Bushfire Resilience Inc. Webinar 2 2020 Presentation 2

How to harden an existing house

Chair: Malcolm Hackett OAM

Presenter: Dr Justin Leonard

Surface fire is an issue about what really is applied to and against house, and what is the detail of the house that comes down adjacent to those materials. There's so much debris that can build up and play against those actions, but really think about the detailing of, particularly, the subfloor access doorways that may be susceptible to that debris. I've seen many houses that have been very well built, but then they do a simple job of the access doorway. In this case it's a metal one that hopefully has significant seals behind it.

Those surface fires can attack stairways, and this one's a very important one to look at because the stairway itself didn't actually contact the ground. If you look to the bottom left, you can actually see that there's a metal stirrup and a certain amount of clearance between the tanbark fuel bed underneath the stairway. And that typical height that those stirrups are set at are actually not far enough to prevent direct ignition and combustion of the adjacent timber elements.

The similar can be said about the typical way that poles are stirrupped with a galvanized footing stirrup, such as this. The typical height clearances are never enough, and at the same time the way these are designed is quite typical to allow debris to pack in at the base of the post but in that U-shaped stirrup. Likewise, an ember attack around decking details is also one of those really important processes to hone in on.

Now, in terms of solutions, you can't really ever completely eliminate the debris build up under a structure or against the structure, but you can think about complete, non-combustible solutions. So, we think about brick piers or bricking in existing timber piers, or having all steel support posts. Now, these ones are actually a securing type. There's screw in piers, and others that are placed in situ and three angular pegs are driven into the ground to secure their location and support.

And, of course, for decking, the steel structures underneath the decking are important, as is, in this case, a mod wood composite decking that was deliberately designed and tested for performance in bushfire, and, of course, it has performed extremely well, despite adjacent fuel loads and impacts on it. And it could actually be an effective deck to use as an egress route in a fire event.

There's plenty of ground cover options, and I would encourage you to think beyond the traditional tanbark and mulch approach, particularly in the few metres up to and immediately against the structure. It's absolutely critical, so please consider stone, various gravels and compressed aggregate finishes, concrete, and also, surprisingly, a high quality artificial turf is actually a reasonable performer in bushfires. We've only found some very low quality artificial grasses that have come in approximately a decade old, to be actually a poor performer. But, by and large, all the reputable brands currently on the market don't tend to perform badly in a bushfire event. And, of course, think about creative garden design and plantings that simply don't provide that additional fuel load to your structure.

So, let's move on to consequential fires, radiant heat and the prospect of flame front contact. So, we can see that most of these are quite challenging things to solve from a house design perspective. And, obviously, for a consequential fire, actually removing the source of consequential

fire is a lot easier than designing a house to handle the long burn out time that the fence, or a retaining wall, or a car, can present to the house.

Radiant heat is a mix between having the prospects of removing all your radiant heat sources from the landscape, versus building a house, or modifying a house, to be adequate for the radiant heat that's imposed. But in terms of looking into how to solve, and what's an appropriate thing to build against radiant heat levels, I guess, it's reasonable to say that our building standards provide a reasonable amount of guidance of appropriate materials for certain radiant heat level circumstances. And, of course, AS3959 is currently a free standard, so I definitely encourage you to go and get a copy of that while it's free. Might not last forever.

Flame front contact is obviously an expensive prospect to deal with direct flame front contact on a house. However, in many cases, it can be solved in the landscape. And, I guess, the 10/30 and the 10/50 rule are good examples of where a landscape approach can, by and large, eliminate most of the flame front contact prospect that a house may face.

So, in terms of what that clearance means, there is a few extra nuances. We spoke about 10/30 and 10/50 that I introduced in our previous webinar. There's actually a lot of detail that can be wrapped around what types of vegetation, clearance, and selection are relevant. And what the actual metrics in the 10/30 and 10/50 mean. For instance at 10m does 10m mean that you can cut down any tree within 10m? Well certainly, if the trunk is within 10m, yes, you can take the tree out. But you can also remove overhanging foliage that reaches into the 10m zone as well.

And if you're interested in the specifics of exactly what to clear and how to clear, I'd actually encourage you to look up this particular website, https://www.environment.vic.gov.au/, and in their landing page, they have a tag that says "Native Vegetation Removal Regulations" (https://www.environment.vic.gov.au/native-vegetation/native-vegetation). And that actually delves very deeply into exactly what you can and can't do. And this is actually the front page of the document you can download for free, and it takes you into the really specifics of what's behind it, and there's a lot of very good guidance advice about the tree removal and the vegetation surface removal out of the 30 or 50m.

And, I guess, that also covers the implications and descriptions around the consideration of dead trees, which by themselves may not present a significant fuel load, provided they're a significant distance away. But the way to consider trade offs about them being habitat trees, and what role they might play in limiting access or egress, or for vehicle access for example. And it also goes into the tree and vegetation clearances along fence lines, which is another important aspect, so, a very valuable document for people in Bushfire Prone Areas.

Now, in terms of house design, the radiant heat and the consequential fire implications are endless, really. And what I'd like to highlight here is there's just so many aspects of vulnerable places on the house, when you start to think about how consequential fires which are materials, be it an adjacent house, be it gas bottles, be it stored can play out on a structure.

This picture here basically provides so many different combinations of issues that it's hard to do it justice, in that we've got gas bottles that are poorly secured against extreme fuel loads that the structure provides, and also even gas bottles that may be awaiting either removal or installation that are laid over in a worst case scenario, where the fuel loads here are enough, if that gas bottle on the ground had any liquid gas left in it, that could basically go off like a bomb in this event. Because gas bottles on their side cannot vent adequately, and can build up pressure to the point that they detonate and take out roughly a 50-80m radius; it will shatter windows.

Other consequential fire sources, like retaining walls and whatnot, are key issues. So, they more or less have to be eliminated if they're in the zero to 3m. And I guess the 3-6m range is the range where you start to consider the size and particular material of the consequential fire source, in combination with the adequacy of the house itself. So, obviously, a masonry clad house that has no windows in it facing a consequential fire source like this isn't a particular issue. But, a similar house with a window or a door in it is vulnerable. So, you either have to seriously think about upgrading the window to be adequate, we're talking about aluminium windows with toughened glass glazing elements in them or shutters or, of course, the removal of the consequential fire source.

The placement of our wheelie bins in the landscape is just one of those obvious ones that, for many, they're diligent and they will have a particular routine about where the wheelie bins get parked during the fire season, while others just simply don't register that as a significant fuel load. They do burn out quite prolifically, and they are enough in themselves, if parked under a window or against a combustible facade, to be the reason why a house is lost.

The places we store our timber is an obvious one, and I guess the question is: is it okay during the winter, when we might use it for wood heating, but how diligent are we about the complete removal of those fuel loads during the fire event itself? And, of course, in a fairly built-up environment, we've seen wood piles built against fences that are sufficient to take out a neighbouring property, built at that normal setback of 900mm from a boundary. And that can be with a non-combustible fence or with a combustible fence in place.

House-to-house spread is another ubiquitous form of consequential fire, so the typical separations we see between neighbouring houses, or houses and sheds on the same property, or houses and sheds on neighbouring properties, when they're significantly less than 12m, say around the 6m range or less, then there is a higher chance that one house can burn its neighbour down.

Now the things you have to do to actually resolve a house-to-house spread are things like very tall steel fences, elimination of fuel loads between those two houses, which simply add to the problem, and quite fire resisting construction on both houses, considering the windows, the eaves, and the fascia materials, is really the types of efforts you need. So, it's a really challenging mutual risk problem that many face, and ideally having good separation is a virtue. However, when you don't, you're really in it together in a mutual risk scenario. And I guess, in a way, it's a very important neighbourly conversation to have when you share a mutual risk like this. And I guess another way to address it is to simply be as diligent as the neighbour that you share the risk with to make both properties as bushfire resistant as you can, so that you don't face anywhere near as much prospect of one house burning its neighbour down.

The use of sprays and spray systems is another quite broad topic, and they can be used for many things, and I guess the best advice I can offer is that they're good for a few particular targeted things. However, I've never seen a spray system design that's particularly effective at solving all aspects of bushfire risk that an otherwise vulnerable house could face. There's particular spray system designs for drenching a house to withstand a neighbouring property fire, there's another quite different sprinkler design that's adequate for filling your gutters and keeping them wet during an event, there's a different type of spray system that's dedicated to keeping glass and glazing systems wet throughout an entire event, and withstand quite a high radiant heat flame load, and then there's a different spray system again that might wet out a deck in an effective way.

What I've seen is spray systems applied to houses in a fairly generic way, with an assumption that that'll solve most of the house's problems, but in virtually all cases that's not the case. Here's a spray system fitted to the eaves. It's spraying most of its water into the air, and under a very windy

day, the vast majority of that water will not impact that house or provide any particularly useful support to protect that house. It doesn't seal any gaps, it doesn't really wet the windows out adequately in this case, and if you're lucky, it might get a little bit of water in the gutter that they're mounted just below.

In a similar vein, the spray systems that are fitted to ridge lines along houses by and large put very little water into the gutter of the roof that they're fitted to under the really windy conditions. And if they are run with enough intensity, they might get a little bit of water in the downwind gutter, but no water at all in the upwind gutter. So, I guess the vast majority of spray systems I've seen just aren't adequate for purpose or meet the claims that they are fitted on the house to achieve. But saying that, I wouldn't discourage the use of spray systems that are specific for a purpose, or a couple of purposes, and designed for that process.

And of course, if you're going to have a spray system, it's absolutely imperative to have a reliable source of stored water, pump, and means for that pump to operate throughout the entire fire event. This is a tongue-in-cheek picture of a very poorly specified and located tank in that it's made of fiberglass, and for the same reason why the semi-transparent, clear fibreglass skylights burn out prolifically, these fibreglass half shell water tanks burn out prolifically in fire events as well, and almost certainly do not provide adequate means to store water. And if they do rupture, and this one's highly likely to in a fire event, it can rupture in a way that can break open the house it's adjacent to. And you can actually see the typical combination of a treated pine edging making a platform that supports this fibreglass water tank. That's enough in itself as a fuel load to ensure that that tank fails in a fairly modest ember attack.

Sheds and supports for water tanks are just as important in consideration. This is another tongue-in-cheek picture to see. We have to be very careful about how we think and design our water tanks and what we put around them, and where the pump and pumping system and supply pipes actually go. It's very easy to say, "I've got an enclosure now so I'm going to store x, y, and z in with my pump." You really have to think about the implications and processes that may unfold in a bushfire, if and when it comes.

Now I'm going to talk about wind and tree strike as our final topic. Now, tree strikes are a relatively easy thing to deal with, and some of the best rules of thumb I've seen is the 45-degree rule. So, if you can project a line out from the base of your house at 45 degrees, and it looks through substantial tree canopy, well, by definition that tree could impact your house in some way if it fell over. And that's a means to consider whether some pruning, and that's hopefully allowed within the 10/30 or 10/50 rule,can adequately support that. I'm not saying the 10/30 and 10/50 rule is adequate if the trees are significantly taller than 10m, but that's a reasonable rule to see whether you've got significant tree strike risk.

And of course, wind implications. Now, this previous picture shows a deliberate retention of the trees in the landscape, and those retention of tall canopy trees do a lot to help moderate the potential risk of this happening, which is direct wind loads acting on your house that is so severe that it could compromise the integrity of your house, or roof, in a fire event.

Now, the fire events that we know all too well, like Black Saturday and Ash Wednesday, both involved wind speeds and wind gusts that were sufficient for exposed houses to be damaged directly themselves. So, wind gusts that exceed 75km/hr are enough to potentially lift tin, or dislodge roof tiles, or project branches through the air that could break a window. So, that degree of weakening obviously then allows the other bushfire actions to play on the house and cause issues. And, I guess, the things that can help support or manage that risk are: retain vegetation in the landscape to reduce the loads on your house itself, but also think very carefully about how

adequately your roofing is fixed, an extra pack of screws on every other ridge on a roof is an excellent consideration, as is means to protect windows by putting shutters, or fly screens, or protective things over the window glass themselves, all help to contribute to hardening those processes.

There's also good building guidance around building in cyclone areas, and I'd encourage you to look to some of those Queensland resources for ideas on how to harden up your house for those rare but particularly critical wind actions on your structure.