

Response to issues raised during the hearing

Legality of driving in a bus lane

See clause “2.3 Use of lanes” of the Road User Rule.

“A driver may also drive wholly or partly in a lane that is unavailable to the driver under subclause (1) or clause 4.6(2) to (4) if the driver— drives in the lane for the minimum length necessary to complete the manoeuvre and for no more than a maximum length of 50 m”

Legality of proceeding straight ahead

Obviously, that is not legal as shown by the sign. But it’s also not enforced hence you will not find straight through drivers queue up behind right turners; they will undertake that right turner. See short video clip.

Colour-blind relatives

Mr Commissioner, since your father’s days of colour-blindness, traffic signals have somewhat improved and become brighter, and are less affected by setting sun.

With regards to Mr. Herries’ son, it needs to be noted that there are different degrees and different forms of colour-blindness. And I also suggest that young men readily think of themselves as bullet-proof and would often state that they aren’t affected by a certain condition etc. I wonder, though, how thorough such a self-assessment can be as they’ve had the condition all their life and don’t know any different?

Vertical overlap

Missing from the original application. I pointed this out in my initial report because if the vertical assessment would show that there is no overlap, there would not have been an issue. But once this was assessed, the billboard always formed the backdrop for those drivers in the critical decision zone that had horizontal overlap. Hence the requirement to discuss what significance the overlap has.

ASD and critical decision zone

Explained as per my evidence (section 3.1).

Some notes on Mr. Carr’s evidence

Para 18) “Importantly, the main role of this particular traffic signal is not to advise drivers whether to stop or not, but to advise them when to restart after they have already stopped.”

That’s a red herring. I will discuss this point in paragraph 55.

Para 20) “I have assessed locations where there are also visual overlaps between traffic signals and billboards in circumstances where volumes and traffic speeds are greater than in this location, but these do not show any adverse road safety effect.”

My response to this is discussed more fully in paragraph 68.

“I have similarly been unable to find evidence of a latent road safety issue arising due to driver colour-blindness.”

That may well be because nobody has ever undertaken a scientific study, as far as I can see, what happens when you put an electronic billboard behind a traffic signal.

Para 42) “When considered in the vertical plane, the visual overlap of the signals commences at:”

Just for accuracy, “commences” is the wrong word. This location is where visual overlap finishes. At least if we are discussing matters in relation to approaching the signals and not driving backwards (i.e. overlap “commences” at that point if one reverses along the road).

Para 55) “In other words, the visual overlap only arises at a signal which does not have a prime function of indicating to drivers whether to stop or not.”

This is a somewhat academic viewpoint. The guidance tells designers which functions specific signal displays must be able to fulfil. That does not stop drivers from looking at a different signal. The point of the guidance is so that in a design that has challenging vertical or horizontal curvature, the guidelines tell designers which functions various poles must fulfil, which can be difficult to achieve. There is never a problem achieving these requirements when the site is a flat cross-intersection.

Para 60) “This road has 20,000 southbound vehicles per day (nearly four times more than Manchester Street), and has a higher vehicle speed (meaning drivers have less time to react to, and avoid, any conflict).”

The speed limit here is 50 km/h. That said, it’s been at 30 km/h since August 2019 due to major roadworks.¹ It is not correct to say that a higher vehicle speed means less time to react; it means that the critical decision zone is further away from the limit line. In a busy urban environment, the reaction time to be used is always 1.5 seconds.

“However no crashes have been recorded at this location due to drivers being distracted by advertising signs over the past ten years.”

The billboard was installed in December 2013, i.e. hasn’t been in place for 10 years. At least according to a report that Mr. Carr wrote in 2016.² And the big issue is of course that we don’t know from the crash records whether a driver was distracted, as this relies on self-reporting to the attending police officer. If a driver assumes that their insurance cover would be voided if they gave a reason for their crash, or if they’d likely suffer any legal consequences, this is likely to result in them telling the police officer “I don’t know what happened / why I had a crash.” We’d never know.

Para 63) “In the first instance, Mr Downard-Wilke states that this risk occurs if the traffic signals change at exactly the same time as the billboard. This would occur extremely infrequently in my view, because the dwell time of the billboard is different to the signal timings, and so the two would not be in phase with one another. Moreover, such a change would also need to occur at the same time as a driver was within the critical decision zone, and the driver would need to be placing more emphasis on the secondary traffic signal, and disregarding the two primary signals (and the tertiary signal). This makes the scenario even less likely in my view.”

¹ Weeks, John (25 July 2019) Auckland Airport: \$100 million for huge road project *Stuff* Available at <https://www.stuff.co.nz/business/114482892/auckland-airport-100-million-for-huge-road-project>

² Carr, Andy (23 June 2016) Digital Billboard Installations : Assessment of Road Safety Records *ETC Media Limited*

This is basically an explanation for the fact that crashes are infrequent and random. It is always the case that for crashes to occur, there are generally several things that all have to go wrong at the same time; it does rely on a chain of events. One of the issues mentioned by Mr. Carr is the billboard's dwell time. Traffic signals in the central city operate at two different cycle times (or dwell times): 78 seconds during the day (generally from just before 7am to just after 7pm) and 45 seconds at the other times. The proposed dwell time for the proposed billboard is 10 seconds. Should the billboard go into sync with the signals during the time that the signals operate the 45 second cycle time, the simultaneous change would occur every 90 seconds, i.e. every second signal cycle. The signals run 920 cycles over night at the lower cycle time, so there would be 460 times over night when simultaneous change of signals and the billboard would occur. During the day, when the signals run a 78 sec cycle time, a simultaneous change would occur every fifth signal cycle (i.e. after 390 seconds) should the signals and billboards go into sync with one another. The signals run about 577 cycles at the longer signal time and as such, it would happen 115 times during the day (i.e. 577 divided by 5) that the billboard and the signals got into sync with one another.

Para 65) "Consequently, it would be reasonable therefore that with up 8% of males having this condition, and up to 30% of these having difficulties in naming colours, that there would be a high incidence of crashes where colour-blindness was cited as a contributing factor."

I don't follow that logic here. Firstly, this again relies on self-reporting (where drivers may well be disincentivised to not reveal what was really going on). Secondly, there isn't a specific factor code for colour-blindness on the forms used by Police that staff then transcribe into the Crash Analysis System that we know as CAS. It therefore cannot show up as it's not asked for.

The 2016 Cole³ paper that Mr. Carr refers to is interesting. The author was an authority on colour-blindness. I draw different conclusions from it than what Carr has stated. See paragraph 70.

Para 66) For "defective vision" to get added to the crash database, we again mostly rely on self-reporting. I personally am aware of one of those 264 crashes where this factor appeared: my direct neighbour, who was cycling on a dead-straight highway, was hit from behind by another very prominent and well-known local. That local's vision had declined since his last driver license renewal to him being legally blind; he never saw my neighbour before he hit him. He immediately admitted to Police that he was practically blind and handed in his license. And he had no other choice, as it's a small community and people knew that he was losing his vision. Had he not volunteered the information himself, somebody would have told the local Police officer. That's the kind of information that makes it into the database. There is no reason to believe that if somebody who is colourblind, say, and where that contributed to the crash, would volunteer that information to Police.

Para 68) "the George Bolt Memorial Drive being just one example"

We once analysed the 2016 report written by Andy Carr where he looked at electronic billboards at traffic signals. It's one of the very few sites that exist in New Zealand where there is existing overlap. There used to be one more site in Auckland where the billboard was directly behind some signals but the billboard was gone within a year and nobody at Auckland Council could tell us anything about the underlying reasons for the billboard's removal. There's another site in Auckland where a billboard forms a backdrop for a bus lane. There is one more site in Auckland where there would be

³ Cole, Barry (2016) Colour blindness and driving. *Clinical and Experimental Optometry* volume 99, issue 5, pages 484-487

overlap of a primary signal if that signal head was not obscured by a tree until a driver is well beyond the critical decision zone.

By all we know, George Bolt Memorial Drive is the one striking example that we have in New Zealand.

Para 69) "In fact, even if the crash records did not specifically record 'defective vision' as a factor, there should still be a higher incidence of crashes at locations where visual overlaps are present. Again, this is not seen."

We have investigated the reported crashes at George Bolt Memorial Drive. Since the billboard has been installed in December 2013, there have been eight crashes where distraction may have contributed or caused the crash; injury was not recorded for any of these crashes. Importantly, distraction was not recorded in any of the cases. The crashes were made up of 7 rear end crashes, and one crash where a straight through driver failed to give way to an ambulance with red and blue lights turning across the driver's path. So, while there is no recorded evidence of distraction, it is also important to note that we are looking at just the reported crashes. The estimate is that if no injury occurs, just 1 in 8 crashes makes it into the database. Where a minor injury occurs, 40% of the crashes are assumed to be in the database. For injuries that result in hospitalisation, 60% of crashes are assumed to be recorded in the database. In conclusion, the eight reported crashes that may have had distraction as a factor, or the cause, reflect dozens of crashes that occurred on this intersection approach. We do not know how often distraction was a factor, or the main cause.

Para 70) "I therefore do not agree with Mr Downard-Wilke that driver colour-blindness presents an inherent risk in this situation."

Mr. Carr quoted the Cole (2016) paper, and it is relevant to state that Cole would not have agreed with him. Barry Cole, who died last year, was an international authority on colour blindness. The paper, which he wrote towards the end of his career, reads as a summary of what he has learned during his professional life as to how colour-blindness and transport safety interacts. Cole has lobbied since the 1970s for colour-blindness assessments to be part of a driver license assessment. Cole states: "The circumstantial evidence for a colour vision standard for drivers is complex and technical, which regulators find hard to grasp. They are also daunted by the prospect of refusing a driver's licence for up to eight per cent of men who have abnormal colour vision. It is easy to require drivers with reduced visual acuity due to refractive errors to wear glasses when driving. It is even possible to contemplate withdrawing the driver's licence of an elderly person with an age-related loss of vision; however, it is quite another to refuse a driver's licence for the life of young people with abnormal colour vision, especially when there are a lot of them who will protest they have no problems seeing colours." Or in other words, Cole argues that it is politically unpalatable to impose restrictions on colour-blind people that from a road safety perspective would be necessary.

Cole then discusses the history of colour vision assessment for commercial drivers in Australia that existed from 1994 to 2003. I quote: "It denied a licence for applicants with a protan⁴ colour vision defect and required those with a deutan colour vision deficiency to pass the Farnsworth lantern. This would have precluded three per cent of men from holding a commercial driver's licence." End of quote. Most of the testing could be done by optometrists. There was one specialised test

⁴ Two of the most common inherited forms of colour blindness are protanomaly (and, more rarely, protanopia – the two together often known as "protans") and deuteranomaly (or, more rarely, deuteranopia – the two together often referred to as "deutans").^[21] Both "protans" and "deutans" (of which the deutans are by far the most common) are known as "red–green color-blind".

(Farnsworth test) that could only be done in certain centres, but many optometrists could do a test and if applicants failed it, they would most likely also fail the Farnsworth test. This was simplified in 1997 when the requirement for the Farnsworth test was removed, and consequently just two per cent of applicants failed the requirements. It was difficult to understand by regulators and not favoured by those who failed. To understand the next matter, it is important to note that colour-blindness is mostly inherited. Cole explains: "The killer protest came from a family trucking business, in which all the owner-drivers were from the one family and all of them had a protan colour vision deficiency. The colour vision standard was abandoned in 2003 and Australia currently does not have a colour vision requirement for drivers."

Cole discusses the seven research papers published between 1960 and 2014 that deal with colour blindness and traffic crashes. Five found there is no effect and two found that the risk is higher for colour-blind drivers. Cole rejects the findings of six of those papers over a variety of methodical issues (notably including papers where he was a co-author). The paper whose findings he supports "shows that protans have significantly more rear-end accidents and accidents involving over-looking red brake lights and tail lights than drivers with normal colour vision".

I attach a slide from Cole's paper that compare the visual perception of two signalised intersections of drivers with normal vision and those who are deuteranope.⁵

Para 73) "If the value of ASD calculated by Mr Downward-Wilke is used (22m) then there is no visual overlap of Signal Pole 5 for southbound drivers in the general traffic lane within the critical decision zone."

Correct. That is what I've written in my report. The overlap is in the kerbside lane.

Para 74) "the effects arising from overlapping remain as previously assessed."

Disagree. The original transport assessment states: "The only overlap therefore occurs for the secondary signal head, and this arises between the stop line and 35m from the stop line. However as the driver approaches the signals, there is no overlap for three of the four signals, and the driver is more likely to be looking ahead to the primary and overhead primary signals."

If the billboard is effective in its purpose of attracting peoples' attention, there is every chance that a driver will only see the secondary signal (pole 5). And the closer a driver is to the intersection, the more likely it is that they do not look at the primary signals, but the farside signals (secondary and tertiary). Especially if something attracts their attention further downstream.

Para 75) "Even in the unlikely event that approaching drivers are only looking at this one signal head, it will appear to move across the face of the billboard, and so drivers will be easily able to differentiate that it is separate to the billboard. This is further reinforced by the traffic signal having a black backing board."

That's the crux of the matter. Will the parallax effect be sufficient? Or will a billboard that succeeds in its purpose of attracting attention be sufficient for a change in traffic signal colour to have insufficient stimulus to be registered by a driver? And is the signal change stimulus further reduced for those 8% of male drivers who are colour blind?

⁵ Protanopes, deuteranopes, and tritanopes are dichromats; that is, they can match any colour they see with some mixture of just two primary colours (in contrast to those with normal sight – trichromats – who can distinguish three primary colours).

Para 76) “There is similarly no evidence of a latent road safety issue arising due to driver colour-blindness.”

Apart from what’s quoted in the research paper submitted by Mr. Carr; see paragraph 70 above.

Para 87) “It is therefore unclear to me why Mr Downard-Wilke discusses the issue of the function of traffic signals (his paragraph 3.1.3).”

That should reference paragraph 3.1.2.

“He states that in his view, drivers that are turning right at the intersection “are most likely to look at Signal Pole 5”.”

I made that statement to refute Mr. Carr’s assertion that a “driver is more likely to be looking ahead to the primary and overhead primary signals”. Where someone looks can be a function of their intended manoeuvre and given that the intersection does not have dual primary signals (i.e. a primary signal on the right hand side of an intersection approach), the most likely signal face that a right turner would observe is the secondary signal. It is agreed that for right turners, overlap will never occur while they are travelling in the critical decision zone.

Para 88) “It also necessarily has to be the case that design guides and driver behaviours are well-aligned – put another way, if roads were designed in one way and drivers used them in another way, then this would inherently be unsafe and one or the other would need to change.”

This distorts the point I was making. The guidance tells us what primary function particular signal poles must fulfil. That is not to say that drivers cannot get the information for fulfilling a particular function from another pole. And if they do, there is nothing inherently wrong or dangerous with it.

What is wrong is to argue that because a particular signal pole does not have a particular primary function that it could never fulfil that function.

Para 91) “If it is accepted (for the sake of argument) that Mr Downard-Wilke is correct in saying that drivers turning right will look solely towards Signal Pole 5 then this is presumably because it is the most convenient for them to look at since it lies in their natural direction of gaze.”

I need to state that I never said that. I said it’s most likely that right turning drivers will look that way because it’s their most convenient signal face. But they may look at other signal faces, or more than just one.

Para 92) “I have also considered the situation of bus drivers, who use the kerbside lane to travel straight ahead (south) on Manchester Street. Again though, I do not consider that drivers will be looking towards the signal on the diametric opposite corner of the intersection, but they will instead use the primary signal and tertiary signals, which are more directly in front of them.”

Unless, of course, the electronic billboard succeeds in its purpose of attracting attention. A driver may always receive a stimulus from something and that may not necessarily strictly align with the direction they travel in.

“Moreover, bus drivers are professional drivers”

That’s a generous view. It’s a low-paid industry where drivers don’t even get the living wage. Staff turnover is massive. Two authorities (Auckland and Christchurch) recently operated weekend schedules during weekdays to cope with driver shortage issues, giving an indication of the low-paid nature of the job.

What we could agree on is that bus drivers hold the required drivers' licence for operating a bus. Whether that constitutes having become a professional is questionable in my mind.

Para 95) "applying Mr Downard-Wilke's own methodology, it seems evident that drivers will not be looking towards Signal Pole 5 anyway but towards other lanterns"

I disagree.

Para 96) "I note that Mr Downard-Wilke has similarly not been able to point to a particular example of where such a visual overlap has led to any incidence of crashes."

The problem here is that to show a statistically significant effect, we would have to have a very large sample size of intersections to get to crash numbers within a 95% confidence interval that we simply don't have.

Given that we cannot possibly show such an effect with sites in New Zealand, we must rely on first principles and the precautionary approach.

Para 100 c) "The overlap only occurs in the kerbside lane and only over a distance of 26m. This therefore only can affect bus drivers traveling straight ahead and general drivers turning left. The latter equates to peak hour flows of just 20 vehicles."

No, it also includes through drivers who travel in the kerbside lane when the central lane is blocked by a right turner. As it's clearly stated in my report. I'm unclear why Mr Carr appears to ignore this. I attach a video clip that shows three drivers proceeding straight ahead from the kerbside lane (I note that none of them was in the critical decision zone; they were all waiting for a green light).

Possible mitigation

Shift sign west by some meters so that the visual overlap occurs after drivers have passed through the critical decision zone.