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## Review of Quantified Tree Risk Assessments

There are a number of serious concerns about the scientific rigour associated with the Quantified Tree Risk Assessment (QTRA) conducted by Treelogic and other arborists.

This review is not funded by any lobby group. The motivation is that as an international expert in risk assessment with 25 years experience I need to speak out when I see risk assessments that are seriously flawed, and to use such risk assessments for decision-making can lead to poor decisions.

*Quantified Tree Risk Assessment Fig Trees in Laman Street, Cooks Hill – Newcastle Treelogic, 2 September 2009.*

1. The probability of one tree failing per year is estimated as 1/7.5 per tree per year. Since there are 14 fig trees then one or two trees should be failing each and every year. Such a high failure rate is not being observed.

2. The two trees that "failed" during the June 2007 storm did not fall over, nor did they pose any hazard to property or people. The trees moved, but remained standing. No branches fell. They were a "serviceability" failure, and not a hazardous failure as assumed in the Treelogic report.

3. The annual probability of failure (per tree) is taken as 2/15 or 1/7.5 because two figs "failed" in the June 2007 storm. There were no failures in 2008 or 2009, so using the same logic as the report uses the annual probability of failure should be 0/15=0%. Clearly, this would be non-conservative, but the annual probability of failure is considerably less than 1/7.5 if a longer time period is considered. For example, if 2 figs failed in 10 years, then the annual probability of failure is 2/15/10 or 1/75.

4. The calculated risk of harm of 1/19.8 per year per tree is incredibly high and fails any reasonable 'reality check'. According to Table 1 of the report, walking or driving along Laman Street is 10 times more hazardous than smoking 10 cigarettes a day, or based on other sources, 10 times more dangerous than downhill skiing. Such large risks due to trees are difficult to believe. Since there are 14 fig trees then, then the probability of harm in Laman Street is $1-(1-1/19.8)^{14}=52\%$ per year. This means there must be a fatality or serious injury once every two years. Such a high risk is not being observed.

5. The risk of harm for trees in areas of high public use in the U.K. is 1 in 10 million. This means that one fig tree is 500,000 times more hazardous than a typical tree in the U.K. Such a high risk is hard to believe.

6. The Treelogic report based its statistics on there being 15 trees in Laman Street immediately prior to the June 2007 storm. In fact, there were 16 trees.

7. Since figs are likely to fail in times of high wind (during a storm), then this is usually a period of reduced pedestrian activity which would reduce the target rating to much lower than 1/2.64

8. The QTRA treats the impact potential of pedestrians and vehicles as identical. In many cases a vehicle will provide protection to occupants as the vehicle frame will absorb some of the impact of a falling tree. Impact potential for vehicles is likely to be less than for pedestrians.

9. Impact potential is taken as 1/1 or 100% probability of harm if a tree falls on a pedestrian or vehicle. While a large limb may cause injury, it will not necessarily cause death. Moreover, vehicle occupants should have a reduced impact potential when compared with pedestrians. The mode of failure of figs is also important, as a tree that fails slowly (as opposed to sudden, brittle failure) will allow sufficient warning time for exposed individuals to move to a safer location. Just because you happen to be standing somewhere under the tree canopy also does not mean there is 100% surety of being hit. Since the tree canopy spreads over 20 m the true impact potential will be 25% or less (e.g. a falling tree will more likely fall away from you than fall directly on top of you).

10. A peak wind speed of 124 km/h experienced during the June 2007 storm was not that exceptional. The annual probability of exceeding the wind speed (124 km/h) is 58.7% according to latest CSIRO modelling of wind speed at Nobbys lighthouse. What was exceptional was the rainfall. The daily rainfall of 209.8 mm was the second highest on record in the past 40 years. Wet soil will reduce soil strength which can contribute to root plate failure. So it appears that it was the combination of high wind and exceptional rainfall that contributed to the two trees failing during the June 2007 storm. The Treelogic report only considered the effect of wind speed.

11. For an arborist to claim they are a “licensed QTRA practitioner” requires the completion of a one day training course. There are many issues associated with a QRA (Quantified Risk Assessment) whether it be for a tree, ship, building, dam, etc - one days “training” is not sufficient. Even a week’s training would not be enough to undertake independent assessments. A QRA for a chemical process plant, dam, airport, etc. would require the practitioner to be tertiary qualified (BE or BSc), preferably with postgraduate experience and work-place training under the supervision of an experienced practitioner. Most arborists are not tertiary qualified, and do not have the advanced mathematical, statistical and probability skills needed to undertake a QTRA.


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*Laman Street Figs, Cooks Hill Newcastle Quantified Tree Risk Assessment Treelogic, July 2010.*

This report considers the effects on the QTRA if the NCC implement risk management measures such as closure of Laman Street to all east traffic, warning signs, removal of seating in Civic Park, etc. as well as closure of Laman Street in times of high wind. In principle, these measures should reduce the target evaluation considerable as most failures occur in high winds and closure of Laman Street will reduce the number of pedestrians and vehicles. However, the report assumes that members of the public will ignore these warnings (and common sense) and that these violations will reduce pedestrian and vehicles by a factor of only 7.5. A larger reduction could be expected.

*QTRA for a Typical Large Tree*

A QTRA is conducted for a large tree in a park using recommended values from the developer of QTRA (Ellison, M.J. 2005, Quantified Tree Risk Assessment Used in Management of Amenity Trees, Journal of Arboriculture, 31(2): 57-67).

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|---|---|---|
| Target Evaluation | 1/27 | 10 pedestrians per hour (Table 2) |
| Impact Potential | 1/2.03 | Large tree of 450 mm diameter (Table 4) |
| Probability of Failure | 1/100 | 'Low' probability of failure (Table 6) |

Risk of harm = 1/27 × 1/2.03 × 1/100 = 1/5,481

This would exceed the risk acceptance level of 1/10,000 and so risks from a large tree in a Newcastle park would be judged as unacceptable according to the QTRA method. This type of result fails a 'reality check' and suggests that the QTRA method may lead to conservative outcomes. A quantified risk assessment should not be conservative, but estimate the risk as accurately as possible by using mean values. However, if the probability of failure is judged to be 'very low' then Probability of Failure=1/1,000 and Risk of harm = 1/54,810 which would be judged an acceptable risk. The probability of failure is subjective and the QTRA method provides no statistical or probabilistic approach to quantify this crucial variable.

*Summary*

The issues raised above, all suggest that the QTRA should be subject to rigorous and independent review to judge the veracity of the calculated risks.

Yours sincerely

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