Two Aspect Roundabout Metering Trial

Tauranga Update

WAKA KOTAHI
NZ TRANSPORT AGENCY

New Zealand Government

Background

Waka Kotahi NZ Transport Agency identified two state highway roundabouts in Tauranga where excessive peak period queuing was occurring. These were:

- Barkes Corner Roundabout– the intersection of SH 29A, Pyes Pa Road and Cameron Road;
- Elizabeth Street Roundabout – the intersection of SH 2, Elizabeth Street and SH 2 right side off ramp to Elizabeth Street.

Queuing at Barkes Corner was extending west through the SH 36, SH 29A, Takitimu Road (toll road) roundabout in the evening peak, restricting southbound toll road users from exiting the toll road and contributing to slow journey times through Tauriko on SH29. Pyes Pa Road local traffic was developing extended queuing northbound in the morning peak.

Queuing at Elizabeth Street Roundabout resulted in SH 2 morning peak southbound queues extending back over 1km north, to the Tauranga Harbour Bridge. The morning peak delays were having a significant effect on southbound freight leaving the Port of Tauranga, with the inbound commuter traffic to the CBD controlling the roundabout.

Aurecon investigated potential options to reduce the delays to traffic and undertook traffic modelling and stakeholder workshops. Within the budgetary limits of the Minor Efficiency Programme, signalised metering was recommended as an effective solution in the short to medium term.

Barkes Corner

For Barkes Corner, the first design was for three aspect metering signals, for the Pyes Pa Road northbound approach, to provide more through capacity for SH 29A eastbound traffic, to shorten the queue and relieve Takitimu Road Toll Road in the evening peak. Similarly, three aspect metering signals were designed for the SH 29A westbound approach to the roundabout to relieve queues on Pyes Pa Road in the morning peak.

SH2 Elizabeth Street

For Elizabeth Street metering signals were designed for the SH 2 off ramp to provide more through capacity for the SH 2 southbound traffic. The Elizabeth Street project included addressing evening peak queuing on Elizabeth Street, leaving the CBD via SH 2. Installing metering signal on this approach is currently on hold, awaiting Tauranga City network alterations.

Safety Issues at Barkes Corner with 3 aspect signals

Within 4 days of commencing metering at Barkes Corner, the signals were turned off as some drivers misunderstood what they meant. With safety being the primary focus it was essential that we understood what was happening and why. Issues were:

- Some drivers were interpreting the green signal to mean that they did not have to give way at the roundabout. Crashes occurred at the roundabout from both metered approaches, where drivers had continued into the roundabout without giving way;
- From comparing the camera footage from before the signals were operating to after operation commenced, entry speed into Barkes Corner roundabout increased, when the signals were on;
- Safety concerns were raised by school bus operators who feared that a driver would collide with a bus on the roundabout;
- On the SH 29A westbound approach, due to physical constraints, one of the signal poles (a tertiary display), was installed closer to the roundabout than the recommended minimum 30m;
- Social media showed mixed understanding.

Why do we have a problem?

Tauranga has three fully signalised roundabout installations. One of these is at Brookfield, managing a complex intersection combining three off set T intersections into one. This is a busy intersection next to a popular shopping centre with schools nearby. Local drivers are familiar with this intersection. The other two intersections are on SH 29A, one at Welcome Bay Road and one at Maungatapu. Both on the same state highway as Barkes Corner. If travelling from Te Maunga along SH 29A, one has driven through two signalised roundabouts before arriving at the metering signals at Barkes Corner, 4.5km away.

This suggests a pre-existing condition and expectation that the roundabout metering installation is the same. The signal is green, so I have right of way.

There were media releases explaining how the metering would operate and how it was different. Variable message signs were in place on the two metered approaches advising motorists.

As professionals we understand it quite clearly, we designed it and know how it works, but will everyone else?

What do we do to resolve the safety issue?

A working group was convened, made up of NZ Transport Agency, Tauranga Traffic Operations Centre staff and Aurecon traffic signal designers and road safety experts.

The group worked through options to make the green signal less obvious to maintain compliance with the TCD Rule. The group consensus was that if the green was still there, the risk remained that drivers would continue into the roundabout.

The Australian Two Aspect system was investigated. AS1742.14.2014 – Manual of Uniform Traffic Control Devices – Part 14 Traffic Signals is the underlying applicable Australian Standard. Section 7.4 that relates to roundabout metering, allows metering signals as close as 3m to the roundabout give way limit line and states "*green signal aspects are omitted as they could cause confusion with the requirement to give way at the roundabout holding line*". The signals operate as follows:

- Two aspect signal (yellow and red);
- A green is not displayed at any time;
- When the NZ three aspect system displays green, in Australia there is no display. The driver sees nothing but a two-aspect display;

Australia has multiple installations across different States.

Gazetting

The NZ Transport Agency encourage anyone thinking about a trial to talk to them first.

A conference call was set up between members of the working group and Mark Edwards and Glenn Bunting (NZ Transport Agency Wellington), to discuss the Tauranga roundabout metering safety issues and our reasoning for a two-aspect trial.

When considering a trial, it is important to:

- Have a good understanding of the issue;
- Understand why the current solution doesn't work;
- Have a logical story as to why the proposed trial, which is outside of the current legislation, will work;
- Understand how you will prove that it has worked.

Trial purpose

- Enable the installation and operation of two-aspect traffic signals as an alternative to three-aspect traffic signals;
- Evaluate the safety and effectiveness of two-aspect traffic signal control at the approach to a roundabout when signal control is being used to periodically manage (meter) the traffic flow entering the roundabout;
- Assess driver understanding and compliance with two-aspect traffic signals;
- Assess driver behaviour at the approaches controlled by two-aspect traffic signals.

Implementation and Operation

The two-aspect metering signals operate as follows:

- a steady yellow signal displayed for at least three seconds, followed by;
- a steady red signal, displayed for at least three seconds and timed to address the traffic delay issue, followed by;
- a blank display for at least three seconds, followed by the sequence commencing with the steady yellow, when appropriate;
- when metering is not required neither a yellow nor a red aspect is displayed.

Monitoring Results

Driver recognition and compliance

- No observed safety concerns or misinterpretation of roundabout give-way rules have been recorded during regular intervals of visual inspection of the roundabout operations, via remote cameras within the Tauranga Traffic Operations Centre (TTOC);
- There are a small number of instances of drivers not complying with the red signal, but still complying with the give-way rules;
- Visual observations of the trial observed drivers slowing when approaching the blank display and approaching the roundabout more cautiously and at a slower speed compared to the approach speeds during the three-aspect trial.

Feedback from road users

- There is a noticeable reduction in customer complaints / comments between the pre-trial “full green” roundabout metering and the two-aspect trial. The change is from concerns over safety and understanding how to use the “full green” metering to comments on the operation benefits and traffic queuing.

Results

Operational issues and incidents

Normal roundabout operation has continued since commencement of the two-aspect trial, with drivers giving way at the roundabout limit lines.

There have been no amendments necessary to the road layout or signal phasing since the start of the operation of the trial. Surge detection has been implemented at Elizabeth Street, SH 2 roundabout.

The signal timings and settings are being adjusted and refined during the trial by TTOC to improve traffic throughput during the metering phasing.

Performance

The benefits of the roundabout metering have been to reduce the high peaks of long delays approaching the roundabouts, to provide more reliable journey times. There is no data to suggest that there is any difference in the efficiency gains between a three aspect and two aspect display for roundabout metering.

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Safety

The number of recorded crashes since the two aspect signals have been operating is of a level similar or less than prior to the installation of the signals. There is a lower crash rate than during the three-aspect “full-green” operation.

Although there is some non-compliance with the red signal, this is not a safety issue.

Conclusions

Safety is paramount, and the issues at Barkes Corner and Elizabeth Street roundabouts was were quickly recognised and responded to. Decisions were made quickly, and the good communications and collaboration between the NZ Transport Agency, TTOC and Aurecon resulted in effective outcomes.

Monitoring at both roundabouts confirms the efficiency gains of roundabout metering and the safety benefits of the two-aspect signal display compared to the three-aspect display in Tauranga.

SH 2 Takatimu / Elizabeth Metering

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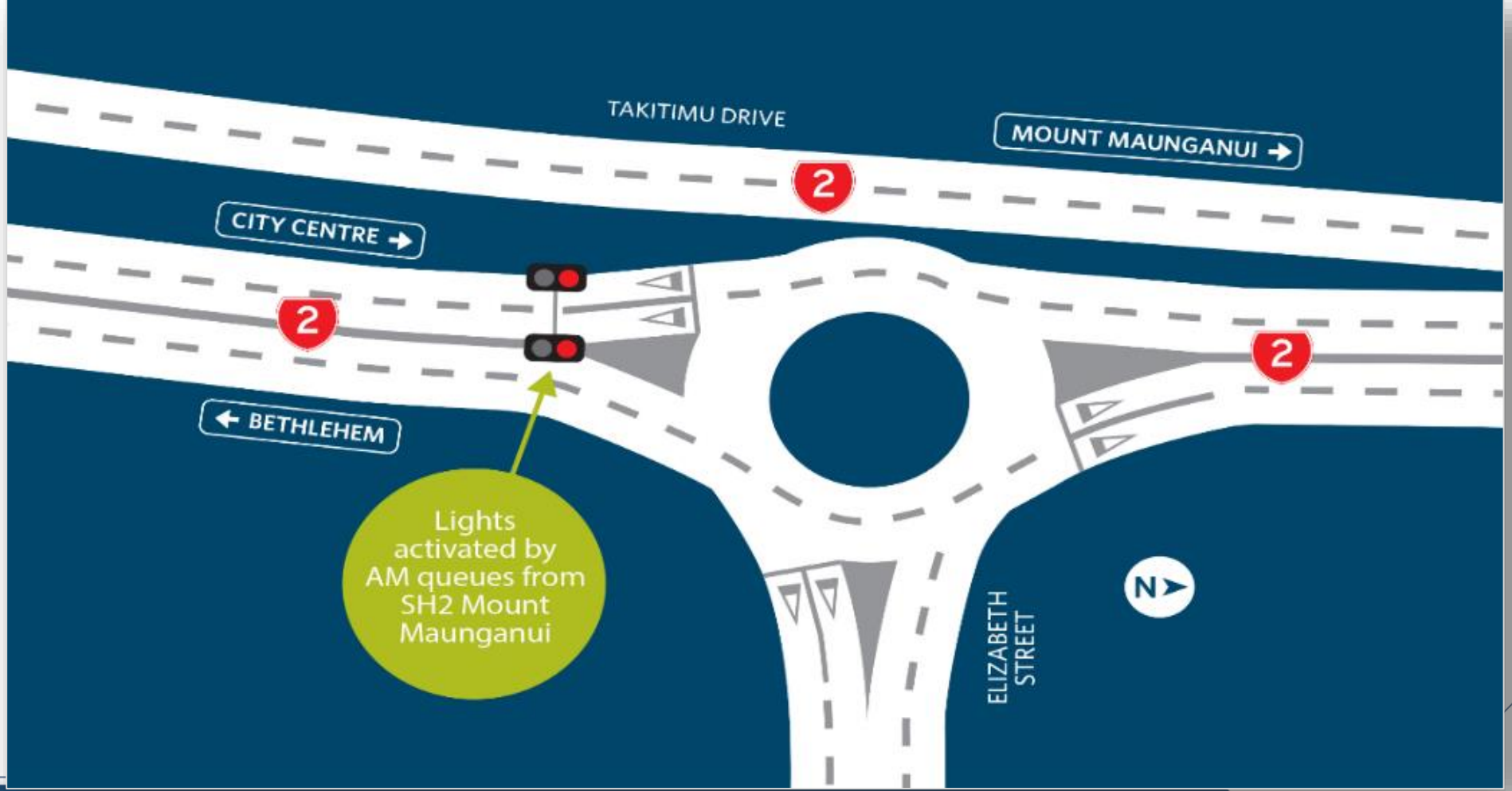
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