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Sanitation during disaster relief and reconstruction; the experiences of Asian Tsunami 2004

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Abstract

Sanitation is an issue often neglected in development decision making. This situation becomes more evident under the extreme conditions of a disaster aftermath, where lack of sanitation can expand from a mere inconvenience to a full-scale secondary disaster causing epidemic outbreaks, permanent degradation of water resources and social unrest. Furthermore neglecting the importance of sanitation during disaster rehabilitation may jeopardize the sustainability of entire rebuilding projects.

This paper is an attempt to delineate and suggest solutions to the critical problems encountered in providing proper and adequate sanitation during refugee situations and post-disaster rehabilitation projects in underdeveloped tropical countries. The author records the experiences gained in several projects carried out as a partnership of Government and NGO sector organizations during the aftermath of the 2004 Tsunami incident in Sri Lanka. The paper also discuss how “proper and adequate sanitation” can be ensured through a proper disaster management framework. The paper would critically review the institutional drawbacks and failures which lead to the above mentioned unfortunate situations.

Keywords: Disaster Sanitation, Post-disaster rehabilitation, Social Acceptance, Sustainability, Institutional frameworks, Governance

1. Background

1.1 Disasters and Sanitation

Sanitation was officially identified as a “Basic Human Need” under the Mellenium Development Goals declared by the UN prior to year 2000. Further efforts are currently underway to recognize Sanitation as a “Basic Human Right”. The available technology and know-how in the sanitation sector is sufficient to provide “Proper Sanitation” in any major geographical/climatic region of the world. Despite all these technical and policy advancements, sanitation still remains a second priority in development decision making in many developing countries. This fact becomes woefully evident during disaster relief and rehabilitation.

Access to “Proper and Adequate Sanitation” is a factor that determines the stability of a community under extreme situations. This makes it an important concern in all the phases of disaster management. But during many recent disaster situations which occurred in the South / Southeast Asia, such as the Asian Tsunami of 2004, Great Earth Quake of Pakistan (2005) etc many failures were recorded in providing access to sanitation. This paper gives a Birdseye View of how the sanitation issues were handled during the Asian Tsunami aftermath in Sri Lanka reviewing technology, management systems and institutional aspects.

Any disaster management program can be divided into three phases, which are namely: a) Immediate relief b) Intermediate rehabilitation and c) Permanent rehabilitation. Provision of “Access to Proper and Adequate Sanitation” is an important aspect in all three phases, but the methods, technology and tools applicable may vary significantly from phase to phase. A proper and adequate sanitation scheme ensures hygiene, minimal environmental impacts, social acceptability, durability, comfort and safety of the users [7]. The adequacy of a sanitation scheme may be easily judged by the existing standards on sanitation (disaster guidelines, regulations etc.), but assessing the appropriateness (“proper”) is not that straightforward and may differ significantly according to the geography, social setup etc. During the immediate relief and intermediate rehabilitation phases the adequacy may be defined by disaster guidelines such as “Sphere Handbook” developed by UNHCR. In the Permanent Rehabilitation Phase the existing standards and regulations on sanitation in the country would ultimately define the adequacy.

An appropriate technology, proper awareness on sanitation among all the stakeholders and an effective framework for implementation should essentially be brought together for success of any disaster sanitation scheme. Failure to fulfil any of the above requirements would inevitably lead to an abrupt or gradual failure of the entire scheme (see figure 01).



Again the nature of technology, strategies for awareness building and the structure of the management framework may change significantly among different stages of disaster relief and reconstruction. The paper will discuss the experience gained by the author during each phase of Tsunami relief and rehabilitation in Sri Lanka with regard to sanitation. It separately takes into account the aspects of Technology, Awareness and Implementation Framework for each phase.

Figure 01: Three Components of Disaster Sanitation

2. Immediate Relief and Intermediate Rehabilitation

2.1 Situation Analysis of 2004 Tsunami

Tsunami wave of December 26th 2004 rendered nearly a million people homeless in the immediate aftermath. Food & Shelter, Medical attention and Sanitation were the three main aspects which had to be given focus by the organizations looking after the Internally Displaced People (IDPs). Although the first two issues were successfully coped with, there is evidence to believe that post tsunami relief operations failed to ensure access to proper sanitation facilities for the IDPs in some places. Table 01 gives a list of such typical failures and their causes along with some actual examples.

Table 01: Reasons and examples for lack of sanitation during the immediate aftermath [5]

Reason	Example	Location
Large number of IDPs concentrated in certain camps	1000 inmates with only one toilet at a transit camp near Colombo	Transit camp at Koralawella –Moratuwa managed by SERV Sri Lanka
Constraint of space	162 IDP families cramped in a 3-4 acre compound in a IDP camp in Negambo	Government IDP camp at Fisheries Training Centre - Negambo
Lack of funds	Allocated funds to provide sanitation facilities are inadequate or diverted to other needs	DO
Unhygienic habits of some groups of inmates	Fisher communities in Negambo had poor sanitation habits this lead to a difficulty in maintaining hygiene in the camps	DO
Lack of expertise & Lack of labor	Skilled workers were also among the affected people in many areas and could not render their services	IDP Camp Malharus Maha Vidyalaya, Sainthamarathu, Eastern Province
Unsuitable physical conditions	High groundwater level and none-soaking soils frequently found in the coastal areas of Sri Lanka made the conventional disaster latrine techniques inapplicable	DO

Lack of awareness about the importance of sanitation among the institutions involved in disaster management could also be observed generally in all the effected areas. The institutional capacity (i.e. Skills or Resources) to handle the issue of sanitation were either inadequate or non-existent. Therefore many weaknesses were observed during the immediate aftermath of the 2004 Tsunami in Sri Lanka in all the three components of Disaster Sanitation (Technology, Awareness and Implementation Framework).

2.2 Technology and Practice

The disaster sanitation techniques that were in practice prior to the 2004 Tsunami were confined mainly to open pit or trench latrine systems. Portable chemical latrines were available in the country, but were mainly hired by private companies for public events [5]. Provision of detergents and sanitation chemicals were not taken as an aspect of sanitation, it was looked after under provision of medical and health supplies. Therefore only the latrine construction techniques will be reviewed here. Some of the weaknesses of conventional disaster latrine techniques are given in Table 02.

Table 02: Weaknesses in conventional emergency latrine techniques [5]

Technique	Main draw-backs
Temporary pit latrines	In most areas the soil was not good for unlined pit latrines. Soil type found in most of tsunami affected coastal areas (Sandy Regasols) would easily collapse under self weight due to the low cohesion factor. The conventional slab and pit configuration can be very dangerous, if the slab is not constructed under proper supervision.
Shallow Open-trench latrines	Due to the fact that sewage or faeces remain exposed to atmosphere and insects/vectors (only covered by a thin layer of soil), open trench latrines may release bad odour and become a threat to public health. This situation will be aggravated under excessive-use conditions in tsunami IDP camps. Many elderly inmates as well as small children will find it difficult and psychologically unfit to use trench latrines.
Portable latrines or "Portaloos"	Both construction and maintenance of Portaloos are expensive in several folds than other emergency latrine types. Portaloos were not readily available with any government institution in Sri Lanka. Portaloos are heavy and bulky structures. The destruction of roads and railways due to tsunami would have hindered the transport of Portaloos to affected areas even if they were available.

Due to the scale and complexity of the Tsunami disaster, the weaknesses of the disaster sanitation techniques practiced until then became more evident. It was clear that these techniques should be replaced with a set of scientifically proven and systematic techniques which are applicable to different site-specific conditions. The author was involved in an intensive program to develop and implement a set of appropriate sanitation techniques for IDP camps in the immediate aftermath of the 2004 Tsunami. This was carried-out as a joint project of Department of Chemical and Process Engineering University of Moratuwa (Sri Lanka), Department of Civil Engineering University of Peradeniya (Sri Lanka) and Network for Women

Water Professionals, Sri Lanka. The project identified the points given in BOX 1 as the essential characteristics of an appropriate disaster latrine technique;

During the problem identification phase of the project it was observed that construction of lined

1. Technically sound and suitable for site conditions.
2. Hygienic and safe for any category of users.
3. Minimum environmental impacts
4. Low cost of construction and maintenance.
5. Simple technology (both construction and maintenance) & Minimum requirement of technical expertise.
6. Local availability of required construction materials.
7. Quick installation.
8. Social acceptance

BOX 1

pits, construction of sanitary toilet floors and discharge of effluent under un-soaking conditions were the main problem areas. Taking these into consideration and based on the above guidelines a series of disaster latrine techniques called the Sri Lankan Disaster Latrine (SDL) Series was developed. There were four versions in the series (SDL 1 – SDL Plat).

SDL 1: Main objective of SDL 1 was to provide a successful fast-construction and low-cost alternative for brick or concrete lined pits. SDL 1 uses a steel or HDPE barrel in

place of a brick or concrete lined pit. It was calculated that with proper perforation and providing adequate soakage area a simple 250l steel barrel could be used as a pit for 3- 5 moths by 20 people. Price of a used barrel is only a fraction of the original fabrication cost but the strength of the material remains intact.

SDL 2: With the delays in constructing intermediate camps and difficulties in providing permanent toilets in them, SDL 1 had to be modified to last longer. To extend the usable life SDL 2 was designed with a provision to for de-sludging and finished with anti-corrosive treatment so that it could remain underground without corroding for at least one year.

Bother SDL 1 & 2 were successfully constructed and used in two IDP camps in Negambo.

SDL 3: Both SDL 2 and SDL 1 could only deal with site conditions which permit soil soaking. In places where soils were water logged or none-soaking the effluent after solids retention had to be released to a surface drain. Therefore a new version had to be developed where the discharge from the barrel is further treated (secondary treatment) before released into the environment. After considering several methods available for low-cost insitu treatment of night-soil, it was decided that attached growth upward anaerobic filter (anaerobic filter) is the best method for secondary treatment in this case. Therefore SDL 3 was designed as a twin barrel system where one acts as the septic tank and other as the Upward Anaerobic Filter.

SDL 3 was constructed in a small IDP camp in Moratuwa (20km South of Colombo) only as a pilot project and was tested for performance.

SDL – Plat: A prefabricated ferro-cement sanitary platform for toiled floors. SDL plat was designed in a way that it can be installed within a site in less than 3 hours. But it is a prefabricated item which should be kept manufactured as disaster preparedness measure.

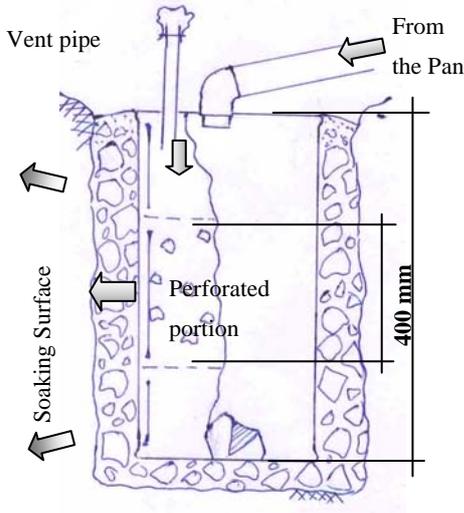


Figure 02: SDL 1

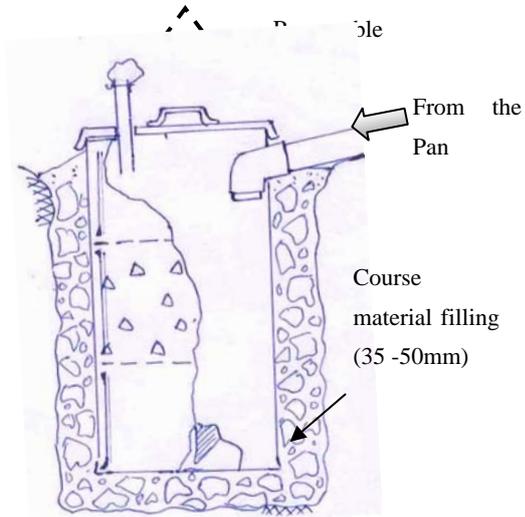


Figure 03: SDL 2

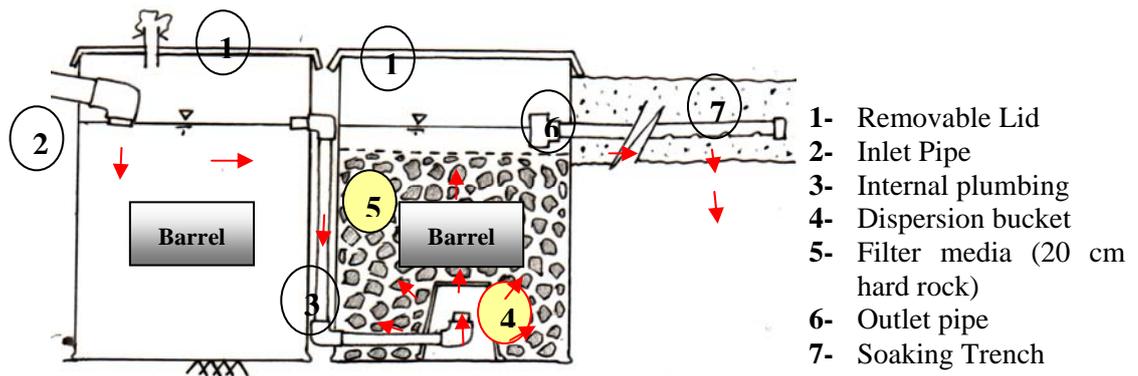


Figure 04: Sectional view of SDL 3

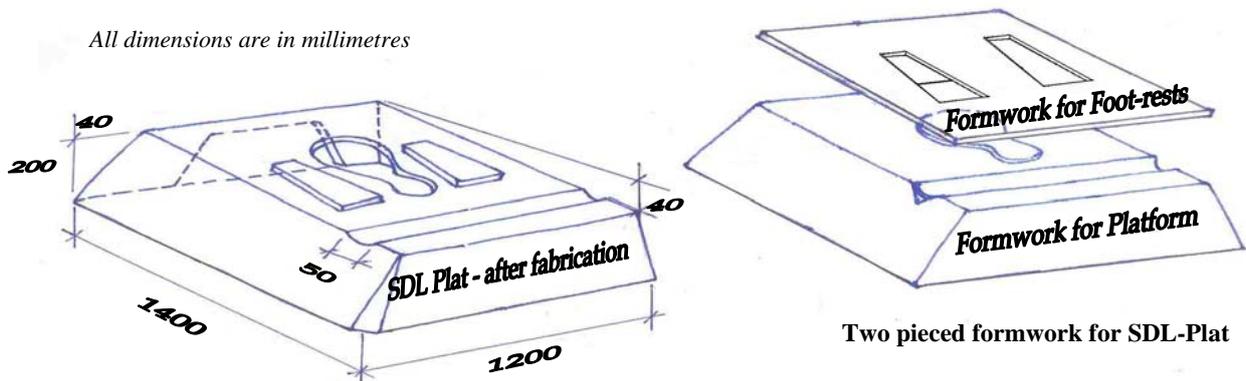


Figure 05: SDL – Plat and formwork

Table 03: Costs and comparison of different SDL units

Unit	Cost (SLR)	Merits	Demerits
SDL 1	800.00	Simple, Low-cost, No need to prefabricate	Short life time, not applicable to waterlogged conditions
SDL 2	1100.00	Simple, No need to prefabricate, Durable	not applicable to waterlogged conditions
SDL 3	3800.00	Applied to water logged conditions, Durable	Cost is higher than SDL 1& SDL 3, Pre-fabricated unit, Needs storage space
SDL-Plat	1200.00	Simple, Low-cost, Fast installation	Pre-fabricated unit, Needs storage space

2.3 Awareness

A general lack of awareness about the importance of sanitation was observed in the disaster management hierarchy of most organizations during the Tsunami Aftermath. A National Disaster Management Centre (NDMC) established in 1994 was already in operation at the time, there were disaster handbooks prepared by this centre for several disaster prone district of the country (Hambanthota, Rathnapura etc.). The sanitation aspects were mentioned in these handbooks but the emphasis given to the importance of it was inadequate [2]. Most of the NGOs involved in disaster management were using the “Sphere handbook” as their guideline, although the “Sphere Handbook” gives sufficient emphasis to the importance of sanitation most of the organisations failed to incorporate the provision of “proper and adequate sanitation” into their “Immediate Relief” check lists. In certain IDP camps some level of access to sanitation was provided but no attempts were made to assess the appropriateness or adequacy of these facilities.

2.4 Implementation Framework

A disaster management act was passed by the parliament of Sri Lanka in October 2005, mainly to cater for the grave concerns which emerged in the aftermath of the 2004 Tsunami. With this act a new Disaster Management Centre (DMC) was established under the Ministry of Disaster Management with a clear and nationwide mandate than its predecessor NDMC which was under the Ministry of Social Welfare. It is commendable that the organizational structure of DMC integrates the government institutions relevant to all aspects of disaster management. Figure 07 gives the Institutional Frame work for Disaster Response and Mitigation under the Disaster Management Act. Not taking into account the role of NGOs and CBOs whose contribution is immense at ground level implementation of disaster relief, is a notable drawback of this proposed institutional framework. Furthermore the arrangement is based mainly on vertical integration; lack of cross sectional consultation and delegation might lead into failures in practice.

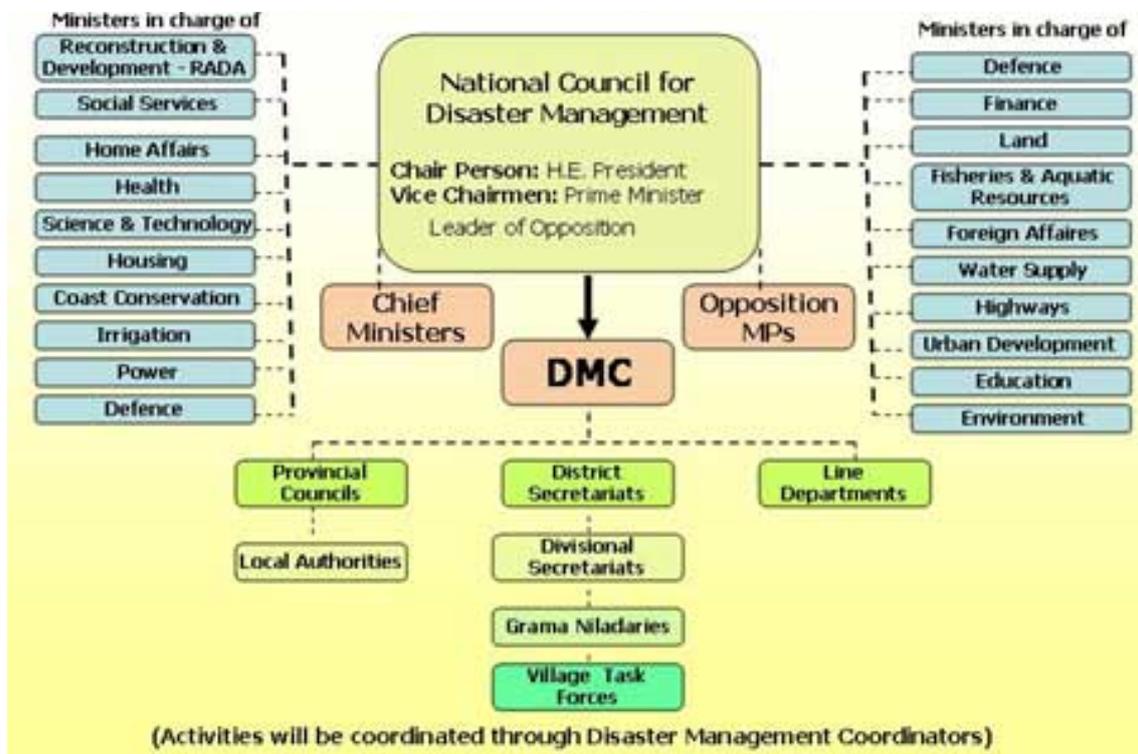


Figure 07: Institutional Framework for Disaster Response and Mitigation Proposed by the Disaster Management Act of Sri Lanka

From the experience of the 2004 Tsunami the author contends that a DRM program should have a mechanism embedded in its framework for providing access to proper sanitation to affected people. The main features of such a mechanism should be,

1. Preparedness ahead of the disaster
2. Training of volunteer foremen/technicians
3. Awareness material and Training kits

4. One subject agency to look after the implementation of work
5. Locations to store equipment and supplies during the pre-disaster period
6. Networking for Technical Support
7. Monitoring and Evaluation
8. Research and Development

Figure 08 gives a generic structure for such a framework. This was suggested as a sub-layer for the main DRM framework given by fig 07. The agency in charge of sanitation (subject agency) should preferably be a central government organization like the National Water Supply and

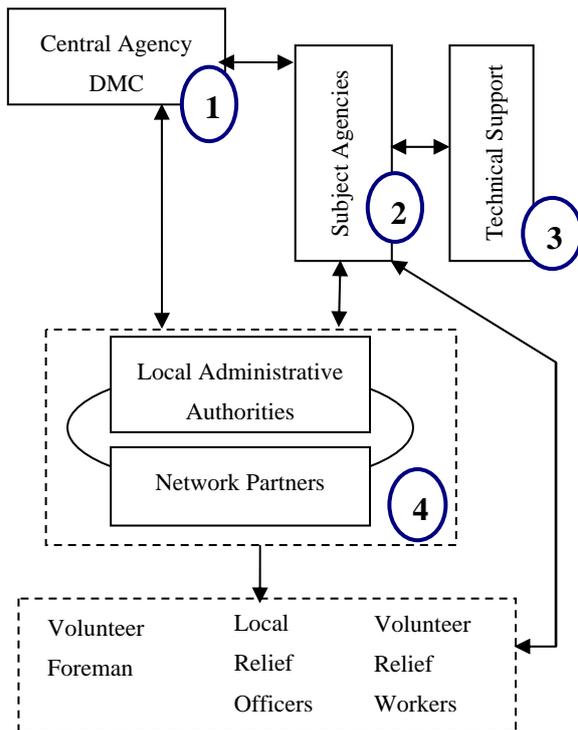


Figure 08: Implementation Framework for Disaster Sanitation

Drainage Board (NWS&DB) which has the expertise and resources at local levels. The partnerships of local administrative authorities and CBOs, NGOs or Cooperatives are essential at community level to operate during a disaster. These partnerships can be assisted and overlooked by the Subject Agency. There should be some pre-identified organizations to provide technical support and R & D, learning from each disaster faced. The agency responsible for sanitation may have its own technical expertise, but it's always better to have relationships with other organizations such as State Universities for research and development work.

3. Permanent Rehabilitation

3.1 Situation Analysis of 2004 Tsunami

With the constrains encountered in allocating land for Tsunami permanent reconstruction projects, the "Environmental Suitability" naturally became a secondary concern. Once the construction of some of these projects started the environmental problems began to get

highlighted. The author was involved in a study to investigate the potential environmental impacts of proposed permanent housing schemes for Tsunami Affected People. One of the major causes of pollution highlighted in this study was the possibility of ground & surface water contamination due to improper sanitation methods/ techniques used. Out of total number of housing projects investigated under this study approximately about 55% had sanitation related problems. The percentage was as high as 90% in Trincomalee district whereas it was less than 10% in the Gampaha district. Most of these problems were related to;

Improper disposal system: Soils soaking systems introduced in low permeability, water logged soils or excessively drained soils

Incorrect design: Incorrect sizing of tanks and soakage pits. Incompatibility with national standards. Inadequate setback distances.

Durability of Structures: Poor material selection, poor workmanship.

It should be noted that these weaknesses were not only encountered in the projects where design or construction was generally poor, but also in some sites where other aspects of design were quite satisfactory. Most of the problems were related to the back-end (disposal system) of latrines. In many cases where attached toilets were provided the front-end (superstructure) of latrine was considerably well designed and constructed.

3.2 Technology and Practice

The most established form of permanent sanitation in Sri Lanka is the onsite soil soaking system. Most of these latrines are single pit systems where solid accumulation and soaking happens in the same pit. Simple pit latrines are still in use but gradually disappearing due to their proven hazards and lack of hygiene. Apart from this Septic tank and Soakage pit systems are also widely used. Septic tanks followed by secondary and tertiary treatment systems such as Anaerobic Filters, Horizontal Flow Wetlands, Vertical Flow Wetlands and Percolation Beds are being introduced at different levels but are yet to enter the wide practice. Ecological sanitation methods are also being experimented with various communities of the country mainly in areas where conventional water borne sanitation systems are not applicable [3].

There are several guidelines and regulations governing the design and construction of septic systems and soak ways in Sri Lanka. The most comprehensive one out of these is the National Standard SLS 745 of 2003. *The Wastewater Manual of National Water Supply and Drainage Board* and the *Manual for the Sri Lanka Public Health Inspector published by the Ministry of Health* are the other guidelines available. Apart from this the National Housing Development Authority (Sri Lanka) published a guideline (CFRR Manual) on housing reconstruction for Tsunami Rehabilitation Projects, this also included a section on sanitation [6].

Although it's difficult to give an exact percentage, no soil permeability tests had been carried out before the design of soak-ways in most Tsunami Reconstruction Projects. Spacing of the

soakage pits were insufficient in some projects especially in Galle, Kaluthara and Trincomalee districts because the land allocated for a single plot was small. The typical shortcomings related to design and construction of sanitation facilities were mainly caused by the following reasons;

1. Lack of knowledge about the sanitation techniques and methods available
2. Lack of awareness about the existing standards and regulations on sanitation in the country
3. Inadequate professional input in design and construction supervision
4. Ineffective monitoring by the relevant authorities (i.e. Environmental Officers/PHI of Local Authorities, Central Environmental Authority etc.)
5. Absence of a proper mechanism to evaluate the appropriateness of the sanitation facilities by the approving agency of the project.

It should also be noted that although the Sri Lankan regulations take the micro level pollution of groundwater by a single toilet into account, none of them cover the macro-level impact of large scale onsite disposal of sewage into a given aquifer. Therefore even the housing schemes which comply with the national regulations can contribute towards a long term degradation of the aquifer especially because most of the lowland aquifers near the coastal areas of Sri Lanka are discontinuous and highly sensitive to local impacts. The situation will be critical in the Jaffna Peninsula where a confined sedimentary limestone domain aquifer is present [1].

3.3 Awareness

The average sanitation coverage (Improved Access to Sanitation) of Sri Lanka is as high as 72.6%, but some areas affected by the 2004 Tsunami were fishing villages where sanitation coverage were particularly poor. Some of these areas (e.g Some parts of Duwa area Negambo) had zero coverage and open defecation was the standard practice in the sanitation culture of these communities. Therefore it was important to improve the sanitation awareness of the IDPs while they are in the Intermediate relief camps. There were some efforts made by the IDP camp managers to accomplish this objective. Different strategies used by them for this purpose ranged from direct lectures to street dramas and film shows.

But unlike in the case of immediate relief & intermediate rehabilitation the institutions involved in Permanent Rehabilitation work had a basic understanding about the importance of providing access to sanitation. The shortcomings in awareness for them were as follows;

1. Inability to assess the appropriateness of sanitation techniques
2. Lack of awareness about the different technical options available in Sri Lanka for providing sanitation
3. Poor understanding about the environmental problems related to inadequate & improper sanitation

Therefore it is important to ensure a substantial improvement of sanitation literacy among the building industry professionals in coming years to avoid the repetition of mistakes and blunders made in the 2004 Tsunami rehabilitation work.

3.4 Implementation Framework

Developing an implementation framework for long term disaster rehabilitation is not as straightforward as in the case of Immediate and Intermediate Disaster Relief. It is difficult to coordinate the entire process through a central agency like a Disaster Management Centre. Usually long term rehabilitation work takes place in the form of any other development program and a Central Agency such as the DMC in Sri Lanka will bear only a monitoring responsibility.

Therefore ensuring access to Proper and Adequate Sanitation in the Permanent Rehabilitation Phase of Disaster Management has more to do with awareness building and improving the Skill levels and Capacities of the Institutions (Government or Non-governmental) with regard to sanitation aspects.

4. Conclusions

Many weaknesses and drawbacks were observed with regard to ensuring access to Proper and Adequate Sanitation during all three phases of the 2004 Tsunami disaster management process. The resulting failures extended from inconveniences for IDPs in the immediate response stage to considerable waste of resources in the permanent rehabilitation stage. From the observations made by the author it is clear that the technical resources available for providing disaster and permanent sanitation in Sri Lanka is satisfactory, the weaknesses exist mainly in the awareness and the implementation frame work of the institutions involved in disaster management. Improvement of Sanitation Literacy among general public is also an important requirement. Furthermore it was observed that a direct intervention and implementation approach will be affective in providing access to sanitation during the Immediate Response and Intermediate rehabilitation stages whereas a more indirect approach which involves awareness & capacity building, development of proper documents on sanitation standards and regulations etc. should be followed in the permanent rehabilitation stage. Mainstreaming the aspect of sanitation in Disaster Management decision making in the country should be the ultimate objective of this whole process.

References

- [1] D R I B Werellagama, Gemunu Herath, Missaka Hettiarachchi and Shiroma Basnayake Safe Distance between a dinking well and a source of fecal pollution for Sri Lanka. Sri Lanka: National Water Supply and Drainage Board, Sri Lanka, 48 pp, 2004.
- [2] District Disaster Preparedness and Response Plan - Hambantota, UNDP, Sri Lanka, 2004
- [3] Herath N., Manual 1: Latrine Construction, Helvetas, Sri Lank,2001

[4] Herath, H.M.S.S.D. (Ed.) (1989) A Manual for the Sri Lanka Public Health Inspector, Ministry of Health, Sri Lanka

[5] Missaka Hettiarachchi and D R I B Warellagama, Improving Access to Better Sanitation during Disaster Situations through Low Cost and Fast Construction Sanitation Solutions, ENGINEER, IESL 2005, vol-4, Sri Lanka

[6] Missaka Hettiarachchi and Induni Hettiarachchi, A comparison of guidelines on septic tanks and soakage systems in Sri Lanka, 32nd WEDC Conference, Nov. 2006, Colombo, Sri Lanka

[7] Peter Havey, Sohrab Bhagri and Bob Reed, Emergency Sanitation, WEDC, Loagbourough,2002, ISBN1 83380 005 5