National Building Research Organisation

Newsletter

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Long-Term Sustainability of Post-Disaster Housing Reconstruction Projects

In This Issue

Features

Dear Readers

Natural disasters impact heavily on life, property and infrastructure, and affect adversely on social and cultural relationships. Such Disasters set societies back by decades and leave them vulnerable to physical, social and economic hardships for years to come.

Aftermath of the tsunami, Sri Lanka faced the enormous challenge of recovery. Post-disaster reconstruction in severly affected coastal areas was one of the most challenging tasks that decision makers as well as recovery practitioners confronted with. In reference to the socioeconomic context of a disaster affected community, post disaster housing reconstruction is a rather difficult task and needs special attention. Sustainability of such settlements in the long run depends on such special attention paid and measures taken. The long term performance of post disaster reconstruction projects and the user satisfaction are factors often overlooked, but articles in this Newsletter addresses them well.

Hence, we are happy to invite you to read the Newsletter published on the theme of "Longterm sustainability of post disaster reconstruction projects'. This presents a myriad of articles on the subjects of natural disaster context of Sri Lanka, long-term sustainability of post-disaster housing reconstruction projects, Sri Lanka post disaster reconstruction context, post-disaster housing reconstruction projects; with reference to experience from resettlements of Meeriyabedda landslide victims, impact of land Selection on cost variation, challenges encountered during post disaster reconstruction in Sri Lanka, institutional economics of post disaster housing aid program in Sri Lanka, the concept of inclusiveness in post disaster housing reconstruction and NBRO initiatives for using drone technology for planning and designing of resettlement sites.

We sincerely hope that the readers will enjoy reading this edition of newsletter. We welcome your feedback and ideas for future action and inclusion in the next Newsletter.

Best Wishes,
Eng. (Dr.) Asiri Karunawardane
Director General, NBRO

Sri Lanka is susceptible to variuos natural hazards that frequently affect different parts of the country. Recent landslides in May 2016 affected some central parts of the country, causing casualties and burying villages under mud. Further, several areas had to be evacuated due to the risk of subsidence and landslides. They were a timely reminder of the destructive nature of landslide hazard. Flooding near Colombo caused widespread property damage and resulted large scale evacuation. These events necessitated rebuilding of property and also the resettlement affected communities. It is essential that such post-disaster and post-conflict reconstruction initiatives consider the long-term wellbeing and requirements of receiving communities.

This newsletter coincides with the launch of a collaborative research initiative between National Building Research Organisation and the Universities of Aston and Huddersfield, aimed at improving policy and practice related to housing re-settlement.This collaborative research initiative funded by the Chartered Institute of Building and contributed in-kind by the participating institutes seeks to better integrate long-term expectations, requirements and performance in planning and execution of such housing schemes. The newsletter includes a number of articles addressing issues related to sustainability and long-term performance of housing resettlement schemes, and introduces the planned research initiative.

Best Wishes,
Dr. Gayan Wedawatta,
Aston University, UK

Cover Photograph

Makaldeniya Resettlment for Meeriyabadda Landslide Victims
Photo taken on 7th June 2016.

Research team is eager to hear from those involved in housing reconstruction and would value their input extremely high. Please contact the research team via the contact details below.

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Natural Disaster Context of Sri Lanka

Eshi Wijegunarathna
National Building Research Organisation

Sri Lanka is exposed occasionally to a range of hazards such as floods, landslides, cyclones, droughts, high winds, lightning, thunderstorms, coastal erosion, subsidence, tidal waves and infrequent seismic events. Such hazards threaten the human life, property, health, livelihood and safety. The number of disasters which the country would encounter in the future is likely to increase due to changes in demography, development patterns and climate change. This is likely to increase the level of vulnerability and exposure to disaster placing communities at risk. Records indicate that over the past 20 years, 23 million individuals and more than 5 million families were affected due to natural disasters as shown in Fig. 1.

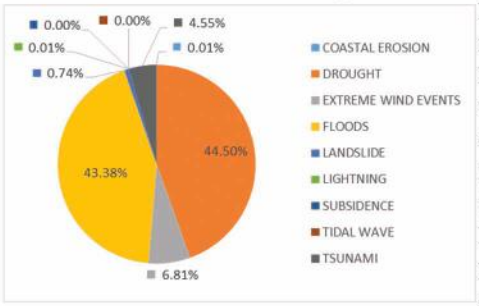


Figure 1: People affected by different disaster categories: 1996 - 2016

Drought was the most significant hazard as it affected the highest number of individuals, and families (45% out of total affected) in Sri Lanka. According to past records, severe droughts were reported in 2001 and 2004. In 2001, droughts affected more than 3 million individuals whereas in 2004 it affected over 2 million. This is thus a hazard of great concern in Sri Lanka due to the changing climate trends. Literature reveals that the number of people affected due to drought has been reduced significantly after year 2004 partly due to the major irrigation development programmes in drought prone districts. However, scarcity of drinking water has been reported annually in parts of Kurunagala, Hambantota, Anuradhapura and Monaragala districts.

Floods affected more than 10 million individuals in Sri Lanka over the past 20 years due to high intensity precipitation (43% out of total affected). Since 2003, floods have had an impact on 16 to 23 out of 25 districts. According to literature, the estimated damage and losses due to floods in May 2010 was approximately 5,059 million rupees or US$ 46 million. Intense precipitation in year 2016 generated flash floods in settlements in flood prone areas of Colombo, Gampaha and Kegalle districts.

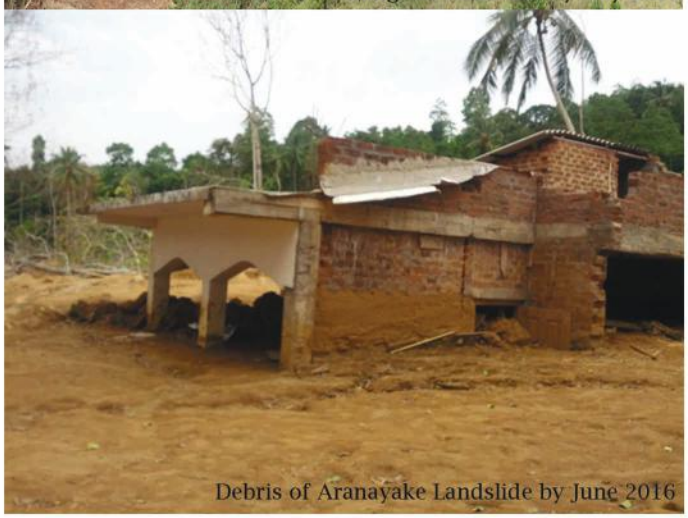
Sri Lanka is also affected by extreme wind events including cyclones which occurs in the Bay of Bengal. Figure 1 shows that 6.81 % individuals were affected by extreme winds. The Eastern, Northern and North Central regions are identified as cyclone prone areas of Sri Lanka. Although cyclones do not occur frequently in Sri Lanka, the records show that cyclones had severely affected the Eastern, Northern and North Central Provinces of the country.

Records shows there is an increasing trend in the loss of human lives due to extreme weather events. The majority had been recorded in 2011, 2013 and 2016.

Heavy and localized rains which fell in Sri Lanka during recent times caused landslides and cutting failures. Depression associated with a slow moving tropical cyclone in the Indian Ocean developed in the Bay of Bengal in May 2016 caused these loclaised rains, and deaths were reported due to several landslides and slope failures in the hill country and floods in the plains.

The Meeriyabadha and Niyadagala, Aranayake landslides occurred in 2014 and 2016 respectively were a timely reminder of the deadly and destructive capability of this type of hazard.

Balangoda Landslide by May 2016



Debris of Aranayake Landslide by June 2016

There were significant damages to the properties of affected people, specially damages to the houses which shows the need of housing reconstruction options.

The most significant event related to disasters throughout the history was undoubtedly the devastating Indian Ocean Tsunami which struck the country on 26th December 2004. This resulted in the deaths of over 30,000 Sri Lankans with a further 1,908 people reported missing and a further more than 1 million (1,076,240) affected. According literature, estimated damage and losses totaled to 1.0 billon US$ and the recovery cost was 1.8 billon US$. Although, tsunami represented an extremely low frequency disaster, but highlighted the need to improve the Disaster Management procedures and practices as well as the mechanisms of institutions which needed to cope with emergencies and disasters.

Disasters damaged and destroyed the properties which reduced the revenue of the country. Figure 9 shows the damages to houses due to different categories of disasters. Accordingly, most significant damage occurring to houses are caused by the disastrous wind events, floods and tsunami which shows 46.3 %, 36.3 %, and 13.8% respectively. Other important disaster types causing damage to houses are landslides. Furthermore, disasters such as lightning and drought have not caused damage to houses.

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Long-Term Sustainability of Post-Disaster Housing Reconstruction Projects

Dr Gayan Wedawatta1 and Prof Bingunath Ingirige2
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Research has shown that permanent re-construction following a natural disaster is often inefficiently managed, uncoordinated, slowly initiated and tend to overlook the long term requirements of the affected community (Lloyd-Jones, 2006). Under extreme conditions, long-term performance and the satisfaction and requirements of occupants are issues that are often overlooked by policy makers, practitioners, funding bodies, and occupants themselves. Whilst criticism is often levelled at government institutes, previous research has demonstrated that property-owners themselves tend to focus on immediate recovery and reinstatement, and overlook long-term requirements in their haste to re-instate properties as soon as possible. Whist urgent action is a necessity during the aftermath of a disaster event requiring re-construction, adopting a long-term approach therein is a must to provide sustainable permanent housing provisions.

Revisiting post-disaster permanent housing schemes that have been occupied by the recipients beyond the short to medium-term can suggest valuable lessons for future practice. Lessons to be learned therein can shape how such housing provisions are planned, delivered and maintained in the future. Nonetheless, how post-disaster housing schemes perform in the long-term is yet to be explored in detail and has received limited attention; as the emphasis is often on short to medium term recovery during the aftermath of a disaster.

Addressing this niche research gap, a research collaboration between Aston University, University of Huddersfield and NBRO Sri Lanka seeks to investigate the long-term performance of post-disaster housing reconstruction projects and make recommendations for effective, sustainable housing re-construction following natural disasters. The case of post-tsunami housing re-construction projects in Sri Lanka will be studied, where more than 100,000 houses were destroyed and re-built. Sri Lanka faced various challenges in its post-tsunami re-construction and this resulted in concentrating more on short term solutions rather than long lasting solutions (Ingirige et.al, 2008). As a majority of these housing schemes have now been occupied for a considerable period of time, it is ideal time to assess their level of performance and occupant satisfaction. A number of suitable housing schemes from Southern Sri Lanka will be selected for the study as it progresses.

The research is expected to enable policy makers and practitioners to make better decisions when developing permanent housing solutions following a major disaster. The lessons learnt will have a wider significance for post-disaster and post-conflict re-construction work in Sri Lanka, regionally and globally. The research will inform practitioners about how decisions made at re-construction stage have affected the long-term performance of housing projects and communities, and how these can be improved. The research is of practical relevance to the work of NBRO and the country's ongoing post-conflict and post-disaster reconstruction processes.

Sri Lanka Post Disaster Reconstruction Context

Anurudda Vijekumara
National Building Research Organisation

Disaster resettlements in Sri Lanka were widely implemented after the Tsunami devastation on December 26, 2004. There were two types of reconstruction programs implemented namely; Home Owner-driven housing reconstruction (In-Situ) and Donor-driven housing reconstruction (Relocation).

Walahanduwa Resettlement site

According Nissanka et al. (2008) several draw backs were found during post Tsunami reconstruction such as; inconsistencies in housing policies, conflicts on land titles, ineffectiveness in monitoring funds, insufficient capacity of the construction industry, affected community's crappy behavior, government's lack of planning and recovery strategies, lack of communication and coordi nation among stakeholders, existence of hostilities. Ismail, et al. (2014) pointed several factors such as, issues of delay, resourcing, community participation, poorly funded reconstruction, preliminary assessment, lack of coordination, corruption and build back better/safer, policies, quality of works, land issues, cost overruns and a shortage of technical staff as the main factors affecting to the failure of disaster resettlement/reconstructions in Sri Lanka.

According to the Duyne (2012) study on the impact of post-tsunami relocation on communities' livelihoods in Sri Lanka, it has been identified that the relocation led to a reduction of earning opportunities, in particular for women and the poor. In pre-tsunami homes, many families had goats, cattle and poultry; homestead gardens and coconut trees and free access to fish. These were important for food security and constituted critical assets in case of financial emergencies. In addition, many women carried out some home-based income-generating activities. This changed dramatically in relocation sites, where people were not able to keep animals and kitchen gardens and women had no access to markets for their products. Distance from the relocation site to market has affected on most of their incomes generated from micro-business in their homes.

Many scholars emphasized, owner driven approach has several advantages over the other approaches in reconstructions and re

settlement programs in Sri Lanka. However, success of owner driven approach is contingent upon appropriate enabling mechanisms, such as access to affordable building materials, building codes that reflect local building technologies, building skills of local masons, and the home owners' capacity to supervise construction and to judge its quality (Duyne, 2012). The absence of a government entity to control grants has caused equity issues all over the country. This has further confirmed by Duyne (2012), accordingly in Sri Lanka, for instance, although there is a consensus that the ODR approach led to higher levels of satisfaction, the enabling mechanisms set in place by the government were not sufficient. As a consequence, in less than two years material and labor costs almost doubled. In some places, NGOs intervened to top up the financial assistance provided by the government with an additional grant that allowed people to complete their houses.

Ahmed and McEvoy (2014) revealed most of the post disaster resettlement projects in Sri Lanka has no or minimal community consultation; most beneficiaries were simply allocated a property for resettlement. Most of resettled communities have inherent adaptive skills and are able to maximize them with some support; whereas top-down heavy-handed processes usually undermine such skills. For the many subsistence-level households, there has been little recourse but to continue living in an unsatisfactory state until funds became available. Future agency efforts should begin by conducting a needs assessment of such vulnerable households and build upon the inherent adaptive skills of such communities.

Sadiqi, et al. (2012) found construction work in Tsunami relocation site in Trincomalee encountered two major problems: 1) the site was perceived to be ready for new construction, but in reality it required major pre-construction preparation work, and 2) there were six different international non-governmental organizations (NGOs) involved in construction programmes, each adopting diverse approaches, varying house designs and different time frames. However, this initiative led to great community anxiety and delays in construction implementation due to lack of community participation. Both the new site and the design of the houses to be placed upon it did not meet the socio-economic and cultural needs of the affected community. Therefore, at the time this research is being conducted these houses still remained unoccupied and the beneficiaries had no desire to return to live in them.

In another case in Sri Lanka reveals that, many construction plans included indoor toilets and kitchens, both of which were considered unhygienic and culturally inappropriate, and thus, in many cases indoor kitchens were transformed into storage facilities. Thus in the cases of Sri Lanka, cultural traditions and norms related to the most acceptable placement of fundamental housing elements such as walls, doors and windows have been ignored (Sadiqi et al., 2012).

Vithanagama, et al. (2015) found in several failures in resettlement of Kananke Watta Tsunami resettlement, in Matara District.

Kananke Watta Resettlement Site

Kananke Watta [illegible]ement Site

The beneficiary selection process appears to have been flawed, as the government relied heavily on the then-Grama Niladhari for information on displaced families and for making decisions about who should be relocated. This over-reliance on a single official created an opportunity for him to play favorites, resulting in an abuse of power. The families who had been engaged in fishing at night were most dissatisfied with the resettlement. These families found it inconvenient to maintain their livelihoods from their resettlement location. They also felt socially excluded in comparison to the way they had lived before the tsunami. All of the relocated families were unhappy with the low quality of their new houses, which they blamed on shoddy workmanship and suboptimal material used by the contractors who built the houses. This experience offered many insights into factors that are important to consider when approaching the issue of relocations following disasters. One of these insights is the recognition of the importance of communication between different stakeholder groups, not only to ensure better decisions, but also to make everyone feel included in the decision-making process. When selection is seen as subjective, the resettlement system is undermined. Most importantly, there should be long-term monitoring mechanisms put in place by the government to support and sustain those families resettled as a consequence of disasters.

Arunatilake, et al. (2006) identified most relocated households are worse off now in terms of quality of housing and access to services and employment. Many relocated households do not have their own sources of water and are worse off in terms of access to roads, pre-schools and health clinics compared to their pre-tsunami levels of access. About 80 per cent of the relocated families claim that access to employment opportunities has worsened as a result of moving to new places. Almost half of the relocated households are not happy with the construction materials used to build houses in the new locations. Lifestyles and socio-economic situations of the people were not taken into consideration when designing houses. Majority of relocated households have not been given ownership legally. There are problems of coordination across various donors, especially those who have provided houses without adhering to government plans. Moreover, although there have been numerous disaster preparedness training programs in the affected areas, only few households have actually benefited from these.

As a summery to the above discussion, scholarly works on disaster reconstruction/resettlement programmes in Sri Lanka show several flaws. As per the above studies, donor driven approach shows more issues compared to the owner driven approach. Among the factor of failure for the resettlement programmes, lack of community participation, lack of communication and coordination among stakeholders, lack of long-term monitoring mechanisms, ignorance of socio-cultural values, poor quality of constructions and land issues are prominent.

Post-Disaster Housing Reconstruction Projects; with reference to Experience from Resettlements of Meeriyabedda Landslide Victims

Chinthaka Rathnasiri
National Building Research Organisation

Landslides are becoming a quite frequent occurrence in Sri Lanka in the recent past. The latest event at Aranayaka area of Kegalle District was recorded on 17th May 2016 where over 100 lives were lost and more than 150 houses were destroyed. The previous landslide that occurred on 29th October 2014 in Meeriyabedda area of Badulla District claimed 37 lives and destroyed 74 building units including 68 estate housing units.
This article briefly describes the experience gained in the process of housing construction for the resettlement of Meeriyabedda landslide victims with reference to its key components as a post disaster housing reconstruction project. Key components of the Meeriyabedda resettlement housing construction program could be categorized as; establishment of process and procedures, land selection, planning and designing, land preparation and house construction, procurement and building materials supply, provision of necessary infrastructures and basic services and project execution and coordination.

Establishment of Process and Procedures

The procedure to be adopted in the provision of houses for landslide victims was specified by a cabinet decision. At the beginning of the resettlements program it was expected to complete the housing construction before 15th October 2015 with the intension to resettle victims within a period of one year after the landslide occurrence. The cabinet decision issued on 13th November 2014 specified the procedure of housing construction as; (i) Ministry of Plantation Industries to identify a suitable block of land in the area in consultation with the Secretary, Ministry of Livestock and rural Community Development and NBRO, and (ii) Ministry of Plantation Industries themselves to formulate a program to build houses for the relocation of the affected families in association with the relevant plantation companies and other authorities. Also, the same cabinet decision instructed to Ministry of Livestock and Rural Community Development to commence resettlement housing construction through the Plantation Human Development Trust in collaboration with the Ministry of Defense and Urban Development.
But, considering the low progress of the resettlements housing program, cabinet meeting held on 24th June 2015 decided that Ministry of Disaster Management should supervise and monitor the programme with the coordination of the Ministry of Plantation Infrastructure Development and the District Secretary, Badulla and instructed to complete the resettlements program within the stipulated time frame of before 15th October 2015.

Anyhow, key agencies that are being operated at ground level in the program implementation are briefly described below;

Urban Development Authority (UDA); design and supervision of ongoing housing construction and as well as the site preparation works including earth formation of the internal roads. District Secretariat, Badulla; Supply of all the building materials following tender process, organize and facilitate progress meetings time to time. Sri Lanka Army; undertake house construction works. Ministry of Disaster Management; Progress monitoring with key implementing agencies and channeling funding requested by project implementing agencies. National Building Research Organisation (NBRO); assist in site selection, guide on land development and resilient construction, supervision and monitoring land development and housing construction and construction of drainages and retaining structures. District Disaster Management Unit; coordinate progress of project activities with key implementing agencies. Ceylon Electricity Board (CEB); supply electricity in the site, Water Board; supply water to individual housing units.
Although, the above process and procedure were established at the apex level, the project could not be completed within the stipulated time frame and made the landslide victims to continue living in camps for almost 2 years after the landslide. Also, some issues were recorded; that could have caused a delay in the construction process, and are described with reference to rest of key components of the housing construction programme. Following picture gives the panoramic view of the resettlements site as in July 2016.

Land Selection

The site selection for the resettlement had been managed by the Ministry of Plantation Industries in consultation with the Ministry of Livestock and rural Community Development, plantation sector and NBRO. Initially, a land had been selected to commence the construction of resettlement houses at Malwarn Division, Ampitikanda estate, Maskeliya Plantaion with NBRO clearance for landslides. Subsequently, most of government agencies representing both administrators and professionals working on land development made an inspection of the same site and necessary actions were taken to initiate the construction. Anyhow, another land was selected for housing construction due to objections made by landslide victims while rejecting the selected land. Accordingly, a second site for the houses construction was selected

Panoramic view of the resettlements site by June 2016

at Macaldeniya Division, Maskeliya Plantation and NBRO clearance for landslide also awarded with recommendations for land development. Also, selected land is located adjoining an elephant corridor and this has caused the incorporation of extra safety measures in the resettlement.

Planning and Designing

Land sub division plan and housing designs were prepared by UDA and forwarded for NBRO clearance as per initial recommendation by the NBRO. Accordingly, NBRO issued guidelines to follow in land development including cuttings and fillings and drainage system development. Also, guidelines were issued to ensure minimum requirements for a resilient house by NBRO. Further, NBRO was in a view to sub divide land with a minimum plot size of 15 perches for a sloping terrain in order to minimize unsafe cut slopes and commence housing construction following land preparation and development including drainage system development and cut slope stabilization. Anyhow, proposed sub division plan had been prepared to sub divide the land into 7 perch of plots. Also, the proposed house plan consisted of 550 sq.ft of floor area per house including two bed rooms, living area, kitchen and a toilet. But, there were no proper plan and design prepared for either drainage system development considering natural hydrological system of the area or stabilize cut slopes following engineering measures.

Land Preparation & Houses Construction

As per the initial plan, land preparation including cuttings, fillings and levelling are done under the direct guidance, supervision and monitoring of the UDA. Houses construction are being done by the Sri Lanka Army initiating construction from plots of land where land preparation is over. Although, initial plan of the Army was to complete house construction within the stipulated time frame under twelve stages, the estimated time period has been extended. As per the progress review meetings, considerable delays were recorded in building materials supply and land preparation works had mainly caused delays in the houses construction. As well as, land development work has been monitored by NBRO as per the recommendation issued. Accordingly, NBRO had to reject few sites considering the possibility unstabilising land by to unsafe cuttings. Subsequently, it was needed to identify a another land to construct 14 houses and the land located just opposite to resettlement site was selected for the same by Divisional Secretary and plantation officials with the approval of the NBRO. Anyhow, houses construction process were further delayed due to this reason and it was triggered as UDA was not involved in land preparation work from that point. Then, Divisional Secretariat under took land preparation work for new site under the technical guidance of the NBRO. At the same time, NBRO had to prepare plans and designs for drainage system development and to stabilize cut slopes which was vital considering potential failure of the site with heavy rain. Finally, NBRO itself had to undertake construction works of the same with its own funds under the instruction of the Ministry of Disaster Management as no any responsible agencies wants to undertake the drainages and retaining walls construction.

Procurement and Building Materials Supply

District Secretariat of Badulla itself manage all the building materials supply to the site following tender procedures. However, as per the SL Army engaged in houses construction, the construction has been mainly delayed due to low progress in material supply to the site.

Provision of necessary infrastructures and basic services

Basic physical infrastructures such as electricity, water and roads are being provided by responsible agencies; Ceylon Electricity Board, Water Board and Road Development Authority respectively. Anyhow, lack of proper agreement or communication for the same at the beginning of the project has caused taking more time for negotiation with service providers at later stage. For instance, even NBRO was requested to undertake road paving activity although it was not a subject that comes under the purview of the NBRO. As well as, Erection of elephant fence is being discussed with Department of Wild Life and funding for the same has been allocated by the Ministry of Estate Infrastructure Development. In case of social infrastructures such as access for market or retail shops, play areas, religious places, pre-school and educational services was given less priority throughout the process. Lack of involvement of spatial planning agency to guide the overall development throughout the process could be the main reason for this issue. Although, UDA was involved as the planning agency, they had set their scope only to the design and supervision of housing construction and site preparation works including earth formation of the internal roads.

Project Execution and Coordination

During the first half of the programme it was observed that there were no single agency to take the overall responsibility of the project rather than key agencies were just focusing on specific work under their scope. This situation seems to impact on overall progress of the project adversely. For instance, in case of drainage and retaining wall construction, NBRO was writing to District Secretariat, Badulla and UDA emphasising the need to construct the same as per the guidelines issued by NBRO on urgent basis prior to other construction as funding disbursements was mainly handled by the District Secretary. Anyhow, NBRO did not get any positive feedback.

However, it was observed that the overall progress monitoring and solution generation for issues recorded from time to time has taken place with the beginning of the second half of the programme where Ministry of Disaster Management was assigned to supervise and monitor the programme with the coordination of the Ministry of Plantation Infrastructure Development and the District Secretary. In this, District Disaster Management Coordinating Unit, Badulla operating under the Disaster Management Centre made necessary coordination with all the technical agencies and assisted the Ministry of Disaster Management and District Secretariat, Badulla. Also, NBRO located its officer at the site to conduct onsite progress monitoring and assist a smooth flow of construction making necessary coordination with District Secretariat, Badulla, DMC and NBRO.

Conclusion and Recommendations

Considering the overall process and progress of the resettlements programme of Meeriyabedda landslide victims described above under its major components, it is concluded that a systematic mechanism to undertake such program has not been established in ground context. In this, establishment of a procedure defining a clear cut role and delegation of responsibilities of each agency as per their mandates assigning overall responsibility of executing such resettlement program by single organisation will be vital for the success of such programs in future.

Impact of Land Selection on Cost Variation - with reference to the Resettlement Housing Construction for Meeriyabedda Victims

Isuri Weerasinghe,
National Building Research Organisation

Selecting a suitable land for resettlement for victims of a disaster should be carried out carefully with sound judgment on various important factors to ascertain the suitability of its location and environment. Some of the main features that should be taken into consideration in such a situation are listed as follows;

· Land and location- permit for residential buildings in the selected land
- minimum risk of natural hazards and any other hazardous condition

· Topography- elevation and slope, ground condition, and drainage

· Subsoil conditions- favourable soil conditions

· Water bodies /reserves- proximity to drainage paths, wet/ marshy lands, coast line
- extent of land allocated for reservations
- proximity to elephant or other wildlife corridors

· Vulnerability to hazards- knowledge and history of any natural or other hazards in or in proximity to the land

· Performance of neighbouring structures - structural damage, appearance of cracks, settlements or tilting of neighbouring buildings

· Accessibility - Need for access roads
- Ground stability issues particularly in hilly terrain
- Convenience of communication and routes of evacuation during an emergency

As a sample project, the resettlement project for the victims of the Meeriyabedda landslide is taken into consideration for this analysis.

Housing Construction for resettlement of Meeriyabedda landslide victims

Meeriyabedda landslide occurred in October 2014 in the Koslanda area causing tremendous damage to property and lives. A housing scheme was initiated by the Government at Makaldeniya Division, Poonagala Estate with 75 new housing units for the victims of this disaster and now reaching its completion stage. As per the present condition, construction of 61 houses have been completed up to 95%; and land is being prepared (cuts) for laying of foundation in the rest (14 houses).

When considering a typical resettlement housing project, the main cost components are the unit housing cost, water, electricity, sewage system combined with septic tanks and soakage pits, internal roads, water tanks and the overall drainage system of the site.

Progress of Mackaldeniya Poonagala Resettlement site by June 2016

In the site area acquired for resettlement, a variation in an average slope of angle from 0⁰to 30⁰ is being observed and hence many precautions and extra work had to be considered specifically for this project. In addition to the general costs, several added works considered as such were the construction of the retaining walls, drainage systems for individual plots, elephant fences, and access steps that were added carried out in this project for completion.

As a result, it is identified that the drawbacks of site selection has resulted in a huge cost variation/ an increase of around 50% of the estimate of this specific project. The following are the most highlighted issues recognized.

Issues	Increase in additional cost due to additional work
High slope	• High drainage costs • Retaining wall structures for each level of houses in the land • Additional Land development work for cut slopes • Development of land for internal roads • Cost for Access steps for individual housing units
Proximity to reserve areas	• Cost of construction of elephant fences due to the proximity to elephant corridors

With reference to this project, we can identify that depending on the site selection an extra cost is being added to housing projects such as resettlement projects which should more appropriately be done at minimum time and cost to meet the immediate need.

Progress of Mackaldeniya Poonagala Resettlement site by June 2016

Emphasizing the main factors that need to be considered in a proper site selection process, the selection of a land with lesser risk of hazard and ability for sudden evacuation is highlighted. In considering these aspects related to the cost factor, it is clear that proper site selection is essential to carry out immediate and safe resettlement. A land with favourable soil conditions, less slope and less drainage conditions will allow less damage to houses in high rainy seasons, thus minimizing the risk of flooding and landslides. Also it will reduce the cost of drainage structures that are essential for a sloped land condition. A site with direct access may allow easy evacuation in an emergency condition and also reduce external costs needed for constructing access paths. Using the knowledge on the history of the hazard possibility in the neighbouring land area will let the decision makers avoid such risky lands.

Further, lesser the proximity to reserves will minimize the disturbance to the community from wildlife, also minimizing additional costs for safety structures to avoid any conflicts. Avoiding proximity to water bodies will also reduce additional structural costs in construction to avoid seepage through soil into the structure.

Concluding this article, the emphasis is made that more priority should be given to in selecting a flat terrain for resettlement housing projects in order to make the projects more beneficial in terms of the cost consideration.

Challenges Encountered During Post Disaster Reconstruction in Sri Lanka

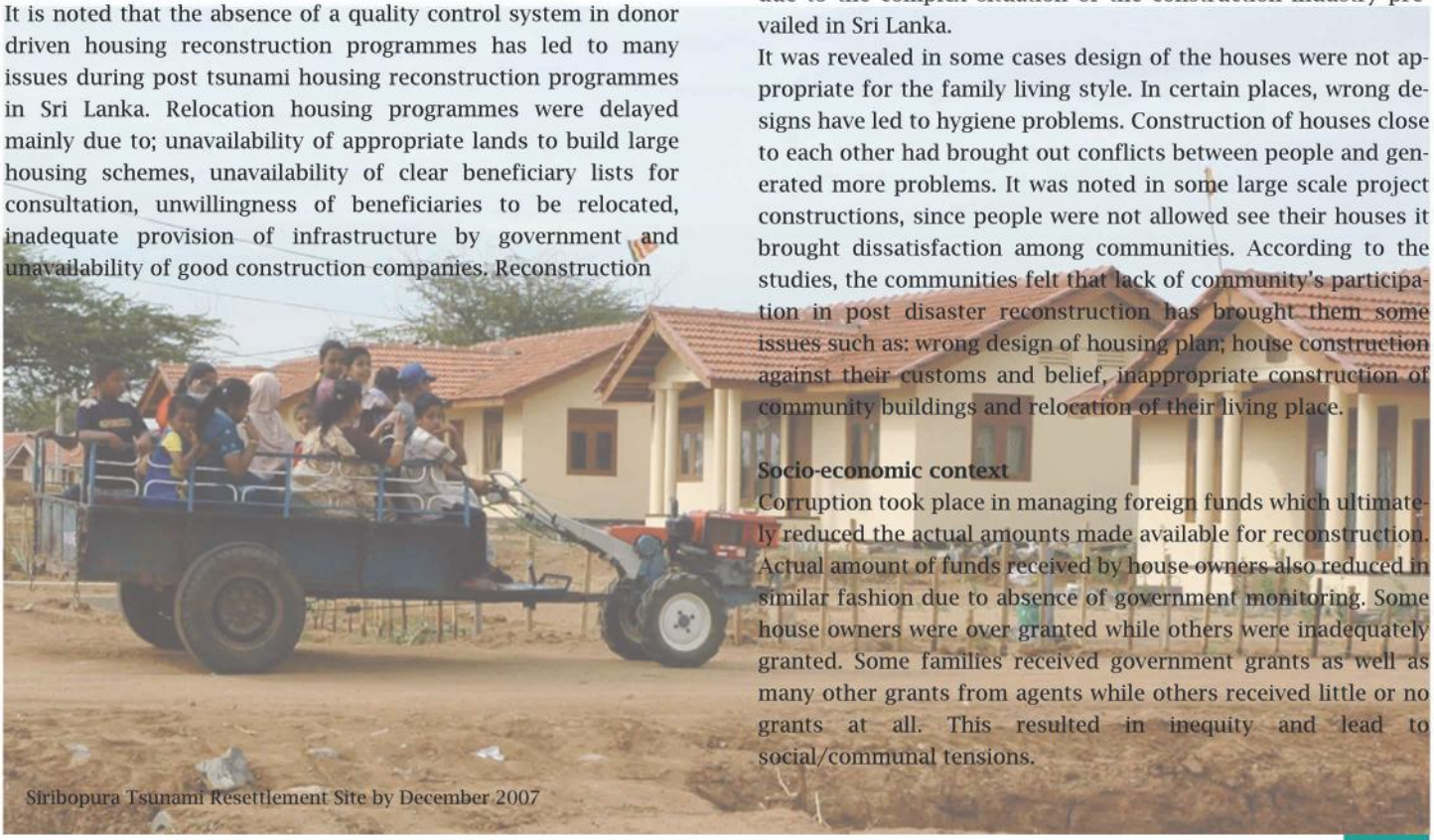
Jude Prasanna
National Building Research Organisation

Post disaster reconstruction is a vital phase in disaster management cycle. It aims to attain a standard of living, which is better than what existed prior to disaster impact. Successful post disaster housing reconstruction leads to successful post disaster recovery. Reconstruction is an opportunity to lay foundation for long-term risk reduction, also to contribute safer and sustainable development. Sri Lanka experienced multiple natural disasters; landslides, floods, high winds, cyclones, and droughts with severe impacts over the past years. Tsunami devastation in December 2004 and the recent landslide devastations proved significant challenges faced by Sri Lanka on post-disaster reconstruction and recovery process. In Sri Lanka smooth flow of construction process has been disturbed by certain gaps that occurred throughout the above post disaster reconstruction programme.
Challenges encountered during post disaster reconstruction in relation to planning and resettlement context, technical context, and socio-economic context are;

Planning and resettlement context
Experience from landslide resettlement programmes revealed that there is no systematic procedure applied. Main factors affecting the landslide resettlement programmes in Sri Lanka are; rational decision making on resettlement alternatives and options, safety assessments, accessibility to existing economic and social infrastructure and livelihood opportunities, community involvement in house designing and consideration of socio-cultural values of the affected community. Inconsistencies of post Tsunami housing policy, land titles, government's lack of planning and recovery strategies, enforcement of buffer zone are the main factors affecting post Tsunami housing reconstruction programmes in Sri Lanka.
It is noted that the absence of a quality control system in donor driven housing reconstruction programmes has led to many issues during post tsunami housing reconstruction programmes in Sri Lanka. Relocation housing programmes were delayed mainly due to; unavailability of appropriate lands to build large housing schemes, unavailability of clear beneficiary lists for consultation, unwillingness of beneficiaries to be relocated, inadequate provision of infrastructure by government and unavailability of good construction companies. Reconstruction programmes were affected by inadequate technical capability and unclear delegation of responsibilities among divisional, district and central government agencies and lack of coordination among community and various other parties.

Technical context
Studies on post-tsunami housing reconstruction process highlighted that the authorities were unable to provide sufficient lands for relocation of housing projects as a result of scarcity of land. Due to insufficient funds, the authorities failed to develop the land, therefore, the donors themselves developed the lands. Due to inferior quality, some of the houses constructed by donors have been advised to be demolished and reconstructed. Involvement of organizations with insufficient experience in housing reconstruction programmes has resulted in lowered effectiveness. By engaging in additional works of land development, donors were unable to complete number of housing units they agreed to reconstruct. Donors spent more time on revising budgets several times as they had to spend more for constructing a house inclusive of land development. The Government provided both state owned and acquired private lands to donors to construct houses under donor driven housing programme. Due to this, some land owners initiated legal actions against such acquisitions, which caused delay in reconstruction process.
It is highlighted that capacity of the construction industry in the aftermath of Tsunami in terms of professionals, material, labour etc. was insufficient to execute construction smoothly due to rise in demand . Prices increased due to unavailability of materials, and labour. Due to high inflation rates house owners were unable to complete reconstruction of houses within limited grants provided for housing reconstruction programme. Particularly for international NGOs, it was difficult to complete number of houses due to the complex situation of the construction industry prevailed in Sri Lanka.
It was revealed in some cases design of the houses were not appropriate for the family living style. In certain places, wrong designs have led to hygiene problems. Construction of houses close to each other had brought out conflicts between people and generated more problems. It was noted in some large scale project constructions, since people were not allowed see their houses it brought dissatisfaction among communities. According to the studies, the communities felt that lack of community's participation in post disaster reconstruction has brought them some issues such as: wrong design of housing plan; house construction against their customs and belief, inappropriate construction of community buildings and relocation of their living place.

Socio-economic context
Corruption took place in managing foreign funds which ultimately reduced the actual amounts made available for reconstruction. Actual amount of funds received by house owners also reduced in similar fashion due to absence of government monitoring. Some house owners were over granted while others were inadequately granted. Some families received government grants as well as many other grants from agents while others received little or no grants at all. This resulted in inequity and lead to social/communal tensions.



Siribopura Tsunami Resettlement Site by December 2007

Institutional Economics of Post Disaster Housing Aid Program in Sri Lanka

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Non-Governmental Organizations (NGOs) have unquestionable role in delivering public or quasi-public goods such as post disaster rehabilitation from micro-level initiatives to macrolevel policy advocacy. However competition among NGOs for funds can result in economic inefficiencies, which limit the rehabilitation support after a disaster event. In the above context this article draws mainly on institutional economics to point likely behaviors of NGOs and implications of such behaviors taking examples from Tsunami reconstruction process of Sri Lanka.

Since it was the first experience of a massive disaster like tsunami Sri Lanka lacked pre-existing policy or institutional framework that suit the large-scale rehabilitation task. Although in theory weak policy environment leads to negative growth impacts, Sri Lankan institutions responded well during the immediate relief stage specially due to the cooperation of public, private and community organizations (Asian Development Bank, 2007). However, during the reconstruction phase, all with the exemption of Red Cross, showed no interest to support the government owner-driven program1. This is due to the lack of sense of belonging by individuals contributing to the activities, moral hazard and agency problem.

Although agency problem is natural with the trade-off between organizational growth and rehabilitation support, there should be a mechanism to monitor the local development impact against the donor agency's implicit goals. Theoretically, when public demand for rehabilitation goods grows rapidly (following an event like Tsunami), can generate possible rent for executives in NGOs, public servants and academics as well. These were shown to be relevant with 65% of unrealized foreign grant commitments of Tsunami housing programs(Asian Development Bank, 2007).

Principle-agent problem is evidenced, for example 23 IFRC and Red Crescent Societies from various countries worked in Sri Lanka on tsunami projects (Namini W. citing Schaar J.,2006; Shaw et al.,2010). As a result coordination among institutions was limited which lead to duplications and forgo scale of economies.

Unreasonable expectations as a result of asymmetric information can lead to community frustrations. As per the ADB (2007), many donor agencies failed to meet even 50 per cent of their original targets, which highlights the information gap between the donor and the victims. There were 134 cases of various donors provided houses without adhering to government plans (ibid), again indicating the asymmetry between donor agencies and government institutions.

Highly vulnerable disaster affected communities became a target of many micro financing based NGOs for adverse selection.

These institutions were proactive in introducing disaster savings accounts2 but not in providing disaster-specific micro insurance(Fernando P.J.S.,2012).

Finally, even if the actions of NGOs are not perfect in disaster rehabilitation, it may not be possible to create institutions that give superior results. Therefore, there is a need for strong policy and institutional framework to monitor NGO behavior to supply disaster readiness and rehabilitation goods, and avoid production of public bads.

1 Beneficiaries were given cash grants and managed the reconstructi on themselves with governmentand donor supervision and technical support.

2 Disaster saving account is a special account that is designed with restricted withdrawal privileges to the holder. The account is maintained to accumulate saving to cope up with a specific disaster event.

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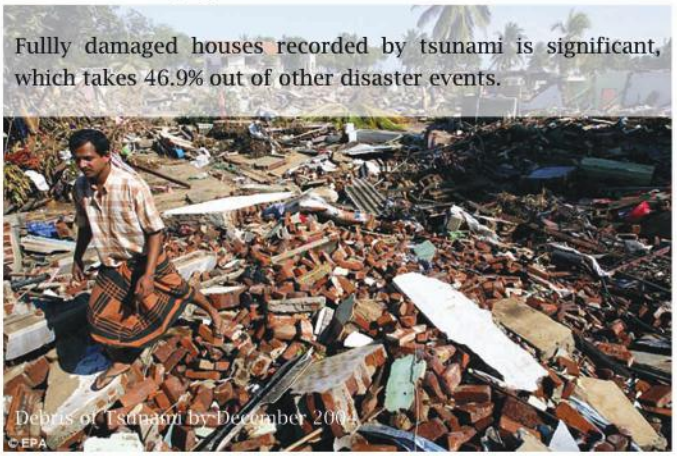

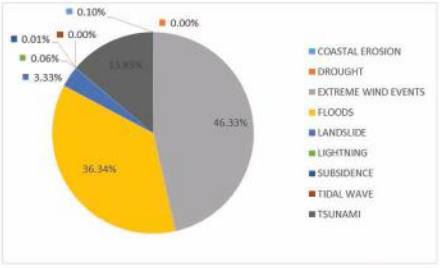

Figure: Houses Damaged due to Different Disaster Categories

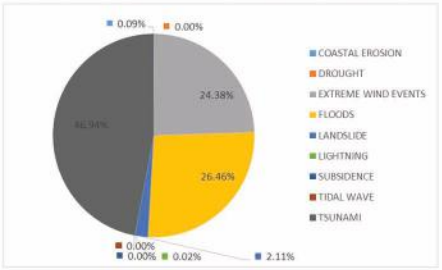

Figure: Houses Destroyed due to Different Disaster Categories

Over the past 20 years destruction to buildings appears to be quite low with the exceptions in 2000, 2004 and 2008. During these years most destruction has been caused by tsunami and extreme wind events. Apart from these three exceptional peaks, most of the damages to houses are generally caused by floods and landslides.

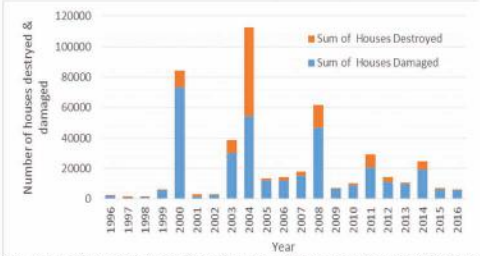

Figure: Annual time series distribution of houses damaged& destroyed due to disasters from 1996 to 2016

Source: DesInventar database of DMC (www.desinventar.lk)

The Concept of Inclusiveness in Post Disaster Housing Reconstruction

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In recent times, with profound increase in the occurrence of disasters every year, sustainability of the prevailing mitigation strategies is under the radar. While, developed countries are taking efficient steps to secure their cities with various new building strategies as a part of their disaster preparedness, developing countries are still coping up with previously hit disasters, rather than emerging with new technologies to prepare themselves for the future. In developing countries, Disasters impact significantly particularly on the housing sector and housing reconstruction is always a key element in post disaster recovery process. Challenges that arise in implementing post disaster housing reconstruction programmes in developing countries are lack of effectiveness in creating some interest among the people on the planning process and absense of accountability – which highlights the aspects such as answerability and responsibility. There have been many debates whether the process mentioned is inclusive of all the stakeholders involved. Though several studies in this respect highlight the importance of community participation, it is very rarely observed in the real dynamics, where the politicians or the supposed "community leaders" make decisions on behalf of the "people" involved.

Community participation – the most important aspect of the housing reconstruction is often a highly ignored process. While, temporary resettlements are chosen as immediate relief, despite its best intentions, it appears that there are numerous intricate challenges related to implementations of post-disaster resettlement housing. With reference to resettlement challenges, it is best understood from various case studies that resettling affected communities away from their original habitats without recognising their original socio-economic and cultural characteristics (e.g. livelihood, ethnic and religious mix, etc.) can cause problems. In addition, there exist political issues/reasons (e.g. territoriality, leadership structures) which limit the success of housing reconstruction. Often, the factors such as accessibility both to the work places and the town centres and locational attributes, are not taken into consideration.

On the other hand, spatial factors (e.g. size of liveable space provided to affected communities, access and distance to infrastructure and facilities, land availability, etc.) also add to the list of constraints. With all of these factors playing a major role, the question of what people want arises, also leading to a major confusion. Inclusiveness is often listed out as a concept "including all the sections of the society in the planning process", and in this aspect of the study – where inclusiveness is being defined based on the post disaster housing reconstruction, involves the high concentration on what the people expect as part of their housing and how, all the cadres in that particular society – including the women, children, the disable and the aged are accommodated in the reconstruction process. If at all are they specifically allotted spaces of their own?

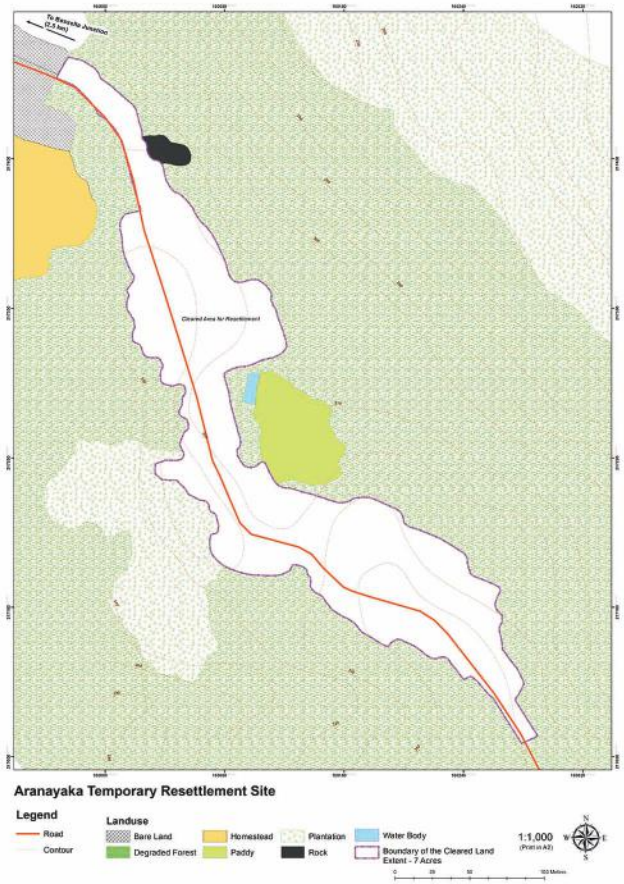
With such questions coming into play, certain parts of the reconstruction process – the part about community participation and the governance should be viewed in consideration of the concept discussed above. Sustainability is to be achieved not only physically through construction, but also by positive community building involving all the age groups for their simultaneous progressive growth. Most of the researchers and academicians view this concept fit for urban development – service provision etc., but is rarely seen as fit for anything else. Inclusive housing means inclusive neighbourhoods, which in turn form communities. This can be seen as an opportunity for income mobilisation through the communities – a "connected" community can emerge leading to self-sustainability – financially. This is one aspect of the study, which is yet to come into the light, but once under the purview can lead to a better planning – post disaster.

NBRO Initiatives for Using Drone Technology for Planning and Designing of Resettlement Sites

Anurudda Vijekumara
National Building Research Organisation

Choice of location, site selection and settlement planning are some of the crucial factors which determine the success or failure of a resettlement project. In a resettlement process, site selection and settlement planning may require extended time period due to associated time consuming works. Demarcation of site boundary, lay out planning and designing are some of the initial tasks that needs to be performed after the identification of a new location for resettlement. Amount of time and work needs to be undertaken mostly depend on the characteristics of the selected location. These tasks become more complex, when a site is in a hilly area. In general practice these tasks are performed by surveyors and planners with detailed site investigations. Specially in a planning resettlement site, placement of houses, internal road system, drainage system and open spaces are needed to be planned carefully based on the building regulations. Survey plans and contour plans are essential for preparing these plans in larger scale. Further, study on surrounding areas of the selected land and their land uses is essential. These studies are often conducted by using the land use maps of survey department. However, due to unavailability of large scale land use maps, site specific land use maps are created using satellite images in most cases.

3D image of the resettlement site – as captured by drone



Land use and boundary of the resettlement site – Drafted using the drone images

National Building Research Organisation (NBRO) as the technical arm of the Ministry of Disaster Management, has stepped in to the use of drone technology for planning and designing of resettlement sites. NBRO initiated this task as a pilot study for a resettlement site at Aranayaka divisional secretariat division. NBRO flied its own drone at Kalugala resettlement site of Aranayaka for this purpose. It took only 20 minutes to capture the images of the resettlement land and surrounding areas. Captured images were used to create 3D image of the area which was taken used to generate contour map and land use map within a half day of work time. Further, 3D image was used to demarcate the exact areas of the resettlement which has been used to draft a layout plan of the site. All these tasks which are highly time consuming and complex in nature, could be completed within two days time with the use of drone technology. NBRO, with the newly acquired knowlege and experience, is planning to extend the application of drone technology to the feild of hazard assessment, risk assessment, risk monitoring, land use planning etc.

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