

Personalised plates that can be unreadable — problem and proposed solution

Date	5 August 2024
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From	Brendon Whiteman Senior Analyst Regulatory Implementation
Pages	11

Roles and responsibilities - RAPID

Input	Consulted and provided expertise and information	Kim Gaffaney Contracts Officer, Contracts Team Regulatory Services Mark Stables –Principal Advisor Safe System Crash Analysis, SME Camera System Programme System Leadership – Road Safety Tom Zotov Platform Lead Te Aukaha Digital Transformation (Tom is an ANPR expert) s 9(2)(a) NZ expert on retroreflectivity standards author of NZTA specifications on retroreflectivity Steve Dejong Senior Engineer Regulatory Services s 9(2)(a) LicenSys
Agree	Must formally agree to how their advice is being presented	Eric Van der Plank
Recommender	Makes the proposal, assess facts, information, and analysis, having obtained input from SMEs	Brook Mitchell
Decider	Makes the final decision	Chris Rodley
Implementer	Accountable for executing the decision	Contracts Team and Regulatory Implementation.

Purpose

1. This memo outlines an efficient approach to solving problems with personalised black background registration plates that are difficult or impossible to read in some commonly encountered situations. It includes:
 - 1.1 two critical decisions about registration plate approvals— revoking approval for the problem personalised black background registration plates and approving a new form of replacement black plate that does not have readability problems.
 - 1.2 steps over weeks and months to put in place an independent, physics and standards-based test for approving the form of plates so we do not have similar problems again.

Background and where we are now.

2. In 2021/2022 NZTA and Police tested two types of plate with silver or white figures¹ on a retroreflective black background². NZTA approved them and they have been on sale through KiwiPlates³ (the sole approved personalised plate marketer) since September 2022. Over [s 9\(2\)\(b\)\(iii\)](#) of them have been issued. In this memo they are called “the problem plates”.
3. NZTA has considered revoking the approval of the problem plates previously⁴ with the decision to maintain current approvals maintained. This memo should be read with the context of the previous [Internal link to 4](#) as referenced.
4. This testing involved driving vehicles fitted with the problem plates past various cameras. The cameras included Police’s current speed cameras (Redflex NK7s) the new model of camera the safety camera programme will use (Redflex Halos), and the cameras used in weigh-in-motion systems and on toll road gantries.
5. After the approvals were made, Police, NZTA staff, and the public, reported many cases where the figures on the problem plates could be hard to read or become essentially invisible to the naked eye under some quite common conditions. Police have repeatedly requested we withdraw approval for the problem plates.
6. We have scientifically and measurably characterised the readability / invisibility problem. The retroreflectivity expert we engaged says that the problem lies with the retroreflective background’s performance relative to the non-retroreflective white and silver materials used to form the figures in the problem plates.
7. Under certain circumstances the retroreflective feature of the background material can become partially initiated and in doing so it develops a silver-white colour that closely matches the non-retroreflective colour of the figures. The colour contrast between the two products reduces to near zero making figures hard to read or indistinguishable from the background.
8. It’s no surprise that this was not picked up in drive-by testing. The cameras used in the drive-by tests were those specifically designed to pick out number plates for direct use in law enforcement (Police speed cameras, our new safety cameras, tolling, and weigh-in-motion cameras).
9. The cameras used in those roles have optics specifically designed for reading plates, have their own IR or visible light illumination, and use configurable and very capable proprietary software. They are designed and configured so as not to cause problems for police forces or road controlling authorities in markets across the world. New camera systems can cost around \$250,000. They are installed using fine tolerances around angle of view and flash illumination.
10. Driving by such cameras doesn’t tell you anything about how plates can be seen by the human eye or by less sophisticated camera set-ups.
11. More generally drive-by tests are a poor way of assessing whether a plate is readable. They are not quantitative, replicable, or adequately defined. They produce non-quantifiable results under poorly controlled conditions and should not be used as the primary test for approval.

What we need to do.

¹ Retroreflectivity is a very different thing from simple reflection and the differences are highly relevant see the short primer on retroreflectivity in appendix 1

² The plate with silver figures uses black retroreflective sheeting—3M 680-85 Black and Kurz Silver Hot Stamp foil M72462. The plate with white figures uses the same material for the background (3M 680-85 Black) and Kurz White Hot Stamp foil B721332. It is important to understand and specify the materials used in plates such as these foils. They have characteristics (usually specified in data sheets) and are typically tested against standards for licence plates retroreflective and materials like ISO 7951 AS/NZS1906.1:2017 and agency adaptations of these like our NZTA M25:2021 Key steps in applications and approvals for plates should require the materials to be precisely specified. Some of the confusion and mis-steps to date are generated by failures to specify and understand the behaviour of these materials.

³ KiwiPlates is the trading name of the only entity to have a (non- exclusive) contract and approval to market personalised plates, Multi Market Services Limited, the ultimate beneficial owner of that entity is Publicis Groupe Holdings B.V. registered in the Netherlands. The KiwiPlates website shows how they market personalised plates including the problem ones see <https://www.kiwiplates.nz/>

⁴ See memo [Internal link to document provided in Attachment 2](#)

12. We need to develop a physics and standards-based test procedure for approving the materials used in registration plates. The test needs to assess whether there is sufficient contrast between figure and base material. That's the key failing that led to the current situation, and it's not covered in existing standards.
13. There is a more immediate need to withdraw approval for the problem plates and to approve a new form of black plate that does not have visibility issues.
14. s 9(2)(b)(ii) [REDACTED]. It would also significantly reduce the revenue share paid to NZTA, which is the only funding source for the Community Road Safety Fund⁵.
15. s 9(2)(h) [REDACTED]
16. s 9(2)(h) [REDACTED]
17. s 9(2)(j) [REDACTED]
18. The decision can't take effect immediately. It will take the plate manufacturer LicenSys until 30 November 2024 to install the equipment and make the necessary software changes to produce the replacement plates.
19. This memo recommends a solution that provides certainty for KiwiPlates and recognises the lead times needed for the plate manufacturer:
1. Make the decisions to revoke approval for the problem plates and approve the replacement plates now.
 2. Establish that these decisions will come into effect on 30 November 2024.
20. The replacement plates would have a non-retroreflective black background and white retroreflective figures⁷. The material for the figures is the same white retro reflective material used in ordinary plates. Put another way the replacement plates use known materials and are essentially the inverse of the ordinary plates found on most vehicles.

21. Interim test

22. The readability issues with the problem plates are, of themselves, a basis for withdrawing approval. Registration plates are (with licensing labels) one of the physical tokens that serve to alert people to the registration status of a vehicle. They are critical to the enforcement of traffic offences and to investigating other criminal offending. They are also critical in identifying who may be liable for civil action such as after accidents. The plates are simply not doing the job required of them if they are difficult to read or the figures on them are essentially invisible.
23. The work to develop a physics and standards-based test has already produced results that allow us to prescribe an interim test on which a decision to withdraw approval can be made. The interim test requires:
1. Using a retroreflective material that conforms with relevant standards.
 2. Having a contrast ratio between figure and base material in an appropriate range (>5:1 and < 11:1)
24. The problem plates fail this test while the replacement plates pass it (see appendix 3 for details).

⁵ See <https://www.nzta.govt.nz/safety/what-waka-kotahi-is-doing/community-road-safety-fund/> for an outline of how that fund is used

⁶ See memo [internal link to document provided in Attachment 2](#)

⁷ the materials are figures in a white retroreflective material (being 3M 4750 or 3M 4780) and a non-retroreflective black background (opaque digital Ink) this is the inverse of the currently issued ordinary black on white plates

What parties think of this approach

25. KiwiPlates (the personalised plate marketer) and Licensys⁸ (the plate manufacturer) support withdrawing approval of the problem plates and simultaneously approving the replacement plates as from 30 November 2024.
26. Internally Scott Henshilwood, Manager, Regulatory Contracts and Kim Gaffaney, Contracts Officer with hands-on responsibility for KiwiPlates and LicenSys and Eric van der Plank, Manager Commercial Services are in favour.
27. Police will support the withdrawal of the problem plates (and have repeatedly sought this) but the officer in charge of CCTV and ANPR (Automated Number Plate Recognition) technology development at the Police Visual Information Centre at Manukau has some significant concerns about the replacement plates' readability.
28. He conducted two series of tests one of which appear, to show significant readability problems with the ANPR cameras routinely accessed by Police. That report was seen in earlier NZTA work as showing the replacement plates "test even worse than the problem plates".
29. In fact, the issue is as much about the capability of the cameras as it is about the plates. Part of the planned future work is to engage with ANPR camera operators and suppliers to allow them to adapt as far as possible to the replacement plates.

The one difficult case: "Police ANPR cameras"

30. It is critical to understand what the "Police ANPR cameras" are, and why we can't possibly devise a system for plate approval that requires readability by all or most of the cameras involved. The term "Police ANPR cameras" is very misleading since few of the cameras belong to Police. Rather they mostly belong to two network operators Safer Cities (which has cameras operated by local authorities and local business associations) and Auror (which has its cameras mostly at major fuel retailer's sites). These vary greatly in quality in terms of optics and ANPR software. There is an explainer on this in appendix 2.
31. The most appropriate policy response for that industry is to set standards for plates and make those standards public. We also need to show ANPR camera suppliers and operators examples of any new plates (and their specs) with sufficient time to adapt their systems.
32. We will need to be clear with Police (and internally) that:
 1. the way forward is objective physics and standards-based testing, not solely drive-by tests.
 2. we are engaging with ANPR operators and manufacturers on the readability of the replacement plates.
 3. these processes will facilitate but do not guarantee readability by all the cameras, firmware, and software combinations in the ANPR cameras accessed by Police.
 4. ultimately, it is an issue for camera operators and suppliers to ensure cameras, over time, are able to read plates in use.
33. I expect that the work mentioned in para 32 above will allow ANPR operators to make changes to software, hardware, or systems that can better read the replacement plates. This should, over time, assuage Police concerns about readability but not eliminate them entirely. We should be aware that some residual risk will remain.

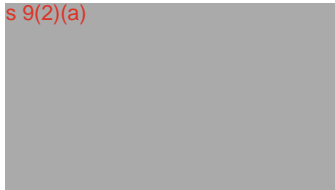
⁸ LicenSys is Licensys Holdings Limited, the only major plate-maker in New Zealand it (along with an equivalent Australian entity) are ultimately owned by Erich Utsch AG a German registered company that supplies plate making equipment. LicenSys has the only contract to supply ordinary registration plates to NZTA agents as well as the personalised plates marketed by KiwiPlates.

<p>These processes are about showing camera operators what's coming. They would not form part of the approval of the replacement plates or any future plates. Plate approvals would be solely based on the physics and standards-based test.</p>	
<p>3) Incorporate the test described in 1) in NZTA documents and by extension the arrangements with LicenSys and KiwiPlates via some or all the following:</p> <ul style="list-style-type: none"> • a revised NZTA plate specification • an application process for approval of plates specifying the exact materials they will be made from and their specifications. • requiring independent evidence that proposed plates comply with the test. • devising criteria for being an independent tester • adjustments to other documented procedures • prescribing a standard process for alerting camera operators to the approval of any new plate providing for them to see how it works with their cameras above recording the results. • being very explicit that such demonstrations of new plates are not a part of the approval process. • remove redundant references to MoT and to other documents and processes. • make the documents internally coherent and explicate their relationship to other documents so there is a single source of truth. <p>Note that both the contracts with KiwiPlates and LicenSys require them (in slightly different terms) to comply with NZTA specifications for plates.</p>	
<p>4) Reconfigure how NZTA does plate approvals including by —</p> <ul style="list-style-type: none"> • recognising plate approval is a regulatory decision and locating the power to make it (and related work) in the core of the regulatory group. • separating decisions on plate approvals from day-to-day contract and relationship management • Separating assessments against the standards and decisions on plate approvals from the standard setter. 	
<p>5) Reconfigure how we appoint the Registrar of Motor Vehicles as a statutory officer under part 17 LTA 1998.</p> <p>We should give effect to the intent of the underlying provision by appointing someone whose span of control at least roughly corresponds to administration and QA for the register and closely connected issues such as registration plates.</p> <p>The idea here is that the registrar should have a clear set of responsibilities around the register and be (to some extent) immune from other (including commercial and income-based concerns). This would create a useful tension between conflicting objectives.</p>	

Approval

Decisions sought	Approval
revoke approval of the problem plates described in detail and using the interim test in appendix 3 with effect from 30 November 2024.	YES
approve under r 34(4) (b) Land Transport (Motor Vehicle Registration and Licensing) Regulations 2011 the replacement plates described in detail and using the interim test in appendix 3 with effect from 30 November 2024.	YES
Agree to the actions, as set out in table 1, to establish a new personalised plate approval process.	YES

s 9(2)(a)

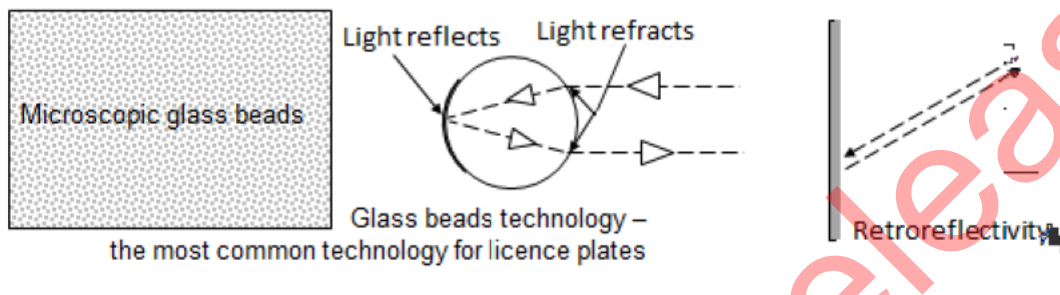
Signed:  **Date:** 15/08/2024
Chris Rodley National Manager Regulatory System Design

Note: I make this decision using the delegation to keep this process moving forward, but as captured above, there needs to be separation between the standard setter function and the assessment and decision making against that standard. In general, the standard setter should retain the delegation though, but only to 'set the standard required' and act as a decision backstop should the regulator and regulated parties disagree on a way forward – essentially providing for semi-independent decision making.

Appendix 1 Retroreflectivity— millions of luminous spheres

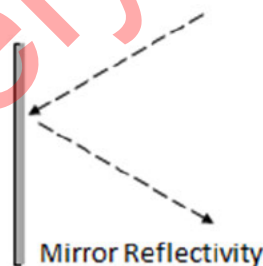
Retroreflectivity

Microscopic glass bead technology is the most common technology used for the manufacture of plates. The small beads are embedded in some form of clear binder which gets bonded to the plate during manufacture.



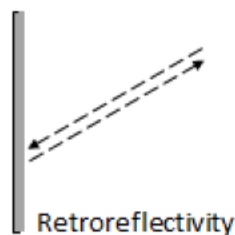
The rear part of the microspheres have a highly reflective aluminium coating represented in the diagram above as the slightly thicker black curve.

It's common for laypeople to refer to the plates using this technology as being "reflective", the correct term is retroreflective. This is because reflective surfaces act like the familiar flat mirror which operates as shown below



In those cases a light beam is reflected away at an equal but opposite angle.

In retroreflectivity the light beam is retroreflected back to the original source of the light – in the case of registration plates typically from headlights.



Standards for retroreflective materials specify quite precisely the cone of retroreflected light that's needed and its colour and intensity.

Retroreflectivity can lead to some strange effects. For instance, the retroreflected light can be of a quite different colour to the surface as seen in say daylight. That effect can sometimes be seen in road signs.

In this context the black retroreflective sheeting (3M 680-85 Black) in the problem plates can under certain illumination conditions (very counterintuitively) actually be white. That is at the root of the issues with the problem plates.

NZTA Requirements for retroreflective materials

We have some quite well-developed standards and practices around retroreflective materials for road signs and dozens of materials have been approved in that context. Our requirements in relation to plates are less developed.

The NZTA M25:2021 Specification for retroreflective sheeting⁹ requires that all retroreflective sheeting used in the manufacture of registration plates must be compliant with AS 1906.1:2017 Standard for retroreflective sheeting¹⁰ and be listed in NZTA M25 Listing of approved vehicle registration plate sheeting¹¹. This requires the specified sheeting properties to be tested both in a materials testing laboratory and at an outdoor weathering testing location in Northern Queensland to prove performance durability.

The two sheeting colours that have passed these tests are white (3M 4750 and 3M 4780) and yellow (3M 4761 lemon yellow 61 and 4780 yellow 81). The approved white is used for the background on all ordinary registration plates other than dealer plates which use one or other of the approved yellows.

None of the materials in the problem plates comply with the requirements listed above. There is also an issue about the standards themselves because they don't deal explicitly with contrast between figure and ground (the root problem— this is why we need to add a contrast test to our internal standards.

Appendix 2

“Police ANPR Cameras”

Tom Zotlof NZTA ANPR expert is to review **and if available in time** material can be added to elaborate as needed in particular on the adaptability of these cameras

ANPR involves something that captures images (often in, but not limited to visible wavelengths) and very rapidly converts that data into formats (there are standards for this) that can be numerically computed so that the character sets on plates can be derived.

You can run a quite effective ANPR with a modern Android smartphone and readily available open-source or proprietary software. A mildly computer literate person can (because standards) add ANPR functionality to many modern dash cameras. There are active online communities where folk participate in this and there are many systems for many platforms.

ANPR can be bolted on to many other kinds of cameras such as those used for surveillance by individuals, shops, residents groups, local authorities (often as part of wider safety initiatives) supermarkets, petrol stations, road controlling authorities, hospitals, airports, and other entities like parking providers.

⁹ <https://www.nzta.govt.nz/assets/resources/retroreflective-sheeting/NZTA-M25-2021-Listing-of-approved-vehicle-registration-plate-sheetings.pdf>

¹⁰ [AS NZS 1906.1:2017 Retroreflective sheeting marked for black plates standards.pdf](https://www.nzta.govt.nz/assets/resources/retroreflective-sheeting/NZTA-M25-2021-Listing-of-approved-vehicle-registration-plate-sheetings.pdf)

¹¹ <https://www.nzta.govt.nz/assets/resources/retroreflective-sheeting/NZTA-M25-2021-Specification-for-retroreflective-sheeting-and-notes.pdf>

These ANPR systems vary hugely in their quality and failures to read. There is a real and active market in this area which (like most markets) involves some fairly clear quality/ price trade-offs. In the better forms the optics and the ANPR processing can be very sophisticated and involve machine learning. In other cases ANPR can work less well.

There is also a market in aggregating, trading and reselling ANPR data between the sorts of parties mentioned above (gas stations, parking providers, local authorities and so on). There are several aggregators in the market and Police buy access to data from two of them SaferCities (which also supplies a front-end viewer) and Auror. Police also operate a few in their own vehicles.

The Police have internal protocols about access to that data and it is used (often in cooperation with other parties) in relation to shoplifting, petrol theft, and general crime, outstanding warrants, and anecdotally in combatting organised crime groups. Sometimes the Police can use them in relation to road safety offences (which are within NZTAs remit) but that probably is more as an adjunct to other law enforcement activity.

Data from those cameras cannot be used for bulk processing of infringement notices. For that you need vehicle surveillance devices which have a gazetted Ministerial approval.

Appendix 3

Decisions— specification of problem plates and replacement personalised black background registration plates, interim test, and the decision that needs to be revoked

Problem plates means

- (i) the plate with silver figures using Kurz Silver Hot Stamp foil M72462 and black retroreflective sheeting—3M 680-85 Black for the background
- (ii) the plate with white figures using Kurz White Hot Stamp foil B721332 and black retroreflective sheeting—3M 680-85 Black for the background

And includes the above plates in any form factor

Replacement plate means

A plate with figures in white retroreflective material (being 3M 4750 white or 3M 4780 white) and non-retroreflective black background (opaque digital Ink).

And includes the above plate in any form factor.

Interim test criterion	Problem plates		Replacement plate
	silver on retroreflective black	white on retroreflective black	retroreflective white on non-retroreflective black ground
Uses retroreflective material approved under NZTA M25:2021 listing of approved vehicle registration plate sheeting	no	no	yes
Contrast ratio >5:1 and < 11:1	No while it has a contrast ratio within the range in many circumstances it drops to near zero when retroreflectivity kicks in	No while it has a contrast ratio within the range in many circumstances it drops to near zero when retroreflectivity kicks in	Yes roughly 6.4 under many conditions when retroreflection kicks in the contrast is much higher making them <u>more</u> readable

Out of Scope

Proactively Released

Out of Scope