Proceedings of the Ninth Pacific Conference on Earthquake Engineering
Building an Earthquake-Resilient Society
14-16 April, 2011, Auckland, New Zealand

Disaster funding mechanisms following the 2010 Canterbury Earthquake: a demolition and debris management perspective

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ABSTRACT: Disaster recovery is significantly affected by funding availability. The timeliness and quality of recovery activities are not only impacted by the extent of the funding but also the mechanisms with which funding is prioritised, allocated and delivered. This research addresses the impact of funding mechanisms on the effectiveness and efficiency of post-disaster demolition and debris management programmes.

A qualitative assessment of the impacts on recovery of different funding sources and mechanisms was carried out, using the 2010 Canterbury Earthquake as well as other recent international events as case studies. The impacts assessed include: timeliness, completeness, environmental, economic and social impacts.

Of the case studies investigated, the Canterbury Earthquake was the only disaster response to rely solely on a privatised approach to insurance for debris management. Due to the low level of resident displacement and low level of hazard in the waste, this was a satisfactory approach, though not ideal. This approach has led to greater organisational complexity and delays. For many other events, the potential community wide impacts caused by the prolonged presence of disaster debris means that publicly funded and centrally facilitated programmes appear to be the most common and effective method of managing disaster waste.

1 INTRODUCTION

Disaster recovery is significantly affected by funding availability. The timeliness and quality of recovery activities are not only impacted by the extent of the funding but also the mechanisms with which funding is prioritised, allocated and delivered. Activities on the critical path to recovery, such as demolition and debris management, in particular must be effectively funded to minimise delays in the recovery and rebuilding process.

The aim of this research is to assess the suitability, constraints and implications of different funding mechanisms for disaster waste management activities. This paper primarily investigates the funding mechanisms (source and delivery mechanism) for demolition and debris management following the 2010 Canterbury Earthquake, with reference to three international case studies (2009 Victorian Bushfires, 2009 L'Aquila earthquake and 2005 Hurricane Katrina). The purpose of this paper is not to look at how disaster funds are accumulated and managed or how much funding should be allocated, but rather to look at how the different kinds of funding mechanism impact the quality of a recovery – with a focus on debris and demolition aspects of a recovery.

2 BACKGROUND

2.1 Disaster funding

2.1.1 *Funding source*

There are four main methods of financially preparing for a disaster event: prevention, self-insurance, market insurance and coping (The World Bank and The United Nations, 2010). Prevention is the pre-disaster mitigation measures taken to reduce disaster risk. Self-insurance is the self-management of

financial portfolios which reflect the potential risk. Market insurance is the transfer of financial risk to private insurance companies. Coping is essentially the forced response for those who do not or cannot financially prepare themselves for disaster. Coping includes reliance on existing resources (human, natural, material and financial), external monetary and in-kind humanitarian assistance and remittances.

In a given community, there is generally an expectation that financial preparedness is either a private individual's responsibility (individuals, households or businesses) or it is a publicly provided service (which all affected persons have 'equal' access to).

2.1.2 *Funding delivery*

How financial or in-kind assistance is distributed to the affected population, varies based on the context and the funding source (as discussed later in the paper). The primary mechanisms for disaster recovery funding discussed in this paper are:

1. Directly facilitated (delegated organisation carries out the works using collective relief funds) (also referred to here as central contractor).
2. Reimbursement (individuals facilitate the work and present receipts for reimbursement).
3. Lump sum (value of recovery works is estimated and paid as a lump sum to the affected person – who is in turn responsible for facilitating the necessary works).

2.2 **Disaster waste management**

Depending on their type and severity and the nature of the built environment, disasters can create large volumes of inert and hazardous debris. Recent natural disasters such as the 2010 Haiti earthquake (Booth, 2010, Johnson and Correa, 2010, Kahn, 2010), Victorian Bushfires 2009 (Brown et al., 2010), Hurricane Katrina 2005 (Luther, 2008, USEPA, 2008, Brown and Milke, 2009) and the 2004 Indian Ocean tsunami (Basnayake et al., 2005, Petersen, 2006) have all generated volumes of waste which overwhelmed existing solid waste capacities and required extraordinary management approaches.

Disaster debris can impede rescuers and emergency services reaching survivors; inhibit provision of lifeline support; pose a public and environmental health hazard; and hinder the social and economic recovery of the affected area. Poor management of a clean-up effort can result in a slow and costly recovery which is potentially risky to public and environmental health in both the short and long term.

Debris management funding often piggy-backs onto general response, recovery and reconstruction funding and is not always considered as a specific task with unique requirements and impacts on the wider recovery. Rules around funding mechanisms can sometimes inhibit debris management programmes. For example, the Federal Emergency Management Agency (FEMA), in the US, stipulates that lowest cost solutions must be used. However, following the 1994 Northridge earthquake, the city of Los Angeles was running short of landfill space and needed to start recycling the disaster waste despite it being a more expensive option. The city of Los Angeles successfully argued that even though it was not currently mandated, recycling was in their long term strategy for the town (State of California, 1997).

Typically debris clearance works are organised based on the source of the waste, the level of damage at the property and sometimes the stage of the debris management process. Funding source and delivery mechanisms are often aligned with these different debris clearance works. Waste management works that are typically observed can be categorised as:

1. Private property detritus (non-structural debris) clearance to kerbside or central collection facility.
2. Waste collection and disposal (includes collection, temporary staging areas[1], recycling and disposal).
3. Major repair debris management (i.e. debris resulting from major structural repair work).

[1] Temporary staging facilities are commonly used in disasters. They are sites where mixed waste can be brought or sorting before onward transportation to end-use management (recycling or disposal) facilities.

4. Full demolition and associated debris management.

3 METHODOLOGY

Qualitative data has been gathered from literature and interviews with professionals involved in disaster waste management for each case study. For this analysis the qualitative data was first interpreted to gain a general understanding of the funding mechanism (source and delivery mechanism) for demolition and debris management works (see Section 4). Second the impacts of the funding mechanism on recovery were analysed: timeliness; completeness; environmental; economic; and social. A list of funding mechanism attributes which contributed positively to each aspect of the recovery were listed (see Section 5). The discussion section (see Section 6) considers the overall suitability of the 2010 Canterbury earthquake funding mechanism for debris and demolition funding.

4 CASE STUDIES

4.1 2009 Victorian Bushfires, Australia

The February 7, 2009 Victorian Bushfires cost 173 lives, affected more than 430 hectares of land (VBRRA, 2009) and over 3000 properties. In affected areas the fire caused almost total destruction leading to large numbers of displaced persons. In an effort to speed-up the recovery and eliminate potential health threats from the burnt house remains, the National and State governments elected to pay for, and facilitate through a centralised contract, the demolition and debris removal of all affected properties. Ordinarily debris and demolition works are the responsibility of homeowners and their insurance companies.

Overall the clean-up was a success. All properties received the same demolition and debris removal services and the process was completed within six months - leading the way for the reconstruction.

4.2 2009 L'Aquila Earthquake, Italy

On April 6, 2009, L'Aquila, Italy, experienced a 6.3 magnitude earthquake. The earthquake killed 314 people and displaced approximately 70,000 (Dolce, 2009). The predominantly masonry buildings were heavily damaged – approximately 22,000 were rendered unusable (Dolce, 2010). In Italy the government provides full funding for national disaster response and recovery. Debris management works are fully covered under this scheme.

The funding provided by the government allowed for a centralised approach to debris management. All costs of the system from demolition to recycling to disposal were covered by the government. The majority of the waste management works (including community drop-off centres, demolition, temporary storage and recycling) were centrally facilitated. Management of debris resulting from major structural repairs was covered through grants or was directly reimbursed.

4.3 2005 Hurricane Katrina, United States

Hurricane Katrina hit the states of Louisiana, Mississippi and Alabama on 29 August 2005. As a result of heavy rain and a levee breach around 80% of New Orleans was flooded in 3-12feet of water (Cook, 2009). Over 1800 people died and over 600,000 residential properties were affected – 77% totally destroyed. Large numbers of residents evacuated and some had still not returned in 2009 (Brookings Institute, 2009). The US, then and now, has well established debris management funding mechanisms. FEMA administers federal funding for collection of debris from public property – including collection of debris removed from private property and placed on the street for collection. This work is generally facilitated by the local authority or the US Army Corps of Engineers. Private property demolition is primarily the responsibility of property owners and their insurer. However, due to the large scale of the event, the high public health risk from toxic flood sediments and the large number of displaced persons, FEMA funded all debris removal and demolition on private properties.

The works were carried out under centralised contracts in line with standard debris management procedures.

4.4 2010 Canterbury Earthquake, New Zealand

On September 4, 2010, at 4:35am, a magnitude 7.1 earthquake rocked the Canterbury region of New Zealand. Fortunately no one died, however, a significant number of commercial and residential properties and infrastructure were damaged. Commercial structures affected were largely unreinforced masonry buildings. Mixed building type residential properties and infrastructure were primarily damaged by the extensive liquefaction that occurred. In January 2011 the government estimated up to 3000 Canterbury homes were uninhabitable (Heather, 2011).

In New Zealand, natural disaster damage on residential properties is covered by a dual private / public funding system. All private property owners with insurance are also covered by the Earthquake Commission (EQC)[2] for damage up to $100,000. Private insurers cover individuals for damage above this. Claimants are assessed individually and compensated according to the level of damage sustained and those who are uninsured are not covered. EQC estimates all 160,000 claims relating to the earthquake will be assessed by March 2011 (EQC, accessed 2010).

Due to the large numbers of claims and need for coordination of works with suburb-wide land remediation, the EQC and insurance companies engaged project managers to manage the recovery works (including demolition and debris management)[3].

4.5 Summary

Table 1, below, summarises the features of the four case studies used in this paper.

Table 1 Case study disaster debris management funding mechanisms summary

	2010 Canterbury Earthquake	2009 Victorian Bushfires	2009 L'Aquila Earthquake	2005 Hurricane Katrina
Funding source 1. Detritus removal 2. Collection and disposal 3. Major repair debris 4. Demolition and debris	1. Private 2. Private 3. Private 4. Private	1. n/a 2. n/a 3. Private 4. Public	1. Public 2. Public 3. Public 4. Public	1. None or public 2. Public 3. Private 4. Public (some private)
Funding delivery 1. Detritus removal 2. Collection and disposal 3. Major repair debris 4. Demolition and debris	1. Reimbursement 2. Reimbursement 3. Directly facilitated 4. Directly facilitated or lump sum	1. n/a 2. n/a 3. Lump sum 4. Directly facilitated	1. Reimbursement 2. Directly facilitated 3. Reimbursement or lump sum 4. Directly facilitated	1. n/a or directly facilitated 2. Directly facilitated 3. Lump sum 4. Directly facilitated (lump sum)

[2] The EQC is a government entity, however, it manages insurance claims like a private insurer.

[3] Ordinarily individuals would be required to facilitate their own repair / rebuilding works under EQC. Private insurers generally elect to facilitate or pay out for repairs on a case by case basis.

5 ANALYSIS

As described in Section 4, the data were analysed to determine the qualitative attributes of funding mechanisms that contribute positively to recovery. Five key impacts were assessed: timeliness; completeness; environmental; economic; and social. The attributes are shown in Table 2 below. This list was then used to qualitatively assess the overall suitability of the funding mechanism for the 2010 Canterbury Earthquake response (see Discussion, Section 6).

Table 2 Positive demolition and debris management funding mechanism attributes

	Positive funding mechanism attributes[4]
Timeliness	• Does not cause unnecessary delays • Encourages expedient management of debris. • Limited / manageable number of organisations involved to reduce delays.
Completeness	• Funding mechanism avoids double-ups and omissions. • Consistency of service (extent and quality) across all organisations. • Equal access to funding, in particular for minimising public health risks and facilitating community wide psychosocial recovery.
Environmental	• Expedites removal of contaminants from affected properties. • Allows for environmentally sound management options, including resource recovery. • Allows for fluctuations in debris management prices during recovery (to avoid inappropriate waste management). • Funding provision depends on proof of appropriate waste management.
Economic	• Allows for economies of scale. • Includes in-kind assistance and/or public participation. • Facilitates the return of local residents (which stimulates the local economy). • Encourages use of local labour and waste management facilities. • Is consistent with community's disaster financing model. • Allows for prioritisation of works to facilitate targeted economic recovery.
Social	• Removes psychological barrier to recovery. • Ability to prioritise funding to expedite / facilitate community-wide rebuilding • Public in-kind participation if feasible (positive psychosocial effects). • Funding is assured (eg not dependent on political climate) with clear funding modalities.

6 DISCUSSION

6.1 *Funding source*

As can be seen in Table 1, there are currently a range of approaches to funding of demolition and debris management works. By and large the responses were primarily publically funded programmes (Bushfires, L'Aquila and Katrina). Given the community wide impact of disaster debris (in terms of psychological impacts on recovery and the potential public health hazard resulting from unmanaged debris), a publically funded demolition and debris management system should theoretically allow equal access to funds to ensure a community wide clean-up. However, public systems can leave the community vulnerable to political influences at the time which may dictate funding provision. Individuals also have less opportunity to direct the management of their own recovery. In L'Aquila, for example, frustrated residents protested over the unacceptably slow management of the waste

[4] Note that many of the attributes have several impacts, for example unnecessary delays are likely to have environmental, economic and social consequences. Here, for brevity, the attributes are only mentioned once.

eleven months after the earthquake (AreaGenova, 2010).

It is interesting to note that the response to the Canterbury earthquake was the only event which relied completely on a privatised insurance approach. The dual EQC / private insurer funding scheme, however, has created a complicated coordination task, exacerbated by the fact that only EQC covers land damage and community-wide land repair is required. For example works for properties with greater than $100,000 damage must first be demolished by private insurance companies / householder, then the property handed to EQC for land repair (if necessary) then handed back to the private insurance company / householder for rebuilding. A public or centrally funded demolition process may have reduced the complexity of this coordination process. The low level of displacement, however, meant that demolition works had to be integrated with land remediation and reconstruction activities to minimise disruption to property owners. This is compared to the Katrina, L'Aquila and Victoria cases where a high proportion of affected properties were uninhabitable and large scale, centralised, demolition works were necessary to facilitate expedient rebuilding. The property by property approach taken in Canterbury will potentially provide opportunities for material reuse – an opportunity that would be lost if a separate contractor carried out all demolition / waste management.

One of the major drawbacks of relying on individual level insurance coverage is that individuals do not always understand the level of risk and are reluctant to take out insurance when they perceive a risk to be low. In the US an attempt was made to make the National Flood Insurance Programme compulsory for all homes in the 100 years flood plain as a condition of their mortgage. However, due to poor enforcement and an absence of flood events, approximately two-thirds of homeowners in Florida had cancelled their policy within five years of it becoming compulsory (The World Bank and The United Nations, 2010). Thankfully the FEMA sponsored clean-up programme prevented uninsured properties from remaining in ruins and potentially posing a public health risk. Approximately 16,000 'unclaimed' properties alone were condemned and removed under the scheme. Following the 2009 Victorian Bushfires only 43% of homes were rebuilt with insurance money due to high levels of under or no insurance. As a result some experts are calling for a national disaster insurance to be established (Sexton, 2010). Fluctuations in premium values may also change the level of insurance over time, which makes community disaster response planning difficult.

Market based insurance schemes present a number of other pitfalls. Insurance claims take time to settle: estimated six months for EQC claim assessment alone following the Canterbury Earthquake. Disputes can sometimes arise: the hazard specific insurance market in the US caused many disputes following Hurricane Katrina as companies argued over flood versus hurricane damage (The World Bank and The United Nations, 2010). Insurance policies do not always include debris removal and/or demolition activities (as observed by the lead author after the 2010 Canterbury Earthquake and 2009 Victorian Bushfires) and as a result some building owners might be tempted to illegally dump waste materials. Privacy and commercial sensitivity surrounding insurance claims (amount, nature etc) can also hinder city or region wide planning for debris management operations. Exact damage figures on insured properties following the Canterbury earthquake are currently unknown and it is unclear how uninsured persons will be assisted.

6.2 *Funding delivery*

The market based insurance approach used following the Canterbury Earthquake relied on the use of loss adjustors to value damage and then either facilitation of repairs or a lump sum payment. Where lump sums are paid, property owners are left vulnerable to post-disaster price fluctuations that may effectively reduce their ability to rebuild using the assessed payment. Possible price variations in demolition and waste management include disposal cost variation, recyclable market flooding and labour value variations.

By appointing project managers to oversee repair works, demolition and reconstruction the EQC and insurance companies have essentially opted to directly facilitate the debris management works. There are many benefits to this. First, directly facilitated programmes essentially take the risk of cost overruns. Cost overruns are a possibility following a disaster where price gouging is common. Second, quality assurance of works can be better affected using a centralised approach. It was alleged

that immediately following the Canterbury earthquake some demolition operators were under-quoting demolition jobs and illegally dumping debris. Centralised contracts can avoid this. Third, economy of scale can be achieved through coordination of works, synergy of waste transportation, and negotiation of high volumes service contracts. Fourth, coordination and timing of works can be better directed. This is particularly important in business areas where other businesses can be disrupted by demolition activities. In Christchurch demolition of a historic building in the central city took approximately 11 weeks and severally disrupted traffic flows, pedestrian access and nearby business trading. Fifth, there is less administration dealing with individual claims. Sixth, direct facilitation allows for additional facilities to be created (such as temporary storage sites or recycling facilities) to process disaster debris if necessary. Privately facilitated works, on the other hand, rely on existing systems and there are no obvious funds for creating other facilities if necessary.

Similar to the Northridge example, some of the funding regulations used by insurance companies in New Zealand restricted debris management options. The Insurance Council of New Zealand advised early in the recovery process that insurers would only pay for 'one shift' of debris. This policy eliminated the possibility of using temporary staging facilities or creation of intermediate waste treatment facilities (such as aggregate or wood chipping processing facilities) to facilitate the debris management process. The Christchurch City Council bylaw requiring separation of construction and demolition (C&D) wastes prior to disposal, essentially dictated that source separation of C&D wastes would be carried out and existing facilities would be required to cope with the additional materials / processing. It is yet to be seen whether there will be any capacity problems.

6.3 *Disaster impacts and degree of hazards*

An important aspect to consider in this discussion is the consistency of approach to funding for various scales of disasters. Many of the case studies discussed here significantly altered established approaches to disaster responses because existing systems were not seen as appropriate for the scale and impact of the event: FEMA funding private property demolition following Katrina; the Australian government paying for and facilitating demolition works (in a market based insurance context); and EQC facilitating repair works following the Canterbury Earthquake. Some argue that this inconsistency in approach, in particular where external agencies (governmental or non-governmental) contribute financial assistance where it has not previously, may increase dependence on aid and reduce future individual preparedness. The World Bank and United Nations (2010) refer to this as the Samaritans dilemma.

For individuals and governments to be adequately prepared for a disaster, funding mechanisms (both source and delivery) need to be flexible in their design and consider the effect of different scales of disaster.

7 SUMMARY

Overall the funding mechanism used for demolition and debris management following the 2010 Canterbury Earthquake was satisfactory but not ideal. Compared to the Victorian Bushfires and L'Aquila earthquake, both primarily publicly based responses including direct facilitation of the demolition and debris removal works, the privatised system generated organisational complexity which has and will cause delays. The proposed management of uninsured properties is unclear and this may impact on land remediation activities on insured properties. However, given the low level of displacement and low public health hazard in the debris, the privatised process allows for necessary coordination with rebuilding activities.

Due to the potential community wide impact of the prolonged presence of disaster debris, publicly funded and centrally facilitated programmes appear to be the most common and effective method of managing disaster waste.

It is envisaged that this analysis will assist in the improved design of post-disaster financing systems for disaster waste management. The findings in this paper will also provide insight into the impact of funding mechanisms on other aspects of recovery.

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