



QUEENSLAND BUILDING AND
CONSTRUCTION COMMISSION



TIMBER DECK AND BALCONY CONSTRUCTION

This handy tool will help you prevent defects.

TIMBER DECKS AND BALCONIES

A number of timber deck failures have occurred in Queensland and in other states over recent years that have resulted in injury to those on the deck and in at least one case that the QBCC is aware of, the death of a person on the deck. The two most recent collapses that the QBCC has investigated were in Ascot and Morayfield in Brisbane and the cause of these failures will be considered in detail in this publication. Having reviewed the cause of these collapses, suggestions will be offered in relation to strategies that builders and building inspectors can consider that may reduce the likelihood of similar occurrences in future.

THE ASCOT COLLAPSE

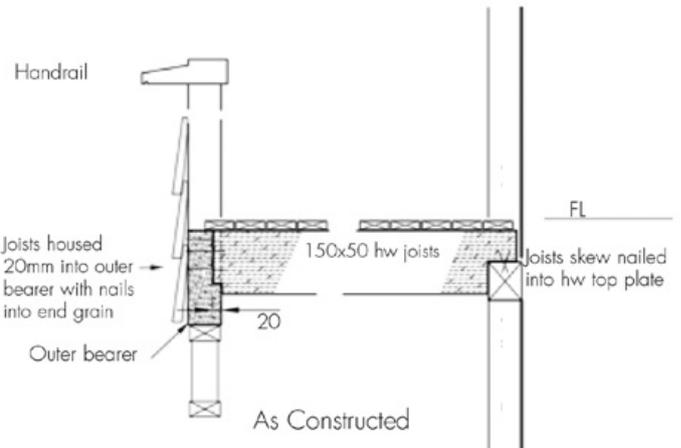
Description of construction - This residence is a two-storey timber-clad building with sheet metal roof estimated to be more than 50 years old. It generally appeared to have been well maintained and the balcony construction generally appeared to be in sound condition for a building of its age. No significant rot or decay to any framing members was observed.



Ascot residence subject to balcony collapse

The balcony that collapsed was located on the front elevation of the dwelling and was a traditional form of timber-framed construction utilising hardwood bearers and deck joists with shot-edge decking fixed above.

The front balcony measured approximately 6.5 metres x 2.75 metres and appeared to be part of the original dwelling. Deck joists were approximately 145 x 55 hardwood fixed at approximately 500mm centres and were cogged into a check-out housing in a deck bearer running across the front of the balcony and cogged over a floor plate where attached to the main residence. The joists were skew nailed to the bearers and many of the nails showed evidence of significant corrosion.

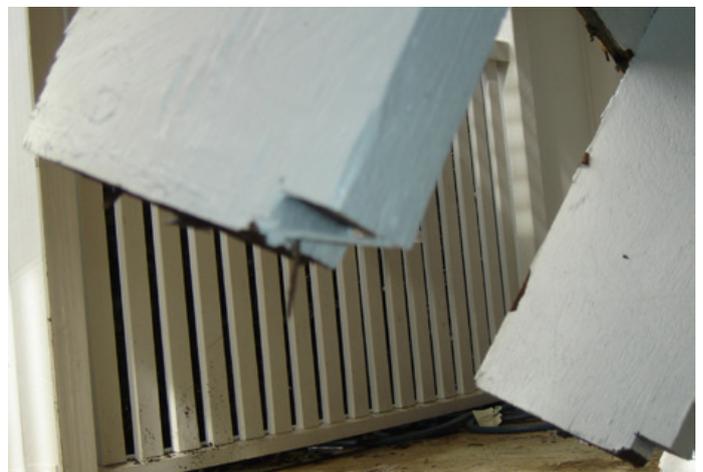


Cross-section of Ascot deck as constructed.
(Drawing provided with generous permission of Peter Wright RPEQ)

Cause of collapse - Over a long period of time the external balcony bearer deflected outward due to the inadequate restraint provided by the nail fixings into the bearers. Corrosion of the nails may have contributed to the inadequate restraint. As the bearer deflected outward the joists began to be displaced from their housing in the bearer and this is evidenced by paint on the ends of joists and into the bearer housings.



Housings in the bearer



Paint clearly evident inside the cog in the joist

In fact paint witness marks indicate that on a small number of joists the full depth of cog measured to be approximately 18 to 20mm had disengaged from their housing due to an outward deflection of the main bearer.

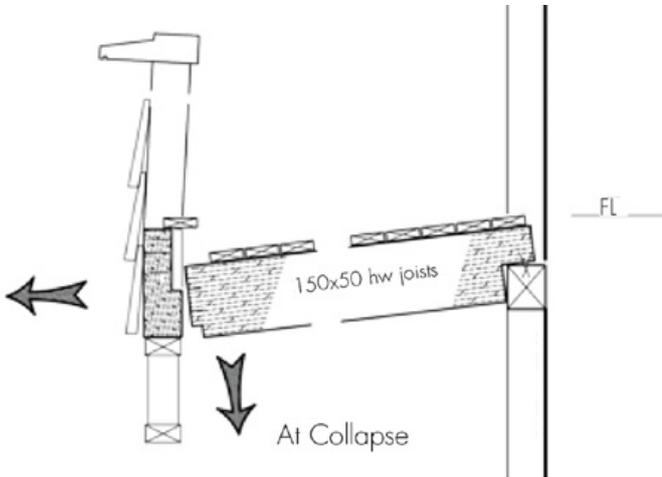
The balcony seems to have been sufficiently rigid to withstand the small loads from small numbers of persons that may have congregated on it under normal family usage conditions. The timber decking may have played a part in providing some rigidity and support sufficient to carry these small loads where the deck joists appear to have been almost totally lacking support.

Unfortunately it appears the deck was unable to accommodate the larger number of persons on the deck that were present at the time of failure.

Once one or two floor joists became disengaged they started a progressive collapse of adjacent floor joists due to a probable outward thrust on the floor bearer as the joists rotated downwards, allowing adjacent joists to pull out of their housing in the bearer.



View of external bearer support



Cross-section of Ascot deck at time of collapse.
(Drawing provided with generous permission of Peter Wright RPEQ)



View of collapsed deck



View of internal bearer support at external wall of home



Mud wasp nests in the bearer housing is evidence that a sizeable gap existed where the floor joist cog was not fully engaged into the bearer

THE MORAYFIELD COLLAPSE

Description of construction - This residence is a 16-year-old two-storey building, clad with fibre cement boarding with sheet metal roof. The collapsed deck was not part of the original dwelling and is a more recent addition and is approximately 2.5 metres above ground level.

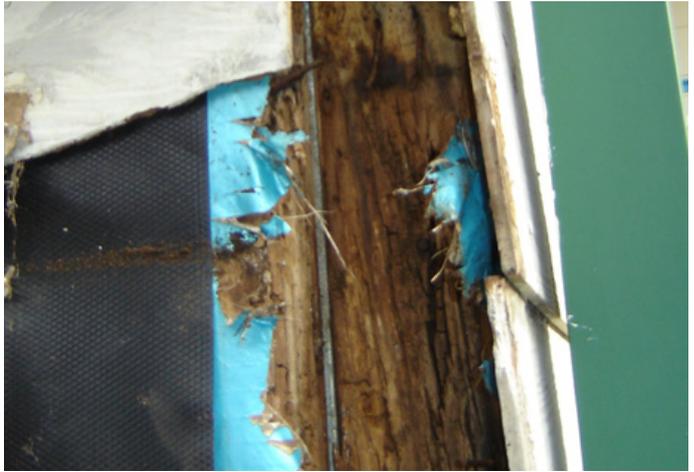
The deck had obvious recent repair work performed to it which included additional timber cleats applied to the sides of the floor joists and steel angle brackets installed under the bearers where connecting to the dwelling. The owner advised that a contractor was engaged to perform the above remedial works sometime after purchase of the property.

Cause of collapse - It appears that the south-west corner of the deck failed initially where the deck bearer was attached to the main dwelling. It was further found that the deck bearer that failed penetrated the external cladding boards and relied upon support by multiple pine corner wall studs in the wall cavity. The pine wall studs supporting the bearer were found to be totally rotted out due to the ingress of water into the wall frame.

When a substantial load was applied to the deck in the direct vicinity of the south-west corner over the bearer being supported by rotted wall studs, the inadequate support allowed the bearer to rotate downwards and the collapse occurred.



Support point for the bearer



Rotted wall studs below the bearer support joint



Collapsed corner of the deck is clearly visible in these photographs

The ingress of water may have occurred where the bearer itself penetrated the wall cladding and also around the base of a timber veranda post of the main dwelling which was located directly above the location of the bearer. These points of water ingress relied solely upon sealant to prevent penetration of water.

Shrinkage/breakdown of the sealant over many years and some shrinkage of timber elements would have occurred, allowing water ingress and causing the decay to the non-durable pine studs in the enclosed wall.



Gaps around base of veranda post allow water ingress into wall cavity

LESSONS LEARNED

Although not currently required by the Building Code of Australia there are three strategies that can be adopted by contractors and builders that will significantly reduce the risk of future deck and balcony failures:

- All structural framing members and their connections and support points below the floor level of structures such as decks, balconies and patios should be unenclosed and not sheeted to allow full visual inspection of those critical elements.
- When structural framing members and their connections and support points are enclosed and not visible for inspection, all framing and connections should be sufficiently durable to accommodate periodic wetting and drying. Alternatively, a method of inspecting the sub-structure to the deck and any building framing to which deck members are connected should be provided.
- No attachments to a dwelling such as patios, decks, balconies or the like should allow structural framing members to penetrate the external fabric of the main building unless the penetrations are flashed and sealed using permanent durable materials to prevent moisture entry.

Additionally, contractors should take care to ensure that nail plate connected joists or bearers are not used on external decks or in any location where they are exposed to the effects of weather. This is often contrary to the manufacturer's recommendations that do not recommend the use of nail plates exposed to the weather as they can eventually lose a substantial amount of their nail-holding strength as the wetting and drying effects of the weather causes the teeth to gradually withdraw from the timber.

Similarly, structural framing members, particularly fabricated timber bearers and joists, should be of suitable durability if exposed or partly exposed to the weather. Cut ends, joints and notches should be treated strictly in accordance with the manufacturer's recommendations and are particularly vulnerable to degradation if they occur in a weather-exposed location. Manufacturer's recommendations may also require a fullpaint system to be applied to H3 LOSP treated members.

BUILDING INSPECTION

The Ascot and Morayfield collapses make it imperative that building inspectors be particularly diligent when inspecting external decks and balconies.

Any concealed fixing points or areas of concealed framing that are reliant upon sealant to prevent water penetration should receive close attention and may warrant recommending a special purpose inspection report that may include intrusive investigations.

Structural framing members and connections should be inspected and their suitability for external use assessed and reported. Inspections should determine if building movement, weather or other effects have compromised any of the fixing details as occurred in the Ascot residence.

Balcony balustrades and handrails should be carefully inspected to ensure the material used to build them is structurally sound and any joints are rigidly fixed and not deteriorated by weather. In addition to structural adequacy, the balustrade must also be assessed against the dimensional requirements of the Building Code of Australia (heights, gaps etc). Finally, the importance of routine and ongoing maintenance should be impressed upon the current or prospective homeowner.

SUMMARY

This publication aims at increasing your awareness of some of the risks associated with the construction, maintenance and inspection of timber decks and balconies and in doing so hopes to minimise the likelihood of future balcony and deck collapses occurring.

REFERENCES

- Building Code of Australia
- The State Coroner's findings in relation to the death of Annette Lee Spencer in the Ascot collapse

ACKNOWLEDGEMENTS

- Timber Queensland www.timberqueensland.com.au
- Peter Wright RPEQ - for permission to use his sketches in this publication

FOR MORE TOOLS

Visit qbcc.qld.gov.au or call us on 139 333.

Need more information?

Visit qbcc.qld.gov.au or call us on 139 333.



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