



A Stakeholder Engagement Approach to Enhancing Transport Network Resilience in Australia

A Sustainable Built Environment
National Research Centre (SBEnc)

Industry Report



Sustainable
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Preface

The Sustainable Built Environment National Research Centre (SBEnc) and its predecessor, the Cooperative Research Centre (CRC) for Construction Innovation, is committed to making a strong contribution to innovation across the Australian built environment sector. We are dedicated to working collaboratively with industry and government to develop and disseminate practical research outcomes that improve industry practice and enhance our nation's competitiveness. We encourage you to draw on the results of this and our many other applied research projects to deliver tangible outcomes for your operations and look forward to opportunities to work together in the future.

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Synopsis

This report presents the key findings from an extensive stakeholder engagement process to identify ways to improve the resilience of the transport network prior to, during and in the aftermath of natural disasters, thereby reducing the impacts of such events on communities and businesses.

The project included stakeholder workshops in Townsville QLD, Broome WA and Grafton NSW, as well as close engagement with local and state government departments, and local and state emergency management committees.

Each workshop involved stakeholders engaged in disaster preparedness, response and recovery, including representatives of the emergency services, government agencies, community groups, infrastructure providers, media and the business community.

Acknowledgments

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The research was advised by the WA State Emergency Management Committee, Toll Plc, WA Road Transport Association, and the Chartered Institute of Logistics and Transport (Australia). The researchers also wish to thank Townsville City Council, Shire of Broome and Clarence Valley Council for their invaluable support for the project workshops

This report is dedicated to the memory of Candia Bruce whose passion for sustainability and expert facilitation of the stakeholder workshops provided a strong basis for our work. She will be missed.

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A Stakeholder Engagement Approach to Enhancing Transport Network Resilience

Introduction

The world is coming to grips with the reality that mankind's emissions of greenhouse gases are likely to lead to an increase in the average global temperature. Hence many are now asking serious questions about what this will mean for the severity and frequency of bushfires, flooding, and mega-storms and, in particular, their impact on road and transport infrastructures. Indeed, it has already become clear that it will be necessary to identify and implement improved strategies to increase the resilience of these networks, but at the same time these emerging strategies must be informed through dialogue with those living and working in the affected areas and appropriately supported by all levels of government.

In response to calls from the state government partners, this project sought to inform the development of such strategies through direct input from stakeholders in a number of regions of Australia that are frequently affected by natural disasters. Using the 'Collective Social Learning'¹ method as the basis for stakeholder workshops in Townsville (QLD), Broome (WA) and Grafton (NSW), this report, and its associated short film available at www.sbenrc.com.au, outlines both

a vision and seven Action Areas that provide valuable leverage points to achieve a more resilient road and transport network. To this end the collective vision is as follows:

'In the face of natural disasters our cities and towns will be well prepared and supported to activate an effective response that harnesses leading edge technologies and practices to minimise disruption to transport networks and achieves a swift return to normal for our communities and businesses.'

The seven Action Areas are:

1. A well informed and prepared community

A key element in natural disaster readiness, response and recovery is a prepared community that is well informed and with strong social structures in place. Such preparation by the community will reduce the pressure on the road and transport networks during and in the aftermath of a disaster. It could include information sessions on key issues such as setting up household disaster kits and stores, increasing the disaster readiness of homes and how to help the community following a disaster. A leading example of this is 'Cyclone Sunday' organised by the Townsville City Council which takes place at the start of cyclone season each year.

2. The assessment of the natural disaster readiness of infrastructure and consideration of betterment options

A key part of mitigating the damage from natural disasters is to identify in advance the infrastructure and facilities that are perceived to have low disaster resilience and to explore options for their betterment. Once such





options have been identified, together with an understanding of the impacts of the failure of that particular infrastructure/facility, the costs and benefits associated with remedial action can be considered, with priority given to the assessment of road and transport infrastructure as well as those assets that are critical to the short term recovery effort.

3. A process to undertake 'Disaster Re-purposing' at a city infrastructure level

In response to calls for a greater number and range of disaster response facilities, there was strong interest from the workshop participants for an investigation into the potential for greater use of existing facilities and infrastructure across a city or town to provide disaster recovery support. This would involve a stakeholder engagement process to identify recovery needs, and link these to existing infrastructure and facilities that could be temporarily re-purposed. Examples might include the use of highways as temporary airstrips and the employment of alternative logistics options such as shipping, air, and rail.

4. Strategic planning to increase whole-of-community resilience to natural disasters

In a similar way to the proposed betterment investment, strategic planning can significantly reduce the impact and disruption to the road and transport network in the case of a disaster. In particular, sophisticated modelling tools can now be used to identify ways to enhance the continuity of critical services, such as access to goods and commodities, including fuel and food, in the event that roads are cut off. Such an approach would not only reduce disruption caused by disasters to the community, but also assist in the continuity of business activities.

5. Streamlining governance structures to support disaster recovery

A key element of the effective resilience of communities to natural disasters is the existence

of governance structures that affect the provision of support for recovery, rebuilding and betterment works. There is a clear need to streamline existing regulations and requirements and remove unnecessary impediments, along with improvements to current funding structures related to funding rules, requirements and eligibility.

6. The use of data to inform a rapid response to transport network interruption

Rather than manually surveying the extent of damage to the transport network following an event such as a cyclone or flood - which may take, at minimum, several hours - there is significant potential to shorten this process by accessing data collected during and shortly after the event. Such data could be collected using sensors (e.g. tilt sensors on electricity poles, light poles and large trees that are located near critical transport nodes), as well as using reconnaissance drones or fixed cameras to photograph key transport network nodes. This input could then be integrated with a range of existing baseline data to identify interruptions to critical-route intersections and/or transport routes that would be prioritised for emergency response vehicles. Further, the data could also be used to route general emergency vehicles around obstacles in the aftermath of a disaster event.

7. Multi-agency coordination and communications strategies and practices

A key part of an effective response is the coordination and communication between disaster response agencies. There is a clear need to investigate options to enhance multi-agency coordination and to strengthen multi-agency communication strategies. Sophisticated modelling tools exist which can be used to identify leverage points in multi-agency interactions that can enhance the resilience of the overall system, and these should be employed more broadly as a matter of course.

Stakeholder Themes to Enhance Transport Network Resilience to Natural Disasters

1. A Well Informed Community

A key element in natural disaster readiness, response and recovery is an informed and prepared community. This theme calls for a focus on options to support the community through the provision of behaviour change programs (such as those related to setting up disaster kits and stores, or to preparing outdoor areas to be cyclone or flood ready), capacity building sessions (focusing on increasing the disaster readiness of homes, ways to increase personal safety during disaster events, and options for volunteer responders to assist with recovery efforts), community events (such as 'Cyclone Sunday' currently run in Townsville to inform residents, along with community practice drills) and events (such as creating a 'Flood Ready Streets Program') where relationships are fostered at a street level to increase the resilience to disasters through greater sharing and goodwill.

The Australian 'National Strategy for Disaster Resilience'² underlines the importance of a well prepared community, stating '*Australian communities are varied in their composition and their level of exposure to disaster risk*' and within these communities '*certain members are more vulnerable than others and may need tailored advice*'. According to the Strategy, factors which can affect a community's vulnerability to a natural disaster include socio-economic status, age profile and language proficiency, as well as the location, density and mobility of the community. Characteristics of resilient communities include a focus on the importance of social cohesion, mutual interest and self-help groups, and social support systems.

Between 2006 and 2010, eight Jurisdictional

Community Partnership projects were introduced by the Australian Attorney-General's Department with the intention of engaging with culturally and linguistically diverse Australians, and increasing their awareness and resilience to natural disasters. Through such projects, societal elements which may cause complications in the case of a disaster as a result of language or cultural barriers are exposed and are thus able to be addressed. It is argued that the overall resilience of not only the individuals involved in these programs, but the entire community is continually increased through such an example of greater knowledge sharing and good will.³

As outlined in the 2015 'Queensland State Disaster Management Plan', all levels of government bear the responsibility to provide 'activities and products such as publications, multimedia information packages, community information events and media releases' in conjunction with other agencies and organisations.⁴ This ensures the community receives information across a range of platforms and programs.

Leading efforts in this area include:

Queensland

- Since 2008, the Townsville City Council has organised 'Cyclone Sunday', a free annual community event to assist residents with cyclone preparedness and provide expert advice. Some 40 different agencies and groups participate, along with food stalls and activities for families. At the event, residents can have important personal documents scanned to ensure their safety and accessibility in case of a cyclone.

- The Queensland town of Theodore was flooded three times in the space of 12 months and was the first Queensland town to undergo total evacuation. The resilient nature of the town has been attributed to the policy of keeping the response local, and helping to create and maintain a strong community spirit. This has been achieved through initiatives such as the provision of a website to allow the community to access information on the disaster. After each flood, the town and its surrounding districts re-established the community and economy in less than three months. The former Queensland Reconstruction Authority Chair Major General Mick Slater was quoted as saying *'Self-starting Theodorians always have two or three options to solve a problem, showing the Reconstruction Authority and the government how the town can help rather than waiting to be shown.'*¹⁵
- In the aftermath of Cyclone Larry in 2006, local dairy farmers were without power for 22 days and this prompted investment in greater levels

of back-up power generation. This investment paid off when Cyclone Yasi hit in the same geographic area in 2011 and left just two farms experiencing difficulties with their back-up systems.

Western Australia

- As part of the Western Australian Natural Disaster Resilience Program, the town of Bassendean in Western Australia marks its light poles with a 100 year flood marker to keep the danger of flooding present in the minds of residents. In addition, affected residents are provided 'hot kits', supported by information signage and press articles.
- The City of Bunbury, in Western Australia's South West, realised that there was a high level of complacency amongst residents in relation to their understanding of disaster risk. As a result, in 2010 the Council initiated a community wide program to heighten awareness of the reality that in the event of a natural disaster they must be capable of being self-sufficient for up to 72 hours.⁶



Image: Example of flooding in Grafton (Source: Compliments of Clarence Valley Council)

- Following the 2009 Victorian bushfires, the WA Government created the 'Principal's Guide to Bushfires' to inform schools about procedures to be followed in the event of a bushfire. Importantly, this advice was not just left on the shelf, rather the Shire of Mundaring's School Principals and Emergency Service Committee conducted bushfire exercises in 2014 to ensure that there was a clear understanding of the processes to be followed and actions to be undertaken in the case of a bushfire.⁷

New South Wales

- The poor response to evacuation warnings in the 2005 floods in Eugowra, led to the creation of an emergency planning committee. This committee undertook a range of actions that

led to an improved warning response during a major weather event in 2010.⁸

- In 2006 a Flood Education Strategy was developed for Maitland. Prior to this program, surveys found that some 70% of the community showed little or no concern about flooding.⁹ The strategy includes collaboration with a range of representatives from various local community sectors with the resultant initiatives centred on raising awareness of flooding in the area. An example of this is the 'Flood Walk' digital application, shown below, developed by the NSW Government to provide a self-guided walk of an area to consider the flooding implications and history.



The old Belmore Bridge

Hello, my name is Peter Bogan and I'm a survivor of the 1949 and 1955 floods in Maitland. This app has been produced as a part of the Local Land Services and State Emergency Services flood education program.

This sign shows a map of the Maitland Flood Mitigation Scheme, which was implemented after the 1955 flood. It is possibly the best designed, implemented and maintained flood mitigation scheme in Australia. However it should be remembered that the scheme is only designed to mitigate the effects of a moderate flood it could not hold back a major flood the scale of which we had in 1955, or even in 1949.



2. Enhancing Infrastructure Disaster Readiness and Betterment

A key approach to mitigating the damage from natural disasters is to identify infrastructure and facilities that have low readiness, and to explore options for their betterment both before and after such events. This theme calls for a focus on designing a process to investigate the 'Disaster Readiness' of roads and transport infrastructure, and to identify opportunities for betterment.

Once identified, the process would consider the costs and benefits associated with remedial actions, with priority given to assessing infrastructure and assets critical to the short term recovery effort, such as primary transport routes. In doing so, the potential economic and social impacts of the failing of critical infrastructure would clearly need to be considered. The outcome would be the identification of specific infrastructure and/or assets that require remedial or betterment action. The investigation could also consider the potential for recommending updates to the associated design codes and performance standards.

According to a recent report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities: *'In 2012 alone, the total economic cost of natural disasters in Australia was estimated to have exceeded \$6 billion. Further, these costs are expected to double by 2030 and to rise to an average of \$23 billion per year by 2050, even without any consideration of the potential impact of climate change'*.¹⁰

This tripling of the costs clearly presents significant economic risk to communities, businesses and governments across Australia. Consideration of such risks strongly supports the argument for investing in infrastructure so that it is more disaster-resilient and, hence, will reduce these ballooning costs. Such investment is referred to as 'betterment' and is defined by the Attorney-

General's Department as *'the restoration or replacement of the asset to a more disaster-resilient standard than its pre-disaster standard'*.¹¹ However according to the roundtable report mentioned above, each year, *'an estimated \$560 million is spent on post disaster relief and recovery by the Australian Government compared with an estimated consistent annual expenditure of \$50 million on pre-disaster resilience: a ratio of more than \$10 post-disaster for every \$1 spent pre-disaster.'*

The findings from a Bureau of Transport Economics study in 2002 stated that, *'flood mitigation can provide a 3:1 return on investment through the avoidance of response and recovery costs'*.¹² This suggests that there is a critical need to re-assess current approaches to the identification of betterment opportunities that will deliver long term cost savings and a lower level of interruption to communities in the aftermath of a disaster.

As an example, a study into the height of the Warragamba Dam wall in NSW found that raising it by 23 metres would cost some \$400 million. However, it was anticipated that it would result in a reduction in the present value of flood costs between 2013 and 2050 from \$4.1 billion to \$1.1 billion, a return on investment of some 6:1.¹³

The following provides a snapshot of leading efforts in this area:

- *Western Australia:* The need for betterment was highlighted in a 2012 report from the WA Government which stated that civil infrastructure will be *'required to adapt to impacts such as higher temperatures, reduced rainfall, larger storm surges and more frequent extreme weather events'*.¹⁴ Supporting such activities the WA Government has created a 'Natural Disaster Resilience Program' which

provides grants to aid those areas of the State which are prone to natural disasters and which can be used as a testing ground for wider adoption.

- *Victoria*: The City of Greater Geelong in Victoria included the 'Betterment of an Essential Public Asset' as part of their municipal emergency management plan in 2014. Essential public assets are deemed to include 'roads and road infrastructure'. The approved betterment proposals will be funded on a one third basis between the Commonwealth, State and local councils.¹⁵
- *Queensland*: In 2010, the Tablelands Regional Council decided to replace a flood prone culvert at Figtree Close with a single span bridge to allow greater transport access by residents in times of flooding.¹⁶ In 2011, the Bruce Highway Upgrade strategy was released that included funding to replace bridges to 'improve flood immunity' along with making stretches of road more flood resilient. In response to the series of natural disasters in 2010/2011 the Queensland Reconstruction Authority was created to monitor and coordinate the Government's program of reconstruction and recovery with the aim to strengthen the 'capacity to prepare for, withstand, respond to and recover from disasters'.¹⁷

In the 6 month period from November 2010 to April 2011, Queensland was subject to extensive flooding which resulted in significant loss of life and, according to the Chief Executive Officer of the Queensland Reconstruction Authority, required the evacuation of more than 70 towns and caused in the order of US\$15 billion in damages and losses.¹⁸ This has resulted in a number of road related betterment projects in Queensland such as:

- The Gayndah-Mundubbera road which is vital to the North Burnett region in central Queensland and which, during the 2011 and 2013 disasters, experienced damage costing over \$8.5 million. This led to a betterment project to relocate and raise the roads by some 11 metres at a cost of \$6.1 million, as shown below. As a result, the damage from Tropical Cyclone Marcia in 2015 was estimated to be some \$4.6 million less than anticipated. Furthermore, the road was re-opened three hours after the flood waters receded, compared with the four months it took in 2013.
- The Grantleigh Pheasant Creek Road near Rockhampton provides access to a farming community off the Capricorn Highway. During the 2013 floods a gravel culvert was washed out, leading to a 60km diversion to reach the Highway. The Banana Shire Council decided to invest in a betterment project to construct a raised concrete floodway at a cost of \$104,500. As a result, in 2015 there was no damage to the floodway from the Category 5 Tropical Cyclone Marcia, leading to an estimated saving of \$55,000.



Gayndah-Mundubbera Road Betterment Project

3. Disaster Re-purposing of Facilities and Transport Infrastructure

In response to the need for a greater level of disaster response facilities, this theme calls for a focus on ways to harness existing facilities and infrastructure across a city or town in order to provide disaster recovery support.

The first stage would focus on a stakeholder led process to identify recovery needs, and then link these to potential infrastructure and facilities that could be temporarily re-purposed to offer recovery centres, emergency operations centres, accommodation shelters, temporary freight transport parking areas, energy supply points, warehouses, access to cash, medical services, support for pets and livestock, and wellbeing services.

Transport related actions would include consideration of the re-purposing of highways as airstrips, and the re-purposing of alternative logistics options such as shipping, air and rail.

The second stage, which would again be stakeholder led, would result in the development of a re-purposing action plan for a city. This would include the process to re-purpose facilities and infrastructure, the allocation and location of supply caches to support re-purposed facilities, the allocation of emergency car parks to assist in re-purposing (at, for instance, potential supply cache locations), as well as the provision of mobile recovery services, especially to isolated communities.

Such an approach would be very much in line with Australia's 'National Strategy for Disaster Resilience', which promotes the use of existing community structures and networks to enhance disaster resilience.¹⁹ Indeed, some excellent re-purposing is already taking place at a State level, as the following examples demonstrate:

- *New South Wales:* In 2015, the NSW Government incorporated an airstrip in the \$4.7 million upgrade to the Silver City Highway at Shannon's Creek. In the event of a natural disaster where supply routes are damaged or blocked, the ability for aircraft carrying supplies to land or for the Royal Flying Doctor's Service to use the facility for medical emergencies, is likely to make life-saving differences for the area's residents.²⁰
- *Queensland:* As part of the 2003 'Queensland Resupply Guidelines' there is a requirement for open spaces near homesteads to provide helicopter landing points in case of disaster or emergency.²¹ Furthermore, the Queensland Government, in conjunction with the United Arab Emirates, is investing \$60 million into the construction of 10 Cyclone Shelters to be located in high risk areas along the northern coast.²² Built on school grounds and community property, the shelters will provide new facilities for schools to use that are then re-purposed with providing safe shelter to those unable to find alternative accommodation after being forced to evacuate their homes in the case of a disaster.
- *Western Australia:* The WA 'Natural Disaster Resilience Program' has recently supported a number of projects that include elements of disaster re-purposing, such as the upgrading of the Nannup Recreation Centre (in South West WA) to become a recovery centre in an event of a disaster. This re-purposing included the installation of a water tank and pump, an electricity generator, a photovoltaic power generation system and additional phone lines.

4. Whole-of-community Resilience

The response to natural disasters involves a number of complex tasks that can be informed by prior strategic (as well as tactical) planning. This theme calls for a focus on stakeholder led processes to develop strategic approaches to building the whole-of-community resilience to natural disasters. The investigation would consider strategic imperatives such as community evacuation plans (for residents and animals), with specific transport routes and staging areas that are clearly delineated and communicated.

The investigation would also include ways to ensure the continuity of critical services (such as transport, electricity, water, sewerage and fuel) and the continuity of business activities (along with ensuring that businesses have a clear role in recovery activities). Additional themes could include the harnessing of data and the use of sophisticated digital modelling tools that can be used to identify ways to enhance the continuity of critical services, such as access to goods and commodities including fuel and food in the event that road access is cut.

There are multiple federal and state plans and reports which contain policies and principles that are consistent with this theme and which provide valuable guidance for a focus on this area. These include:

Australian Government

- The 'Critical Infrastructure Resilience Strategy'²³ seeks to support '*effective understanding and management of strategic issues*'. This strategy discusses the strong link between resilience of infrastructure and the resilience of communities affected by a disaster, arguing that critical infrastructure provides resources, expertise and essential services which communities rely upon during and after a disaster event.



- In 2009, a project under the Australian National Emergency Management Projects Grants Program developed a training program for emergency management volunteer leadership. The program was developed to train volunteers in emergency response and recovery organisation. This program has been conducted across Australia (Albury, MT Gambier, Gold Coast, Perth, Darwin, Hobart and Mt Macedon) and across volunteering sectors, including fire agencies, State Emergency Services, Red Cross, Surf Life Saving Australia and Anglicare.

Queensland

- The 'Queensland State Disaster Management Plan' describes the need for 'Developing awareness in communities of the nature and potential impact of hazards' and ensuring the community understands their role in supporting and contributing to disaster management.

This includes the need to ensure that the community understands the delivery methods and necessary responses to emergency warnings, where evacuation routes are and where to obtain local information during the disaster, whether this is from radio, television or a notice board.²⁴

- The Queensland 'Storm Tide Evacuation Guide' was created through a local consultation process in 2009-10. The guide provides information on designated evacuation zones, routes and road capacity, timeframes for evacuation, recommendations for mitigation work and online mapping. The guide was distributed to at risk areas and was supported

by a dedicated disaster website, with social media links, and available in multiple languages.²⁵

Western Australia

- As part of the 'Natural Disaster Resilience Program 2014-2015' the Chamber of Commerce and Industry Western Australia has developed a program on 'Regional Business Resilience', which aims to increase local business community awareness of potential risks, including education on how natural hazards may impact businesses, and how to complete risk assessments and develop risk management procedures and plans.

As part of this SBEnrc research project, researchers from Griffith University led by Associate Professor Matthew Burke developed a tool to model the supply of commodities after a disaster to identify key leverage points. The model draws on data related to demand, location, transport modes and the natural disaster risk to achieve a holistic view of where vulnerabilities may be in a logistics system. This research is described in greater detail in the complimentary report on this topic available on the SBEnrc Website (See Project 1.35).



Visit the SBEnrc YouTube channel for a short film on this project

5. The Use of Data and New Technologies

This theme calls for a focus on the use of data to inform a rapid response to transport network interruptions. Rather than manually surveying the extent of damage to the transport network following a cyclone or flooding event – an activity which may take, at minimum, several hours – this theme would investigate the potential to significantly shorten this process by accessing data collected during and shortly after the event from various sources.

For example, data could be collected using sensors (such as tilt sensors on electricity poles, light poles and large trees that are located near critical transport nodes), through the use of both fixed cameras on key transport network nodes, as well as reconnaissance drones, as shown in the image over page, referred to as ‘Remotely Piloted Aircraft Systems’ and possibly social media streams.

The input from these various sources would then be integrated with a range of data that is currently accessible in order to identify interruptions to critical-route intersections and/or transport routes that would be prioritised for damage response crews. Furthermore, the data could also be used to route general emergency vehicles around obstacles shortly after disaster events, as well as helping to ensure that regular commercial and private traffic avoids the affected areas.

This is an area of growing global interest with the National Science Foundation in the USA collaborating with Japan’s Science and Technology Agency to link American and Japanese universities to undertake a number of projects related to the integration of data and disaster response, including:²⁶

- Development of computer platforms for decision makers to analyse incoming data and

coordinate responses.

- Development of context-aware and user-specific information delivery systems that could be deployed during disasters to supply accurate information to the local population.
- An investigation into new methods to compress, transmit and query data from sensor networks.
- An investigation into resilient networks, social media mining and information dissemination during disasters.
- Development of smartphone-based ad hoc emergency networks that can evolve as a disaster unfolds.

The need for such a focus is demonstrated through the development of the ‘Australian Public Service Big Data Strategy’ that highlights the government’s responsibility to realise the value of such data and information.²⁷

The Australia Research Centre for Aerospace Automation (ARCAA) has already begun research into the use of drones in the aftermath of a disaster as part of the first response effort.

As team leader Professor Duncan Campbell said, *‘If we could use unmanned aircraft as multiple eyes in the sky and detect people that are in trouble – that way the manned assets can come in and target their response.’*²⁸

Further to data collection from emerging sensors and drone technology, there is also great potential for social media to be used as both a communication platform and a data source.

While there are clear concerns about how such data can be assessed and verified, there are already a number of examples of social media application to disaster response, including:



- *Western Australia:* A study by the WA Government suggests that the use of social media can be as effective as public information and community warning tools given their ability to reach target audiences directly, interactively and instantly in the case of emergencies.²⁹
- *Queensland:* After the Queensland floods in December 2010 when three-quarters of the state of Queensland was declared a ‘disaster zone’, social media was used to organise over 55,000 volunteers.³⁰
- *Victoria:* A research collaboration led by the University of Melbourne has developed technologies which can be employed in pre-disaster planning (simulation and optimisation models) and as a real time information source for those dealing with natural disasters.³¹

However, accessing data is only part of the solution, as there needs to be networks in place

to distribute data to the right places. A number of efforts considering the challenges in this area.

These include:

- *Australian Government:* A new national emergency warning system was commissioned in 2012 that enables voice and text messages to be sent to phones within a danger zone.³² By 2015, the system had been used to send over 153,000 voice messages and over 400,000 SMS messages.
- *Western Australia:* Following a review of concerns over the use of SMS messages for disaster information that looked at timing, availability, and accuracy, the WA Government developed an emergency alert system. As with its national equivalent, this web-based system sends SMS text and voice messages based on areas at risk. It can achieve this at a rate of nearly 500 SMS messages a second.



6. Streamlining Governance Structures

A key element to achieving community resilience to natural disasters is the efficiency and effectiveness of governance structures that are designed to provide support for preparatory, recovery, rebuilding and betterment works.

This theme calls for a focus on two specific areas: firstly, an investigation into opportunities to streamline existing regulations and requirements, and to remove unnecessary impediments to the delivery of the preparation and response activities; and secondly, an investigation into the opportunities to amend funding structures.

This would focus on funding rules and requirements, eligibility, access to funding, controls over the use of funding, as well as exploring the potential for social impact bonds. A key element of this project would be to inform decision making in these key areas through community stakeholder interaction with decision makers.

Natural disaster events can result in major damage to infrastructure and this clearly places a financial strain on local and state governments, although this is mitigated by support from the Federal Government. For example, the Natural Disaster Relief and Recovery Arrangements, administered by the Attorney-General's Department on behalf of the Australian Government, can reimburse up to 75% of reconstruction costs in the wake of natural disasters.

This contribution is evident through the government's \$7.5 billion assistance to the recovery projects of Queensland's 2011-2013 disasters.

Whilst progress has been made in this area, as indicated below, the clear perception of the workshop participants was that more can be done using a collaborative approach.

- **Australian Government:** In 2009 the Council of Australian Governments (COAG) created the 'National Emergency Management Committee' (NEMC) as part of a whole-of-nation resilience approach to disaster management. The NEMC aims to strengthen and coordinate the link between government and community, and allocates \$3.6 million to projects related to pre-disaster resilience and preparation.³³
- **New South Wales:** During the 2009 Far West Floods, the New South Wales Government provided an overwhelmed local government with an experienced State Government recovery expert to provide consultation on important strategic decision-making. This contribution led to a council which was much better prepared to respond to the floods the following year.
- **Queensland:** The 'Queensland State Disaster Management Plan' nominates the lead agency in the case of each disaster event. The lead agency is responsible for communication to the Queensland Premier and associated commonwealth agencies, including the Prime Minister. Section 4A of the plan specifies that the responsibility primarily falls upon the local governments for the management of disaster events in their local area, with the necessary resources and support to be received from District and State levels.³⁴
- **Western Australia:** The Western Australian Government 'State Emergency Preparedness Report' in 2012 addresses the need for effective funding arrangements for relief and recovery. The Auditor General of Western Australia described the process for receiving funding as '*Generally made in a timely manner to eligible recipients and for eligible purposes*'.³⁵



7. Enhancing Multi-Agency Cooperation

One of the keys to a strong response is the coordination and communication between disaster response agencies. This theme calls for further research and implementation in two areas:

1. Investigating options to enhance multi-agency coordination through a focus on: the clarification of roles and responsibilities; the development of inter-agency structures and standard operation procedures; undertaking succession planning and capacity building for staff; the assignment of greater responsibility to local actors; and the potential for equipment; facilities and staff sharing.
2. Investigating multi-agency communication strategies through the development of: standard protocols for communication (including frequencies, technology types, and conversation protocols); a strategic approach to the accurate and timely sharing of information; investigating the potential to harness social media and smart phone

applications; and the identification of specific communication needs and audiences to match to appropriate communications platforms, technologies and message.

There are multiple federal and state government reports that support this necessity to improve multi-agency cooperation, which include:

Australian Government

- In 2003, the Trusted Information Sharing Network (TISN) was developed by the Australian Government and, coordinated by the Critical Infrastructure Advisory Council, it provides a mechanism for businesses and governments to share information. The TISN consists of sector groups including banking and finance, communications, energy, food, health, transport and water services, along with a resilience expert advisory group.³⁶



- The Australian Government ‘Critical Infrastructure Resilience Strategy’ calls for ‘effective understanding and management of strategic issues’, and emphasises the importance of multi-agency cooperation.³⁷ Furthermore, the ‘National Strategy for Disaster Resilience’ states that, *‘the resilience-based approach is not solely the domain of emergency management agencies rather it is a shared responsibility between governments, communities, business and individuals.’*³⁸
- Importantly, this latter report was careful to point out that the concept of shared responsibility does not mean equal responsibility, and that there are some areas in which the States should take on a greater role.

Western Australia

- The idea of ‘shared responsibility’ is features in the Western Australian Government ‘State Emergency Preparedness Report’ which argues that, *‘effective emergency management relies on a complex synergy between agencies, industry, other levels of government and the community’*. The report emphasises that preparedness and recovery after a major weather event is a shared responsibility between local government, business and community.³⁹
- Western Australia’s Department of Fire and Emergency Services (DFES) utilises the purpose-built State Operations Centre (SOC) for state-wide, 24/7 monitoring, control and coordination of disaster events throughout Western Australia. Following the introduction of the centre during the 2012-13 cyclone and bushfire season, multi-agency organisation, information transfer, technology, and support has been greatly improved, as was evidenced during events such as Tropical Cyclone Rusty in the North West and multiple bushfires

including Perth’s Avon Valley fires of 2013.

Queensland

- The Queensland Government has allocated a specific task force for coordinating public information in a crisis, known as the ‘Crisis Communication Network’, and argues that the network *‘provides a mechanism to assist agencies to coordinate their public information and communication activities, without impeding, duplicating or complicating their work’*.⁴⁰

As part of this SBEnrc research project, researchers from Griffith University, led by Professor Sherif Mohamed, have demonstrated the use of the Functional Resonance Analysis Method (FRAM) to model the interactions between multiple agencies and stakeholders to identify leverage points to improve cooperation. This research is described in greater detail in the complimentary report on this topic available on the SBEnrc website (Project 1.35).



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SBEnc Overview

The Sustainable Built Environment National Research Centre (SBEnc) is the successor to Australia's CRC for Construction Innovation. Established on 1 January 2010, the SBEnc is a key research broker between industry, government and research organisations for the built environment industry.

The SBEnc is continuing to build an enduring value-adding national research and development centre in sustainable infrastructure and building with significant support from public and private partners around Australia and internationally.

Benefits from SBEnc activities are realised through national, industry and firm-level

competitive advantages; market premiums through engagement in the collaborative research and development process; and early adoption of Centre outputs. The Centre integrates research across the environmental, social and economic sustainability areas in programs respectively titled Greening the Built Environment; People, Processes and Procurement; Productivity through Innovation.

Among the SBEnc's objectives is to collaborate across organisational, state and national boundaries to develop a strong and enduring network of built environment research stakeholders and to build value-adding collaborative industry research teams.

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