

Craig Zerk

Consulting Engineer

Registered Professional Engineer of Queensland

General Manager
Ballina Shire Council
PO Box 450
BALLINA NSW 2478

20 April 2017
Ref No. 770108

Dear Sir,

Assessment of Damage to Property at 7 Castle Drive, Lennox Head

This is to advise that an inspection of 7 Castle Drive, Lennox Head was conducted by the undersigned on 6 April 2017 for the purpose of reporting on tree root damage to the dwelling and associated concrete pavements and masonry walls.

The owners of the property Mr. and Mrs. Lowry were also interviewed and a previous report prepared by Peter Lucena and Associates Pty Ltd (19 August 2015) was reviewed along with design documentation for the dwelling.

1. Background

The property includes a single storey rendered brick veneer dwelling that is approximately 17 years old and is located on the northern side of Castle Drive. A concrete driveway, approximately 30 metres long and of varying width, extends from Castle Drive up a 2 metre high slope to a level building pad that accommodates the dwelling. A large fig tree is located within the road reserve and approximately 12 metres from the south-eastern corner of the dwelling.

The building has been constructed on a building platform created by cut and fill earthworks. The front of the dwelling is located on the filled part of the platform, however the design drawing (refer to foundation sketch attached) indicate that the footings of the dwelling are supported on 450mm diameter concrete piers founded in natural ground. The design of these piers is such that they would resist downwards loads but not upwards loads.

It is noteworthy that the design documentation recommends as follows:
"a root barrier is placed between any tree and the dwelling if the trees are in the zone of influence. Please refer to 'Home Owner Responsibility for Care of Foundations' for details" (refer to the attachment).

It appears that the house does lie 'within the zone of influence', however it cannot be confirmed whether a root barrier has been installed.

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2. Site Observations

While a tree root was observed on the property in only one location close to the south-western corner of the dwelling, damage to brickwork and concrete pavements is apparent in a number of locations at the front of the dwelling as described below and indicated in the attached Drawing No. 108-01.

a) Leaning pillar at the dwelling entry door

The Lucena report makes note of evidence that the soffit lining around the top of this pillar on the eastern side of the house has been repaired in the past. There is a gap in the edge trimming around the soffit which indicates that the top of the pillar has rotated outwards from the dwelling by about 15 millimetres (refer to Photo No. 1). This lean in the pillar however is otherwise not perceptible to the naked eye.

This 600mm x 600mm x 2.8m high brick pillar is attached to a brick privacy screen wall that extends across part of the southern side of the dwelling and returns to the south-eastern corner of the dwelling. According to the design drawings for the house, both the brick pillar and the associated brick privacy screen wall are supported on concrete piers.

Comparison of the photographs taken in 2015 and 2017 indicate that the degree of rotation of the pillar may have increased slightly over the past 20 months.

b) Driveway slab

The driveway to the house comprises a number of panels of pebblecrete concrete separated by contraction joints as indicated in Drawing No. 108-01.

As noted in the Lucena report, the driveway slab has lifted at the construction joint against the garage slab and this has induced significant cracking within the panels of concrete slab that adjoin the garage (Refer to Photo No. 2). At the junction with the garage, the driveway slab has now lifted by up to 30mm (Refer to Photo No. 3) and comparison of the photographs taken in 2015 and 2017 indicate that the amounts of movement and cracking in the slab appear to have increased over the past 20 months.

One of the cracks at this location also propagates across a contraction joint in the driveway slab into an adjoining panel of concrete to the south (refer to Photo No. 4).

A crack is also present in the next panel (that extends out to the property boundary). However this crack may be a shrinkage crack induced by the acute shape of this panel of concrete. At the front boundary of the property, the contraction joint in this panel has a significant step of up to 15mm high (refer to Photo No. 5). It is uncertain whether this can be attributed to tree root action or settlement of the adjoining slab. It is noted that a sewer line traverses beneath the adjoining slab and consolidation of backfill within the associated pipe trench offers a possible alternative explanation for this discontinuity in the driveway level.

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While comparatively minor cracks are also evident in the driveway sections located further to the south within the road reserve, here there is no evidence of vertical displacement of the slab and these cracks typically traverse across the driveway and do not appear to emanate from the upper sections of the driveway where the tree root damage is strongly evident. It is therefore more plausible that these are shrinkage cracks which often occur in driveway slabs where the spacing of joints exceeds 3 metres.

c) Masonry wall adjacent to garage

This brick privacy screen has been built on top of the driveway slab that extends across the front of the western side of the dwelling. This slab has also lifted as evident from the step in the joint where the slab abuts the house (refer to Photo No. 6).

As noted in the Lucena report, the top of this wall has also rotated outwards away from the house (Refer to Photo No. 7). This is consistent with the upwards movement of the driveway slab, which is likely to have been pushed upwards by the tree root that extends across the front of the house.

At this location, the concrete slab has now lifted by up to 25mm and comparison of the photographs taken in 2015 and 2017 indicate that the amounts of movement and cracking in the slab appear to have increased over the past 20 months.

d) Path on the western side of the house

As noted in the Lucena report, the 1.3 metre wide path on the western side of the house has separated from the house by about 30 to 40mm (refer to Photo No. 8) and in parts there is evidence that the path has lifted. There are also cracks in this path (refer to Photo No. 9) which have most likely been caused by the lifting of the slab.

As noted in the Lucena report, this movement has been caused by the tree root extending along the western side of the house. This tree root is probably the same tree root that extends across the front of the house.

e) Diagonal crack in brick wall (east side)

As noted in the Lucena report, a diagonal crack is located on the (eastern) side wall at the south-eastern corner of the house and this crack follows the bed joints in the brickwork (refer to Photo No. 10).

The Lucena report suggests that the crack is "associated with subsidence of fill that this corner of the house is sitting on".

However the design drawings indicate that this corner of the house is supported on concrete piers that extend through the fill. Also there is no evidence of cracking elsewhere in this eastern wall of the house even though the design drawings indicate it is supported by a sequence of concrete piers that extend along almost the entire length of this wall.

This part of the building is closest to the fig tree and since the most significant structural movement observed on the site is evident on the southern side of the house, it can be concluded

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that the tree root traverses east-west across the front of the house. It is important to note that the pattern of the cracking indicates that at this location, the top of the brickwork in the southern wall has rotated outwards from the building (towards the south, in a similar fashion to both the adjoining brick privacy screen wall and the entry pillar). In addition to rotating towards the south, this cracked section of brickwork has also rotated outwards towards the east.

On the basis of the above, and in the absence of any evidence that the piers specified in the design drawings have not been provided in full, it is concluded that this crack is more likely to be attributed to tree roots.

Comparison of the photographs taken in 2015 and 2017 indicate that the amounts of movement and cracking in the brickwork at this location appear to have increased over the past 20 months. This is consistent with the cracking observed elsewhere on the property.

3. Conclusions

Fig trees are known for their extensive root systems with a strong propensity to lift pavements, kerbs and structures. As is evident elsewhere within Ballina, these root systems often cause distortion and cracking in masonry structures.

The location and pattern of the structural movement in the driveway and footpath pavements and the brickwork at the front of the house indicate that root(s) emanating from the fig tree located about 12 metres to the south-east of the house are likely to have caused the damage described in Section 2 above.

While there are cracks evident in almost every panel of the concrete driveway, some of the cracks, particularly those located close to or within the road reserve, may have been caused by shrinkage - as is often the case with driveway slabs.

4. Recommended Rectification Works

While the tree root damage to the driveway slab is strongly evident only in the concrete panels closest to the garage, it is recommended that the extent of the driveway replacement work extends to the front boundary. There are two reasons for this recommendation:

1. It will be difficult to match the existing pebblecrete finish and having a slightly different concrete finish occurring at the property and extending to the road could be considered to be an acceptable outcome
2. The 15 step in the driveway pavement at the property boundary could thus be corrected

It is recommended however that this issue is discussed further with the property owner.

The following scope of rectification works are therefore recommended to address the damage that appears to have been caused by the tree root(s):

- a) Remove the privacy screen on the western side of the garage.
- b) Remove the 1.3metre wide footpath on the western side of the house and all of the driveway slab between the garage and the contraction joint at the front boundary.
- c) Locate and remove the subject tree root and backfill the excavation with granular material.

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- d) Re-lay the 1.3metre wide footpath on the western side of the house and the driveway slab between the garage and the front boundary.
- e) Remove and replace the cracked brickwork at the south-eastern corner of the house.
- f) Re-construct the brick privacy screen on the western side of the garage.
- g) Bag and paint the restored brickwork.
- h) Provide new painted timber trimming around the top of the brick pillar at the entry to the house.

Yours faithfully,



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Encl.:

- 1. Photos. No. 1 to 10
- 2. Drawing No. 108-01
- 3. Foundation sketch
- 4. Home owner responsibility for care of foundations

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Photo No. 1 – Leaning brick pillar at the entry to the house.

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Photo No. 2 – Typical cracking of the concrete driveway slab abutting the garage floor slab.

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Photo No. 3 – Lifted concrete driveway slab abutting the garage floor slab. Note the presence of cracks.



Photo No. 4 – Reflected cracking across a joint in the driveway slab.

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Photo No. 5 – A step in a contraction joint in the driveway slab at the property boundary.

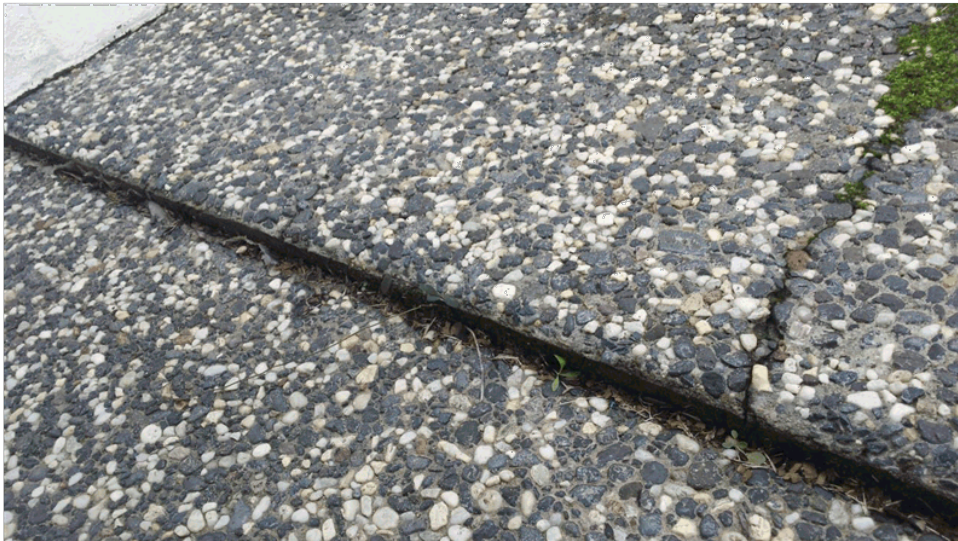


Photo No. 6 – A step and crack in the slab behind the privacy screen on the western side of the garage.

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Photo No. 7 – Rotation of the brick privacy wall on the western side of the garage as evident from the gap that has opened up in the vertical joint.

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Photo No. 8 – Separation of the 1.3metre wide path from the wall on the western side of the house

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Photo No. 9 –A crack in the 1.3 metre wide concrete path on the western side of the house

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Photo No. 10 – Cracking in the brick wall at the south-eastern corner of the house.

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