

Making buildings resilient to weather events

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- What are the costs of weather events?
- What are the hazards caused by weather?
 - Known hazards: bushfire, flood, storm
 - Emerging hazard: leaky buildings and others
- What is maintenance?
- What can maintenance contribute?
- What can we do?

Annual cost of weather events

Average proportional annual cost in each S&T by type
1967-1999 Bureau of Transport Economics. Updated version
being worked on by CRC natural hazards – not yet available.

	Bushfire	Flood	Cyclone	Storm
VIC	35	41		24
NSW	4	29		41
SA	26	39		35
WA	7	4	66	18
QLD	38	47	0.2	16
TAS	59	35		6
NT		6	94	
ACT	27			73

- Weather events:
 - Known hazards: bushfire, storm ,flood
 - Emerging hazards: leaky buildings, soil heaving
- Annual occurrence - Causes major losses
- Victoria: Average \$100M/year (1967-1999) – about 10% of national loss.

EVENT	BUSHFIRE	FLOOD	STORM
Percentage of total loss	35%	41%	24%

- Can maintenance make a contribution to make buildings more resilient to these events?

- Sustainable Built Environment – National Research Centre (SBEnc) is conducting a research project on **contribution of maintenance into making buildings more resilient to weather events.**
- The project is sponsored by WA and QLD governments with participation from NSW and is limited to maintenance of government assets
- **Aim is using scientific knowledge to inform policy and practice in disaster mitigation**



- **Bushfire** (CSIRO, GA, Bushfire CRC, ...)
 - Damage is associated with ember attack usually within 100m of the bush but could be up to 1000m
 - Regulation allows construction in bushfire prone areas for Class 1, 2 and 3 buildings since 1999
 - Resilience of buildings in bushfire prone areas is related to evacuation policy:
 - Mandatory evacuation: better safety for people
 - Stay to put out spot fire: better for buildings

- **Storm (CTS, GA, CSIRO, ...)**
 - Damage is associated with high wind, hail and heavy rain (flash flood and water penetration)
 - NCC requires design for wind with annual probability of 1:500 to 1:1000 for most buildings
 - NCC also requires weatherproofing with a test method for verification
 - No design requirements for hail at present – most heavy loss per single event

- **Flood** (GA, NFRAC, CSIRO ...)
 - Damage is associated with the effects of water on materials such as wall finishes and timber, mud collection inside the building and under the floor space
 - Regulation allows buildings in flood prone areas for Class 1, 2, 3, 9a & c since 2012
 - Standard for construction of buildings on flood-prone land will prevent structural failure but not damage for the submerged parts as described above

- **Leaky building syndrome**

What is it?

Certain types of construction, particularly for walls, allow moisture or water to collect within the system but do not provide for drainage and ventilation. Under this condition, the water is trapped and potential for fungal growth and rotting rapidly increases.

What causes it?

Changes in construction techniques and materials such as the increase use of 'monolithic cladding systems' such as fibre cement sheet and externally insulated plaster systems that allow the water into the cladding system but not allow it to dry out.

Can it happen here?

It happened in NZ (\$11 billion) and Canada (\$4 billion)



- Maintenance: activities taken while the buildings are in use to keep the building performance at a level acceptable to the users including periodic inspection, repair, replace, retrofit etc.
- NCC is a construction code:
 - No maintenance provisions
 - No durability provisions (only a Guideline from ABCB in contrast to NZ)
- Maintenance is considered as a States & Territories responsibility (so is enforcement)
- Maintenance should be considered in the design process

- There are mandatory maintenance of essential services in S&T regulations (mainly about fire safety and a few health issues)
- Maintenance includes actions to be taken by the owner/occupier but could also involve neighbours and local government
- There are facility management software involving maintenance (RMIT, CTS,...)
- While there is a manual for a car with a maintenance program, there is no manual for a house?

Bushfire hazard

- Maintenance is critical in preventing ember attack
- What need to be maintained are well established
- Only 'high risk' properties in bushfire prone areas need to be protected
- Risk assessment for individual buildings is needed to decide on the level of action
 - Location hazard
 - Building characteristics
 - Occupancy type
- A check list of what to do may be useful



Flood hazard

- Best is to design to minimise flood damage in flood prone areas
- Opportunities for maintenance (repair, replace, clean up ..) after event
- Only limited areas are affected by flood – may change with improving drainage, flood management scheme etc.
- A check list of what to do may be useful

Storm hazard

- Wind resistant features are normally hidden from view, opportunities for inspection only exist during repair
- Remove features that may cause debris impacts
- Water penetration is an issue that can be improved with maintenance
- A check list of what to do may be useful

Leaky building hazard

- Damp walls can be easily detected by inspection
- Many causes for damp walls:
 - Leaky pipes in walls
 - Condensation because house sealed too tight for energy efficiency (another emerging risk)
 - ‘Leaky’ building
- Positive identification of ‘leaky’ building requires inspection of wall cavity
- A check list of what to do may be useful



What to do?

- Need a change in industry culture and practice:
 - Design for maintenance
 - Guidance for building owners
- We have eight S&T systems with different needs
- A national handbook provide guidance on maintenance to make buildings more resilient is a feasible positive step.
- Specific maintenance check lists for specific events could be prepared from which maintenance schemes for public and private buildings can be prepared.



Concluding remarks

- A brief overview of contributions that maintenance can make to mitigate the impacts of weather related events such as bushfire, flood and storm.
- A general handbook on maintenance including check lists for weather related events could be prepared from which maintenance schemes for public and private buildings can be devised.

Thank you for your attention.