BUSHFIRE, HEAT WAVE AND FLOODING

CASE STUDIES FROM AUSTRALIA

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Overview

- Project aim
- The 2009 Victorian ‘Black Saturday Bushfires’
  - economic costs and implications
  - Policy response and adaptation strategies
- The Heatwaves in Victoria
  - economic costs and implications
  - Policy response and adaptation strategies
- Flooding in Queensland and Victoria
- Summary
The Aim

• The overarching aim is to provide an overview of the impacts of recent extreme weather events on Australia’s transportation systems.

• to review the mitigation and adaptation strategies and policies, proposed or adopted, to respond to those extreme weather events.
Research Questions

- What is the order of damages to infrastructure assets and operations, user time losses and safety?
- Which protection measures existed before the event and how effective were they?
- How have adaptation strategies changed after the event and which policy instruments are applied or expected to be implemented.
National Highway System & International Airports in Australia

Source: Department of Transport and Regional Services.
Railways and Major Ports of Australia
The 2009 Victorian ‘Black Saturday’ Bushfires
The 2009 Victorian ‘Black Saturday’ Bushfires

• The last week of January 2009 was one of the most extreme and protracted heatwaves ever for the Australian state of Victoria.

• For three consecutive days, the temperature in Melbourne was above 43°C (the first time in recorded history). It was forecast that on Saturday 7th February the temperature would be in the low 40°C’s, accompanied by strong winds (Nguyen, 2010).
Bush Fire Sites

- Bendigo: 1 Death
- Kinglake Area: 120 Deaths
- Marysville Area: 39 Deaths
- West Gippsland: 11 Deaths
- Beechworth: 2 Deaths
Impacts – the Black Saturday Bushfires

– Of the 173 people who died, 113 perished inside their homes and a further 27 just outside. 11 died in cars fleeing the fires with a further 10 dying on roadways. (Bushfire CRC, 2009).

– Three of the five rail corridors were shut down

– Loss of Access/Escape routes during the bushfire, resulted in people being trapped and restricted operations of emergency services.

– 51 townships were directly impacted, over 2,000 homes destroyed, along with many businesses, and schools.
Scale of damage and the intensity of bushfire

Top left: Hamintor n.d. Top right: Hargest n.d, Bottom: Black Saturday
Economic costs

– Estimated cost of the fires to be more than $AUD 4 billion (Victorian Bushfire Royal Commission (a), 2009)
– The estimated total value of claims for lost or damaged assets and infrastructure is $AUD 76.7 million
– Of 11,834 scheduled services over these two months, 515 were technically ‘cancelled’
– Fire destroyed 3000 sleepers in the Camperdown areas on the Warrnambool line. The damage was greater in the north-east with 1200 sleepers, the Wandong Station platform and two rail bridges destroyed.
– Australian Government contributed $465 million towards the reconstruction and recovery efforts
New legislations and policies

– Wildfire Management Overlay (WMO) was revised to improve safety and is now called the Bushfire Management Overlay (BMO).

– The BMO requires that new developments implement appropriate bushfire protection measures including where the building is located on the site, emergency access and fire-fighting water supply.

– Stay Or Go policy is now more accurately described by its full title, ‘Prepare, Stay and Defend or Leave Early’.

– VicRoads implement a systematic statewide program of bushfire risk evaluation for all roads

– A new Rail Operations Management System (ROMS) is established with the ability to undertake simulations of a number of scenarios across rail network.
Heat waves
The Heat Wave

• A heat wave is a condition of severe, extensive and prolonged exposure to high ambient temperatures.

• The 2009 heatwave broke previous records with daily maximum temperatures 12°C - 15°C above the seasonal average of 28°C – 32°C for successive days. New daily maximum temperature extremes were observed for Adelaide (45.7°C) and Melbourne (46.4°C).
The Heat Wave – Costs and Impacts

- Financial losses from the heatwave mainly resulted from power outages and transport service disruptions, as well as response costs, have been estimated at $AUD 800m.
- In Melbourne on 30 January, train cancellations peaked when more than 24 per cent of services did not run.
- Buckling, power failures, or failure of components such as air conditioners occurred.
- Impact of the heatwave on the tram subsector was minimal (Croucamp, 2009); whilst on trains it was much more severe.
- More than 750 services out of 2400 were cancelled, that is, more than one-third of services (Connex media release).
Temperature and Cancellation Record

Temperature and cancellation record in January–February 2009 (Metcalfe et al. 2009)
The Heat Wave – Impacts

– 22 days of heat-related speed restrictions on at least one or more of V/Line’s routes were imposed.
– Impact of concern was on the physical comfort of tram passengers.
– From 29 January to 7 February, 15 incidents of flushing or bleeding (patches of stickiness on the surface of roads made of bitumen and stone aggregate) were reported from three regions.
– Concrete slab footpaths lifted and cracked during the heatwave in a few places.
– Traffic signals at 124 intersections in metropolitan Melbourne and three in regional Victoria were reported to be malfunctioning not only due to excessive heat, but primarily due to failure of electrical supply (Croucamp 2009).
The Heat Wave – Port infrastructure

- Asset life of port infrastructure to decrease by 10 to 20 per cent.
- Increased stop work for stevedores with more frequency and longer periods when weather reaches 38 degree (Celsius).
- Roughly 5% of the 36-hectare terminal was cited to have been out of action during the heatwave, which contributed to a reduced working capacity.
- High temperature poses a potential risk for the loading and unloading of volatile substances such as petroleum and gas products
- Vessel delays experienced due to the slowdown in loading/unloading operation.
- There was a loss of 49.5 crane hours in January 2010, as compared to the 72 crane hours which were lost in January 2009.
Adaptation and policy response

- To reduce discomfort or improve thermoregulatory performance in a condition of heat stress, various adaptations such as increased water cooling, provision of extra shading, use of alternative time schedules for activities or shifting to alternative locations or operating regimes were suggested.

- The structural response to prevent track buckling is to replace old timber sleepers with concrete sleepers (Metcalfe et al., 2009). Increasing from 22,000 sleeper replacements to 64,000 per year.

- More climate-appropriate design of residential and commercial buildings is suggested to cope with extreme heat events.

- The practice of track being joined by ‘fish plates’, bolted at the side, has now been replaced by the use of continuous welded joints, which have no expansion gap.
Rail Buckling and replacement of old timber sleepers with Concrete sleepers

(Metcalfe et al. 2009)
Policy Response

- On hot days drivers and workers are required as a part of heat policy to carry thermos flasks for carrying iced water on the job.
- Tram depots are equipped with ice machines. At times of excess heat, work hours are reduced and outdoor workers are advised to stay under shade Yarra Trams.
- Other measures include maintaining a standby train fleet (an extra 10 trains), bus contingency arrangements, interface between operations and infrastructure staff, and an increase in funding for maintenance.
- Provision and compaction of additional ballast and track strengthening at 400 locations.
- A/C units in the Comeng fleet have been serviced by cleaning condenser coils and radiators, and changing filters.
- Changing filters at 2-week intervals instead of 3-week intervals as before.
- New fleet of X’Trapolis trains are being brought in, which have a higher heat tolerance level.
- Sufficient A/C upgrade by 2010 so that all driving cabs will be fed from a new unit to ensure driver comfort and safety, and compliance with new Fatigue Management Plan FMP.
The Queensland and Victoria Floods
Flooding – Queensland and Victoria

• In 2010/2011 Australia experienced an extremely strong La Niña effect, the second strongest in its history. La Niña is the positive phase of the El Niño Southern Oscillation which is the cooler than average sea surface temperatures (SSTs) in the central and eastern tropical Pacific Ocean which normally results in higher than average winter, spring and early summer rainfall over much of Australia.
### Victorian Floods - Transportation Sector Damages 2011

<table>
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<th>Issue</th>
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<tr>
<td>State-controlled bridges damaged</td>
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<tr>
<td>State-controlled (arterial) roads damaged</td>
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<td>Railway bridges damaged</td>
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<td>Local-controlled roads damaged</td>
<td>$AUD 116M</td>
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*(Victorian Floods Review, 2012)*
Flood impacts on road networks in Victoria

Major Road Closures due to floods 2010/2011 (map taken from Lost Press Marketing, 2011)

Flood impacts on road networks in Queensland (Dove, 2011)

(Roads Collapsing, n.d)
Iron Ore and Coal Export Volumes

Export Volumes (Oct’10=100, nsa) (Australian Bureau of Statistics, 2011)
Destruction to Queensland Rail Lines – 2011 Floods

Victorian Bushfires

• Existing protection measures

• Some of the key existing measures in place were not designed or clear enough to deal with the size and extent of extreme bushfire events, these include:

• WMO identifies areas where the intensity of wildfire is significant and likely to pose a threat to life and property. The purpose of a WMO is to ensure that building development in areas subject to high fire risk includes appropriate fire protection measures.

• ‘Stay or Go’ policy revisited and adapted to a ‘Prepare, Stay and Defend or Leave Early’ policy with more clarity for future extreme bushfires.
Victorian Bushfires

Adaption strategies

Following the bushfires a Royal Commission was held to attempt to avert the future loss of life and infrastructure should such a bushfire event occur again. A core adaption strategy was increased preparedness to respond to such an event and the establishment of formal communication systems to forewarn those exposed to similar risk in the future, and to have clear response plans. Of the four options open to government they have been applied as follows:

- **Codes of practice** – ensure all roads operated by VicRoads adhere to 1985 Codes of Practice
- **Operation and management plans** – development of Rail Operations Management System
- **Condition licenses** – introduction of Bushfire Management Overlay
The Heatwaves

• Existing protection measures
  - There was little existing in place.

• Adaption strategies
  - Codes of practice – none currently implemented.
  - Operation and management plans – public transport providers have developed management plans for staff, passengers and standby contingency equipment to rapidly respond to issues at times of excessive heat.
  - Condition licenses – enhancing and maintaining existing above and below rail infrastructure to cope with times of excessive heat.
  - Fitness for purpose obligations - modernisation of transport infrastructure to be able to withstand future excess heat events, for example increasing replacement of wooden sleeper from 22,000 to 64,000 per year, additional rail ballast and changing to continuous welded joints.
Floods in Queensland and Victoria

• **Existing protection measures**

• There are state Acts and government guidelines in place but generally regarded as inadequate in situations of extreme weather events.

• **Adaption strategies:**


• *Operation and management plans* – improve management of roads, bridges and dams by reviewing and updating existing guidelines, and provide assistance to local governments to enhance their ability to cope with extreme weather events.

• *Condition licenses* – state road and water authorities to enhance and clearly define roles and responsibilities.

• *Fitness for purpose obligations* – authorised government agencies to provide timely information to the public and communities in preparation for floods, and to improve public awareness and education of those in risk areas.
Summary

• existing transportation and infrastructure systems were not able to cope with disaster situations that are considered extreme Development.

• there is a significant opportunity to improve all aspects of existing disaster management planning, *in situ* policy response and post disaster recovery.

• instigating legislative changes to develop and implement policies that enhance community resilience to extreme weather events

• the urgency for actions to improve communication amongst stakeholders, improve and increase the visibility of information flow, and called for more centralised command structures responsible for collaborating and coordinating the efforts of various authorities

• post-event actions most likely result in only marginal improvements in resilience to such events unless a systematic and structured response, as recommended by the inquiring committees, is adopted