**Traffic Engineering Manual**

Volume 3 – Additional Traffic Engineering Standards & Guidelines

Part 2.20

# Temporary Yellow Linemarking for Worksite Traffic Management

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VICTORIA State Government | Department of Transport

**Traffic Engineering Manual Volume 3**

**Additional Traffic Engineering Standards and Guidelines**

### Document purpose

This document is a Department of Transport (DoT) Additional Traffic Engineering Standards and Guidelines document.

The aim of this document is to provide practitioners guidance on a topic not covered (or not covered sufficiently) by other national or state standards and guidelines.

This document provides the primary guidance for the subject, and in the event of a conflict between guidance in this document and another standard or guideline, the guidance in this document takes precedence.

Practitioners are advised that guidance in this document be followed in order to achieve best practice outcomes.

### Document hierarchy

This document has been published as a *Guideline* in DoT's document hierarchy. A *Guideline* contains relevant engineering knowledge which MUST be acknowledged and considered by a practitioner.

Where information contained in this guideline cannot be followed, the practitioner should seek technical advice from DoT and gain acceptance (where necessary) for a departure from the content in this guideline.

### Document information and revision history

Further document information and revision history can be found at the end of this document.

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# 1 INTRODUCTION

## 1.1 Purpose

The purpose of this document is to provide guidance on the use of temporary yellow linemarking for worksite traffic management. This document provides information on the application of temporary yellow linemarking for worksite traffic management, specifications for installation and ongoing maintenance requirements.

This guidance should be considered after the removal of pavement marking in accordance with DoT / VicRoads Technical Note *TN 112 Removal of Pavement Markings* has been considered.

## 1.2 Background

Temporary yellow linemarking is a worksite traffic management treatment whereby yellow lines are installed to shift the alignment of traffic lanes through long term roadwork sites. Temporary yellow linemarking is used where it is considered that efficiencies can be obtained over more traditional temporary traffic management practices.

The key objective of temporary yellow linemarking is for the yellow lines and markings to be far more prominent than the existing white lines and markings to ensure that there is no confusion regarding which set of lines and markings drivers must follow. Section 4 sets out requirements to achieve this.

In most situations, the existing white line and pavement markings are retained where they do not cause confusion and compromise achieving the key objective of the treatment. Signage throughout the roadwork site instructs drivers to follow the temporary yellow linemarking and not the white linemarking.

The potential benefits of temporary yellow linemarking include:

- Reduced costs
- Savings in time and effort
- Reduced delays to the travelling public
- Reduced safety risk to road workers.

***Figure 1: Temporary yellow linemarking (9 m yellow line with 3 m gap standard) on a freeway***

# 2 CONSIDERATIONS

## 2.1 Line and pavement marking removal or covering

The removal or covering of existing white line and pavement markings is required wherever they are considered to cause confusion or compromise achieving the key objective of the treatment. However, it is important to understand that line and pavement marking removal or covering may result in a different surface texture to other parts of the pavement where the line and pavement markings previously existed. This can result in the removed or covered line and pavement markings becoming highly visible under certain light and weather conditions, creating confusion for motorists. For this reason, care should be taken to ensure that an appropriate line and pavement marking removal or covering treatment is selected and that it is implemented correctly to prevent this from occurring.

Typical pavement marking removal and covering treatment methods include:

- High pressure water blasting
- Grit, shot or soda blasting
- Grinding
- Strip sealing
- Covering with an appropriately durable product (e.g. paint or tape) that is of similar colour as the pavement. It should be noted that black may not be appropriate on light coloured pavements as it results in a “ghosting” effect (see Figure 4)).

Each treatment has advantages and disadvantages depending on the pavement surface type (and often pavement structure) being treated and duration of implementation. VicRoads / DoT *Technical Note TN 112 Removal of Pavement Markings* should be referred to for selection of an appropriate removal treatment method to avoid ambiguous or confusing delineation.

## 2.2 Research associated with emerging technology

Yellow linemarking for worksite traffic management has been a topic of interest as part of recent research into existing physical and digital infrastructure in Australia and New Zealand and its compatibility with emerging connected and automated vehicle (CAV) technology. As part of the Austroads Future Vehicles and Technology Program, findings and recommendations have been published in the form of reports which can all be accessed on the Austroads website.

Notable reports published by Austroads are:

- ‘Infrastructure Changes to Support Automated Vehicles on Rural and Metropolitan Highways and Freeways: Project Findings and Recommendations (Module 5)’ published in October 2019
- ‘Implications of Pavement Markings for Machine Vision’ published in September 2020

Roadworks have been noted as a key concern for CAV technology. It has been identified that temporary changes to the road conditions through lane lines or traffic control devices presented challenges for CAVs as machine vision systems are sometimes unable to distinguish which set of traffic conditions to follow. For temporary yellow linemarking specifically, although the technology could identify the yellow lines, the presence of existing white lane lines caused challenges for the vehicle to accurately determine the correct edges for lane travel, resulting in poor performance of the technology (Austroads 2019).

Notwithstanding the above, the ‘Victorian Connected and Automated Vehicle Trials’ undertaken by Transurban in 2018 found that “vehicles navigated roadwork areas quite well, especially in instances where white lines had been blocked out at the transition to or from yellow lines.” A report on the trial recommended “where yellow lines are used for roadworks, block out ‘competing’ lines, especially at transition” (Transurban 2018).

Practitioners must acknowledge that the use of temporary yellow linemarking over existing white pavement markings (without removing the white pavement markings) for worksite traffic management may pose challenges to CAV technologies and bear this in mind when considering implementing the treatment.

DoT will continue to monitor the use of temporary yellow linemarking for worksite traffic management and its compatibility with CAVs as the development and uptake of the technology progresses.

# 3 APPLICATION

## 3.1 Suitable usage

Temporary yellow linemarking for worksite traffic management is most suited for roadwork sites on freeways where efficiencies can be obtained over more traditional traffic management practices. In some cases, it may be suitable for rural divided arterial roads with multiple lanes, few conflict points and where pavement resurfacing will occur at the conclusion of the works.

Implementation of temporary yellow linemarking for worksite traffic management should only be considered where removal of pavement marking in accordance with DoT / VicRoads Technical Note *TN 112 Removal of Pavement Markings* is considered to be less suitable.

## 3.2 Unsuitable usage

Temporary yellow linemarking for worksite traffic management is especially unsuitable for roadwork sites with a high number of conflict points, such as urban arterial roads.

Other locations where yellow lines and markings should not be used include:

- Urban arterial roads (as stated above).
- Rural roads with conflict points.
- Undivided rural road carriageways.
- Roads with trams due to existing yellow linemarking.
- In alpine areas due to existing yellow linemarking.
- Roads with yellow edge lines (used to prohibit parking).
- Any other location where the use of this treatment has the potential to cause confusion.

Yellow linemarking is not to be used to make a one-way carriageway into a two-way carriageway unless a physical barrier is installed between opposing directions.

## 3.3 Implementation as part of a Traffic Management Plan

Temporary yellow linemarking for worksite traffic management should be implemented as part of a Traffic Management Plan that has been developed in accordance with the Code of Practice: Worksite Safety – Traffic Management and all relevant standards and guidelines (Austroads Guide to Temporary Traffic Management, Australian Standards, and any DoT supplementary information to these standards and guidelines).

## 3.4 Approval

Given temporary yellow linemarking for worksite traffic management is still a relatively new treatment in Australia, approval from DoT Manager - Traffic Engineering is required for the use of this treatment in Victoria to ensure the application of yellow linemarking is appropriate.

Approval requests shall be sent via email to tem@roads.vic.gov.au including details of the works and a site specific traffic guidance scheme (TGS).

# 4 SPECIFICATIONS

## 4.1 Installation requirements

To meet the key objective of temporary yellow linemarking for worksite traffic management, it shall comply with the following requirements:

- All lines to be yellow in colour with a minimum width of 150 mm
- All lane lines to be a 9 m line with 3 m gap (see Figure 2)
- All edge and dividing/barrier lines (single and double) are to be continuous
- All other new temporary pavement markings within the yellow linemarking zone shall also be yellow (e.g. pavement arrows, chevron pavement markings etc.)
- Retroreflective raised pavement markers (RRPMs) are required to be installed and shall be:
    - Yellow for lane line, inside edge lines and dividing/barrier lines
    - Red for outside edge lines
    - Positioned in accordance with AS 1742.2 and DoT Supplement to AS 1742.2.
- All redundant RRPMs shall be removed.
- Any existing white linemarking or pavement markings should be removed (refer Section 2.1) where it is considered that they may cause confusion and compromise achieving the key objective of the treatment. Particular attention should be given to transition areas, continuous white lines, pavement arrows, merge areas and exit gore areas (see Figure 3).

***Figure 2: Comparison of 9 m yellow line, 3 m gap, 150 mm width (left; standard) to 3 m yellow line, 9 m gap, 100 mm width (right; substandard)***


*Figure 3: Example of remnant white markings potentially leading to confusion*

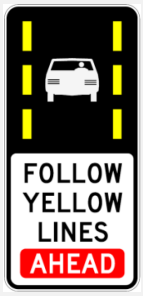
*Figure 4: Example of "ghosting" effect as a result of a black covering material used on a light coloured pavement with a (substandard) 3 m yellow line, 100mm wide and 9 m gap treatment.*

## 4.2 Signage

### 4.2.1 Static signage

The following signs in Table 1 shall be installed as part of this treatment. It should be noted that larger sign sizes than what is specified should be used where this would improve conspicuity of the sign.

***Table 1: Yellow linemarking signage***

| Sign | Details |
|---|---|
|  **R6-V118** | Location:<br>• Approximately 400 m before the commencement of the yellow linemarking zone.<br>• At the start of an entry ramp before the commencement of the yellow linemarking zone.<br>• At any other location ahead of the yellow linemarking zone where the use of this sign is required to alert motorists of the upcoming yellow linemarking zone (except on side road approaches).<br>Size:<br>• C size minimum – on freeways and M Routes (excluding entry ramps)<br>• B size – all other roads or where C size cannot fit due to site restrictions |
|  **R6-V117** | Location:<br>• At the commencement of the yellow linemarking zone.<br>• Throughout the yellow linemarking zone as a repeater sign at approximately 3 km intervals.<br>• At the end of any entry ramps within the yellow linemarking zone or at the point where the yellow linemarking commences along the entry ramps.<br>• At any other location where the use of this sign would be required to communicate the instruction to motorists.<br>Size:<br>• C size minimum – on freeways and M Routes (excluding entry ramps)<br>• B size – all other roads or where C size cannot fit due to site restrictions |
|  **R6-V119** | Location:<br>• On side road approaches to a road with yellow linemarking (excluding before freeway entry ramps).<br>Size:<br>• A size minimum |
|  **R6-V120** | Location:<br>• At the end of the yellow linemarking zone<br>• On exit ramps where the yellow linemarking has ended<br>• On side road departures from the yellow linemarking zone<br>Size:<br>• C size minimum – on freeways and M Routes (excluding entry ramps)<br>• B size – all other roads or where C size cannot fit due to site restrictions |
| Other roadwork signs | Other roadworks signs shall be installed as required in accordance with the Code of Practice: Worksite Safety – Traffic Management and/or standards and guidelines (Austroads Guide to Temporary Traffic Management, Australian Standards, DoT supplementary information). |

### 4.2.2 Electronic signage

Electronic signs (including variable message signs) may be used to supplement the static signs listed in Table 1. Where used, the electronic signs shall communicate the same message as the signs they are supplementing.

Any electronic lane use management systems (LUMS) within the temporary yellow linemarking zone should not confuse or contradict the temporary yellow linemarking arrangement.

## 4.3 Transition areas

Careful consideration shall be given to transition areas (both entry and exit points) to ensure that drivers are able to transition safely into and out of the temporary yellow linemarking zone. Transitions, especially into the temporary yellow linemarking zone, are often associated with higher risks as motorists must make the adjustment of following white linemarking and pavement marking to yellow linemarking and pavement markings.

It is strongly recommended that removal or covering of the existing white linemarking occurs, at the minimum, at the transition entry for a length of road to assist motorists in following the correct set of markings.

Removal or covering of existing white linemarking in transition areas should be undertaken in accordance with Section 2.1.

Other considerations at transition areas (both entry and exit points) include:

- A sufficient transition distance to allow drivers an ample amount of time to adjust to the new linemarking arrangement or back into the original linemarking arrangement at the end of the temporary yellow linemarking zone.
- A sufficient angle of transition to allow a gentle lateral movement into the new linemarking arrangement or back into the original linemarking arrangement at the end of the temporary yellow linemarking zone.
- Compliance with relevant Austroads Guide to Road Design requirements.

## 4.4 Typical arrangements for temporary yellow linemarking

Typical examples of temporary yellow linemarking for worksite traffic management can be seen in Figures 5, 6, 7 and 8.

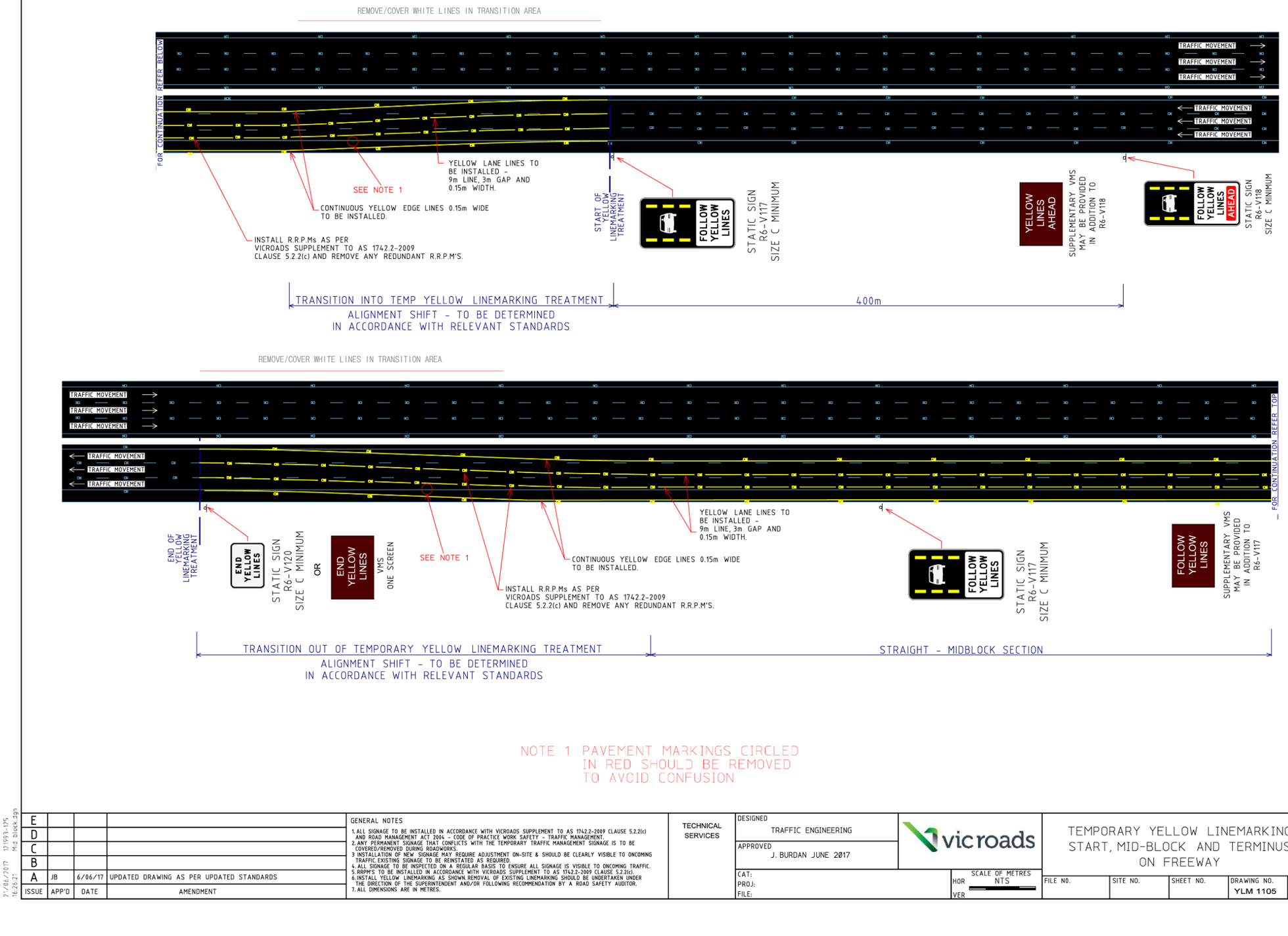



***Figure 5: Temporary yellow linemarking – start, mid-block and terminus on freeway***

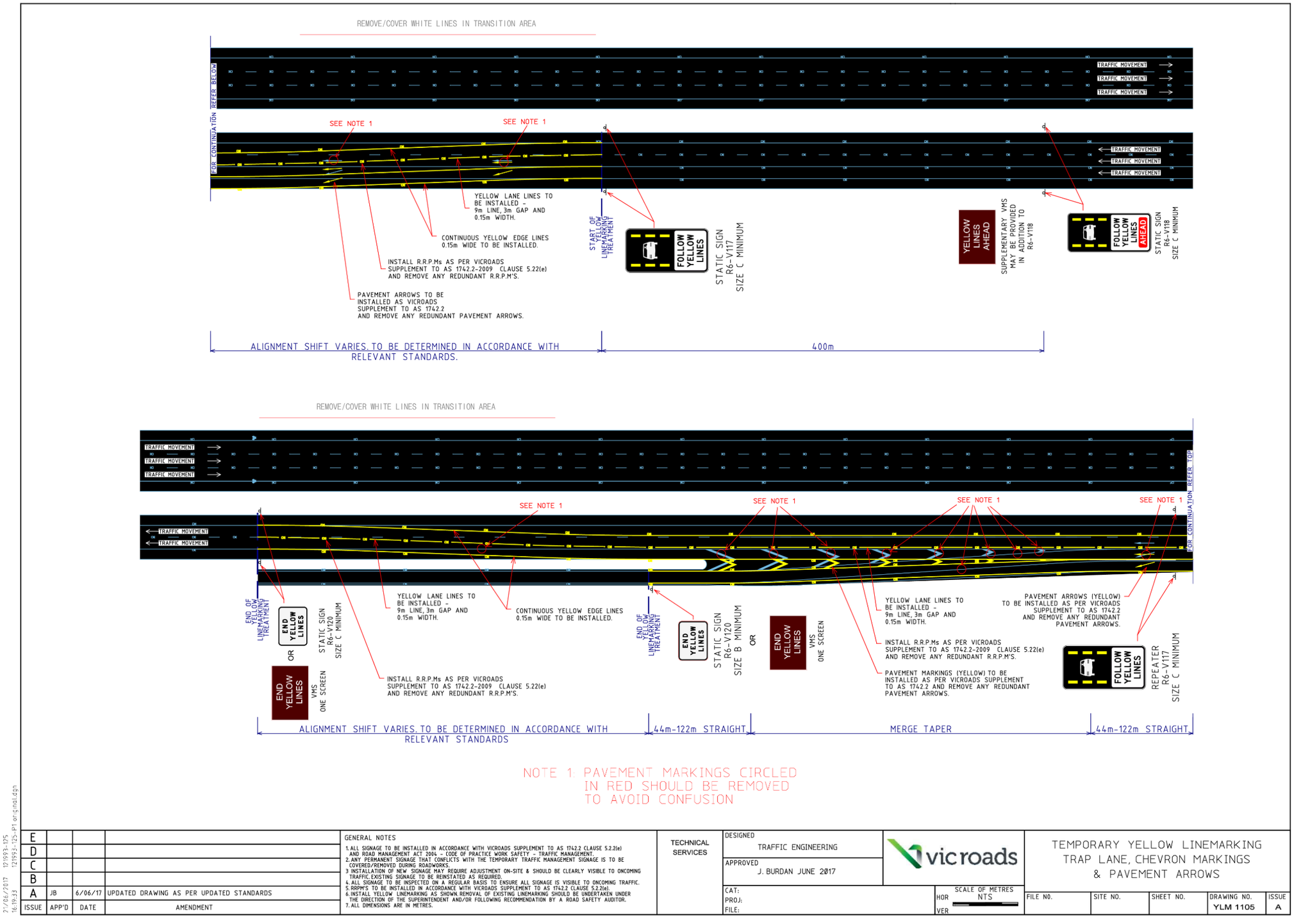
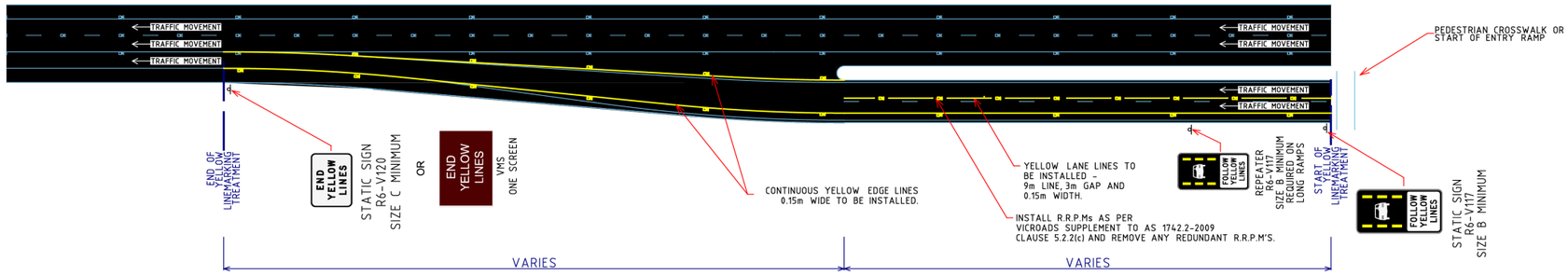
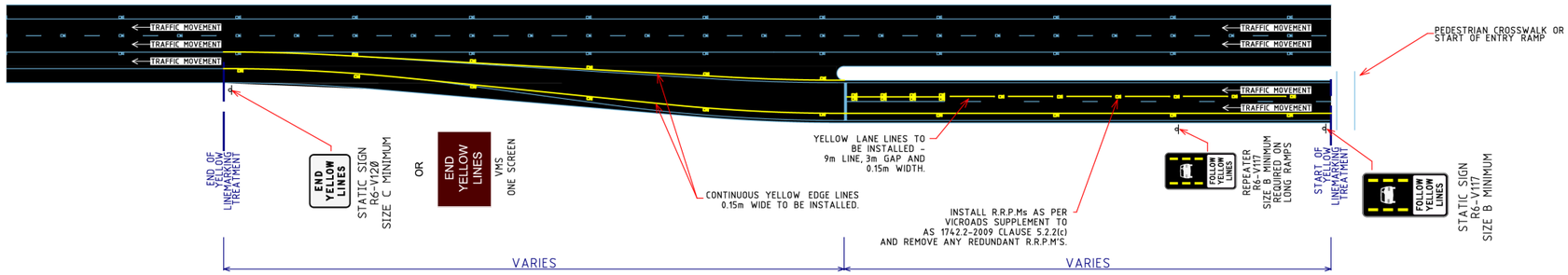


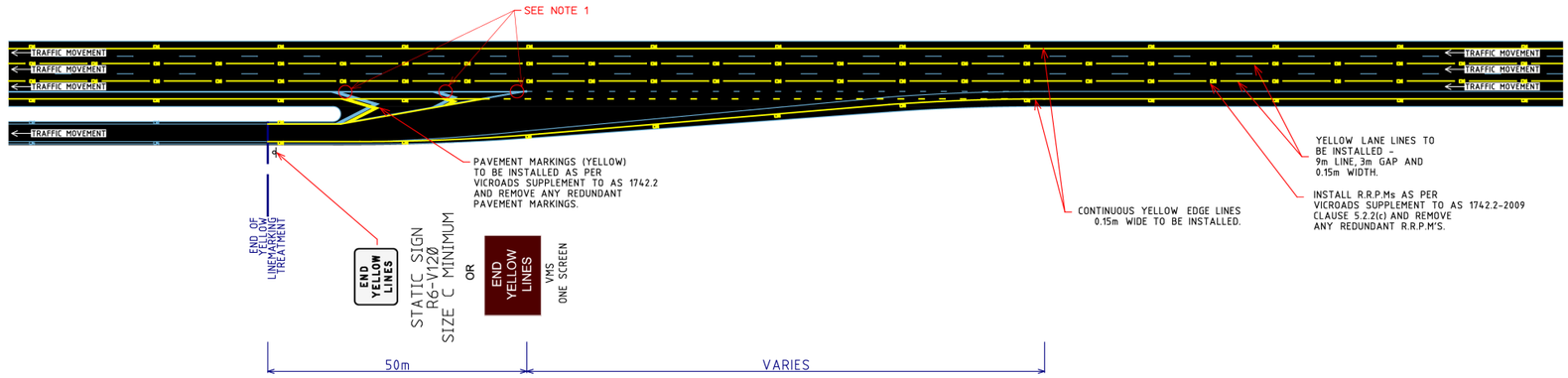

***Figure 6: Temporary yellow linemarking - trap lane, chevron markings and pavement arrows***




ON-RAMP ENTRY USING TEMPORARY YELLOW LINEMARKING




ON-RAMP ENTRY SIGNALISED USING TEMPORARY YELLOW LINEMARKING




NOTE 1: PAVEMENT MARKINGS CIRCLED IN RED SHOULD BE REMOVED TO AVOID CONFUSION

| ISSUE | APP'D | DATE | AMENDMENT |
|---|---|---|---|
| E | | | |
| D | | | |
| C | | | |
| B | | | |
| A | JB | 6/06/17 | UPDATED DRAWING AS PER UPDATED STANDARDS |

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GENERAL NOTES
1. ALL SIGNAGE TO BE INSTALLED IN ACCORDANCE WITH VICROADS SUPPLEMENT TO AS 1742.2-2009 CLAUSE 5.2.2(c) AND ROAD MANAGEMENT ACT 2004 - CODE OF PRACTICE WORK SAFETY - TRAFFIC MANAGEMENT.
2. ANY PERMANENT SIGNAGE THAT CONFLICTS WITH THE TEMPORARY TRAFFIC MANAGEMENT SIGNAGE IS TO BE COVERED/REMOVED DURING ROADWORKS.
3. INSTALLATION OF NEW SIGNAGE MAY REQUIRE ADJUSTMENT ON-SITE & SHOULD BE CLEARLY VISIBLE TO ONCOMING TRAFFIC. EXISTING SIGNAGE TO BE REINSTATED AS REQUIRED.
4. ALL SIGNAGE TO BE INSPECTED ON A REGULAR BASIS TO ENSURE ALL SIGNAGE IS VISIBLE TO ONCOMING TRAFFIC.
5. RRPM'S TO BE INSTALLED IN ACCORDANCE WITH VICROADS SUPPLEMENT TO AS 1742.2-2009 CLAUSE 5.2.2(c).
6. INSTALL YELLOW LINEMARKING AS SHOWN. REMOVAL OF EXISTING LINEMARKING SHOULD BE UNDERTAKEN UNDER THE DIRECTION OF THE SUPERINTENDENT AND/OR FOLLOWING RECOMMENDATION BY A ROAD SAFETY AUDITOR.
7. ALL DIMENSIONS ARE IN METRES.

DESIGNED: TRAFFIC ENGINEERING
APPROVED: J. BURDAN JUNE 2017
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TEMPORARY YELLOW LINEMARKING
ONRAMP ENTRY,
ONRAMP ENTRY SIGNALISED & OFFRAMP EXIT

| FILE NO. | SITE NO. | SHEET NO. | DRAWING NO. | ISSUE |
|---|---|---|---|---|
| | | | YLM 1008 | A |

***Figure 7: Temporary yellow linemarking - entry ramp entry, entry ramp entry signalised and exit ramp exit***

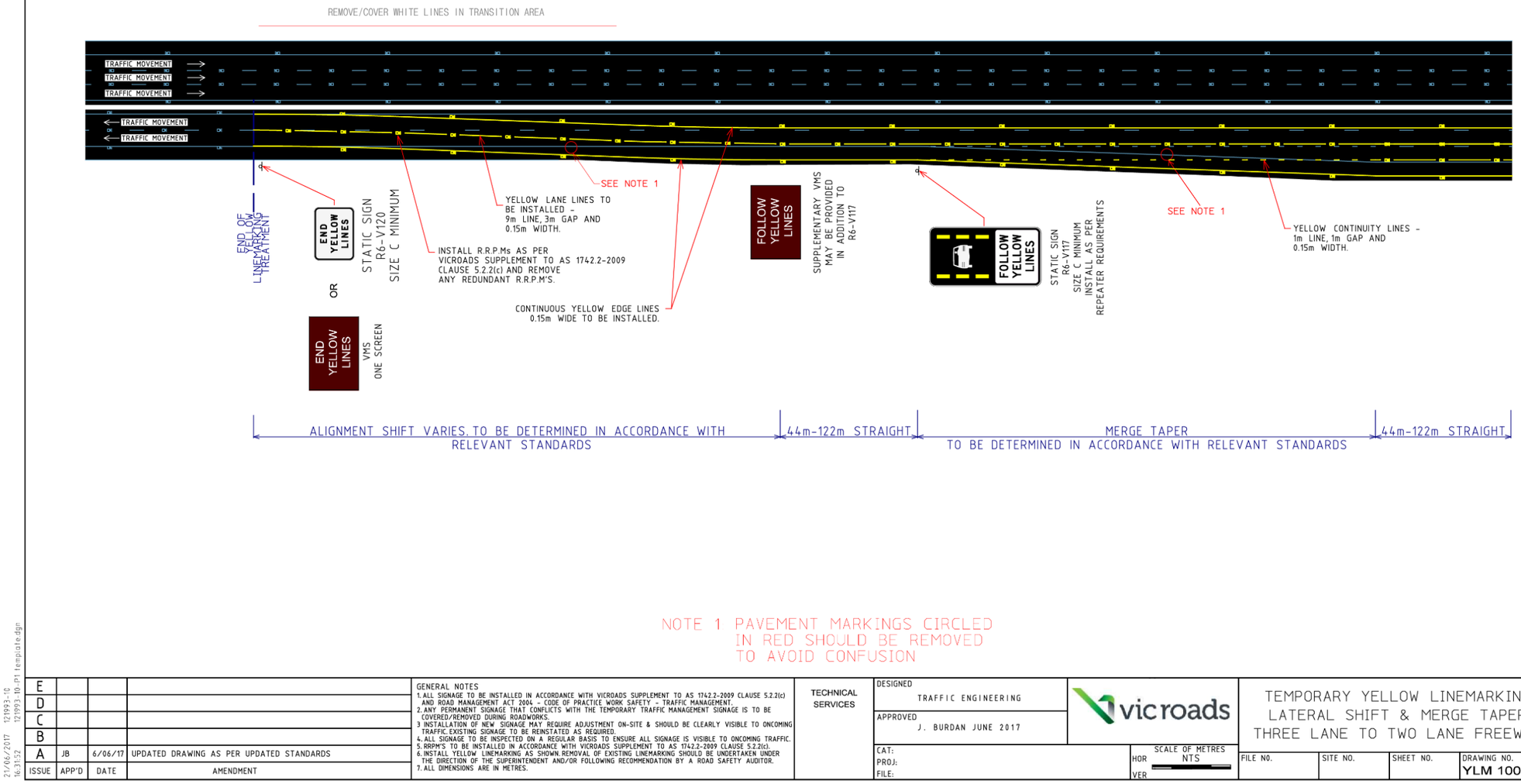


***Figure 8: Temporary yellow linemarking - lateral shift and merge taper, three lane to two lane freeway***

# 5 MAINTENANCE

It is important to ensure that the temporary yellow linemarking arrangement is adequately maintained so that the key objective of the treatment is continually met throughout the duration of the works.

Maintenance activities shall include:

- Periodic refreshing of the yellow linemarking to ensure its integrity is maintained at all times (i.e. the lines do not look faded and retroreflectivity levels are maintained).
- Periodic refreshing / replacement of any 'blacked out' (painted over or covered) line or pavement markings.
- Reinstating RRPMs as required.
- Ensuring signage remains conspicuous at all times.

***Figure 9: Example of faded temporary yellow linemarking - risk of confusion to motorists increases***

# 6 REFERENCES

Austroads, 2019. *Infrastructure Changes to Support Automated Vehicles on Rural and Metropolitan Highways and Freeways: Project Findings and Recommendations (Module 5)*. [online] Sydney: Austroads.
Available at: https://austroads.com.au/publications/connected-and-automated-vehicles/ap-r606-19/media/AP-R606-19_Infrastructure_Changes_to_Support_AVs_Findings_Recommendations_Module_5.pdf [Accessed 1 October 2020].

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Available at: https://austroads.com.au/publications/connected-and-automated-vehicles/ap-r633-20/media/AP-R633-20_Pavement_Markings_for_Machine_Vision.pdf [Accessed 1 October 2020].

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Available at: https://cavs.transurban.com/content/dam/cavs/documents/victorian-trials-report.pdf [Accessed 1 October 2020].

# 7 DOCUMENT INFORMATION

| | |
|---|---|
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| Approved by: |  <br>David Barton<br>Chief Engineer – Roads |
| Date of Approval: | October 2021 |

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For enquiries regarding this document, please contact the DoT Traffic Engineering team via tem@roads.vic.gov.au.