1 The benefits of upgrading to VALID

The case for upgrading DSG's tree risk management and assessment with VALID

1 This is a briefing note for the General Manager State Roads, Department of State Growth (DSG), Tasmanian Government. The note explains why DSG is updating their approach to tree risk-benefit management and assessment with **VALID**. DSG based their original Tree Risk Management Framework on QTRA. VALID has many substantial improvements which are explained on this page. On the other hand, it's now clear there are critical shortcomings in QTRA and we cover these on the next page.

1.1 Tree Risk-Benefit Management Strategy

VALID is a complete Tree Risk-Benefit Management and Assessment system

2 VALID is a complete Tree Risk-Benefit Management and Assessment system and not just another way of assessing tree risk. At its core is a Strategy that explains why and how the DSG is taking a reasonable, proportionate, and reasonably practicable approach to managing the risk from trees or branches falling. This establishes the context of any risk-benefit assessment. In the extremely unlikely event that a tree kills or injures someone on a state road, and there's a threat of legal or enforcement action, it's the Strategy that equips DSG with robust lines of defence about how they managed the risk.

1.2 VALID's risk model

VALID's risk model has been developed with a Risk Professor

3 We built the engine of how VALID calculates risk with a Professor of Natural Hazards & Risk Science. The Professor's an internationally distinguished expert in this field and has driven the model to breaking point:

> *"We have stress-tested VALID and didn't find any gross, critical sensitivities. In short, the mathematical basis of your approach is sufficiently robust and dependable for any practical purpose."*
>
> Willy Aspinall
> Cabot Professor in Natural Hazards & Risk Science
> University of Bristol

1.3 Comprehensive, uncomplicated, & cost-effective

Ease of use & improved consistency
Reduced chances of error
Increased cost-effectiveness

4 VALID's strategic approach to managing the risk by Passive and Active Assessment is much easier to understand and carry out at every level, and it's more cost effective. By substantially reducing the complexity, we increase consistency in application and reduce the chances of assessor error.

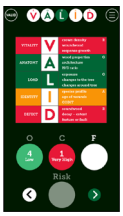
There are only 2 road use zones instead of 10

5 We'll only have 2 zones of road use instead of 10 in the QTRA framework. Roads that have a traffic volume of 1400 vehicles per day or more, no matter the speed limit, are high-use zones. We'll manage the risk on all state roads with Passive Assessment, day in day out. We'll manage the risk on high-use roads with Active Assessment, at a Basic Drive-by level, every 5 years.

Field staff only need to identify 5 Obvious Tree Risk Features

6 Field staff who carry out Drive-by Assessments have had **Basic Validator** training in essential tree risk assessment. They're trained to recognise 5 Obvious Tree Risk Features, make decisions about Emergency Callouts and Priority 1 Work, and when to get a **Validator** (trained Arborist) in to take a closer look. With the QTRA framework, field staff had to align pre-defined and questionable tree defect categories with a Probability of Failure range, and the tree part Size Range, for each of the 10 road use zones.

Validator consistency



7 Consistency with VALID is a key asset. In the Tree Risk App, we gain consistency by making Likelihood of Occupancy and Consequences decisions painless. Then, with a unique and innovative approach to the challenging Likelihood of Failure assessment. That is to break Likelihood of Failure down into bite-sized decisions for each letter of the VALID mnemonic. How these letters are coloured guides the Validator to a base rate colour, and then to a Likelihood of Failure category. The App also prints a one side of A4 pdf report that has the same design and formatting, no matter who's assessed the risk.

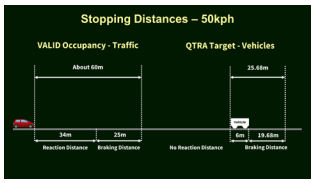
2 Some critical issues with QTRA

Several critical faults in QTRA are now clear

8 DSG adopted the QTRA approach to tree risk when developing the Tree Risk Management Framework in 2015. They regarded it as the most robust tree risk assessment out there. Since then, important faults in how QTRA assesses risk have come to light and we explore some below.

2.1 Traffic likelihood of occupancy

Vehicle Targets are systematically undervalued



9 The way QTRA works out the Targets for 'Vehicle Occupation' is to calculate it from speed limits and stopping distances, plus a 6m vehicle length. There are substantial problems with how QTRA goes about this. Most importantly, there's no recognition and reaction time. In Australian (and International) highways literature, the recognition and reaction time most commonly cited is 2.5 seconds. 2.5 seconds is significant additional exposure to the risk that's not counted. On top of that, tree failures are most likely during storms when roads are wet. The braking distances in QTRA are too short for wet roads.

2.2 Risk undervaluation

The highest risks are x10 too low

10 QTRA's systemic stopping distance errors mean it chronically undervalues 'Vehicle Targets'. The busiest roads all have an occupancy that's greater than QTRA's highest Target, Range 1. Though less relevant for roads, the busiest pedestrian zones are even more undervalued. If Targets are undervalued, then so is the risk. This means QTRA Users regularly understate the highest and most important risks. Target errors alone mean the risk is usually too low by a factor of x10, and it's even further out for people, or traffic and people.

2.3 Size ranges and consequences

Size Range and Impact Potential consequences aren't credible

Size Range	Size of tree or branch	Impact Potential
1	> 450mm (>18") dia.	1/1 - >1/2
2	450mm (18") dia - 260mm (10½") dia.	1/2 - >1/8.6
3	250mm (10") dia. - 110mm (4½") dia.	1/8.6 - >1/82
4	100mm (4") dia. - 25mm (1") dia.	1/82 - 1/2 500

* Range 1 is based on a diameter of 600mm.

11 The Size Ranges are integral to the QTRA framework. However, there are fundamental problems with how QTRA measures these Impact Potential consequences. Apart from the obvious premise that a larger tree part is more likely to cause greater injury, the Size Ranges aren't credible. This is why:

- 600mm is a 1/1 fatal consequence. There's no evidence to support this. It's simply the largest diameter in the allometric data used. 600mm is also the weakest data because there are so few data points. All QTRA Size Ranges are scaled from this 600mm baseline presumption.
- Size Range 1 is a 1/1 - >1/2 of a fatality. At less than a factor of x2, this is too accurate and compact a range to be believable. Similarly, Size Range 2 is also a narrow range at a factor of about x4. It also introduces a far-fetched two significant figure decimal point accuracy at 1/8.6 of a death.
- Size Range 4, by comparison, is extraordinarily wide at a factor of x30. It measures consequences down to 1/2500 of a fatality. In the medical professions' Abbreviated Injury Scale the lowest rating is a minor injury, which is not much less than 1/300 of a fatality. QTRA is claiming to measure injuries x8 lower than the medical profession does.

2.4 Risk calculation credibility

'Risk of Harm' outputs are too accurate to be plausible

12 Tree risk has too much uncertainty to claim single figure accuracy, which QTRA does with risks like 1/4, 1/300, 1/20 000, or 1/5 000 000. Neither is it plausible to claim a measurable difference between a risk of 1/10 000 and 1/50 000. Or then to modify these risks by point values like 0.25 or 2, 3, or 4.

QTRA fails some basic reality checks

25mm deadwood over busy roads is not an 'Unacceptable Risk of Harm'

13 With QTRA, a 25mm diameter (Size Range 4) piece of deadwood over a Target Range 1 road, with a Probability of Failure Range 1, is a risk between 1/500 and 1/2000; depending on whether a 'reduced mass' factor of 0.25 or 0.5 is applied by a QTRA User. This is an Unacceptable risk. If we reality-check this, there are countless 25mm diameter pieces of deadwood over such roads. Yet, self-evidently all these Unacceptable risks are not happening.