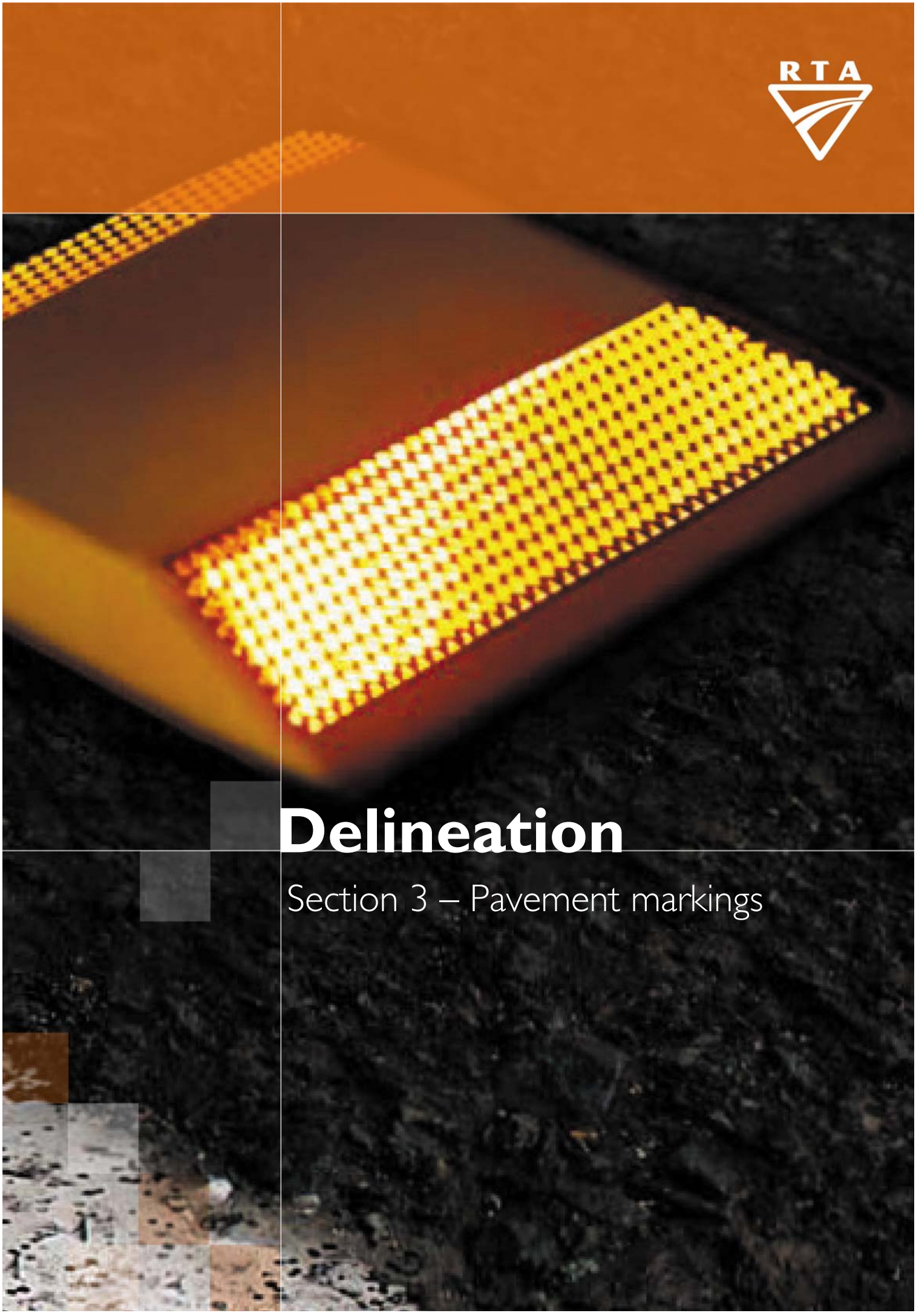

Delineation

Section 3 – Pavement markings

The delineation guidelines have been developed to assist in designing and maintaining a quality delineation system.

The guidelines are to comprise 19 sections and an appendix. These are initially being released individually and in no specific order. The sections which are to be released are as follows:

Part	Title
Section 1	Introduction
Section 2	Delineation principles
Section 3	Pavement markings
Section 4	Longitudinal markings
Section 5	Enhanced longitudinal markings
Section 6	Transverse markings
Section 7	Transverse markings - Pedestrian facilities
Section 8	Diagonal and chevron markings
Section 9	Messages on pavements
Section 10	Pavement arrows
Section 11	Pavement markings at roundabouts
Section 12	Pavement markings for bicycle facilities
Section 13	Pavement markings for kerbside parking restrictions
Section 14	Maintenance of pavement markings
Section 15	Raised pavement markers
Section 16	Guide posts and delineation of safety barriers
Section 17	Alignment signs and markers
Section 18	Delineation systems
Section 19	Delineation management and audit
Appendix A	Locating and setting out of dividing (barrier) lines

To determine which sections are currently available go to:

www.rta.nsw.gov.au/doingbusinesswithus/downloads/technicalmanuals/delineation_dl1.html

The information contained in the various parts is intended to be used as a guide to good practice. Discretion and judgement should be exercised in the light of the many factors that may influence the choice of delineation devices in any situation. The guidelines make reference, where relevant, to current Australian Standards and are intended to supplement and otherwise assist in their interpretation and application.

Delineation

Section 3

PAVEMENT MARKINGS

Special Note:

As from 17 January 2011, the RTA is adopting the Austroads Guides (Guide to Traffic Management) and Australian Standards (AS 1742, 1743 & 2890) as its primary technical references.

An RTA Supplement has been developed for each Part of the Guide to Traffic Management and relevant Australian Standard. The Supplements document any **mandatory** RTA practice and any complementary guidelines which need to be considered.

The RTA Supplements **must** be referred to prior to using any reference material.

This RTA document is a complementary guideline. Therefore if any conflict arises, the RTA Supplements, the Austroads Guides and the Australian Standards are to prevail.

The RTA Supplements are located on the RTA website at www.rta.nsw.gov.au

Roads and Traffic Authority
www.rta.nsw.gov.au

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APPROVED BY:

SIGNED	**SIGNED**
Phil Margison General Manager Traffic Management	Steve Levett A/General Manager Safer Roads

AUTHORISED FOR USE BY:

SIGNED

Michael Bushby
Director
Network Management

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Traffic Management Branch
Email: technical_directions_publication@rta.nsw.gov.au

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Contents

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3.1 Purpose

Pavement markings are the most common and effective means of regulating traffic flow. Pavement markings may simply guide traffic or give advance warning or they may impose restrictions, which are supported by traffic regulations. They may also act as a supplement to other traffic control devices.

Pavement markings are often part of restrictions covered by the relevant traffic regulations. It is essential to check the use of these pavement markings against the current Road Transport Legislation (see Section 1.5.1), before installation or removal, to avoid possible conflict or confusion.

Markings required on account of particular road conditions or to impose restrictions shall be removed if those conditions cease to exist or the restrictions are withdrawn.

3.2 Benefits

Pavement markings are effective delineation devices under favourable conditions. Pavement markings are in the driver's direct line of vision and convey information to drivers without diverting their attention from the road.

The pavement markings provide positive guidance by defining the limits of a driver's field of safe travel or by giving guidance to the desired travel path.

The following pavement markings are examples of positive guidance:

(a) Lane lines

(b) Dividing lines

(c) Edge lines

(d) Stop lines

(e) Turn lines

(f) Step out marking

Figure 3.1: Pavement Markings providing positive guidance

They are also used for prohibitory guidance, that is, for informing the driver where it is generally NOT safe (or permitted) to travel. The following pavement markings are examples of prohibitory guidance:

(a) Painted medians

(b) Painted islands

Figure 3.2: Markings providing prohibitory guidance

3.3 Limitations

Pavement markings have the following limitations:

(a) High maintenance requirements (resulting from excessive traffic wear)

(b) Less effective on wet roads (particularly at night)

Figure 3.3: Limitations of pavement marking - wet roads

(c) They can be obscured by traffic

Figure 3.4: Limitations of pavement marking – obscured by traffic

(d) They cannot be applied on unsealed roads

3.4 Colour

3.4.1 General

All longitudinal and transverse pavement markings in NSW are WHITE in colour, with the exception of yellow being used in the following circumstances:

(a) Linemarkings denoting parking restrictions. See Section 3.7.4.

(b) Centre lines and edge lines on roads experiencing snow. (Note: Where yellow edge lines are used they will also denote parking restrictions, therefore, any permissive parking signs must be removed).

In addition to above:

(c) Disabled parking bays are marked with a white 'people with disabilities symbol' on a blue background.

(d) School zone patches are black numerals on a yellow background.

(e) E-tag patches are red legend on yellow background.

(f) e-pass patches are red legend on white background.

3.4.2 Colour of pavement for special purpose lanes

Special purpose lanes, as listed below, are treated with coloured surface to:

(a) Reduce unauthorised vehicle encroachment

(b) Enhance efficiency of public transport

(c) Provide a distinctive and easily recognisable facility

3.4.2.1 Colour of pavement for bus lanes

Red coloured pavement or overlay material is used exclusively for 'bus lane' and 'bus only' lane.

Figure 3.5: Bus lane

3.4.2.2 Colour of pavement for 'on-road' bicycle lanes

Green coloured pavement material or overlay material is used exclusively for on-road bicycle lanes. Not all bicycle lanes may be appropriate for this treatment and all proposals must be forwarded to the General Manager, Traffic Management Branch for approval.

Figure 3.6: Bicycle lane

3.4.2.3 Colour of pavement for 'any other special purpose lanes

Any proposals to use coloured pavement or overlays for any other type of special purpose lane must be forwarded to the General Manager, Traffic Management for approval.

3.4.2.4 Coloured pavement specification

QA specification R110 gives the specifications for materials used for coloured surface coatings for bus lanes and bike lanes.

3.5 Retro-reflectivity

3.5.1 Retro-reflectivity values

Retro-reflectivity (See Section 2.4.4 for details) is measured by the coefficient of retro-reflectivity, defined as the ratio of the luminance of the surface to the illumination falling upon it. It is often referred to as the coefficient of luminous intensity per square metre (CIL/sq.m.) and its unit of measure is millicandela/lux/sq metre (mcd/lux/m2). It is measured with a retro-reflectometer.

There is a hierarchy of minimum levels of retro-reflectivity requirements to suit various road situations, for both dry and wet conditions. This is measured by the use of portable hand held, or high speed mobile, retro-reflectometers. Refer to Section 14 for values of minimum levels of retro-reflectivity.

3.5.2 Glass beads

Pavement markings must use the mechanism of retro–reflection (refer Section 2.4.4) to meet the requirement of visibility at night. All pavement marking, except in school zone markings, e-toll, e-toll/e-tag and colour pavements, must use glass beads, to provide retro-reflectivity.

Figure 3.7: Glass beads

The methods are used to mix the glass beads in the pavement markings. They are:

3.5.2.1 Pre-mixed

Glass beads are 'pre-mixed' with pavement marking materials to impart retro-reflectivity. However, pre-mixed glass beads do not impart initial retro-reflectivity until traffic travelling on the line causes the beads to be exposed.

3.5.2.2 Drop-on

Glass beads are 'Dropped–on' to impart instant retro-reflectivity. They are sprayed onto the pavement marking material at the time of marking's application.

As a general rule, the wet film thickness should be at least 60% of the nominal diameter of the drop-on glass beads to achieve the maximum retro-reflectivity.

Glass beads shall conform to the requirements of the RTA QA specification 3353.

3.6 Pavement marking materials

The following types of materials are used for pavement markings. They shall comply with the requirements contained in RTA QA specification R141.

Figure 3.8: Typical pavement marking application

3.6.1 Solvent borne paint

The most commonly used line-marking material in New South Wales, until the mid 1980s, was solvent-borne paint**.** Occupational health and safety risks associated with the solvents and environmental concerns regarding their evaporation into the atmosphere have led to these paints being phased out in favour of water-borne paints.

Sparing use of the solvent-borne paint may still be found, for example, in wet weather, for traffic switches etc.

3.6.2 Water borne paint

Water-borne paint is generally used in rural areas. Typically the thickness of the wet paint film applied is around 375 microns although the film thickness after the paint dries is considerably less as the percentage of solids in the paint can be as low as 30 per cent. Glass beads (see Section 3.5.2) are dropped on to the paint film immediately behind the spray gun to

provide night time retro-reflectivity (the principle of retro-reflectivity is described Section 3.5).

Aside from addressing the above environmental and occupational health and safety welfare concerns surrounding solvents, RTA is using water-borne paint due to a number of significant advantages over solvent borne paint -

(a) Waterborne paints are non-flammable, eliminating the danger of fire and/or explosion

(b) Waterborne paints have much lower toxicity and volatile organic content. They present a much lower risk to the operators and to the environment

(c) Waterborne paints can be transported in bulk containers, composed of a supported plastic membrane, which can be dried and disposed of as solid waste

(d) Waterborne paints are more durable than solvent-borne paints

(e) Waterborne paints can be applied at greater thickness than solvent-borne paints, allowing the use of larger glass beads. This leads to improved wet-night visibility

(f) Water-borne paints also have higher solids content than solvent-borne paints, typically around 60 per cent. Being largely hydrocarbon solvent-free, it tends to perform better on fresh bituminous road surfaces to yield whiter, brighter markings

For the above reasons water-borne paint is now the dominant line-marking material, although there are more constraints on the times at which it can be sprayed arising from weather conditions; high humidity and lack of wind increasing its drying time.

QA specification 3356, gives detailed specification of water-borne paint.

3.6.3 Long life materials

Long life materials are used in the metropolitan area and on heavily trafficked routes. Long life materials are more expensive than paint but are more cost-effective as their life span is much longer. The long life materials should not be used if resurfacing is proposed within the following three years.

3.6.3.1 Thermoplastic material

Thermoplastic materials are more durable, yielding a longer service life, but are more costly. The resins used in these markings have thermoplastic properties, melting at elevated temperature and solidifying at ambient temperature. The molten material is to be applied to the pavement by spraying or screeding or extrusion methods. The material cools to form a solid marking of about 1 to 4 mm thickness, depending upon the application method. Thermoplastics possess quick drying properties with drying times for sprayed materials usually in the order of seconds, an advantage on highly trafficked roads. Thermoplastics are usually only applied on highly trafficked roads where the high durability under traffic provides a sufficiently long life between re-marks to compensate for the higher cost.

QA specification 3357, gives detailed specification of thermoplastic road marking material.

3.6.3.2 Pre-formed tapes

Pre-formed tapes consist of high quality plastic material, pigments and glass beads. These markings are fabricated as roller sheet stock in a factory or as cut-out legends. The pre-formed markings are installed using either a pre-applied adhesive on the marking or adhesive applied to the pavement. The thickness of the tape is usually 1.5 to 2.3 mm.

3.6.3.3 Two-part Cold Applied Plastic materials

Two components - a resin and a hardener - are mixed just before or during application to the pavement. A chemical reaction then occurs to form a solid resin. Application is by spraying. Mixing of the two components may be internal or external to the spray equipment. Marking thickness is about 1 to 2 mm.

QA specification 3360 gives detailed specification of Two-part cold applied plastic materials.

3.6.3.4 Selection of material

The material should be selected so that it gives the best overall return in terms of cost-effectiveness. This will vary depending on the location, type of road surface, traffic volume and environmental conditions, and consequently a system of priority cannot be assigned in the general case.

The following properties should be considered to find the material, which gives optimum return:

(a) Durability

(b) Cost

(c) Visibility

(d) Ease of application

(e) Maintenance

(f) Environmental impact

(g) Removal

3.7 Types of pavement markings

Pavement markings comprise longitudinal lines; transverse lines; diagonal and chevron markings, arrows and messages; markings for parking restrictions, buses, bicycles and pedestrians.

3.7.1 Longitudinal markings

A longitudinal marking consists of a broken or unbroken line, or a combination of both, marked generally in the direction of travel. Longitudinal pavement markings include the following types:

(a) Dividing lines

(b) Lane lines

(c) Edge lines

(d) Continuity lines

(e) Turn lines

See Section 4 (Longitudinal markings) and Section 5 (Enhanced longitudinal markings) for specifications, drawings and warrants.

Figure 3.9: Longitudinal markings

3.7.2 Transverse markings

Transverse markings are marked across or partly across the road in association with certain traffic control devices, such as traffic signals and other regulatory devices.

Transverse markings consist of:

(a) Stop lines

(b) Give way lines

(c) Marked Foot Crossings

(d) Pedestrian crossings (Zebra)

(e) Zig Zag markings (in advance of Pedestrian Crossings)

See Section 6 (Transverse markings) and Section 7 (Transverse markings for pedestrian facilities) for specifications, drawings and warrants.

Figure 3.10: Transverse markings

3.7.3 Diagonal and chevron markings, arrows and messages

These markings consist of the following types:

(a) Diagonal and chevron markings

(b) Messages on pavement including words, numerals and Keep clear lines

(c) Pavement arrows

See Section 8 (Diagonal and chevron markings), Section 9 (Messages on pavement), Section 10 (Pavement arrows) and Section 11 (Pavement markings at roundabouts) for specifications, drawings and warrants.

Figure 3.11: Pavement arrows

3.7.4 Markings for parking restrictions, buses and bicycles

These markings consist of the following types:

(a) Pavement markings for Bus lanes and Bus Only lanes

(b) Pavement markings for Bicycle facilities

(c) Pavement markings for kerbside parking restrictions

See Section 9 for Pavement markings for Bus lanes and Bus Only lanes, Section 12 for Pavement marking for bicycle facilities and Section 13 for Pavement marking for kerbside parking restrictions.

Sections contain specifications, drawings, warrants and applications of these markings.

Figure 3.12: Kerbside marking for parking restrictions

3.7.5 Markings for electronic tolling

On fully electronic motorways, approaches to electronic collection points are supplemented with pavement markings. Symbols 'E' or both 'E' and 'e' are marked on the pavement on the approaches as appropriate.

Figure 3.13: Markings for electronic tolling

See Section 9 for Markings for electronic tolling. The section contains specifications, drawings, warrants and applications of these markings.

3.7.6 Markings for school zones

All school zones are supplemented with the yellow pavement patches to increase the conspicuity of the zone. The patch consists of a '40' black numeral marked on a yellow background contained within a white border.

Figure 3.14: Markings for school zones

See Section 9 for pavement markings for school zones. The section contains specifications, drawings, warrants and applications of these markings.

For further enquiries
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