per cent of barangays in Quezon City, and 23.3 per cent of barangays in Caloocan are potentially at high risk of flooding. Most of these high-risk barangays are situated along creeks, rivers and waterways.

Situationer

The Philippine Disaster Risk Reduction Law (R.A.10121) mandates local government units (LGUs) to lead disaster risk reduction and management (DRRM) planning as well as the resilience building of communities in their respective jurisdiction. Past events have indicated vast discrepancies in their ability to fulfill this mandate as limited by various constraints in terms of resources, manpower, and capacities.

The study conducted a rapid needs assessment in targeted cities which straddle the banks of the 15-kilometer stretch of the Tullahan River from the La Mesa Reservoir to Manila Bay that forms part of the larger Malabon-Navotas-Tullahan-Tinajeros River System; namely: Malabon, Valenzuela and Quezon City.

Fig. 1. Partner Cities along Tullahan River

(Source: *Google Earth 2018, processed by ACCORD, Inc.*)

Fig. 2. Typical housing units along Tullahan River

(Source: *ACCORD, Inc.*)

This river is home to a sizable number of informal settler families spread across various barangays. Through focus group discussions and key informant interviews of DRRM officials in these select barangays and cities, it became evident that the urban poor are seen as factors that aggravate risks. Local authorities reveal that hazard events are seen as providential in removing urban poor communities from high-risk zones. DRR and basic services are also withheld in order to discourage settlement in these zones. In effect, inhabitants in these informal settlements are constrained into the role of internally displaced persons (IDPs) every monsoon season and during typhoon events as they are "forced to flee their homes or places of habitual residence…as a result of, or in order to avoid the effects of…natural or human-made disasters" (UNCHR, 1998 p.5).

Among the key challenges in addressing urban disaster risk in Metro Manila is the lack of safe and adequate space for shelter. The assessment found this to be consistent among the twelve communities included in the study. Urban poor shelters are often located in high risk areas prone to flooding, earthquake, and fire. Construction is patchy at best; utilizing substandard housing materials and non-engineered construction methods. In addition, existing systems on disaster preparedness, response, and evacuation center management are insufficient. Evacuees are exposed to a plethora of other risks such as health, security, protection, and gender-based violence. These issues, including safeguarding their properties and livelihood, are the leading reasons why at-risk households refuse to evacuate preemptively, placing them and their rescuers in grave danger during disasters.

Methodology

Prior to developing the alternative temporary shelter "menu of options", a detailed needs assessment was carried out in the following barangays:

Table 1. Partner Communities

City	Barangay Name
Malabon City	Catmon, Hulong Duhat, Panghulo, and Potrero
Quezon City	Bagong Silangan, Batasan Hills, Roxas, and Tatalon
Valenzuela City	Arkong Bato, General T de Leon, Punturin, and Ugong

Specifically, the assessment:

- Determined current practice in evacuation planning of these barangays,
- Identified the gaps in the provision of temporary emergency shelter services involving inventory of safe spaces and existing evacuation centers;
- Quantified the number of families that will sustain significant damage to their houses, or whose location would put them in harm's way, and therefore would require safe temporary shelter assistance;
- Determined potential temporary shelter needs based on worst-case scenarios for flood and typhoon and earthquake event; and
- Provided information inputs to the development of alternative temporary shelter solutions for adoption by local government units and communities.

Necessarily, the methodologies employed scientific and participatory approaches that are cost-efficient to enable communities and local governments to sustain, replicate, and scale up the practice.

Primary Data Collection

Focus Group Discussion (FGD) and Key Informant Interviews (KII) –A total of 24 FGDs were conducted in the twelve partner communities. Separate FGDs between barangay leaders and community members were done to encourage better sharing of experiences amongst the participants. Community members selected to participate in the FGDs live in high-risk, urban poor communities who experienced flooding or evacuation in the past. Local barangay officials who were selected for the FGDs are key personnel in disaster risk reduction, with prior experience handling small to large-scale emergency situations. The FGDs looked into the worst disaster experiences including data on the characteristics and number of affected populations, extent of urban poor areas, and actual flood height experienced. In addition, existing evacuation planning process and systems, evacuation center conditions, factors affecting evacuation, and duration of displacement were also discussed.

Household survey– A combination of stratified and random sampling methods was employed for the representation of the surveyed households. At-risk and flood-affected households in urban poor settlements were determined first through the FGD, from which the sample population and number of respondents was computed. The survey was designed to complement available information from official sources, such as disaggregated information on housing from NSO.

To validate the assumptions drawn from MMEIRS (2004), the survey adopted the PHIVOLCS "Self-Check for Earthquake Safety of Concrete Hollow Block Houses in the Philippines" as a component. While this tool is designed only for houses made with concrete hollow blocks, houses made of concrete and a mix of concrete and wood make up 60 per cent of all residential houses in Malabon, 76 per cent in Quezon City, and 78 per cent in Valenzuela City. Nonetheless, the use of the self-assessment tool on a more significant portion of the total population strengthens the findings from the table exercise on estimating the damage potential.

For the *analysis of ATS gaps*, an inventory of available space in existing evacuation centers was conducted through ocular inspections of identified evacuation facilities. As-built plans of these structures were requested for reference purposes where available. The total amount of space needed for the potentially displaced population was compared with the available space in existing evacuation facilities to compute the gaps in alternative temporary shelters.

Secondary Data Collection

Review of related literature on risks and hazards such as City Risk Atlas, CDRRMP and BDRRMP plans were conducted. Other thematic data such as population and poverty were obtained from the Philippine Statistics Authority. Various humanitarian aid manuals such as the "Sphere Handbook and the Humanitarian Charter and Minimum Standards in Humanitarian Response" as well as some Federal Emergency Management Agency (FEMA) guides were consulted in conjunction with local laws and standards.

Needs Assessment Findings

In all of the partner communities assessed in the study, the following common features emerged in the survey (Table 2):

- The household size in these communities exceed the national average of 4.4 person per household in 2015 (PSA, 2016) at six to seven members per household
- Prevalence of two or more households occupying a single structure (100 per cent)
- Prevalence of female-headed households (48 to 84 per cent)
- Close to or more than half of the families have minors (46 to 85 per cent)
- The percentage of families that have members with disabilities in all of these communities exceed national average of 1.57 per cent in 2005 (PSA, 2013) at 8-14 per cent
- While persons aged 60 years old and above constitutes 6.8 percent of the household population in 2010 (PSA, 2012), the percentage of families having members aged 60 years old and above in these communities from 7 to 20 per cent

The 12-question survey on "Self-Check for Earthquake Safety of Concrete Hollow Block Houses in the Philippines"

Table 2. Profile of Partner Communities

	MALABON CITY				QUEZON CITY				VALENZUELA CITY			
	Panghulo	Hulong Duhat	Catmon	Potrero	Tatalon	Bagong Silangan	Batasan Hills	Roxas	Punturin	Arkong Bato	Gen T. de Leon	Ugong
Flood affected population	1,110	718	13,085	3,267	33,320	32,000	5,840	9,320	1,340	8,500	7,880	1,504
Average number of families per structure	2	2	3	2	2	2	2	2	2	2	2	2
Average number of persons per structure	6	7	6	6	7	7	6	7	6	6	6	6
Percentage of families with minors	84%	69%	72%	65%	84%	85%	46%	56%	55%	77%	71%	72%
Percentage of families that have members with disabilities	9%	14%	11%	9%	11%	7%	8%	10%	20%	13%	12%	8%
Percentage of families that have members aged 60 years old and above	22%	38%	24%	33%	24%	20%	13%	27%	32%	33%	28%	34%
Percentage of female-headed households	62%	51%	79%	51%	84%	73%	73%	61%	48%	54%	70%	49%

provided the following score interpretations: (a) *11 to 12 points out of 12 possible points* - this seems safe for now, please consult an expert for confirmation, (b) *8-10 points out of 12 possible points* - This requires strengthening, please consult experts; and (c) *0-7 points out of 12 possible points*-this is disturbing, please consult experts soon. The questionnaire was adopted in the study in order to determine the worst-case scenario number of potential IDPs in these barangays – the magnitude 7.2 generated by the nearby West Valley Fault (MMEIRS, 2004).

With 65 to 76 per cent surveyed of the households in partner communities garnering scores of 7 points or less, self-reported perception of house safety among residents reveal widespread awareness of unsafe conditions of their dwelling units (Table 3). Anecdotal evidence relate the "self-build" nature of houses in these communities using salvaged materials and non-engineered construction methods to the large number of families needing pre-emptive evacuation as their houses are easily damaged by the strong winds and torrential rains.

Given the magnitude of households that will require evacuation during disasters, the total amount of space needed was computed using the Sphere Standard of 3.50 square meters (sq.m.) per person. Estimates revealed severe deficit in the space available to meet each communities' evacuation needs.

Compared with the amount of space available in identified

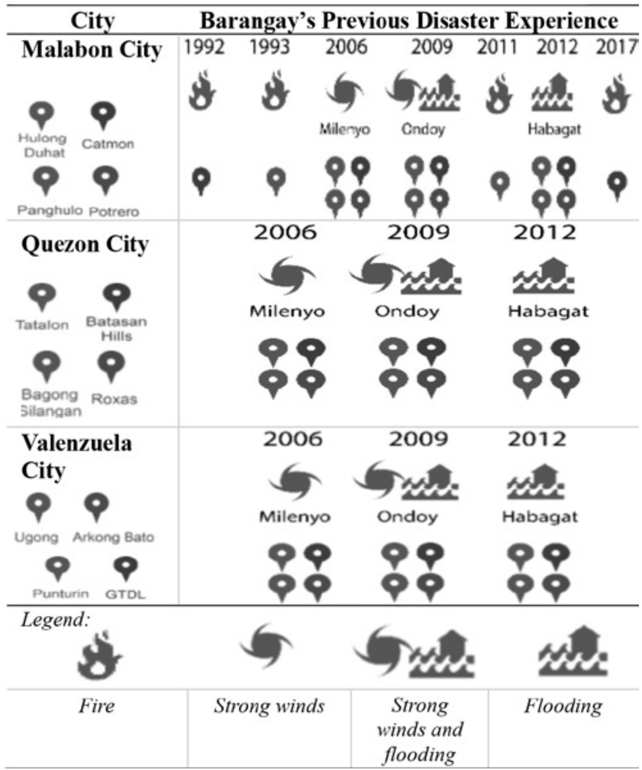
Table 3. Summary of Household Safety Survey Results

The house we live in is:	MALABON CITY				QUEZON CITY				VALENZUELA CITY			
	Panghulo	Hulong Duhat	Catmon	Potrero	Tatalon	Bagong Silangan	Batasan Hills	Roxas	Punturin	Arkong Bato	Gen T. de Leon	Ugong
Safe	1 %	2%	1%	1%	1 %	1 %	2%	1%	3%	4%	1 %	0 %
Needs strengthening	29 %	23%	23%	34%	29 %	33 %	23%	23%	22%	31%	29 %	24 %
Disturbing/ not safe	70%	75%	76%	65%	70%	65%	75%	76%	75%	65%	70 %	76 %

Table 4. Gaps in terms of Evacuation Spaces/ Temporary Shelter

City	Percentage of Potential Evacuees that can be Accommodated in Existing Evacuation Spaces at 3.50 sq.m. per person
Malabon City	3% - 6% *based on SPHERE and PHIVOLCS standards
Quezon City	5% - 6% *based on SPHERE and PHIVOLCS standards
Valenzuela City	7% - 12% *based on SPHERE and PHIVOLCS standards

Table 5. Previous Disaster Experience



evacuation spaces in each community such as barangay halls, covered or open courts, schools, and churches, FGD participants agreed that the 3.50 sq.m./ person requirement will mean less people will be accommodated in these shelters. In most of the communities, the shortfall ranges anywhere from 88 to 94 per cent.

Majority of the respondents in these barangays have experienced a number of disasters. All twelve barangays were severely affected by three hydro-meteorological events, namely: (1) Typhoon Xangsane *(Milenyo)* in 2006, (2) Typhoon Ketsana *(Ondoy)* in 2009, and (3) Monsoon rains enhanced by Typhoon Haikui *(Habagat)* in 2012. Fire outbreaks have also featured in some barangays in Malabon, particularly: (a) Panghulo in 1993, and (b) Catmon in 1992 and in 2017. In the unaided recall of events among FGD and survey participants, earthquake and other geological hazards did not figure in the discussion.

Design Considerations

Recognizing that "people, even the poorest and most marginalized, have capacities that they can put to work in order to prevent, resist, cope with, and recover from stresses and shocks" (Wisner, et al., 2014) is a central concept in CDRRM. Framed as a self-help solution whereby partner communities will be involved in varying capacities during the design, fabrication and integration of the ATS solutions into community-based contingency plans, the focus of the intervention is on bridging design-engineering knowledge among building professionals with local knowledge and capacities available in the community as enabled by partners from local government units, non-government and humanitarian organizations and the academia. In line with the findings from the needs assessment, additional site visits; this time with volunteer planning, architecture and engineering professionals, in the twelve partner communities were conducted in order to fully understand the evacuation site conditions, potentials and challenges that are specific to each locale from a technical standpoint. Parallel series of stakeholder engagements were conducted in order to refine the design criteria which will guide the development of the alternative temporary shelter model designs (see Table 6) along with the following considerations:

Space per occupant

In the subsequent discussions, DRRM officials and community members recognize that evacuation spaces must be augmented given the large number of potential IDPs in each community. However, since resources and land available for the construction of additional evacuation facilities are severely constrained, the interim strategy adopted is to reduce the amount of space each person will occupy in the evacuation center without compromising dignity and privacy.

Aside from SPHERE standard of 3.50 sq.m./person, the FEMA guidelines (2010) recommend 1.86 sq.m./person for short-term evacuation and up to 3.72 sq.m./person for sheltering longer than 72 hours. People who use wheelchairs, lift equipment, a service animal, and personal assistance services can require up to 9.30 sq.m./person. While these are ideal, the stakeholders noted that anthropometrics vary depending on ethnicity, biological factors, context and culture; and that the international standards may not reflect the tight-knit Filipino culture where the concept of personal space is smaller compared to Western cultures. FGD participants further suggested patterning the module after the area occupied by a sleeping bag. From 1.44 sq.m./person (1.80m x 0.80m), the size was reduced further to a bare minimum of 1.20 sq.m./person (+/- 1.70m x 0.70m) for the project since the average height among adult Filipinos 20 yrs and older is 1.63m for males and 1.51m for females (FNRI- DOST, 2014).

Capturing additional space

Besides the existing spaces identified by the barangays for evacuation, external and internal capacities of communities and cities could be tapped to fill in the huge gap for space where temporary shelters may be set up. Private establishments, parking lots, open grounds in schools and other public institutions, vacant lots and other alternative spaces may be considered as potential locations for temporary shelters.

Considering the limited area available where temporary shelters can be set up, vertical space should also be maximized, whenever possible.

Context-rooted designing

Considering the profile of the potentially displaced population with high number of women-headed households, children per family, and persons with disability, evacuation centers and alternative temporary shelter solutions should consider at least the following factors: accessibility, ease of deployment, and privacy.

In addition to this, according to anecdotal evidence, the duration of stay under evacuation situations may vary anywhere from: (a) 2-3 days for monsoon rains, typhoons and flood events, (b) 7 days or more for storm surges and tropical cyclones; and (c) 14 days or more in case of fire and earthquake events. Duration of stay has a large bearing on the durability; and in turn, the cost of production of the ATS solutions that will be developed.

Table 6. ATS Design Criteria

Design Criteria	Weight	Points
ROBUSTNESS	*22%*	
Design should be robust enough to be re-used many times instead of "disposable" solutions. This reduces wastage and allows for buildup of assets for the community		10
Design should consider means to sanitize and clean the unit after each use to ensure hygiene		5
As much as possible, materials used should prevent or deter the spread of fire		7
AFFORDABILITY	*21%*	
Design should be fabricated using locally available materials and, as much as possible, incorporate reused/ recycle materials / and/ or utilize rented/ leased/ sub-contracted materials to lower production cost		9
Design should consider possibility of using local labor or sweat equity to lower production cost		5
Design should also consider the cost of transporting and setup/ dismantling of ATS		7
SCALABILITY	*21%*	
Design should be modular to facilitate ease of deployment		8
Design should be versatile in terms of application and configuration		5
Design should be gender-sensitive as well as provide access to persons with disabilities		8
RANGE OF APPLICATION	*15%*	
Outdoor open space (parking lots, parks, open lots)		5
Covered court/ multipurpose halls, ware house, multi-level parking buildings		5
Classrooms and chapels		5
SPEED OF CONSTRUCTION	*21%*	
Should be easy to construct or fabricate		7
Connections are easy to understand and can be made using simple tools		7
Design can be easily assembled and dismantled		7
Total	***100%***	**100**

Developing the ATS Menu of Options

A range of possible alternative temporary shelter solutions that takes into account varying timeframes of occupancy, availability and configuration of space, as well as deployment conditions were developed resulting from these participatory engagements.

Lightweight Indoor Solutions

These options were developed to manage enclosed or semi-enclosed spaces used as evacuation shelters such as community halls, covered courts, schools and churches. These spaces are often used not only because it can provide much needed shelter from the elements but also because of the availability of large floor areas which can accommodate a sizeable number of people. Since these spaces are designed to provide unobstructed visual from end to end, families evacuating in these facilities commonly complain about lack of privacy aside from cramped conditions. In covered courts, families located at the periphery of the enclosure are exposed to the elements if screens are not provided.

Fig. 3. Lack of privacy as well as exposure to the elements for families located at the periphery of the enclosure is commonly observed in covered courts used for emergency evacuation.

(Source: *ACCORD, Inc.*)

Since these spaces are already provided with a shell, the ATS are primarily designed to provide some form of enclosure to maintain privacy. The Foldable Sleeping Module (Figs. 4a and 4b), made up of tubular pipe framing, plyboard panels for bed base and opaque plastic sheet privacy panels, was designed for use in covered courts, municipal halls, and churches in order to maximize vertical space. Once connected side by side, it can provide some level of privacy for four occupants per module.

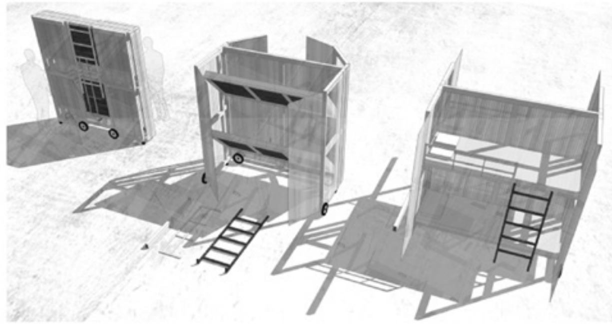


Fig. 4a. Foldable Sleeping Module (single unit) which can be wheeled into place, unfolded and setup in minutes.

(Source: *UAP-EA*)

A Temporary Classroom Partition System (Figs. 5a and 5b) using threaded pipes and fixtures to form the frame on which tarpaulin or fabric sheets can be stretched was conceived to partition a typical 56 sq.m. (7.00m x 8.00m) classroom into four modules that can fit six persons each.

Fig. 4b. Multiple unit Foldable Sleeping Module placed back to back, side by side to form an enclosure for four people per module

(Source: *UAP-EA*)

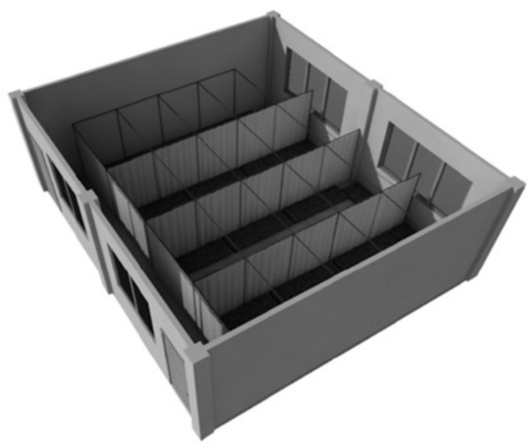


Fig. 5a Artist's rendering of the Temporary Classroom Partition System (3D model) of the design to provide some privacy for sleeping spaces in classrooms and other enclosed spaces.

(Source: *UAP-EA*)

Fig. 5b Mockup model being inspected by social workers.
(Source: *ACCORD, Inc.*)

Fig. 6 Barrel Vault Tent prototype features being discussed with stakeholders.
(Source: *ACCORD, Inc.*)

Fig. 7 Folding Tent prototype on exhibit during the MOVE UP National Resilience Conference
(Source: *ACCORD, Inc.*)

Lightweight Outdoor Solutions

These options were developed to take advantage of open spaces found in school yards, parks, parking lots and vacant lots as infill solution to augment spaces for evacuation. The modules are lightweight, easy to store and assemble by women or in some cases, even adolescents. These options were deemed advantageous in communities where families prefer some level of autonomy in their evacuation and where warehousing of temporary shelter solutions cannot be done en masse due to space limitations. While many tent solutions are readily available for purchase, partner communities see the advantage of being coached to fabricate their own ATS units as it allows for some level of customization to better accommodate larger family sizes. Aside from savings accrued through a communal "do-it-yourself" approach, this also has the potential of providing another income stream for urban poor families.

The Barrel Vault Tent (Fig. 6), which can fit four adults and two children for sleeping, makes use of pre-fabricated metal tubes with snap-in-place connections to provide a sturdy frame on which tent fabric can be stretched and fastened in place using hook-and-pile fastening fabric strips. The units can be connected end to end with metal plate connectors to enlarge available space. Organized side by side, rows can be reinforced with metal plate connections to increase wind resistance.

The Folding Tent (Fig. 7) is made of similar materials and provided with a pivot hinge connection which allows the tent to be folded in a nested manner similar to a fan. An option to further lighten the frame using PVC pipes was piloted successfully. Each unit can fit four adults and two children for sleeping.

In both above mentioned designs, the openings that will serve as the door and windows are provided with a layer of mesh to keep insects out while cover flaps are typically rolled up and secured with a strap.

The Snail *(Kuhol)* Tent (Fig. 8) features a structure made up of a series of elliptical frames made up of PVC pipes across which tarpaulin material is stretched. The design allows for better air circulation during hot or humid periods. Ad hoc, the tarpaulin sheets can be secured in place using duct tape. For ease of assembly, a heat-sealed sleeve located at the edge of each tarpaulin panel where PVC pipe frames can be slipped through can be incorporated in the design. Eyelets and snaps may be provided in strategic areas to secure the tarpaulin panels in place. Each unit has an enclose-able space at the rear that can fit seven individuals for sleeping which can be fitted with mesh and fabric privacy panel. Unlike the first two designs which will require a separate communal setup for meals and other activities, the front portion of the Snail Tent provides a shaded area that can accommodate a table and some chairs to serve as living and dining space for families.

Along with waterproof membrane to prevent ground moisture infiltration, other accessories to be included in the kit are guy wires, ropes, pegs and other fasteners in sufficient quantities to anchor the tent firmly onto the ground. Ideally, an additional tarpaulin sheet can be anchored on pipes raised at least 6 inches from the ground as flashing to provide a second barrier against the entry of mud and water within the units.

Fig. 8 Snail Tent prototype inspection

(Source: *ACCORD, Inc.*)

Durable Outdoor Solutions

These options were developed bearing in mind protracted evacuation periods which will require shelters that are fairly durable. The design took into account the possibility that some open lots will be exposed to the elements; needing sturdier construction to ensure occupant safety. Another consideration is the ubiquity of concrete surfaces which will make tent pitching difficult. For instance, in Malabon, where almost every nook and cranny is already built-up, closing off some road sections to provide additional area for the setup of temporary shelters in order to augment evacuation spaces is being explored. These options were designed to make full use of ordinary building materials that can be easily found in neighborhood hardware stores that are familiar to community members, as some of them work in various capacities in the construction sector.

The Slotted Steel Angle-framed Shelter (Fig. 9) is clad in 18mm marine plywood fastened with Tek® screws onto a balloon frame composed of 3mm x 50mm x 50mm slotted angle steel. The roof is made up of corrugated GI sheets on slotted steel angle frames. Spaced every 0.60m and bolted back-to-back, the slotted steel angle provides a robust structure take can accommodate significant vertical and lateral forces. A single module of 2.40m x 2.40m, the size of two boards joined side-by-side, can fit four individuals in two customized bunk beds. Units can be joined to fit more people, and arrayed in a line or back to back in order to maximize space. A stacked version of the design, which can support over 1,000 kilograms, was piloted.

Fig. 9 BDRRM officers from partner communities inspected a two-storey prototype of the Slotted Angle Steel-framed Shelter for the community feedback session.

(Source: *ACCORD, Inc.*)

The Urcia Street Shelter (Fig.10) works on a similar principle; however, structural support is provided by scaffolding frames and the cladding material is made out of lightweight concrete panels. Each 3.60m x 4.80m module can be fitted with two double deck bunk beds and provided with a tiny common living-dining area to accommodate 5-7 individuals.

Fig. 10 Artist's impression of the Urcia Street Shelter which was designed for deployment in parking lots and streets.

(Source: *UAP-EA*)

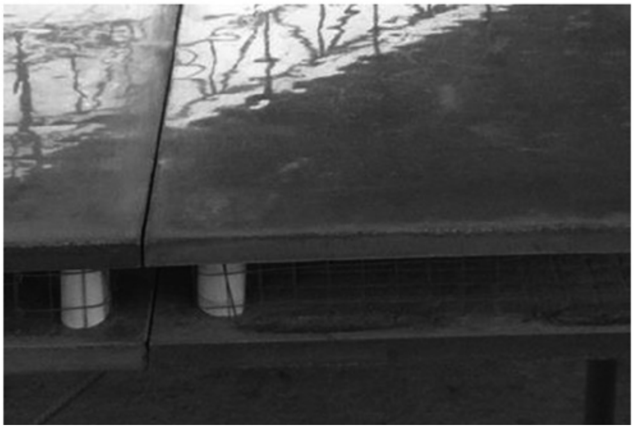


Fig. 11 **The lightweight concrete panel has a sturdy clean, smooth, water-resistant surface**

(Source: *UAP-EA*)

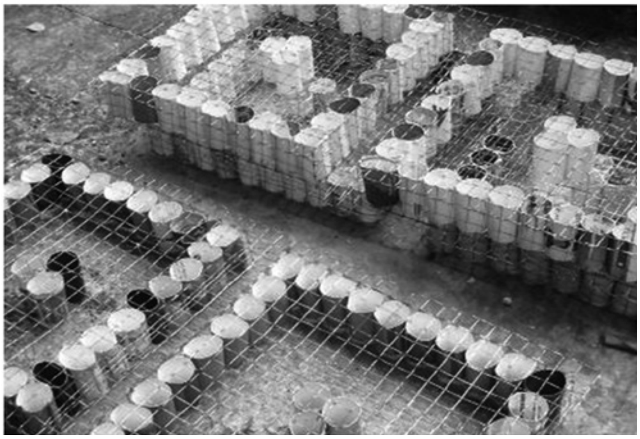


Fig. 12 **A cross-section of the panel shows the cardboard core assembly reinforced by wire mesh**

(Source: *UAP-EA*)

Fig. 13 **Salient features of the prototype Container Van Shelter were discussed during the the community feedback session.**

(Source: *ACCORD, Inc.*)

The cladding panel (Fig. 11) is a wire mesh-reinforced assembly with cylindrical cardboard core covered in thin lightweight concrete that is finished to a water- resistant semi-gloss sheen.

To improve thermal comfort, the core assembly recycles discarded toilet paper cores to serve as spacer and insulating material for the panel (Fig. 12). This panel, which requires production in advance, is envisaged as a potential source of additional livelihood for the community through an LGU or private sector sponsored capacity building program.

Built for rough conditions at sea, retired container van units were explored for modification into mobile emergency shelter (Fig. 13) suited for protracted evacuation situations in open spaces and parks. This model is envisioned to form part of a fleet composed of mobile kitchen, showers and lockers that can and portable toilet system for a total mobile solution that can be deployed and transported where needed. Each 20-foot container van is divided into two sleeping capsules, each with two levels on which three individual sleeping mats are provided to fit a family of six. Chequered plate set on metal frames that form the second sleeping level of the capsule can be slid into place through angle bars provided on three sides of the cabin. By simply removing the flooring, one can use the capsule's full height. A roof assembly consists of tarpaulin material stretched on tubular frames that provide shade for an outdoor lanai which may be used as living-dining space. For ventilation, louvered windows and doors made with recycled pallet wood were set onto the walls of the sleeping capsules.

Conclusion and Recommendations

Past experiences have shown that access to materials and supplies can be challenging during disasters. As such, materials for these shelters may be acquired, stored and distributed by the LGU at the city or barangay level, or through a community-based cooperative/enterprise ahead of time using any of the following modalities: (a) outright purchase of materials and stockpiling, (b) rental arrangement with suppliers, (c) retainer arrangement with suppliers, (d) a combination of any of the suggested modalities.

Despite efforts to: (a) reduce the minimum space allotment per person, (b) create modular units that are relatively easily to assemble and expand as needs arise, (c) manage and stack units vertically to maximize space available, and (d) explore usage of car parks, streets and other open spaces to increase the evacuation area, the demand for space is still too large to be met. Since community members vary in adaptive capacities, increasing their coping mechanisms may effectively reduce the potential number of displaced persons. The researchers recognize that moving urban poor families out of harm's way is still the best option, but this will take much time and resources. In the meantime, community members with the least capacity to move him or herself to safety may be identified and prioritized in LGU-provided evacuation spaces through an ID system which can be matched with an inventory of safe evacuation spaces.

Having an "ATS Menu of Options" is not enough. It can only work effectively in conjunction with appropriate local contingency plans that are matched with detailed, responsive community-based operation plans. Understanding how many units and what options to be deployed, when, where, and how to lay them out is crucial in ensuring that ATS deployment will support and enhance disaster response efforts.

Creating an enabling environment for partnerships to flourish through innovative and progressive use of local incentives will help in the buildup of capital or assets, technology, and skills that will make these communities resilient. Leveraging idle land tax regulations along with fiscal incentives for land owners may facilitate access to unused private land. LGUs may also explore the possibility of approaching mall or shopping center owners to partner with the government in its emergency response efforts by allowing the use of their parking space/ building for temporary evacuation. Tapping into Corporate Social Responsibility (CSR) initiatives may also assist urban poor communities in sourcing out funds for the acquisition, development, construction and stockpiling of their ATS solutions.

Finally, participating in hazard assessment and workshops in reducing risks and managing disasters empowers the marginalized, restores their dignity and upholds their rights as human beings. Building the resilience of the urban poor should anchor into a wider, comprehensive suite of urban management and development plans consistent with provincial, regional and national planning and development frameworks.

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