bushfire&natural HAZARDSCRC

IMPROVING THE RESILIENCE OF EXISTING HOUSING TO SEVERE WIND EVENTS (B7)

Progress – Work ahead

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An Australian Government Initiative

CRC AUSTRALIA

JAMES COOK UNIVERSITY AUSTRALIA

CYCLONE TESTING STATION

PROJECT SCOPE

1) Identify and broadly classify Pre-80s house types across Australia wrt; Structural system, material, age, etc.
2) Assess the vulnerability of these house types wrt wind hazard (Wind regions in AS/NZS1170.2 or AS4055) based on CTS tests and damage investigations.
3) Specify targeted, practical, structural retrofits to reduce vulnerability
4) Provide structural system models and wind load data for vulnerability analysis for GA to develop economic models

BACKGROUND

Cyclone Tracy (Darwin 1974)

→ Peak gust estimated 70 m/s (250 km/h Cat 4 event)

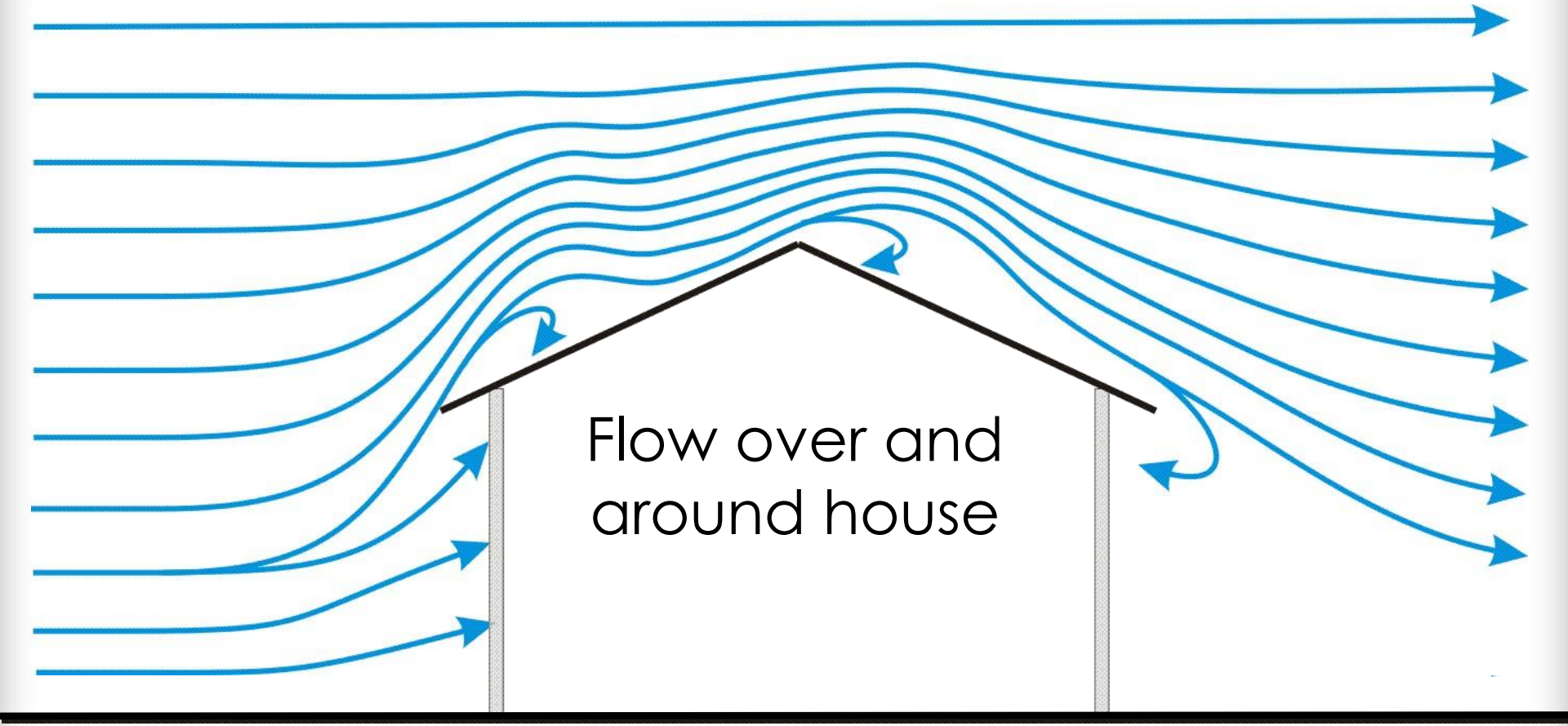
→ Over 70% of houses suffered severe damage

→ Some suburbs; 90% of houses destroyed

→ Engineered structures performed well

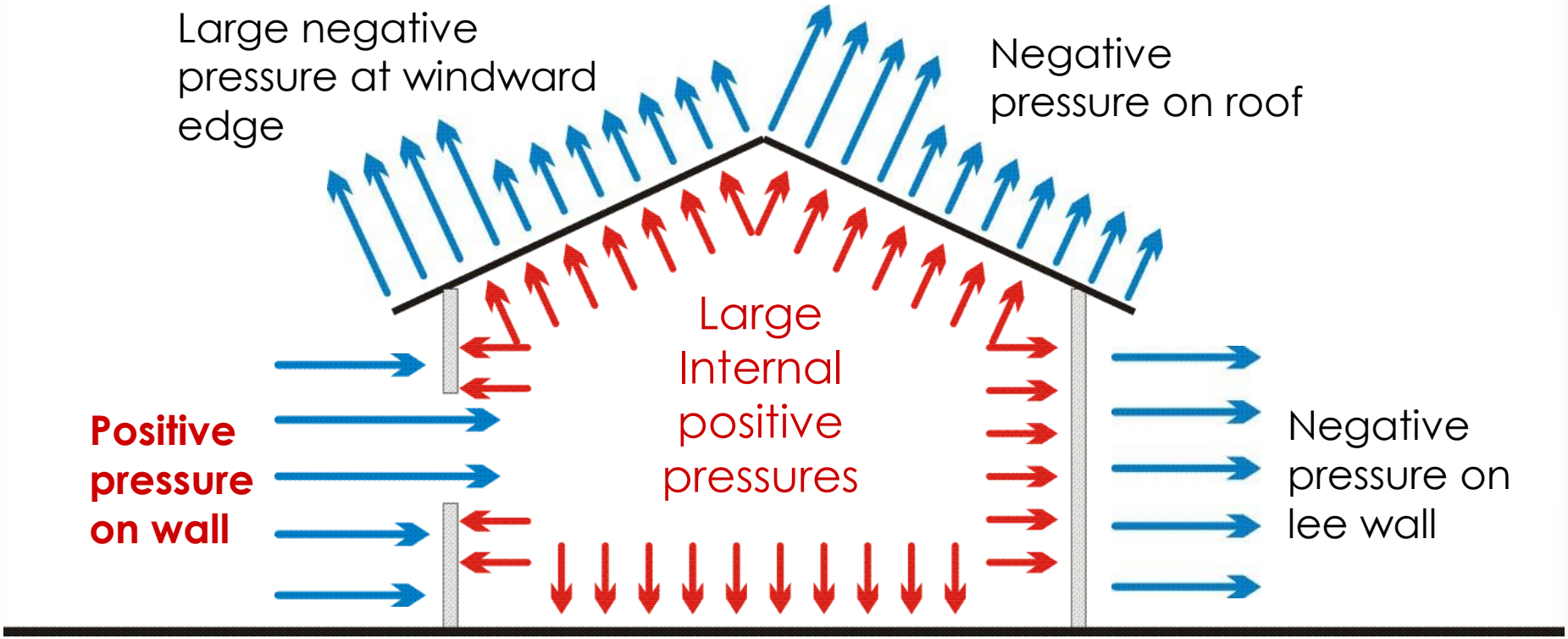
WIND LOADS ON HOUSES

Consider the forces caused by pressures induced by wind passing over structure



WIND LOADS ON HOUSES

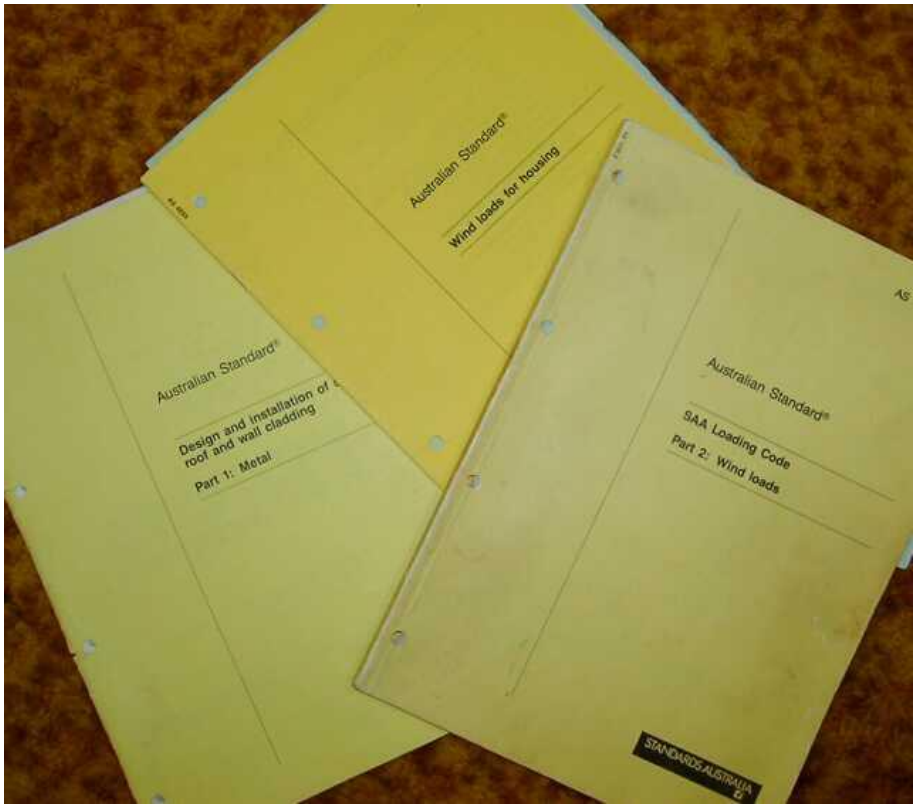
If an opening forms in the external envelope of the building e.g. a window is broken or a door blows in…



Housing design standard AS4055 requires that a dominant opening is assumed in the design. (for cyclonic regions, C and D, only)

CODE DEVELOPMENT

→ Standards and guides for designing houses to resist wind loads
→ Mid-1980s



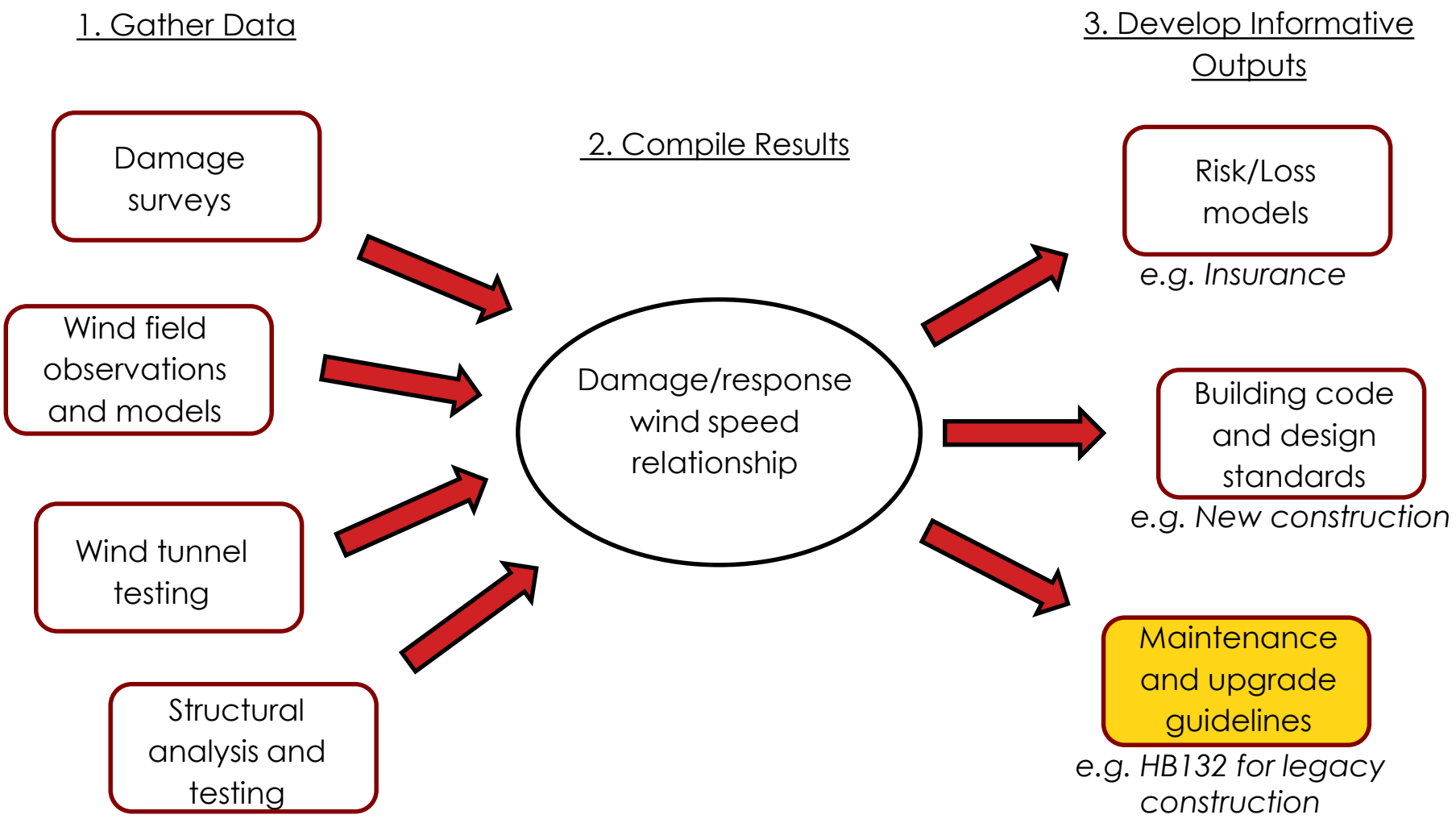
Australian Building Standards:

- AS1170.2 Wind loads
- AS4055 Wind loads on housing
- AS1562.1 Design and installation of metal cladding
- HB132 "Handbook on retrofitting older housing"
- AS1684 Timber Framing

Great for new construction….

…doesn't help pre-1980s houses

PROJECT CONCEPT



RESEARCH OBJECTIVES

Year 1

Task 1 → *Determine typical construction and vulnerabilities for legacy housing*

Task 2 → *Assess effectiveness of current upgrade methods*

Year 2 onward

Task 3 → *Develop practical methods of retrofitting*

Task 4 → *Model vulnerabilities and cost/benefit of retrofitting (VAWS)*

Task 5 → *Develop upgrading strategies for dissemination*

ONGOING RESEARCH ACTIVITIES

1. **Collation of existing housing information**

→ CTS housing surveys + damage assessments

→ NEXIS database?

2. **Canberra housing survey**

→ Geoscience employee volunteers

→ 10 on-site surveys + 30+ online surveys

3. **Survey of HB132.2 uptake**

→ Nationwide

→ 200+ responses

CTS DATABASE (QLD)

Built During	Example of features	Generalised features
< 1920s		Hip roof, reduced rafter spans, central core, exposed studs, on stumps (low and high)
1920 – 1950s		Hip and gable, VJ lining, reduced rafter spans, on stumps (low and high)
1960s – 1970s		Gable low pitch, vermin proof flooring (studs not mortice and tennon into bearers), panel cladding, on stumps
> early 1980s		Reinforced masonry block, hip and gable, large truss spans, medium roof pitch, slab on ground

POST-EVENT DAMAGE ASSESSMENTS

→ Cyclones Yasi, Larry, etc.

→ Brisbane thunderstorms

→ Dubbo, Port Stephens

→ Brisbane supercell (2014)

NEXIS DATABASE ?

Age	AS 4055 Classification	Roof Material	Wall Material				
			Brick Veneer	Reinf'd Masonry	Cavity Double Brick	Timber or Metal Clad	Fibre Cement Clad
1996 to Present	N1	Sheet Metal					
		Tile					
	N2	Sheet Metal					
		Tile					
	N3	Sheet Metal					
		Tile					
	N4	Sheet Metal					
		Tile					
1980 to 1995	N/A	Sheet Metal					
		Tile and Slate					
1960 to 1979	N/A	Sheet Metal					
		Tile and Slate					
		Fibre Cement					
1914 to 1959	N/A	Sheet Metal					
		Tile and Slate					
		Fibre Cement					
1891 to 1913	N/A	Sheet Metal					
		Tile and Slate					

Utilise GA's NEXIS database for house classification for non-cyclonic regions to determine housing types to investigate

→ building age
→ roofing type
→ construction type

CANBERRA HOUSING SURVEY

Goal

Collect construction details from legacy housing

10 onsite + 30 online surveys

Collected Data

Age

Construction type

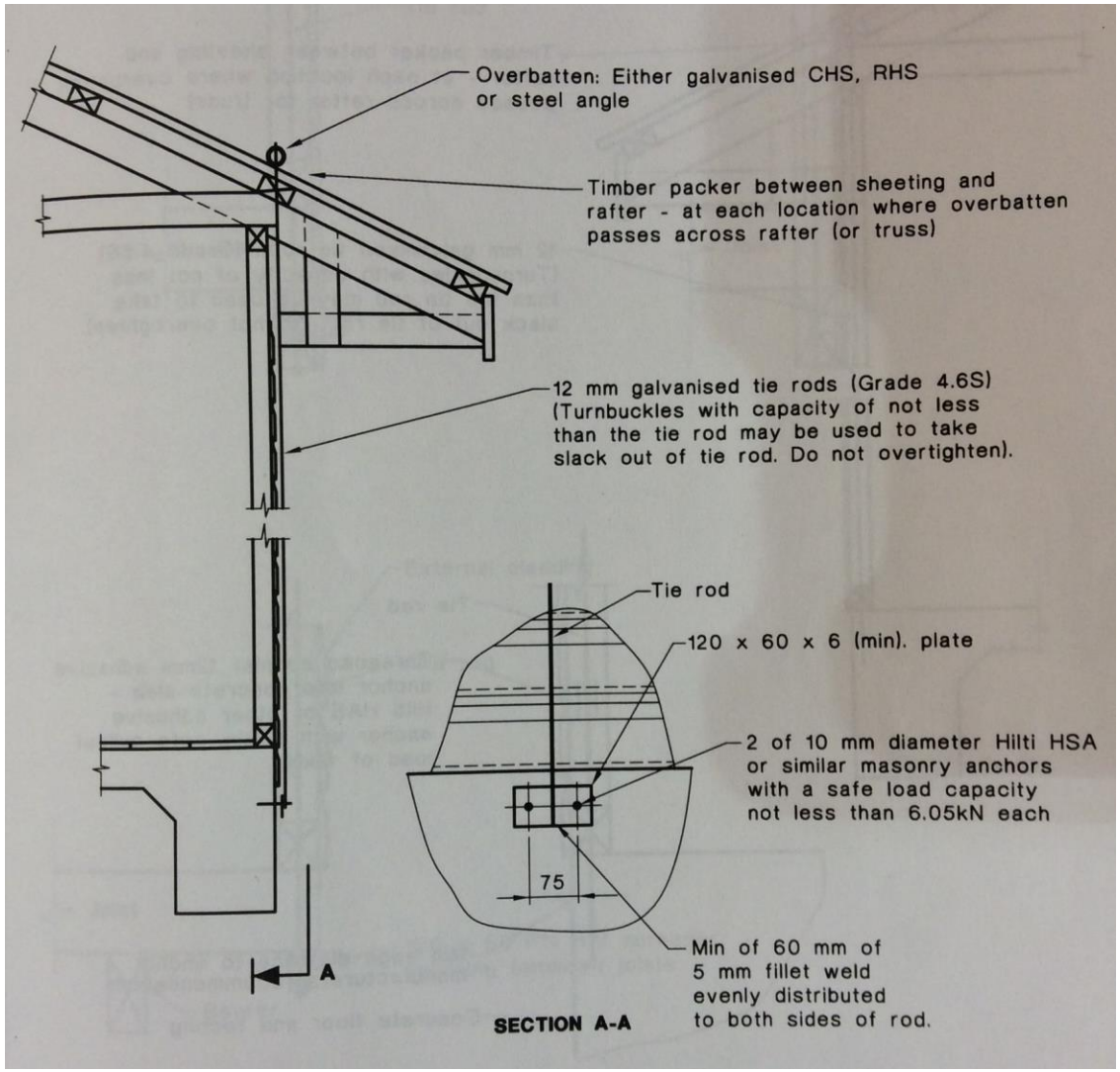
Number of windows/doors

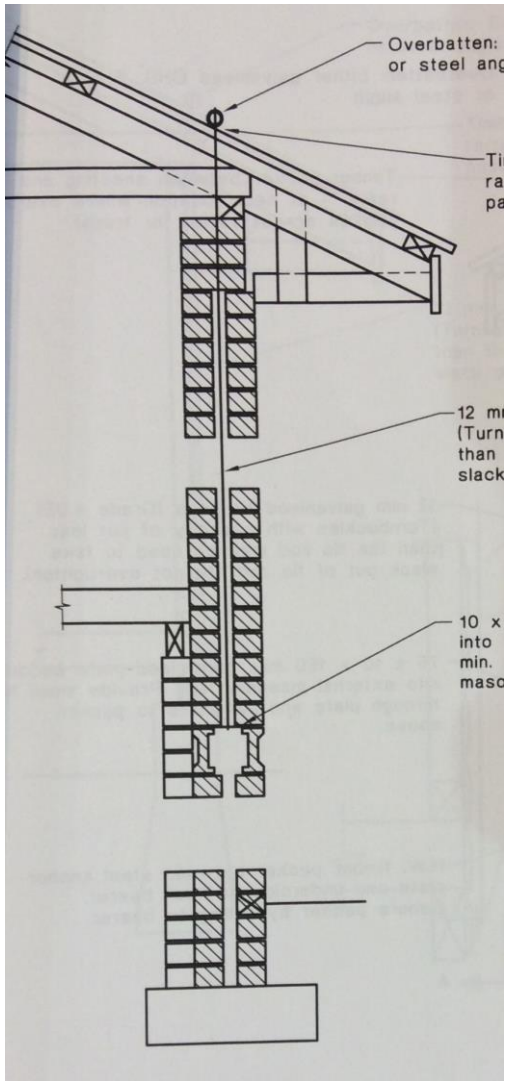
Roof construction and dimensions

Apparent vulnerabilities


CANBERRA HOUSING SURVEY

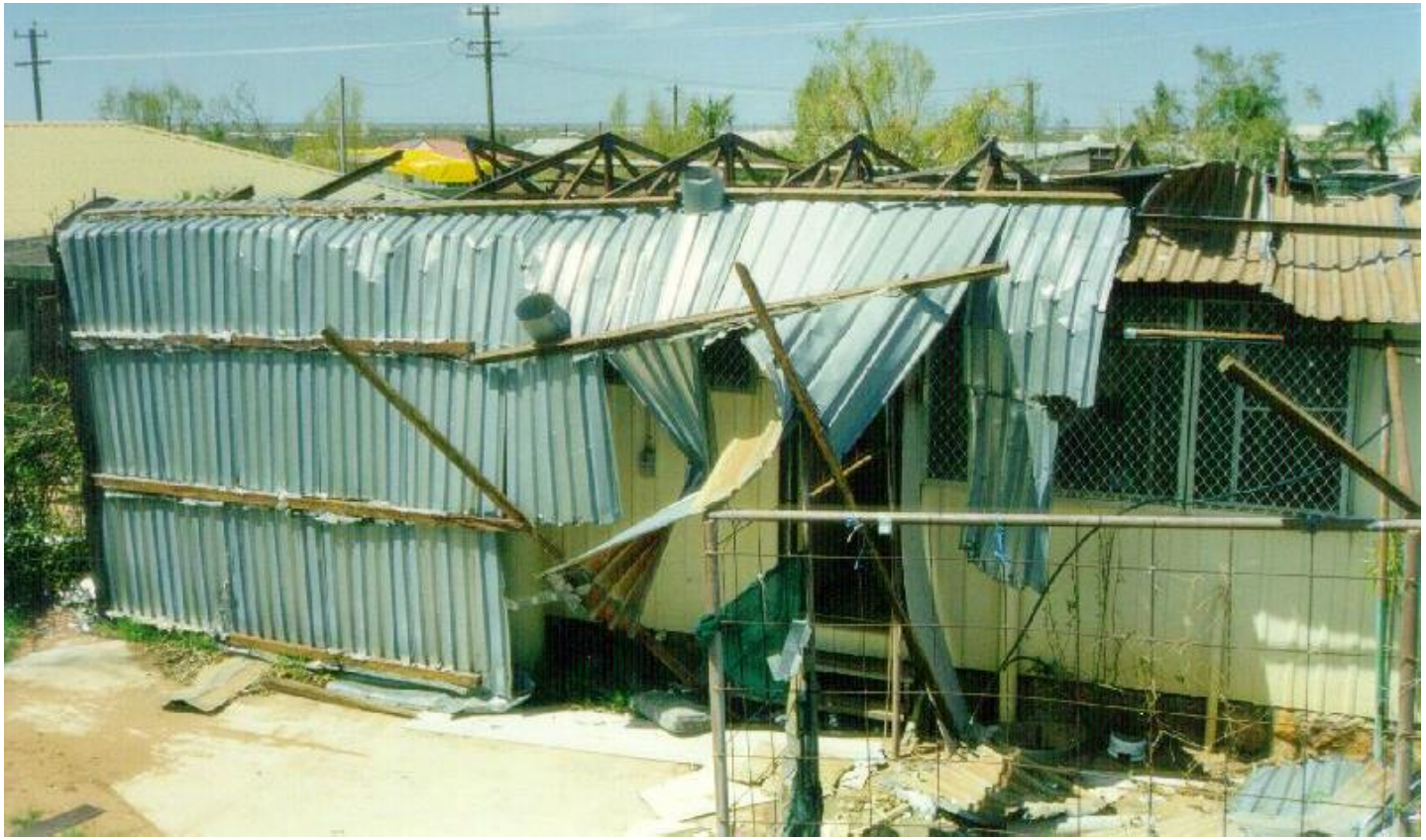
CURRENT GUIDELINES EFFECTIVE?





Structural Upgrading Detail from HB132.2

CURRENT GUIDELINES EFFECTIVE?



1) Cladding connection improved during reroof but…
2) Moved failure to next link in chain – the batten / truss joint
3) Retrofitting effective??

HB 132.2 SURVEY

Goal

Determine effectiveness of HB132.2

220+ responses thus far

Structure

Web-based survey

11 questions (multiple choice + short answer)

5 minutes

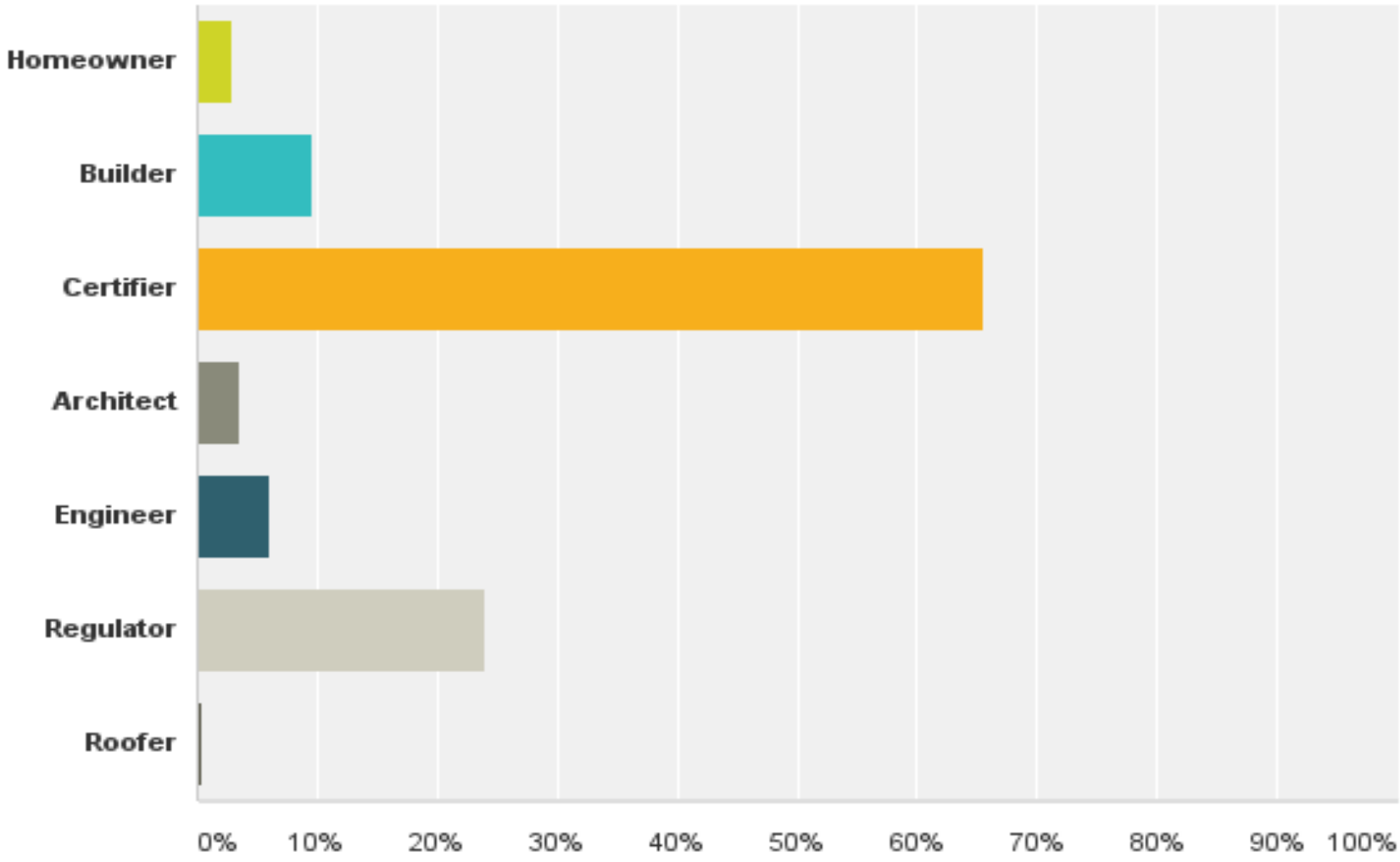
Distribution

Via email alert or newsletter

HIA, AIBS, MBA, BCQ, etc.

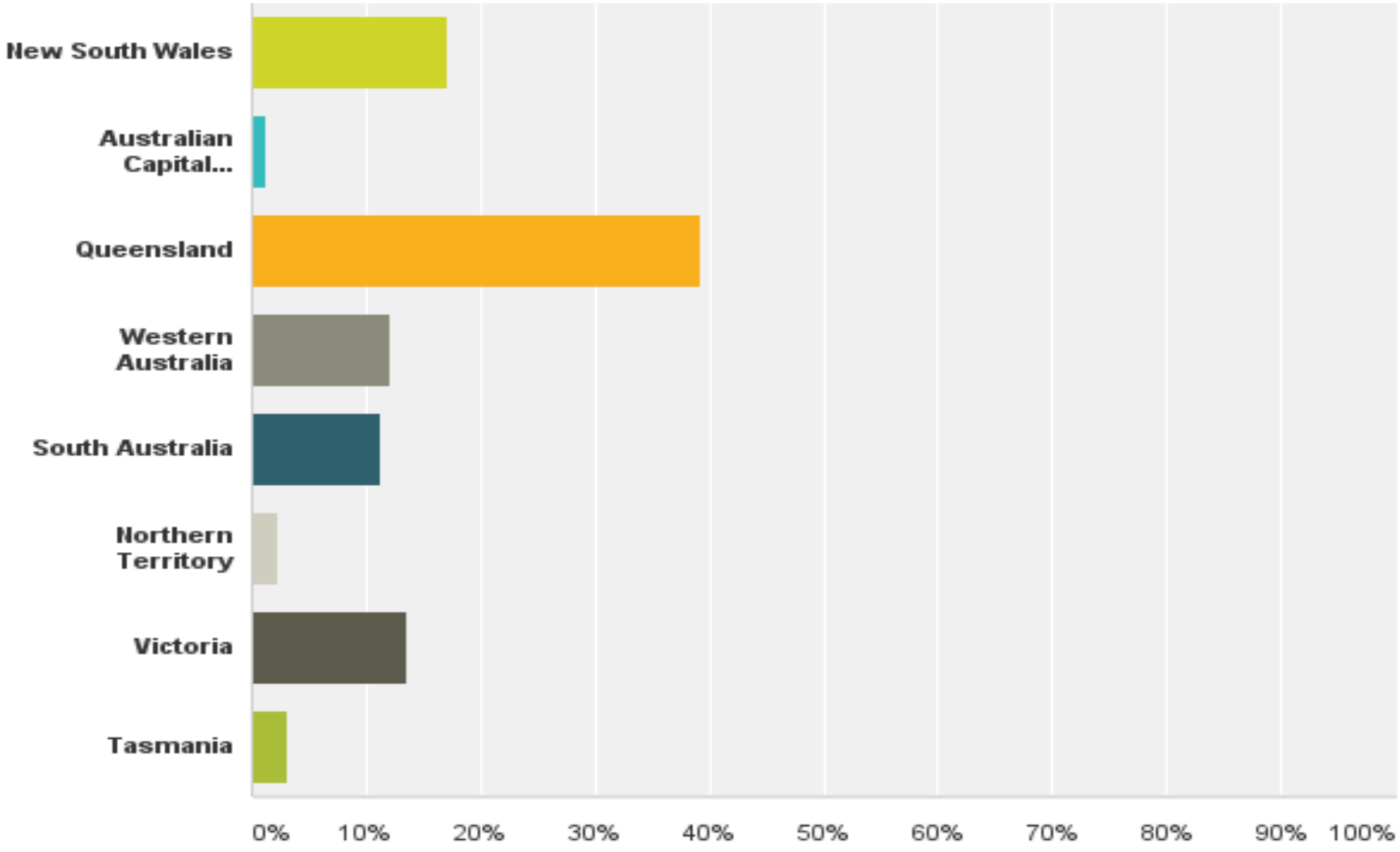
Q1 Which of the following best describes your occupation?

Answered: 200 Skipped: 23



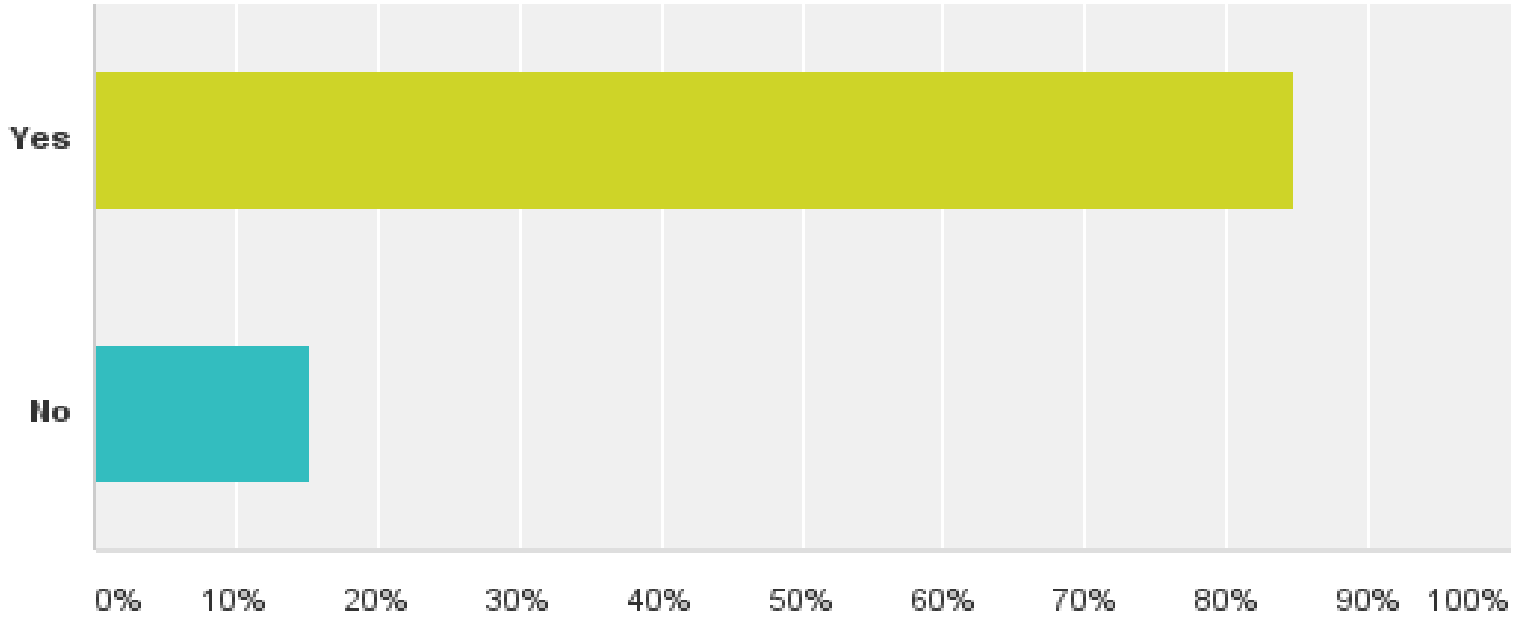
Q3 In which state/territory do you typically work?

Answered: 222 Skipped: 1



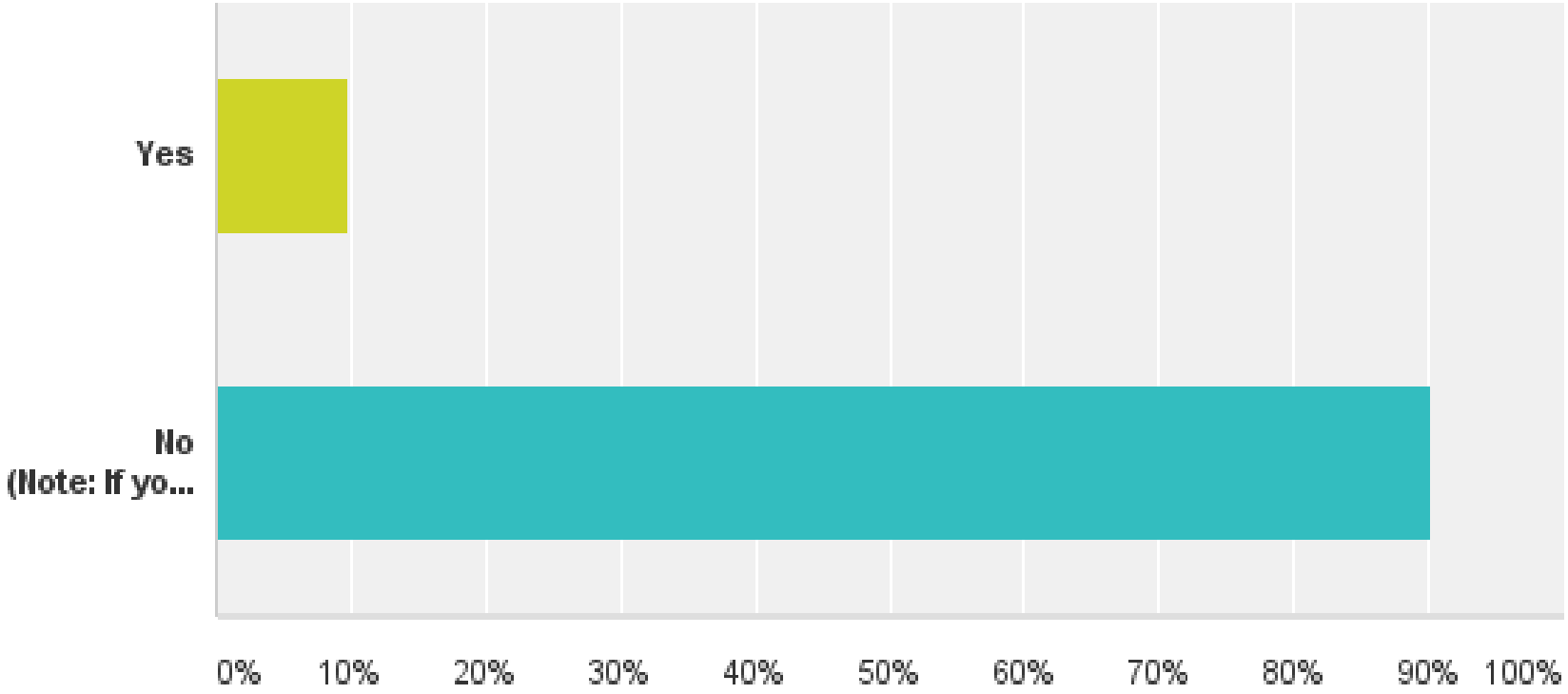
Q7 When carrying out alterations or reroofs to timber framed structures and potentially increasing loads or altering the structural soundness of the building is AS 1684 (Residential Timber-framed Construction Standard) referenced?

Answered: 218 Skipped: 5



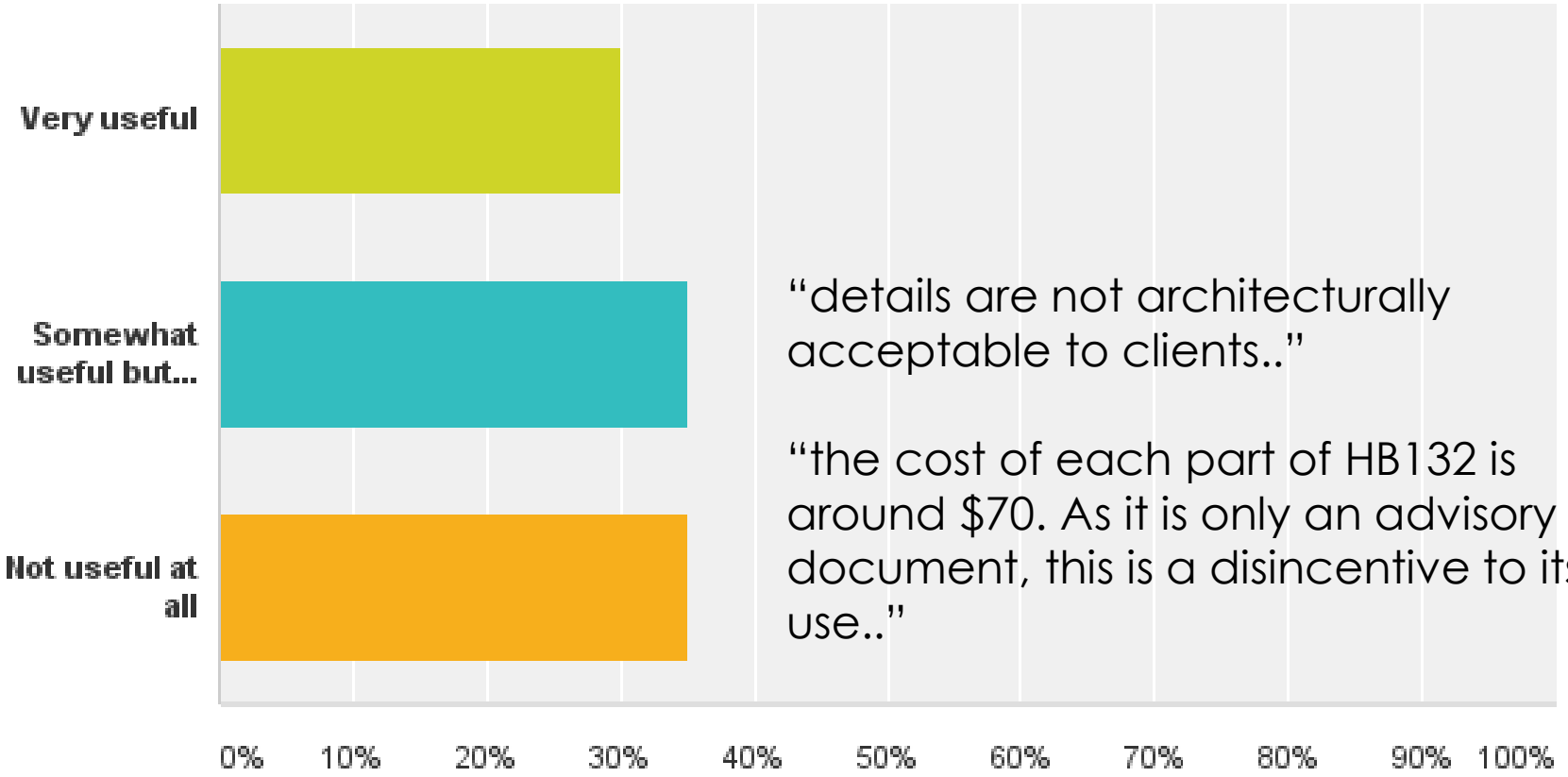
Q8 Are you familiar with the guidebook SAA HB132: Structural upgrading of older houses?

Answered: 222 Skipped: 1



Q9 Please comment on how useful you find HB132.

Answered: 20 Skipped: 203



"details are not architecturally acceptable to clients.."

"the cost of each part of HB132 is around $70. As it is only an advisory document, this is a disincentive to its use.."

FUTURE WORK

1. Develop practical methods of retrofitting

→ Structural analysis testing (system and component level)
→ Cost-effective considerations

2. Model vulnerabilities and cost/benefit of retrofitting (VAWS)

→ Expand current VAWS database (GA) to more housing types
→ Model vulnerabilities with and without upgrades

3. Develop upgrading strategies for dissemination

→ Outcomes must be tailored to different stakeholder groups
→ Products will be linked but different..

Questions?