How much does it really cost to build homes that will survive bushfire?

A new West Australian study, Project BAL Build, has sought to address the misinformation and confusion about the cost of building bushfire-resistant houses.

By Kathryn Kinnear, Bio Diverse Solutions, and Julie de Jong, H + H Architects

Building a BAL-rated house, like this BAL 19 home, is not as expensive as often thought. Credit: Lee Griffith.

In regional Western Australia questions continually arise about the cost of building to Australian Standard AS 3959 *Construction of buildings in bushfire-prone areas* and the Bushfire Attack Levels (BAL) it prescribes. Project BAL Build was a study developed by this article's authors to provide information on the cost of building to AS 3959 in regional WA. The study aimed to examine costs using a building design that is common in regional WA, rather than hypothetical house plans or what we think should be built, the cost of constructing the seven levels of BAL, and a comparison of these ratings with a base design built in regional WA.

Background to AS 3959

The practice of building to AS 3959 in not new to Australia. AS 3959 was originally released in 1991, with the current fourth edition published in 2018. Construction to AS 3959 was legislated in December 2015 by the WA Government, however, making the practice relatively new in the WA building industry.

Poor information availability

There is little public information about how much building to BAL requirements adds to the cost of a house. What information is available puts broad ranges on that cost. One insurance company was reported by the Daily Telegraph in 2018 as putting the cost of meeting BAL12.5 to BAL 40 as $16,000-56,000 more than a non-BAL house. Their estimate of costs to meet BAL Flame Zone (FZ) requirements was $65,000-277,000.

Charges of $50,000 to $120,000 additional for construction to BAL FZ and $45,000-65,000 additional for construction to BAL 40 were described by WA land owners to the authors, demonstrating that there are clearly financial impacts attributed to BAL compliance, but the nature and extent of these costs is extremely variable.

Regulatory Impact Statement

In 2009 the Australian Building Codes Board (ABCB) published a Regulatory Impact Statement (RIS) that assessed the cost benefits of the revised AS 3959. The RIS assessed three house types as the basis for comparison and calculated the generic cost impacts for compliance across the six different BAL ratings. The three house types were:

- A base house: a single storey, three-bedroom house, timber weatherboard construction, slab on ground
- A large two storey, four-bedroom house, brick veneer construction, slab on ground
- An elevated lightweight construction (ELC) single storey, four-bedroom house, timber weatherboard construction, elevated subfloor.

The cost implications the ABCB found are presented in Figure 1.

Figure 1 (ABCB, 2009)

Category of bushfire attack	Base house	Large two storey	ELC house
Current Standard			
LOW	$0	$0	$0
MEDIUM	$9,196	$12,586	$19,174
HIGH	$24,469	$36,529	$42,573
EXTREME	$29,483	$43,810	$53,489
Proposed Standard			
BAL-LOW	$0	$0	$0
BAL-12.5	$11,535	$14,981	$21,428
BAL-19	$11,535	$14,981	$21,428
BAL-29	$15,471	$17,095	$35,024
BAL-40	$17,107	$19,751	$62,357
BAL-FZ	$20,885	$28,905	$76,679

Some key findings of the RIS were:

- It accepts that some individuals will pay more for their house to comply with AS 3959, offering them some benefits (inherent in the higher construction standard, such as reduced damage costs, wellbeing, etc.) but primarily offering a cost benefit to the broader community, particularly by reducing the economic impacts of property loss from bushfires.
- Costs can be seen to favour different building types (i.e. brick veneer), potentially reducing consumer choice and design innovation for alternative construction types

- The RIS tends to minimise the broad scale impacts of these cost implications. When used out of context, this could lead to ill-considered or restricted choices regarding site selection, building type, materials and construction methodology. The reality is, some home owners may not be able to afford to build in a bushfire prone area.
- Consumers may be misled about the value of the real cost of bushfire compliance, with generic figures being applied by 'shonky builders' under the guise of variations.
- It is difficult to calculate the cost of applying a higher standard of construction to an industry standard that has much higher tolerances for error (i.e. maximum gaps of 2mm).

BAL construction can struggle with industry tolerance of lower standards, such as this BAL 12.5 build with gaps greater than 3mm. Credit: J de Jong

Are all these costs attributable to bushfire compliance?

We must recognise that bushfire compliance needs to be considered in conjunction with other construction standards that already require higher levels of performance, including Section J of the National Construction Code (NCC) on energy efficiency. In particular, many bushfire-prone areas are those which are cold in winter and hot in summer, already requiring a passive-solar design response, thermally efficient glazing and thermal mass.

Site responsive design should already take into consideration all aspects of the site including topography, sunlight and solar orientation, prevailing winds, shading and sun protection, thermal insulation and thermal mass, retention of environmental features, functioning of local ecosystems and habitats, site access and egress, proximity to neighbours, provision of site services, etc. Good design and construction should already consider suitability of materials and their performance in a range of environmental conditions, including summer heat, winter storms, seasonal flooding, insect and vermin infestations and bushfire events.

Site responsive design incorporates all aspects of the build and local environment. Credit: K.Kinnear

Many of the provisions of AS 3959 are just part of good design and construction

From an architect's perspective, the positive outcomes of the construction standards and BAL planning principles of AS 3959 is the importance placed on site-responsive design. It also reinforces higher standards of construction in residential building, an industry that doesn't necessarily prioritise the importance of 'building to last', and where we are constantly seeing more consumers being convinced to upgrade their kitchen benchtops instead of their insulation levels.

Some key building requirements in AS 3959 are just plain old good practice in building a durable house, for example:

Durable products: Use of durable and resilient cladding/construction materials will increase the life of the building and reduce maintenance costs long term.

Minimal gaps, seals and weatherstrips: Minimal gaps in buildings means better weather-proofing, improved insect and vermin control, and better thermal insulation properties of the internal conditioned spaces.

Glazing: Higher-spec glazing improves thermal performance and energy efficiency of buildings.

Cladding: Eaves and subfloors reduces maintenance and allows concealment of structure and services.

Metal screens: Mesh screens made of corrosion resistant steel, bronze or aluminium have superior performance and improve security.

Sarking: Sarking improves the thermal performance of all roofs and assists with controlling condensation in buildings, which is a significant issue resulting from the higher insulation requirements of Section J.

Setbacks between buildings: The NCC already requires consideration of setbacks and separation distances between buildings and boundaries that are considered 'fire-source features', to prevent the spread of fire and property damage, and the BAL standards reinforce this approach.

Project BAL Build: a case study

In developing the cost comparison, the Project BAL Build authors wanted to be sure an actual design used in regional WA was the reference house. The design had to be the current building market's expectations and had to take into account materials that can be sourced in regional WA (noting some materials, especially timber species for BAL 40, often cannot be sourced in WA).

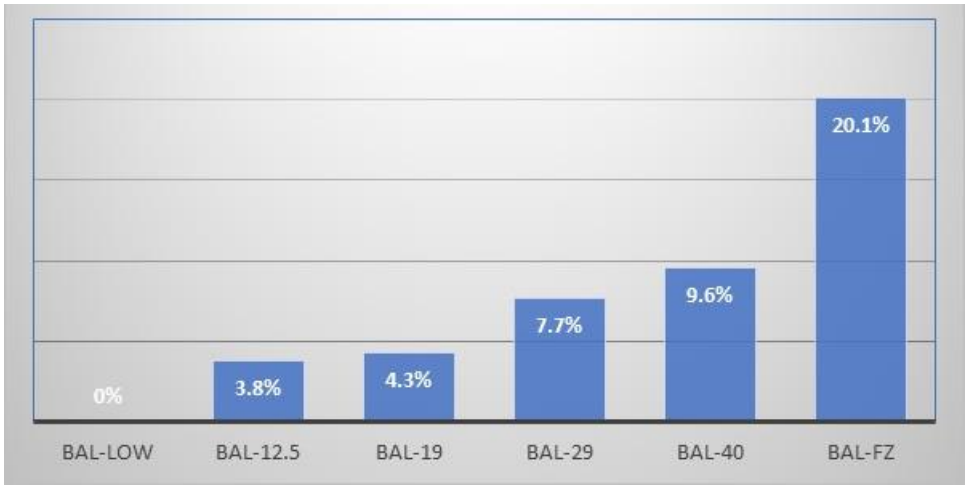
The reference building used was a house built in Tambellup, WA, approximately 200km from Perth. The reference house was a single storey, four-bedroom house, brick veneer and weatherboard cladding and Colorbond roof. The reference house had no special construction requirements, aligned to the NCC, and was a typical size and type of construction seen throughout regional WA.

Figure 2 (a) – The reference house

Figure 2(b) – Images of the reference house built Tambellup WA

The study found that it was feasible to build to all BAL levels, and major cost impacts are likely to be experienced only for BAL-40 and BAL-FZ. A summary of the findings for the building construction requirements and the cost increase through the seven levels of AS 3959/BAL construction is shown in Figure 3.

Figure 3 – Project BAL Build increase in construction costs to reference house



Full details of the construction requirements of the reference house from BAL-Low to BAL FZ is shown in Figure 4.

Figure 4. Summary of construction requirements Project BAL Build and Cost

Design requirements	BAL Allocation and revised specification					
	BAL LOW (reference house)	**BAL 12.5**	**BAL 19**	**BAL 29**	**BAL 40**	**BAL FZ**
Floors	Concrete slab on ground	As per refence house (no change)	As per refence house (no change)	As per refence house (no change)	As per refence house (no change)	As per refence house (no change)
External walls	brick veneer with feature cedar weatherboard sections. fully sarked.	Upgrade Cedar weatherboards to Spotted Gum.	As per BAL 12.5	As per BAL 19	substitute timber weatherboards with FC weatherboards	FRL30/30/30 cladding system (fire-rated HardieSmart)
Screens	standard pet mesh to doors and windows.	Upgrade to Corrosion resistant steel, bronze or aluminium.	As per BAL 12.5	As per BAL 19	As per BAL 29	As per BAL 40
Glazing	Aluminium framed windows with 4mm standard glass.	Where less than 400mm from the ground, glass upgraded to 4mm Grade A safety glass.	Where less than 400mm from the ground, glass upgraded to 5mm Grade A safety glass	all glazing to be 5mm toughened glass min. External screening required to all glazing less than 400mm from the ground.	BAL 40 rated Windows to be 6mm toughened glass min. With all fixed and operable portions screened. Seals to have FI no greater than 5. Or protect with bushfire shutters.	BAL-FZ rated window system or fully protected by bushfire shutters
Side hung doors	Solid core doors with glazing panels (kitchen & entry), external grade fibreglass doors (Garage & store). Jarrah door frames.	Weather strips and draft seals to be installed; upgrade fibreglass doors to solid core. Upgrade glazing to meet window requirements.	As per BAL 12.5	As per BAL 19 plus glazing to be a minimum 6mm toughened glass.	BAL rated door system only	BAL-FZ rated system (-/30/-) or protected by bushfire shutters
Sliding doors	Aluminium sliding doors.	Upgrade glazing to 4mm Grade A safety glass.	As per BAL 12.5, but with glazing upgraded to 5mm Grade A safety glass	Any glazing must be minimum 6mm toughened glass.	BAL rated doors with Glazing must be 6mm toughened glass min. All fixed and operable portions screened. Seals to have FI no greater than 5. Or protect with bushfire shutters	BAL-FZ rated door system or fully protected by bushfire

Roller door	Colorbond.	Install guide tracks with brush strips. No gaps greater than 3mm.	As per BAL 12.5	As per BAL 19	As per BAL 29	As per BAL 40
Roof	Colorbond profiled steel roof with PVC downpipes. Unlined eaves and verandah roof.	Seal roof functions (fascia and eaves lining or sealing junction itself). Seal all penetrations in roof.	As per BAL 12.5	As per BAL 19 plus verandah roofing support structures to be lined with 6mm FC sheet. Eaves lining shall be 4.5mm FC sheet or bushfire resistant timber	As per BAL 29 eaves lining shall be 6mm FC min. Gutters to be non-combustible	As per BAL 40 plus any conduits penetrating roof to comply with AS1530.8.2. Eaves lining shall be at least (-/30/30) or compliant to AS1530.8.2
Pergola	Separate Exterior grade pine framed pergola with polycarb roofing.	As per refence house (no change)	As per BAL 12.5 (translucent roof sheeting allowed for BAL12.5 and BAL 19).	No translucent roof allowed.	Steel supports and framing	As per BAL 40
Decking	Pine decking with unenclosed sub-floor.	Upgrade decking to Jarrah.	As per BAL 12.5	Non-combustible or bushfire resisting timber (Jarrah deck rated up to BAL-29).	Hardie Deck non-combustible decking with fully enclosed subfloor	As per BAL 40
Joints	No special provisions, general weather proofing only	All joints shall be covered, sealed or butt jointed to prevent gaps greater than 3mm.	As per BAL 12.5	As per BAL 19	As per BAL 29	As per BAL 40
Vents and Weepholes	Open vents and weepholes to suit NCC and Masonry Construction standards	Protected with screen mesh.	As per BAL 12.5	As per BAL 19	As per BAL 29	As per BAL 40
Cost increase from reference house as a percentage	**Nil**	**+ 3.8 %**	**+ 4.3 %**	**+ 7.7 %**	**+ 9.6 %**	**+ 20.1 %**

Findings of study

The biggest cost impacts revolved around the gap and join sealing (applicable to all levels), upgrading glazing (but starting from a very low standard in the reference house), screens (applicable to all levels), bushfire shutters or BAL 40/BAL FZ-rated window systems, and lining the eaves, verandas and subfloors.

It is in the interest of the consumer to minimise their BAL, both to limit their upfront construction costs as well as long-term maintenance costs (for the building and the site, to manage the Asset Protection Zones). Some building types are more readily compliant to the AS 3959 bushfire standard, and this is already the dominant type of housing construction in WA (i.e. masonry or fibre-cement weatherboard with slab-on-ground and profiled steel roof). It was noted that many of the upgrades required to comply with AS 3959 are already required in order to comply with Section J – Energy Efficiency provisions of the NCC and good practice generally.

Recommendations and conclusions from this study include:

- Consumers should request quotes from their builder that clearly demonstrate the extra-over provisions related to AS 3959 compliance, which aren't already required for their 6-star energy rating.
- Builders should clearly articulate in plans the BAL provisions addressing compliance with AS 3959. Many building surveyors require this to be submitted as a separate drawing at time of building permit application.
- Bushfire consultants should not give advice about construction cost implications unless they are a construction cost consultant.
- Designers and builders should consider bushfire compliance as part of their consideration of all site conditions that affect the building and its site planning, and mitigate impacts where possible.
- Building to BAL-12.5 to BAL-29 is not as significant a cost as previously thought.
- The cost of building to BAL-40, surprisingly, added less than 10% cost to the reference house.
- Significant cost increases occur in the BAL-FZ building standard.
- Building to AS 3959 and BAL is good building practice; it prioritises resilience, durability, building performance and site responsive design.

Julie De Jong
H + H Architects
Director/Principal Architect
Level 1 BPAD BAL Assessor

H+H ARCHITECTS

Kathryn Kinnear
Bio Diverse Solutions
Director/Principal Environmental and Bushfire Consultant
Level 2 BPAD Bushfire Practitioner

BIO DIVERSE SOLUTIONS

References

Daily telegraph, Nov 2018 “What you need to know about building in a bushfire prone area”, 30 November 2018.

Australian Building Codes Board (2009) (ABCB) Regulatory Impact Statement (RIS)