

A Safety Innovation for Closely Spaced Intersections

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10 Year Alliance to June 2018



Auckland Motorways

New Zealand Government

Auckland Motorways Alliance

Why a maintenance alliance?

- Not a big network in terms of length (230 centreline km)
- But very busy (900,000 vehicles per day)
- Congestion effects over much of the day, impacts on freight
- Complexities – constrained between urban land uses
- NZTA wished to bring together the best team, working cohesively to manage the network
- Maximise opportunities to identify innovations, efficiencies

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Many Auckland Motorway interchanges have a diamond configuration.



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Diamond interchanges are popular as they

- Accommodate all turns
- Are reasonably compact in terms of footprint
- Can start off with priority controls, easily upgradeable to signals when demand increases
- Provide reasonably good safety, including for cycles and pedestrians

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Diamond interchanges feature two intersections with a local road, one at the terminal of each off ramp. These are usually signalised at the busier interchanges.

In a constrained urban environment this can produce two sets of signals, very closely spaced.

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Auckland Motorways Crash Reduction Study has identified some issues with such off ramp terminals under signal control:

- Red light running is a serious issue
- Drivers may be inadvertently running the red
- Confusion is created by the proximity of the two intersections
- Police crash reports show both drivers believe they had a green signal

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Possible reasons:

- Drivers starting from introduction of a green phase at the first intersection may not recognise the red at the second,
- At the second intersection drivers might anticipate the red changing to green, but this doesn't always follow – depending on the calls
- Drivers stopped at the first set of signals may see the lights ahead turn green and start off

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- Where possible clearing vegetation to open up visibility splays has been found to be beneficial in reducing crashes
- Drivers better recognise the second junction if they can see the side road approaches
- Bridge edge barriers (motorway underpass) or bridge abutments (motorway overbridge) hide the side roads, so drivers fail to recognise the intersection beyond

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Other remedial actions include:

- Using 300mm displays at the up stream intersection
 - Only addresses the upstream intersection
- Using overhead mast arms
- Increased all red time
- Red light cameras?

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Motorway overpasses particularly noted to have HA and LB type crashes:

- Cone of vision along local road reduced – tunnelled down or driver attention drawn to brighter pavement beyond the overpass
- FSD to primary signal may be limited by the motorway overpass



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Motorway underpasses can also have problems, with JA type crashes

- Particularly where the bridge hand rail obscures the side road (off ramp) approaching the second junction



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- How can we improve driver recognition of the second set of signals?
- Change therefore needed in the driver focus area – not the periphery
- Confirmed by failure to notice large numbers of signal displays or confused by them

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A new concept:

- Introduce additional signal phase indication within the pavement area, by using Illuminated Raised Pavement Markers (IRPM's) such as "Smartstuds"TM
- No change required to legislation
 - Does not alter the pre-existing signal displays, which remain as the main signal phase indication
- No change required to controller
 - Low wattage of system

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Concept Development:

- IRPM's placed along lane lines and edgelines approaching the second intersection limit line, but well clear of the upstream intersection
- Possible placement across the limit line
- Align LED's so they are only visible in close proximity to the second intersection, such as by recessing the LED unit into the pavement
 - reduces impact on motorcycles

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Concept Development:

- Dual colour LED's in orange and red, or red only?
 - Red and orange co-ordinated with second set of signals' displays maximises warning period to approaching drivers
 - Red only not favoured as red colour conflicts with orange, or does not display then

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Extensions of the Concept:

- Locations where signal displays lack conspicuousness
- Locations where glare/sunstrike reduces effect of signals
- Parallel controlled approaches
 - Nelson Street off ramps
 - Wellesley Street off ramps
- Fire/Ambulance stations

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Next step:

- Proof of concept – actually linking IRPM's to controllers
 - Has been successfully done in North America, using IRPM's to illuminate turn lane continuity lines when the phase is called
- Approval for trial from NZTA
- Selection of a suitable trial site
 - Use CRS experience to find best site

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Watch this space...

Thank you

Any Questions?