VOLUME 8 TRAFFIC SIGNS AND LIGHTING

SECTION 2 TRAFFIC SIGNS AND ROAD MARKINGS

PART 2

TD 26/17

INSPECTION AND MAINTENANCE OF ROAD MARKINGS AND ROAD STUDS ON MOTORWAYS AND ALL-PURPOSE TRUNK ROADS

SUMMARY

This Requirement Document sets out the inspection and maintenance requirements for road markings and road studs on motorways and all-purpose trunk roads. It supersedes TD 26/07.

INSTRUCTIONS FOR USE

This Requirement Document is to be incorporated in the Manual.

1. This document supersedes TD 26/07.
2. Remove Contents pages for Volume 8 dated May 2007.
3. Insert new Contents pages for Volume 8 dated February 2017.
4. Remove TD 26/07 from Volume 8, Section 2, Part 2.
5. Insert TD 26/17 into Volume 8, Section 2, Part 2.
6. Archive this sheet as appropriate.

Note: A quarterly index with a full set of Volume Contents Pages is available separately from The Stationery Office Ltd.

HIGHWAYS ENGLAND

TRANSPORT SCOTLAND

LLYWODRAETH CYMRU
WELSH GOVERNMENT

DEPARTMENT FOR INFRASTRUCTURE
NORTHERN IRELAND

TD 26/17
Volume 8, Section 2, Part 2

Inspection and Maintenance of Road Markings and Road Studs on Motorways and All-Purpose Trunk Roads

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Contents

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1. INTRODUCTION

Background

1.1 Road markings and studs make an essential contribution to road safety e.g. by clearly defining the path to be followed through hazards, by separating conflicting movements and by delineating the edge of carriageway on unlit roads at night. They can also help to improve junction capacity, and make best use of available road space.

1.2 For road markings to be effective they shall be clearly visible to road users, both day and night; their effectiveness depends on how well the marking stands out on the road (luminance) and the amount of light reflected back to the road user to make the marking visible (retro-reflectivity). For road studs to be effective they shall be clearly visible to road users during the hours of darkness; their effectiveness depends on the amount of light reflected back to the road user.

Scope and Purpose

1.3 The requirements of this document relate to road markings and retro-reflective road studs of all types and colours.

1.4 This document sets out the inspection and maintenance requirements for road markings and retro-reflective road studs (including light emitting studs) on motorways and all-purpose trunk roads, and contiguous local roads as agreed by the relevant Overseeing Organisation.

1.5 This document details the steps required to determine an appropriate frequency of the associated inspections based on asset performance and condition and the required period within which maintenance is necessary to ensure that road markings and road studs are maintained to the required level.

1.6 Compared to the predecessor standard (TD 26/07), this updated document provides a less prescriptive approach. This allows Maintaining Organisations greater flexibility on the choice of inspection frequencies and choice of techniques.

1.7 This document does not provide specific requirements for inspection and maintenance of non-reflecting studs, although these shall be inspected to ensure that they remain in place and in a safe condition.

1.8 This document does not provide design advice for new or replacement markings or retro-reflective studs. Technical guidance on the correct use of road markings and retro-reflective road studs is given in Chapter 5 of the Traffic Signs Manual (TSM) [Ref. 3]. For further technical guidance, the appropriate manufacturers or suppliers should be consulted after seeking the advice of the Overseeing Organisation.

1.9 The relevant Regulations and General Directions applicable to road markings and any type of road stud are set out in the Traffic Signs Regulations and General Directions (TSRGD) [Ref.2].

1.10 The relevant standards applicable to road markings are BS EN 1423 [Ref.15], BS EN 1424 [Ref. 16], BS EN 1436 [Ref.17], BS EN 1790 [Ref.18], BS EN 1824 [Ref.19] and BS EN 1871[Ref. 20].

1.11 The relevant standards applicable to road studs are BS EN 1463 Parts 1 and 2 [Ref. 21 and 22].

Definitions, Acronyms and Abbreviations

1.12 The document makes use of the following terms, defined below:

British Standard: any standard published by the British Standards Institution including adopted European or other international standards.

Chromaticity: this is the definition of the colour of the line by reference to the chromaticity diagram in BS EN 1436 [Ref. 17].

Contract: a legal document that states the formal agreement between two different groups, enforceable by law. In some forms of procurement this is termed as an "Agreement".

Critical Defect: a defect that requires prompt attention because it represents an immediate or imminent hazard, or there is a breach of statutory duty, including where markings are not prescribed in Regulations nor authorised by the relevant Secretary of State. In some contracts this is defined as a Category 1 (or Category I) defect. See Chapter 5 for required action.

EEA State: a state which is a contracting party to the European Economic Area Agreement.

Functional Life: this is the period during which the road marking fulfils all the performance requirements initially specified. The life will be influenced by thickness of the laid materials, the type of materials and the nature of location, including the traffic. This is either the number of roll overs identified on the product test certificate to BS EN 1824 [Ref. 19] or as identified by the markings manufacturer.

Luminance: this is the property of the marking which describes the brightness of its colour, measured as either the luminance co-efficient (Qd) or luminance factor (β), as described in detail in BS EN 1436[Ref. 17].

Maintenance Requirements Plan – An overarching strategic plan that sets out the Maintaining Organisation's approach to inspections, assessment, defect repair, resources, processes and procedures.

NHSS: National Highway Sector Scheme [Ref. 1]

Non-Critical Defect: a defect that requires replacement within a pre-defined period in line with agreements reached with the Overseeing Organisation, as detailed in the relevant Maintenance Requirements Plan. In some contracts this is defined as a Category 2 (or Category II) defect. See Chapter 5 for required action.

Retro-reflectivity: this is the ability of a road marking to reflect light from a vehicle's headlights back to the driving position of a vehicle.

Skid Resistance: Skid resistance measurement on road markings is carried out using the standard British pendulum apparatus. BS EN 1436 [Ref. 17] specifies skid resistance classes.

Mutual Recognition

1.13 Where there is a requirement in this document for compliance with any part of a British Standard or other technical specification, that requirement may be met by compliance with:

(a) a standard or code of practice of a national standards body or equivalent body of any EEA state or Turkey;

(b) any international standard recognised for use as a standard or code of practice by any EEA state or Turkey;

(c) a technical specification recognised for use as a standard by a public authority of any EEA state or Turkey; or

(d) a European Technical Assessment issued in accordance with the procedure set out in regulation (EU) No. 305/2011;

provided that the relevant standard imposes an equivalent level of performance and safety provided for by the stated Standard or technical specification.

1.14 BS EN 1463 Part 1 [Ref. 21] is a harmonised standard that applies to passive road studs and so these types of product must now carry a CE marking. Non-reflecting road studs and those incorporating active elements are not within the scope of BS EN 1463 Part 1 [Ref. 21] and require Type Approval to comply with the TSRGD [Ref. 2]. SA 1 in the Manual of Contract Documents for Highway Works MCHW, Volume 0 [Ref. 4] lists road stud products which have been Type Approved for use in the UK. SA 1 shall only be used for studs excluded from the scope of BS EN 1463 Part 1 [Ref. 21]; the Type Approval document will give any limitations or requirements relating to the use of the specific product. Series D Drawings in Section 2 of MCHW, Volume 3, Highway Construction Details [Ref. 7], also give requirements for passive studs (and active studs including passive elements).

1.15 The design of replacement road markings must comply with TSRGD [Ref.2] and shall also comply with BS EN 1436 [Ref. 17], the Specification for Highway Works [Ref. 5] Series 1200 and it's Notes for Guidance on the Specification for Highway Works [Ref. 6].

1.16 The design of replacement road studs must comply with TSRGD [Ref.2] and shall also comply with BS EN 1463 [Ref 21 and 22], the Specification for Highway Works [Ref. 5] Series 1200 and it's Notes for Guidance on the Specification for Highway Works [Ref. 6].

Application in Devolved Administrations

1.17 Whilst the general principles of this document are endorsed, this standard is not mandatory for use in Northern Ireland. Reference shall be made to 'Roads Service Policy and Procedures Guide (RSPPG) E019' [Ref. 13] for the procedures to be followed in Northern Ireland.

1.18 For application in Northern Ireland all reference to "The Traffic Signs Regulations and General Directions" shall be interpreted as "The Traffic Signs Regulations (NI) 1997" [Ref. 11]. Any other reference to legislation shall be similarly interpreted as referring to the Northern Ireland equivalent legislation.

Implementation

1.19 This document shall be implemented immediately, except where:

(a) The procurement of works, at any stage from conception through design to completion of construction, has reached a stage at which, in the opinion of the Overseeing Organisation, use of this document would result in significant additional expense or delay progress (in which case the decision shall be recorded in accordance with the Overseeing Organisation's procedure); or

(b) A contract has terms which apply specifically to the implementation of new requirements

1.20 Requirements are identified by statements that include the word "shall".

1.21 In exceptional situations, the Overseeing Organisation may be prepared to agree to a Departure from Standard from requirements where the particular requirement is not realistically achievable for social, economic or environmental reasons. Maintaining Organisations faced by such situations and wishing to consider pursuing this course shall discuss any such option at an early stage with the Overseeing Organisation. Proposals to adopt Departures from Standard shall be submitted by the Maintaining Organisation to the Overseeing Organisation and formal approval received before incorporation into asset management plans.

Feedback and Enquiries

1.22 Users of this document are encouraged to raise any enquiries and/or provide feedback on its content and usage to the dedicated Highways England team. The email address for all enquiries and feedback is:

DMRB_Enquiries@highwaysengland.co.uk

2. PERFORMANCE REQUIREMENTS

General

2.1 A risk based inspection and maintenance regime for road markings and studs shall result in the identification and rectification of defects by the times identified in Chapter 5.

Road Markings

2.2 European Co-operation in the Field of Scientific and Technical Research Report No. 331- Requirements for Horizontal Road Marking (known as "COST 331") [Ref. 23] investigated data on drivers' needs for visibility of road markings at night. A driver needs to be able to see the road in front of the vehicle at a certain minimum distance in order to keep the car under full control in the driving lane. The preview time is the number of seconds taken to drive a distance equal to the road marking visibility distance. A preview time of 1.8 seconds is an absolute minimum limit for safe driving. A preview time of 2.2 seconds is a desirable minimum. For the purposes of this document, values lower than the absolute minimum are classed as Critical Defects and those between absolute minimum and desirable minimum are classed as Non-Critical Defects.

2.3 Table 2, based on the COST331 report [Ref. 23], provides required visibility distances for different values of speed and preview time and thus provides information about the desirable minimum and absolute minimum preview times required, and thereby a measure of the requirement for in-use minimum performance of road markings in terms of visibility to a road user.

2.4 Where the observer is not making use of a calibrated video play back technique, including the case of stationary observation during a road closure, consideration shall be given to the age of the observer carrying out the survey. Table 2.1 provides correction percentages to be applied for different ages.

Table 2: Required road marking visibility distances (m) for various speed limits and preview times (dry conditions)

Preview Time (secs)	Speed Limit (miles per hour)					
	20	**30**	**40**	**50**	**60**	**70**
1.8 (absolute minimum)	16	24	32	40	48	56
2.2 (desirable minimum)	20	30	39	49	59	69

Table 2.1: Age Related Corrections to Achieved Visibility Distances from Initial Surveys

Age Related Corrections to Visibility Distances				
Age <30	**Age 30-40**	**Age 40-50**	**Age 50-60**	**Age >60**
-14.2%	-9.5%	-4.8%	-2.4%	N/A

Notes for Table 2 and Table 2.1:

1. On multi-lane carriageways each lane shall be considered separately. Where nearside and offside markings are present and are visible for different distances, the longest achieved visibility can be used, but both shall be recorded.

2. In Table 2.1 the corrections take account of the fact that eye structures become less effective as a person ages. For example if a 31 year old carrying out the test can see a road marking at 100m, the survey record will show a corrected distance of 90.5m to take account of the relatively young age of the observer. Interpolation for intermediate ages is required.

2.5 BS EN 1436 [Ref. 17] has differing performance classes for certain characteristics to enable purchasers in different Member States to select a performance level appropriate to the conditions in that Member State. Where no particular class is recommended, specifiers shall choose the class(es) most appropriate to their requirements. Further information is given in Annex A of this document.

2.6 Frequent changes in the performance of road markings may cause driver distraction or fatigue. Replacement markings should be laid to a length of 4 x Sight Stopping Distance (as defined by TD 9 Highway Link Design [Ref.8]) in length in order to avoid frequent changes of performance; this does not apply to markings laid over lengths of 20m or less e.g. after small patch surfacing repairs. When replacing a road marking, the whole module, arrow or legend shall be replaced to avoid an inconsistent appearance to road users.

2.7 It is also noted that in some cases renewing markings immediately upstream of a hazard (e.g. a tight bend) may increase the risk at the hazard if markings are retained in a poor state of repair at the hazard location. Maintaining Organisations shall consider a route in context and ensure a suitable length of renewal is specified.

2.8 Some historic marking types do not have a current legal status in TSRGD [Ref. 2] and other existing prescribed markings may be inappropriate for the current circumstances on a route. When replacing existing road markings the Design Organisation shall design and specify the road markings to suit the current circumstances, taking into account the current requirements of TSRGD [Ref. 2] and advice in the Traffic Signs Manual Chapter 5 [Ref. 3]. The process shall be recorded. It should be noted that the selection of lane line dimensions from within the permitted ranges in TSRGD [Ref. 2] will have a strong influence on the achieved retro-reflectivity in service.

2.9 Some road markings are used to give effect to regulatory provisions of the TSRGD [Ref. 2] and this legal status, and police enforcement, may be affected by their deterioration or method of replacement. For example, TSRGD [Ref. 2] requires that the maximum height of plain markings must not exceed 6mm. TSRGD [Ref. 2] also prescribes maximum heights for ribbed lines for different road types.

2.10 Markings with less than 70% of the intended surface area remaining shall be considered to be inadequate at indicating the prohibition, requirement or guidance associated with the relevant marking. If the marking is regulatory or is in a critical area, the marking shall be replaced if more than 30% of it is worn down to the road surface. If a marking forms part of a system of markings, which together provide guidance to road users, then the monitoring and assessment of the markings shall be undertaken in accordance with Chapters 4 and 5.

2.11 A marking with more than 30% of the marking surface area worn down to the road surface will have a wear index, as identified in Annex C, of less than 30.

2.12 The continuing performance of road markings is determined by the quality of installation (including surface beneath), the retention of skid resistance and the retention of material (including glass beads, where used).

Retro-reflecting Road Studs

2.13 Studs shall be fixed in accordance with the manufacturer's instruction (or test certificate) and maintained as indicated by any Type Approval document or the manufacturer's instruction if not so indicated.

Street Lighting Regimes

2.14 For roads with dimmed or part time street lights, road markings and studs shall be maintained as if the road is unlit.

Special Circumstances

2.15 The Health and Safety Files of completed schemes shall be reviewed before designing renewals of studs and markings in order to ensure that the original design intent is understood. It should be noted that some parts of the network (e.g. Smart Motorways) may require different actions, in comparison to traditional networks.

National Highway Sector Scheme (NHSS) 7 [Ref. 1]

2.16 NHSSs, together with BS EN ISO 9001 [Ref.14] are designed to:

- provide an industry benchmark;
- ensure that all processes are planned;
- provide a basis for continuous improvement;
- focus on quality as an objective;
- reduce costs for client and contractor;
- provide and maintain a properly trained and competent workforce;
- involve all sides of industry in scheme ownership within a partnership framework;
- provide the basis for the technical knowledge and experience that Certification Body auditors will use in the sector concerned; and
- promote confidence in quality management systems through provision of a robust transparent system.

NHSS 7 [Ref 1] applies if specified by the Overseeing Organisation in their contract for the execution of road marking (permanent or temporary) and/or installation of road studs. In using this Sector Scheme, users should use best practice in specifying any other NHSSs relative to the nature of the work being undertaken.

3. INSPECTIONS FREQUENCIES AND RISK MANAGEMENT

General

3.1 Inspection regimes shall follow a risk based approach. The reasons for the selected approach shall be documented and be retrievable via a Maintenance Requirements Plan. All inspection records shall also be retrievable.

3.2 The format and content of risk assessments to support a Risk Based Inspection approach is a matter for the Maintaining Organisation. Further guidance to assist the Maintaining Organisation in determining suitable inspection types and frequencies is provided in Annex B.

Risk Based Inspections

3.3 Risk Based Inspections can assist the Maintaining Organisation:

- to ensure inspection techniques and methods are clearly defined based on a thorough understanding of potential failure modes to move from a reactive to a proactive maintenance regime;
- to provide a holistic, interdependent approach for understanding and managing risks;
- to move away from time based inspection often governed by minimum compliance with rules, regulations and standards for inspection;
- to apply a strategy of doing what is needed to safeguard integrity and improve reliability and availability of the asset by planning and executing only those inspections that are needed;
- to provide economic benefits such as fewer inspections, fewer or shorter duration interventions;
- to increase network availability and reduce unplanned maintenance;
- to reduce unnecessary associated risks of working on the network, without compromising road user safety or reliability;
- to provide a flexible technique able to continuously improve and adapt to changing risk environment;
- to select cost effective and appropriate maintenance and inspection tasks and techniques; and
- to produce an auditable system.

3.4 For routes with available, accurate asset data, a cyclical approach to renewals can assist with reducing the cost and inconvenience of formal surveys.

3.5 Risk Based Inspection is a proven method used to optimise inspection activities based on risk analysis. Risk Based Inspections, when implemented and maintained properly, improve asset reliability and safety whilst reducing unplanned maintenance and repair costs. Once the inspection programme is operational, learning is fed back to help lower the risk profile of assets.

3.6 Additional safety inspections should be carried out in response reports of extreme conditions that may increase the risk of asset damage, for example a major road traffic accident or extreme weather.

Street Lighting Changes

3.7 Proposals to dim street lighting or turn off street lighting (fully or partially) either via a trial or permanently shall be supported by a suitable and current assessment of condition of road markings and studs. For an assessment to be considered as current, the period between the condition assessment and enactment of the lighting change shall be no greater than 6 months.

Smart Motorways

3.8 Smart Motorways represent a special case and the Maintaining Organisation shall take specific account of the circumstances when determining the inspection and maintenance of road markings and studs. For example on dynamic hard shoulder running schemes the traffic operational regime requires solid lines to be run over at the ends of many merge junction entries and also when moving to the nearside to enter a hard shoulder at any point along a link. Design spacings for studs between the hard shoulder and the nearside lane are different from a traditional motorway and the inclusion or omission of studs at emergency refuge areas depends on the location of a refuge area relative to a diverge junction.

Road Markings

3.9 The selection of the time for the first formal inspection shall take account of the claimed functional life. The period may be increased (beyond the functional life) or decreased depending on the Maintaining Organisation's knowledge of :

- the characteristics of the site;
- the product genre and actual product used; and
- assurance of the quality of installation, including the road surface condition.

3.10 Evidence to support the choice of timing of the first formal inspection shall be recorded. Prior to the first formal inspection, new markings shall be included as part of the normal network safety inspections.

3.11 Immediately prior to the replacement of road markings, the Maintaining Organisation should measure the residual performance of a representative sample of road markings in order to generate a knowledge base of the rate of deterioration, providing further evidence of risk to assist in formulating future inspection frequencies and intervention timings. Paragraph 4.10 describes representative sampling.

3.12 The purpose of inspection is to identify when deterioration of road markings is such that a reduction in the delivery of safety functions could result. Thus the appropriate timing for maintenance intervention can be determined. The use of local collision data is not likely to be fully informative in many cases, particularly as collision causations are multi-factored. Collision data also has a "time-lag", which when added to the time to mobilise an intervention scheme, means that Maintaining Organisations may be at risk of failing in their duty to maintain a safe network via the use of preventive interventions. That said, different classes of road have established default accident rates and those classes of roads with poorer accident performance or individual roads historically performing worse than expected intervention levels may attract a higher level of importance when determining risk profiles.

Characteristics requiring inspection

3.13 Road marking inspection regimes shall determine if some or all of the following characteristics will be inspected and how often:

- wear;
- retro-reflectivity (dry);
- retro-reflectivity (wet);
- colour;
- Luminance Factor or Luminance Co-efficient; and
- skid resistance.

3.14 Road markings characteristics detailed above, combined with the site characteristics, will present differing inspection priorities for lit and unlit locations. Maintaining Organisations shall assess the needs and priorities of those characteristics deemed important for any given inspection site.

3.15 Road markings framed by longitudinal road markings, such as hatched road markings or ghost islands, will often deteriorate at a slower rate than the surrounding markings. Road markings of this type shall be maintained along with the replacement of any surrounding deteriorated boundary road markings. Specific locations where such markings are subject to increased wear or deterioration (e.g. reduced lane widths, reduced ghost island width) shall be identified and managed by the Maintaining Organisation.

3.16 Visual inspections of road markings framed by longitudinal road markings should identify specific locations where additional sweeping may be required in order to deal with build-up of detritus that can affect the legibility of road markings of this type.

3.17 Compliance with requirements for luminance poses difficulties where the Texture Depth of the road surface is above 2 mm. Where the surface is very coarse; e.g. freshly surface dressed roads with a texture depth of 4.5 mm it may prove extremely difficult to achieve a suitable luminance value and such sites should be carefully considered for marking renewal.

3.18 The skid resistance of freshly applied road markings tends to increase in value due to the effects of trafficking and weathering, although this is not always the case and is dependent on the blend of aggregate or beads within the material, type of road surface and the type of marking, e.g. embossed, profiled, etc.

Retro-reflecting road studs

3.19 Daytime visual inspections of road studs shall be carried out at relevant intervals determined by the Maintaining Organisation, in accordance with the methods set out in Annex C Figure C.1 for the following characteristics:

- identification of unlawful double–studding;
- wear, corrosion, gaps, voids, ponding, damage;
- loose or missing studs or inserts;
- loss of or damage to retro-reflective lenses; sinkage or settlement or masking due to adjacent raised road surfacing (e.g. surface dressing)
- detritus on lenses or masking by adhesive;
- integrity and security of casings of “embedded” studs (housings);
- loss of adhesion or breaking up of surface mounted road studs under traffic loading; and
- misalignment with existing road markings

3.20 Inspections for reflective conspicuity of retro-reflecting road studs shall be carried out during the hours of darkness using a reference sample in accordance with the method set out in Annex C Figure C.2.

3.21 Consideration should be given to the risks of surface break-up between a historic stud location and a nearby replacement; a suitable separation distance should be specified.

3.22 Consideration should be given to the type of studs in use and the level of expected traffic.

Light emitting road studs

3.23 The maintenance of light emitting road studs (active studs) shall be undertaken according to the manufacturers' recommendations or as specified in the Type Approval document. The design of inspection regimes for active studs shall be specifically considered (see paragraph 4.20). Physical characteristics of active studs not related to the active element shall be inspected and maintained in the same manner as passive studs if not specified by the manufacturer or in the Type Approval document.

4. INSPECTION METHODS

Introduction

4.1 This chapter of the document provides requirements and advice on the methods of inspection techniques. These are also described in further detail in Annex C of this document.

Road Markings

4.2 High level visual assessment surveys shall be carried out as part of normal network safety inspections to obtain a general understanding and overview of performance.

4.3 Inspectors carrying out high level assessments may use preview times and visibility distances in Table 2 as a guide to provide an outline initial assessment of road user experience. Obtaining formal records of preview times and visibility distances requires either road closures (for static survey) or development of video camera capture techniques. See paragraphs 4.12-4.16 for further details.

4.4 The network shall be formally surveyed using a logical basis as set out in asset maintenance management plans specific for each route and homogenous sections of route. A mixture of survey techniques may be appropriate. For example detailed techniques of smaller samples can be used as supporting evidence if generally using higher level techniques for markings known to be of similar age, traffic level and material.

Machine Surveys

4.5 Acceptable machine survey techniques for measurement of retro-reflectivity are:

- Vehicle Mounted Devices, calibrated and maintained in line with the manufacturer's recommendations; and
- Certified hand held retro-reflectometer devices

4.6 Annex C provides additional information on the use of current survey techniques for different circumstances. Until such time that certification processes are available, any vehicle mounted devices to be used for measurement of retro-reflectivity shall be approved for use by the Overseeing Organisation by application of the Maintenance Organisation on a contract specific basis. Additionally, in future it may also be possible to measure aspects that are additional to retro-reflectivity using vehicle mounted survey devices based on other technologies (e.g. lasers) and in these circumstances the Overseeing Organisation's approval shall also be sought. Where requested by the Overseeing Organisation, Maintaining Organisations shall provide independent evidence to demonstrate that survey techniques provide results that are representative of road users' experiences for all aspects to be measured by such devices. Such devices shall be calibrated and maintained in line with the manufacturer's recommendations.

4.7 Vehicle Mounted Device survey results shall be aggregated and reported over 100m lengths.

Detailed visual surveys and skid resistance measurement

4.8 Some areas of the network cannot be surveyed with vehicle mounted devices (e.g. STOP lines, Give Way lines, "SLOW" markings, yellow bar markings, lane designations and exit arrows) and thus require use of a hand-held device to measure retro-reflectivity.

4.9 Where use can be made of planned road closures put in place for other reasons, hand held devices can be used to provide primary data as well as increasing confidence in measurements taken using vehicle mounted devices on longitudinal markings. Hand held devices shall be used when wet retro-reflectivity data is required e.g. for markings specified to Specification for Highway Works (SHW) [Ref. 5] clause 1212.5.

4.10 Where detailed visual assessment is carried out it shall comprise splitting the survey area into 100m segments for record storage purposes and carrying out the following assessments:

- wear assessment:
  - for continuous longitudinal markings, measurement every 20m on a 5m length of an area. Results shall be presented as averaged values.
  - for other markings, including modular longitudinal road markings: the assessment shall be carried out on the worst worn 25% of the markings at each location. Results shall be presented as averaged values.
- retro-reflectivity using a handheld device (see Section C5 in Annex C)
- an assessment of the luminance

4.11 Skid resistance measurements shall be carried out on defined critical areas of the network. The Maintaining Organisation shall define the critical areas taking into account the examples given in Annex C Figure C.5 and the condition or age of the road marking material. Measurements shall be taken on the most trafficked areas of the road markings at each location and an average calculated.

Preview Time of Road Markings

4.12 Visual inspections can be employed to confirm visibility of road markings' preview time in both day time and night time dry conditions, although on unlit roads the night time performance is likely to be the most important factor.

4.13 Table 2 provides the achievable visibility distances for different values of speed and preview time. So, drivers on a motorway travelling at 70mph would need to see markings 69m ahead to achieve a preview time of 2.2 seconds. This table provides the desirable and absolute minimum preview times required, and thus a measure of performance of road markings in terms of visibility to a road user. Where absolute minimum values are close to being reached, this should be taken into account when determining the appropriateness of the technique and also the timing of the next survey.

4.14 If performing surveys to ascertain preview times, the Maintaining Organisation should give regard to the typical car and typical driver and hence the need to replicate this set of circumstances when selecting the survey vehicle. The preview time values presented in Table 2 are based on the assumption that typical vehicles are used i.e. a typical family car with standard headlight height and output not exceeding 1150 lumens.

4.15 Determining accurate visibility distances in a moving vehicle is not possible without the use of video recording equipment. Such equipment shall be mounted at a normal driving height. This would allow the Maintaining Organisation to initially review road marking preview times from video data in a desktop exercise. Where a video survey is not undertaken, machine surveys shall be undertaken in addition to any high level visual survey.

4.16 Where requested by the Overseeing Organisation, Maintaining Organisations shall provide independent evidence to demonstrate that video systems replicate road users' experiences when obtaining preview times and distances.

Road Studs

4.17 Single carriageway roads shall be inspected for defects in both directions where bi-directional road studs have been installed.

4.18 In situations where earlier or additional inspections and/or in-situ measurements are warranted in the event of incidents or accidents, they shall be carried out as necessary during the next available safety inspection.

4.19 Inspections for reflective conspicuity of retro-reflecting road studs shall be carried out both during the day and also hours of darkness in accordance with the method set out in Figures C.1 and C.2 of Annex C respectively. Whenever possible road stud inspections should be carried out to be synchronized with night outage inspections referred to in TD 23 Inspection and Maintenance of Road Lighting [Ref. 9] and TD 25 Inspection and Maintenance of Traffic Signs on Motorway and All-Purpose Trunk Roads [Ref. 10].

4.20 The definition of "safety critical location" for road studs (as shown in Figure C.2) shall be agreed in the Maintenance Requirements Plan, but shall, as a minimum, include the following locations:

- regulatory markings e.g. double white lines, solid edged ghost islands;
- lay-bys, including emergency refuge areas;
- merge and diverge tapers;
- roads where the horizontal alignment constitutes a Departure from Standard from TD 9 [Ref 8]; and
- active road stud locations.

4.21 Loose casings of "embedded" studs can have serious safety implications; they shall therefore, be classed as Critical Defects. However, inspection of all road studs for looseness is a time-consuming and costly operation, with associated risk to road operatives, particularly on heavily trafficked roads. Therefore detailed inspections for this purpose should, wherever possible, be carried out when lane closures for other activities are in operation e.g. coincident with night outage inspections referred to in TD 23 and TD 25 [Ref. 9 and 10]. Displacement occurring in significant groupings may be indicative of a general fault condition and specific closures for road stud inspection shall be arranged in such circumstances.

4.22 When re-rubbering into existing inset castings, these shall be checked for wear along the shoulders of the casting. Re-rubbering into a worn casting can cause accelerated wear of the insert and can lead to its insert becoming detached.

4.23 All inspections shall be programmed to enable maintenance works to be completed before the winter season. Further inspections shall be carried out as soon as possible after the winter season to detect damage by snow ploughs in affected areas.

5. DEFECT CATEGORIES AND MAINTENANCE

5.1 Any defects discovered shall be categorised as Critical Defects or Non-Critical Defects using the requirements of this document (see Chapter 1: definitions), including the methodology given in Annex D.

5.2 Critical Defects shall be corrected or made safe (including filling of any cavities) at the time of inspection if reasonably practical or within no more than 24 hours of notification. The response times determined shall be detailed in the relevant Maintenance Requirements Plan.

5.3 Non-critical defects shall be repaired within a maximum of six months of the initial inspection that identified the defect. Any assets that require a response times of less than six months shall be detailed in the relevant Maintenance Requirements Plan.

5.4 Where there is no record of the expected functional life for a marking and no recorded value of in-service performance, any such marking shall be considered as a Critical Defect three years after its application. For markings in defined critical areas, this period is reduced to two years after the marking is laid.

5.5 Where the expected functional life of a marking is known, then the marking shall be considered as a Non-Critical Defect after that period is reached (and re-classified as a Critical Defect one year after it is reached), except where any of the following conditions are met:

i. the recorded in-service performance identifies a deterioration rate which would indicate that performance is higher than the threshold for a defect.

ii. the recorded in-service performance identifies a Critical Defect.

iii. the measured performance (at replacement) of a similar product in similar conditions for a similar length of time showed that there was a measurable residual life for the relevant feature.

6. ASSET MANAGEMENT DATA RECORDS

6.1 Records shall be placed on the Overseeing Organisation's systems, either directly or via interface with systems employed by the Maintaining Organisation.

6.2 Data shall be collected and maintained in accordance with contractual requirements.

6.3 All data shall be stored on a computer system that is able to output records in a format agreed by the Overseeing Organisation. The integrity of the inventory shall be maintained through back-up facilities with agreed security procedures.

6.4 An inspection report in a format agreed by the Overseeing Organisation shall be maintained for all inspections.

6.5 All measurements collected and defects identified during inspection shall be reported and recorded, including details of any action taken or required. The dates of surveys, location on the network and condition shall be easily identifiable on survey records.

6.6 All records shall be recorded in the relevant asset management information system. Where records are not held in a system managed by the Overseeing Organisation, these shall be retained for a minimum of seven years or a longer period if this is contractually required and disposed of only with the written agreement of the Overseeing Organisation. These records shall be handed over to the Overseeing Organisation on termination of the agreement with the Maintaining Organisation.

6.7 To enable an effective risk based approach to road marking and stud maintenance to be implemented the Maintaining Organisation shall understand the design rationale and also the likely rate of deterioration for different network circumstances. "As installed" drawings and associated records shall be kept up-to-date by the Maintaining Organisation. The records shall show:

- the physical characteristics of the location of road markings and studs;
- the size and type of the installed feature including reference to TSRGD [Ref. 2] diagram numbers;
- where the designer's initial specification exceeds the normal requirements of the National Annex, with reasons;
- the date of installation;
- the marking thickness and type of product for each marking and stud; and
- the method and product used to fix studs to the road surface.

7. REFERENCES

Table 7.1: Normative references

Ref	Title	Publisher
1	National Highways Sector Schemes for Quality Management in Highway Works No7: For the application of road marking materials and road studs to road surfaces	United Kingdom Accreditation Service
2	The Traffic Signs Regulations and General Directions	The Stationary Office
3	Traffic Signs Manual, Chapter 5: Road Markings	
4	Manual of Contract Documents for Highway Works, Volume 0, Section 3, Part 1: SA 1: Lists of Compliant/Approved/Registered Products.	
5	Manual of Contract Documents for Highway Works, Volume 1: Specification for Highway Works.	
6	Manual of Contract Documents for Highway Works, Volume 2: Notes for Guidance on the Specification for Highway Works	
7	Manual of Contract Documents for Highway Works, Volume 3, Highway Construction Details, D – Series Drawings.	
8	Design Manual for Roads and Bridges, Volume 6, Section 1, TD 9: Highway Link Design.	
9	Design Manual for Roads and Bridges, Volume 8, Section 3, TD 23: Trunk Roads and Trunk Road Motorways: Inspection and Maintenance of Road Lighting.	
10	Design Manual for Roads and Bridges, Volume 8, Section 2, TD 25: Inspection and Maintenance of Traffic Signs on Motorway and All-Purpose Trunk Roads.	
11	Traffic Signs Regulations (NI)	
12	The Highways Act	
13	Road Services Policy and Procedures Guide (RSPPG) E019.	Department for Infrastructure Northern Ireland

14	BS EN ISO 9001 Quality management systems - Requirements.	British Standards Institution
15	BS EN 1423: Road marking materials – Drop on materials – Glass beads, antiskid aggregates and mixtures of the two	
16	BS EN 1424: Road marking materials – Premix glass beads	
17	BS EN 1436: Road marking materials – Road marking performance for road users	
18	BS EN 1790: Road marking materials – Preformed road markings	
19	BS EN 1824: Road marking materials – Road trials	
20	BS EN 1871: Road marking materials – Physical properties	
21	BS EN 1463 Part 1: Road marking materials – Retroreflecting road studs – Initial performance Requirements	
22	BS EN 1463 Part 2: Road marking materials – Retroreflecting road studs – Road test performance specifications	

Table 7.2: Informative references providing additional background information

Ref	Title	Publisher
23	European Co-operation in the Field of Scientific and Technical Research Report No. 331- Requirements for Horizontal Road Marking (known as “COST 331”).	European Commission Directorate General Transport

8. APPROVAL

Approval of this document for publication is given by:

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ANNEX A: APPLICATION OF NATIONAL ANNEX TO BS EN 1436

BS EN 1436 [Ref. 17] is an end performance specification concentrating on the needs of the driver and it contains differing performance classes for certain characteristics to enable purchasers in different Member States to select a performance level appropriate to the conditions in that Member State. The standard specifies the various levels of performance that are approved for use in a contract specification, which will govern the required quality of new or modified road marking. It also describes the methods of measuring the various performance characteristics. This means that it is essential that purchasers specify which performance level class they wish to have. If this is not done but the purchasing document specifies only that the product has to meet BS EN 1436 [Ref. 17], then manufacturers may supply the lowest class. This may not be suitable.

For each of the performance characteristics contained in this document, the National Annex to BS EN 1436 [Ref. 17] gives the recommended class(es) considered most suitable for permanent road markings in the UK, as follows:

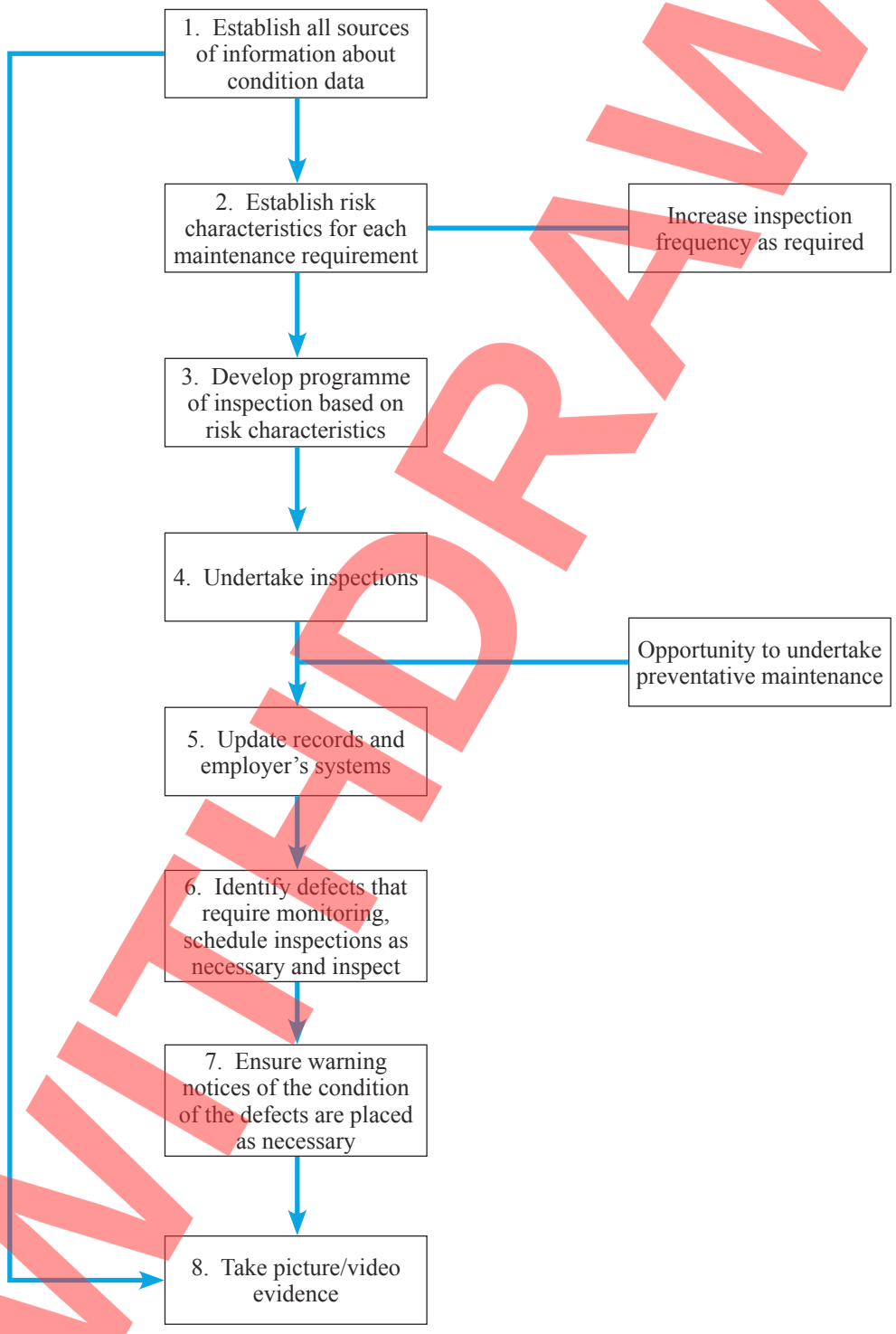
- Reflection in daylight or under road lighting: 3 classes of performance
- Retro-reflection under vehicle headlamp illumination:
  - Classes for dry road markings: 3 classes of performance
  - Classes for road markings in conditions of wetness: 2 classes of performance
- Colour:
  - Luminance: 2 classes of performance
  - Chromaticity: co-ordinates to fall within a defined square on the chromaticity diagram
- Skid Resistance: 2 classes of performance

When using BS EN 1436 [Ref. 17], it is possible to inadvertently ‘over specify’, for example it is difficult to obtain high retro-reflectivity and skid resistance together, for a normal flat line, as a gain in one property is often achieved at the expense of the other. Typically, and dependent on the bead type, the more drop-on glass beads applied the greater the retro-reflectivity and the lower the skid resistance. Classes of high performance cannot always be achieved simultaneously.

ANNEX B: RISK BASED INSPECTION PROCESSES

Figure B.1 details the methodology the Maintaining Organisation should employ in order to determine inspection frequencies of road markings and road studs, based on the risk those assets present.

Figure B.1: Risk based inspection process



NOTES ON RISK BASED INSPECTIONS (RELEVANT TO NUMBERED BOXES IN FIGURE B.1)

2. During the Mobilisation Period the Maintaining Organisation shall review existing records and establish all sources of information where knowledge can be gained about asset type, products employed, condition and location specific factors. The Maintaining Organisation shall take all reasonable care to identify parts of the area network that are likely to cause danger to users of the highway.

3. There will be different risk characteristics for each Maintenance and Operational Requirement i.e. the different types of risk that could affect achievement of the Maintaining Organisation Outcomes or cause a danger to users of the highway. The Maintaining Organisation shall establish these risk characteristics in the context of the variable nature and character of the Area Network i.e. a normally low risk may become a high risk depending on its context in the Area Network.

4. The Maintaining Organisation develops a programme of inspections for each Maintenance Requirement recognising the risk characteristics. The programme shall be coordinated in order to minimise lane closures and take account of the potential inability to enforce traffic law until renewal of markings or studs has been completed.

5. In addition to any procedures mandated by the contract, the Maintaining Organisation shall have procedures in place for undertaking inspections. The Maintaining Organisation shall have mechanisms in place for checking and controlling the quality of inspections. The Maintaining Organisation takes the opportunity to undertake preventative maintenance or make defects safe following inspections.

6. The Maintaining Organisation updates their own systems as necessary and also the Overseeing Organisation's systems in accordance with the contract.

7. The Maintaining Organisation monitors Defects that have the potential for deterioration and could cause a risk to the achievement of the Maintaining Organisation's Outcome or cause a danger to users of the highway. The Maintaining Organisation adjusts his inspection regime accordingly.

8. The Maintaining Organisation displays warning notices of the condition of the highway in relation to defects that could cause harm to the users of the highway.

9. The Maintaining Organisation shall take picture or video evidence during inspections to be made available as evidence of compliance with these Maintenance and Operation Requirements.

ANNEX C: ASSET INSPECTION METHODS

Available inspection methods are detailed in this Annex C.

C1. DETAILED VISUAL ASSESSMENT SCORING SYSTEM

Road Markings

Table C.1 provides information on visual assessment scoring. Photographic examples for each of the scores below can be found in Annex E. The visual assessment system should be applied to each road marking and aggregated over 100m. The assessment shall not mix materials or line types i.e. each line type shall be associated with its own averaged score. In the case of lane dividing lines, each lane line shall also be associated with its own average score.

Use of Table C.1 is appropriate when carrying out a step required after applying Figures C.3i and ii.

Where detritus or vegetation encroaches onto a road marking the assessment score shall be taken before and after remedial action has been taken to remove the defect. The defect shall be scored and categorised in the same way as wear defects based on the residual visible area.

Table C.1: Visual Assessment Scoring for wear

Assessment	Score	Defect type when score averaged
Non-existent, residue only	0	Critical Defect
Barely visible	10	Critical Defect
Visible, but has randomly spaced small bare spots	20	Potentially Critical Defect – judgement required taking into account location and function and plan shall be put in place to manage
Marginal – some visible wear, larger bare spots	30	Non-Critical Defect
Very little wear	40	Non-Critical Defect
No obvious wear	50	Not a defect

Notes

1. Whilst the criteria of Table C.1 also apply to raised rib edge markings when viewed from above (plan view), consideration also needs to be given to the vertical profile of raised rib markings because these provide an auditory function as well as a visual function.

2. Raised rib markings initially classed as having a wear score of 30 or more, shall be re-categorised as being a Critical Defect where the residual rib height is 6mm or less on motorways or 3 mm or less on all purpose trunk roads if this affects any individual worn section of length equal or greater than the desirable minimum preview distance (Table 2) relevant for the speed limit of the road.

C2. ROAD STUDS

Figures C.1 and C.2 provide guidance on survey of road studs. A Non-Critical Defect from applying Figure C.1 may need to be re-classified after applying Figure C.2.

Figure C.1: Daytime assessment of retro-reflecting road studs

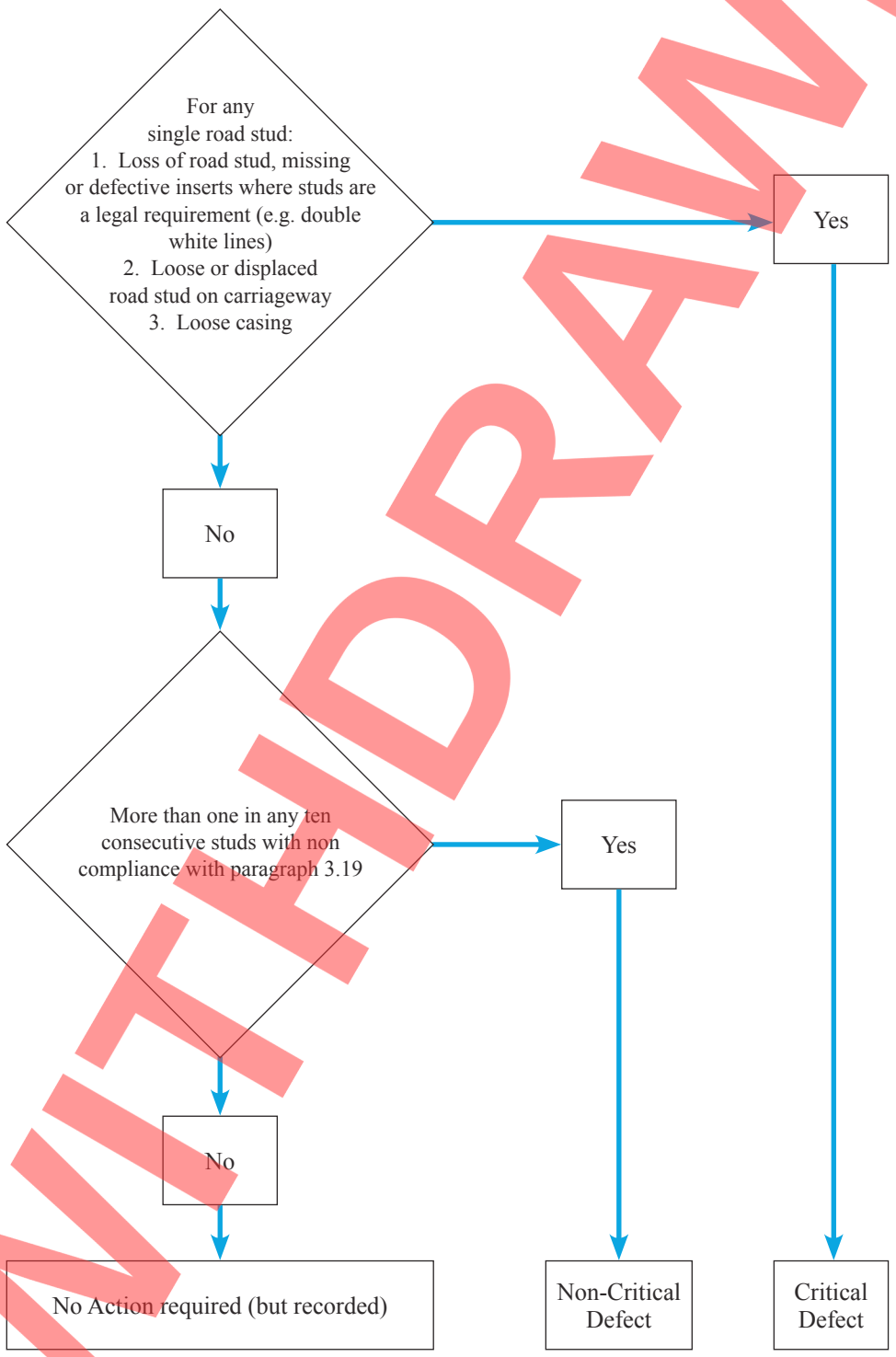
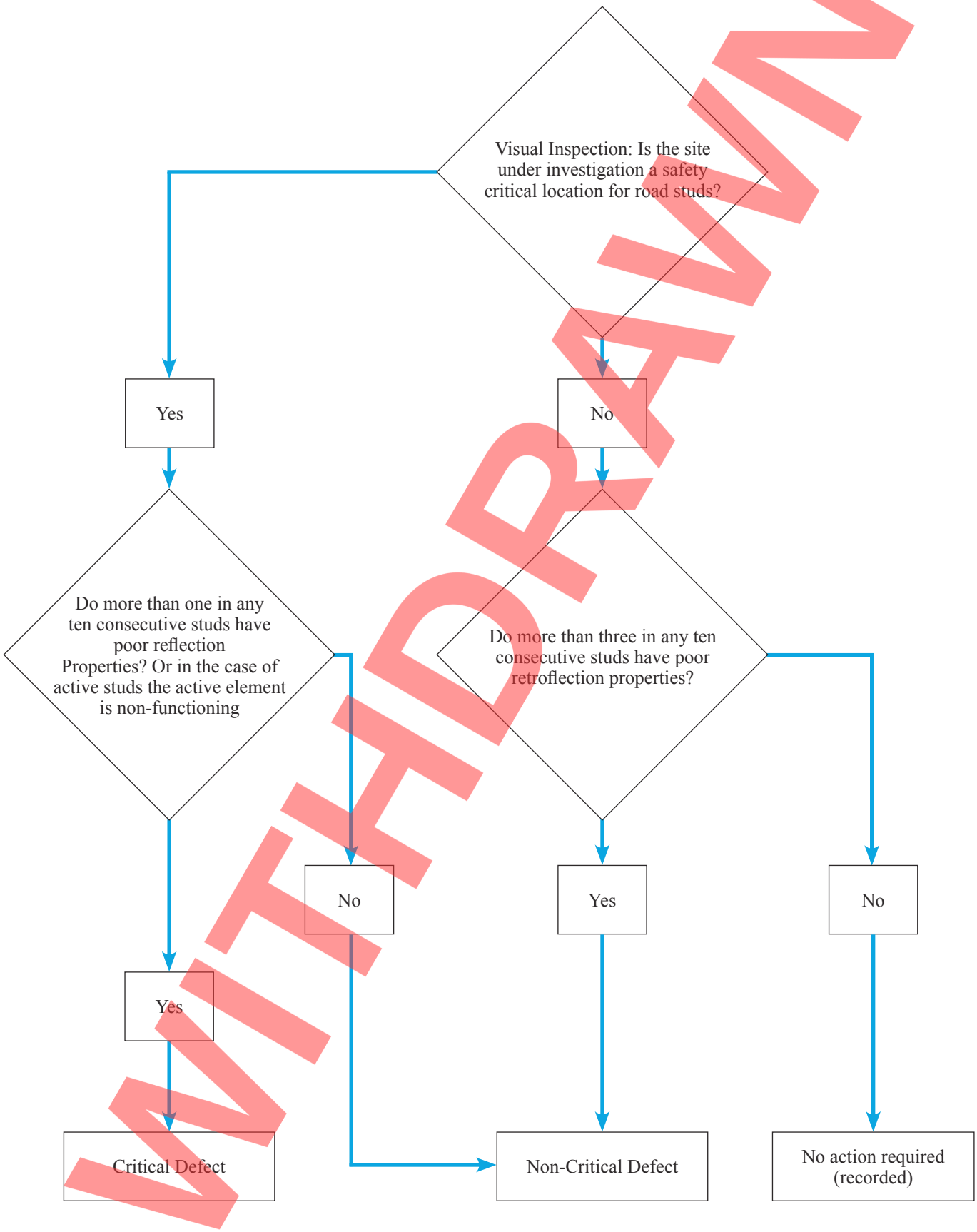


Figure C.2: Night-time assessment of retro-reflecting road studs



C3. MACHINE SURVEYS

Figures C.3i and ii provide requirements when carrying out Vehicle Mounted Device surveys in unlit and lit areas respectively. Figure C.4 is for areas that cannot be surveyed by vehicles.

Figure C.3i: Assessment of longitudinal road markings by Vehicle Mounted Device in unlit area

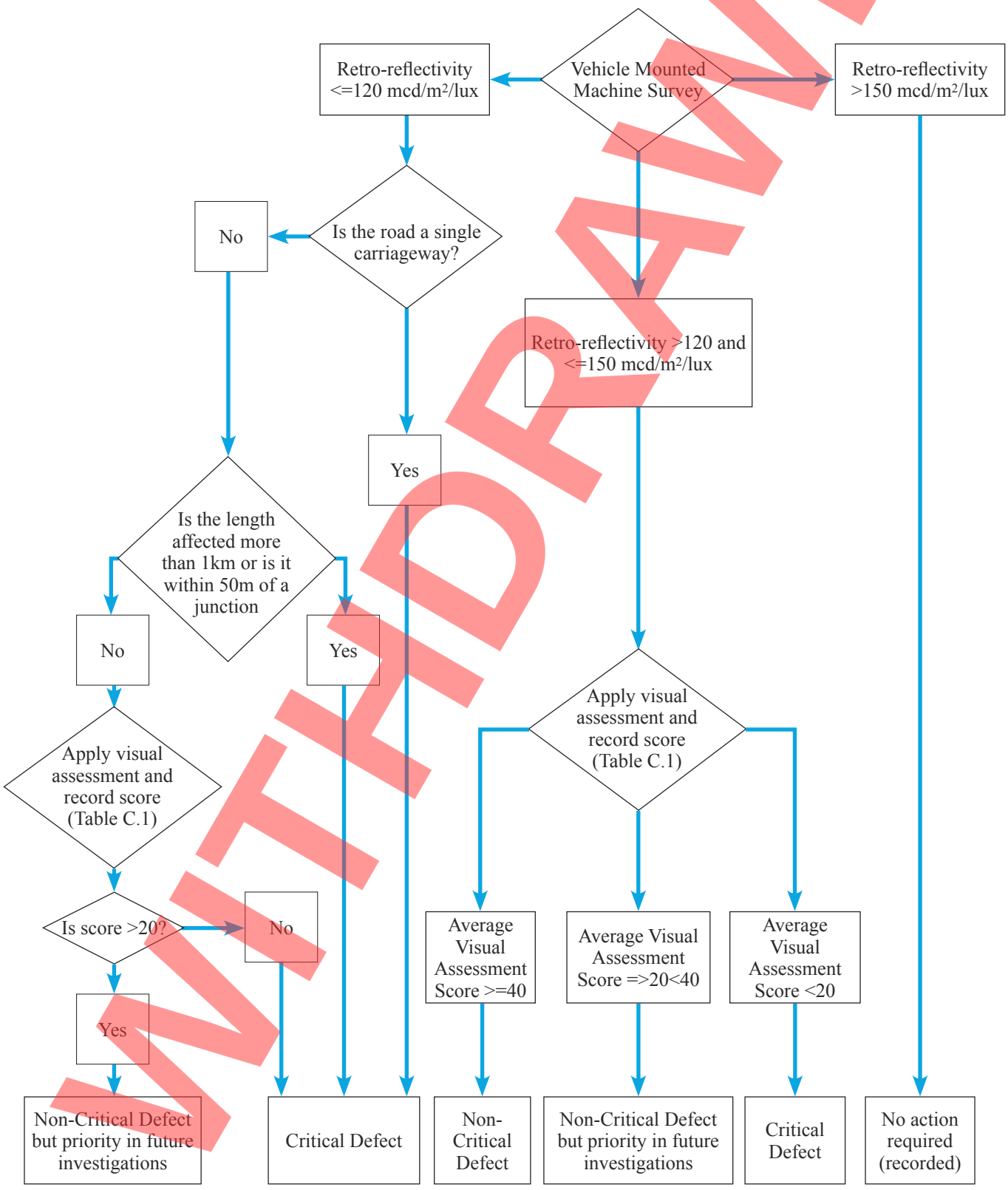


Figure C.3ii: Assessment of longitudinal road markings by Vehicle Mounted Device in lit areas

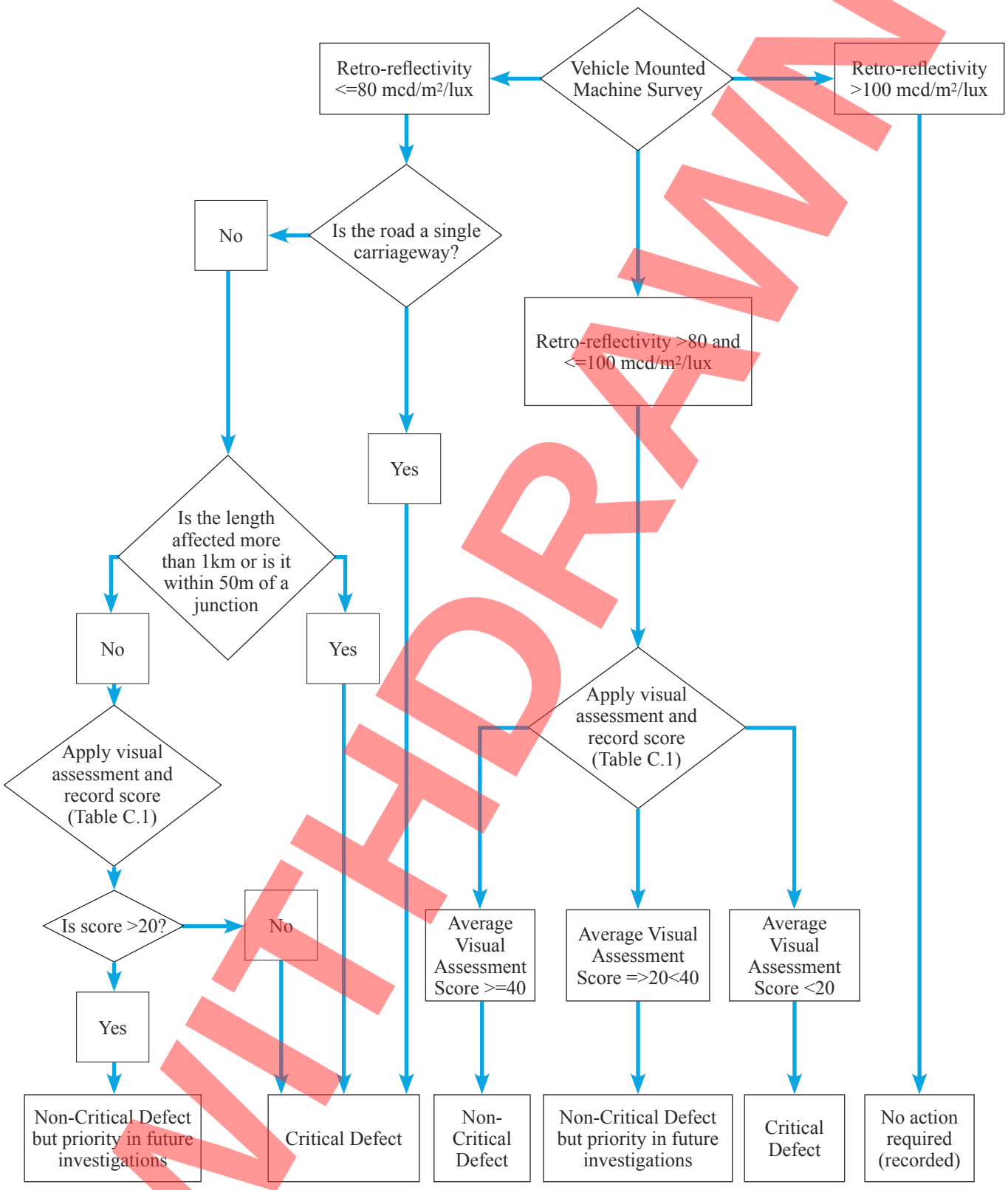
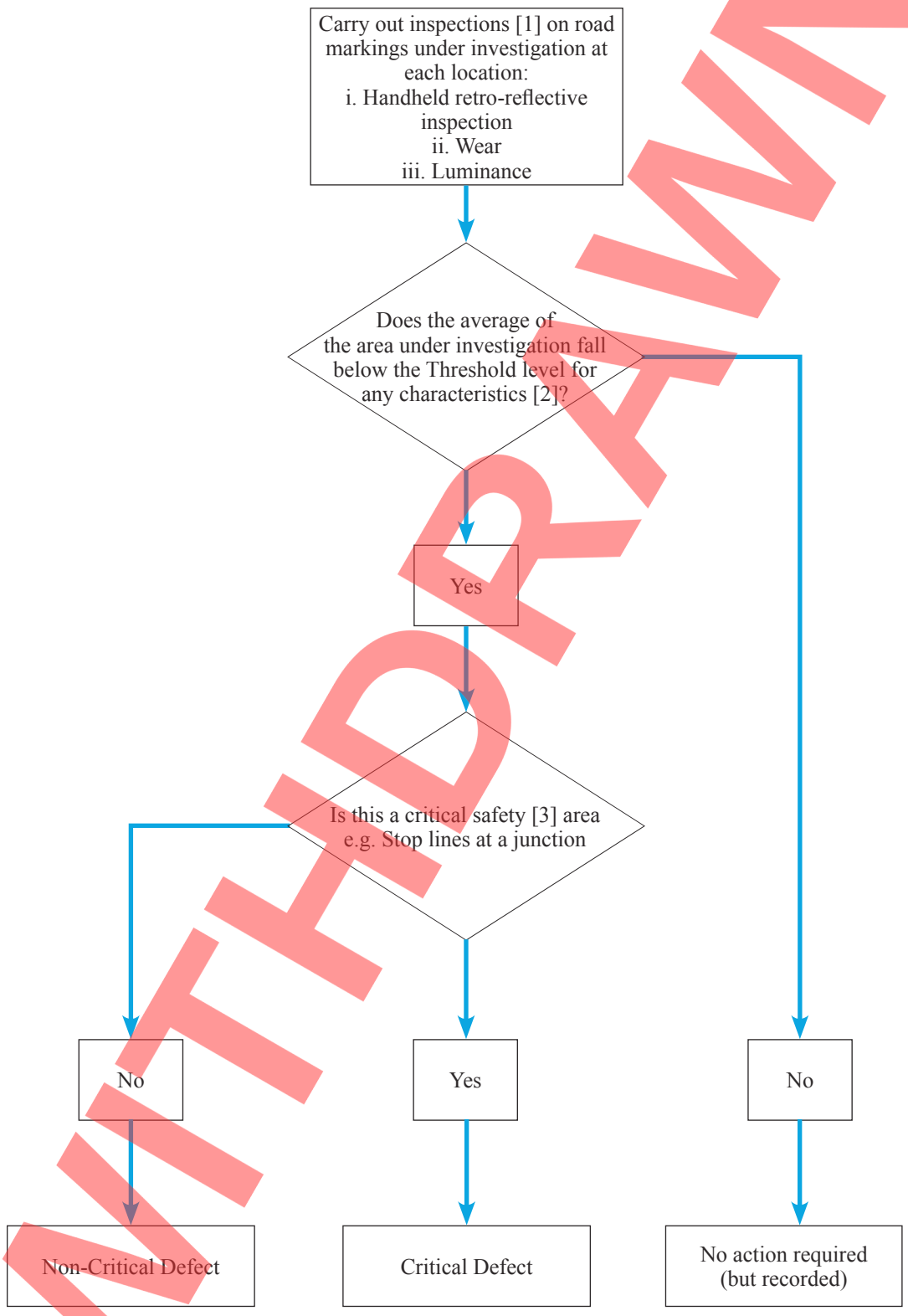


Figure C.4: Assessment of areas that cannot be surveyed by Vehicle Mounted Device



Note 1: Measurements of retro-reflectivity shall be carried out as set out in Annex C5. Measurements for wear and luminance factor shall be carried out as per paragraph 4.10.

Note 2:

Characteristic	Threshold Level	Method
Retro-reflectivity (R)	< 100 mcd/m²/lux in lit areas and < 150 mcd/m²/lux in unlit areas for line type (a) – see note 3 < 80 mcd/m²/lux in lit areas and < 120 mcd/m²/lux in unlit areas for line type (b) – see note 3 < 35 mcd/m²/lux for "Condition of wetness"(where applicable for markings specified to SHW [Ref. 5] clause 1212.5)	BS EN 1436 [Ref. 17]
Wear	< 30 Score for each type of marking	Visual assessment (Table C.1)
Luminance factor (β) Or Luminance Co-efficient (Qd)	< 0.30 for white or < 0.20 for yellow line type (c) Or Q2 or B3	BS EN 1436 [Ref. 17]

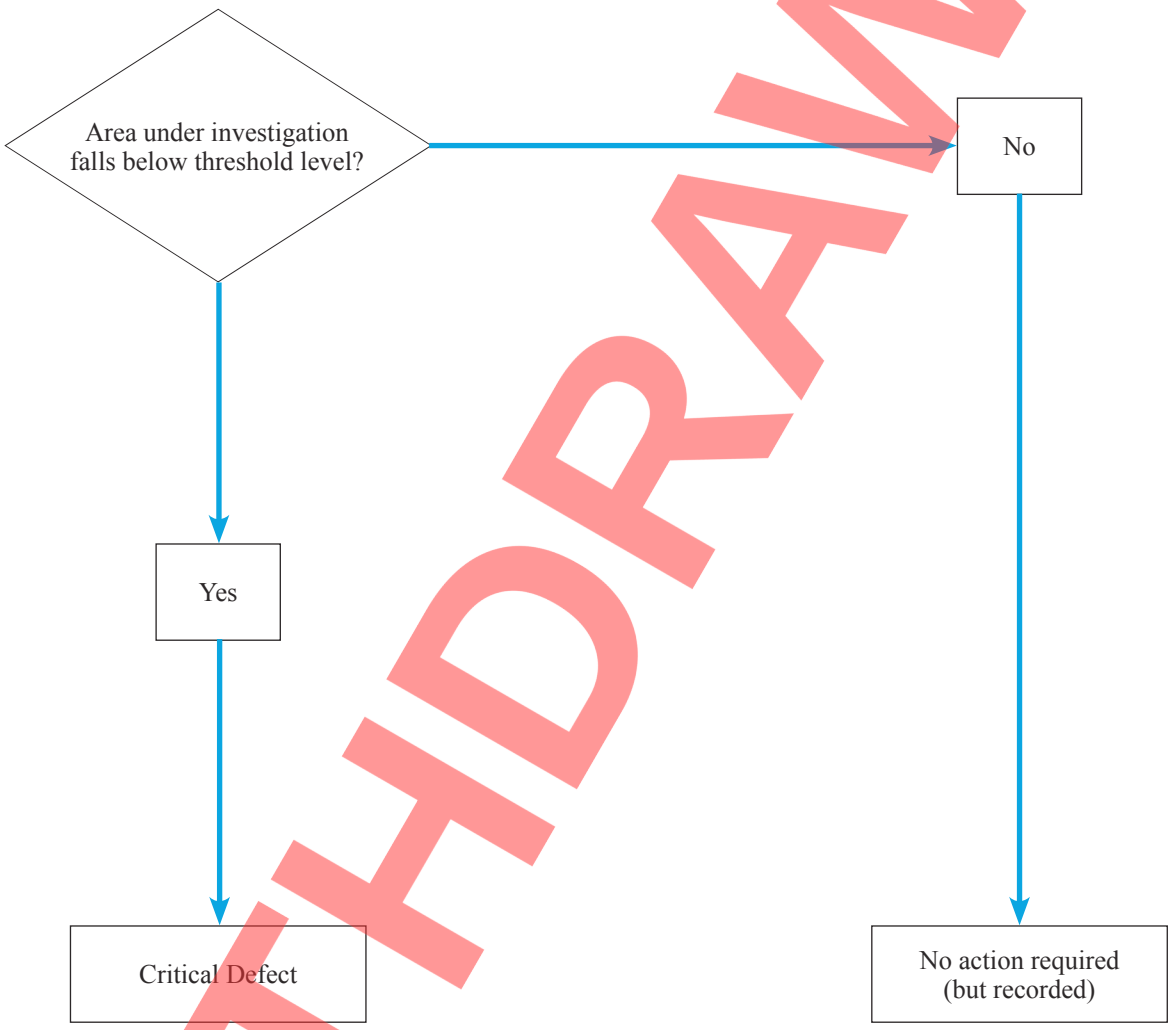
Note 3: Critical areas of the network refer to those areas of the network that may pose a risk to the road user if badly worn. These shall be defined with local knowledge but shall include:

(a) GIVE WAY lines and STOP lines
(b) Regulatory markings e.g. double white lines, solid edged ghost islands
(c) Large areas of markings, e.g. "SLOW" markings, exit arrows to slips on the main line and on-carriageway 'destinations'
(d) Transverse yellow bars
(e) Markings at or within 50m of a junction

C4. SKID RESISTANCE ON CRITICAL AREAS

Pendulum measurements of the critical areas of the network shall be taken using Figure C.5 in conjunction with the inspections detailed in Figure C.4. Measurements should be taken on the most trafficked areas of the road markings at each location and an average calculated.

Figure C.5: Skid resistance on critical areas



Note : Skid Resistance Criteria

Area	Threshold Level	Method
Critical areas (as Note 3 of Figure C.4)	<55	BS EN 1436 [Ref.17]
Non critical areas	<45	

C5. PROCEDURE FOR THE IN-SITU TESTING OF RETRO-REFLECTION USING HANDHELD DEVICES

This Section sets out the method of inspection of road markings that cannot be surveyed by vehicle mounted devices. These areas may be measured by hand-held retro-reflectometers.

General

(a) This procedure is for the use of handheld retro-reflectometers as described in BS EN 1436 [Ref.17] "Road marking performance for road users" – Annex B.

(b) Always calibrate and operate the equipment in accordance with the manufacturer's instructions and Annex B of BS EN 1436 [Ref. 17].

(c) Avoid moving the instrument through large temperature changes (i.e. allow time for equipment to acclimatise to prevailing operational temperatures).

(d) If necessary, ensure that the instrument is effectively shielded from direct sunlight.

(e) For longitudinal lines, position the equipment so that its light source shines in the same direction as a vehicle's headlights would.

(f) Measurements on other road markings (such as symbols, letters etc,) should be taken, wherever appropriate, in the general direction from approaching vehicles.

(g) All markings to be measured should be free from dirt and completely dry. A suitable brush should be used to remove loose dirt and/or loose glass beads prior to testing.

(h) Safety is a prime consideration during this type of operation with constant attention given to the safety of the operator and of other road users.

Selection of the test area

(a) Choose an area of marking which appears to be representative of the total to be assessed.

Number of Readings

(a) For continuous lines, take 15 readings over a 5 metre section minimum. If the marking is a centre line, take 15 readings with the equipment facing in each direction.

(b) For intermittent lines, take 5 readings per mark for 3 consecutive marks. Note readings should not be taken at the very beginning or end of the line.

(c) For markings wider than 150mm, take readings down the central axis of the line but including some "off-centre" ensuring that any such measurements are still made within the confines of the marking.

(d) For other markings, i.e. 'symbols', 'lettering', transverse lines etc., readings should be taken at approximately 5 equidistant points on the surface of the marking.

(e) If a particular reading appears inconsistent, that reading should be repeated.

Recording and interpretation of results

(a) A survey report for each location should be produced. Information to be included in the report should be as follows:

(i) Operator's name

(ii) Equipment type and geometry

(iii) Test procedure

(iv) General location

(v) Length of site

(vi) Location of measurement point

(vii) Date and time of test

(viii) Ambient temperature

(ix) Type and dimensions of markings

(x) Condition of marking

(xi) Pre-treatment of marking, i.e. washed/brushed

(xii) Weather conditions at time of testing

(xiii) Road surface type

(xiv) Picture or video evidence

(b) Calculate an average of all readings for a particular area.

(c) Readings for individual marks should be "sub-totalled" before being combined.

Measurement of Retro-reflectivity in Conditions of Wetness

(a) In addition to the measurement method for the retro-reflectivity, R, of dry markings, BS EN 1436 [Ref.17] also includes inspection methods for "conditions of wetness" and "conditions of rain". The inspection method for "conditions of rain" is not intended for use with the standard measuring equipment currently in general use in the UK.

(b) Where required, the inspection method for "conditions of wetness" is as follows:

The test condition is created using clean water poured from a bucket with an approximate capacity of 10 litres and from a height of approximately 0.5m above the surface so that the measuring field and its surrounding area is momentarily flooded by a crest of water. The retro-reflectivity shall be measured under the test condition one minute after the water has been poured.

Although not specifically defined in BS EN 1436 [Ref.17], a volume of 1 litre per metre of marking should be used for this purpose.

Figure C.4 provides requirements.

C6. COMPARISON OF VEHICLE MOUNTED DEVICE AND HANDHELD RETRO-REFLECTOMETER READINGS

Suitable Retro-reflectometers

The benefits of using Vehicle Mounted Devices are that they provide:

- savings in traffic management costs as road closures are not required;
- fast and reliable data collection on straight roads for decision making; and
- a focus for further investigations.

The dis-benefits of using Vehicle Mounted Devices are that:

- they do not give the same results as hand held instruments for site location per se and hence multiplication factors are required as described below;
- they sometimes generate large amounts of missing data for single carriageway roads as vehicles cannot drive sufficiently close to centrelines due to oncoming traffic;
- the level of data confidence can vary, dependent on device; and
- they can only measure dry retro-reflectivity values and therefore require dry conditions, if required by vehicle manufacturer, to produce accurate results.

The benefits of using handheld instruments are:

- they are reliable for small areas or areas where road closures are already planned (for other reasons) or where Vehicle Mounted Devices are not suitable; e.g. closely spaced junctions or sharp bends or heavily trafficked single carriageways;
- they can be used to measure wet retro-reflectivity values; and
- they are easily carried

The dis-benefits of using handheld instruments are that:

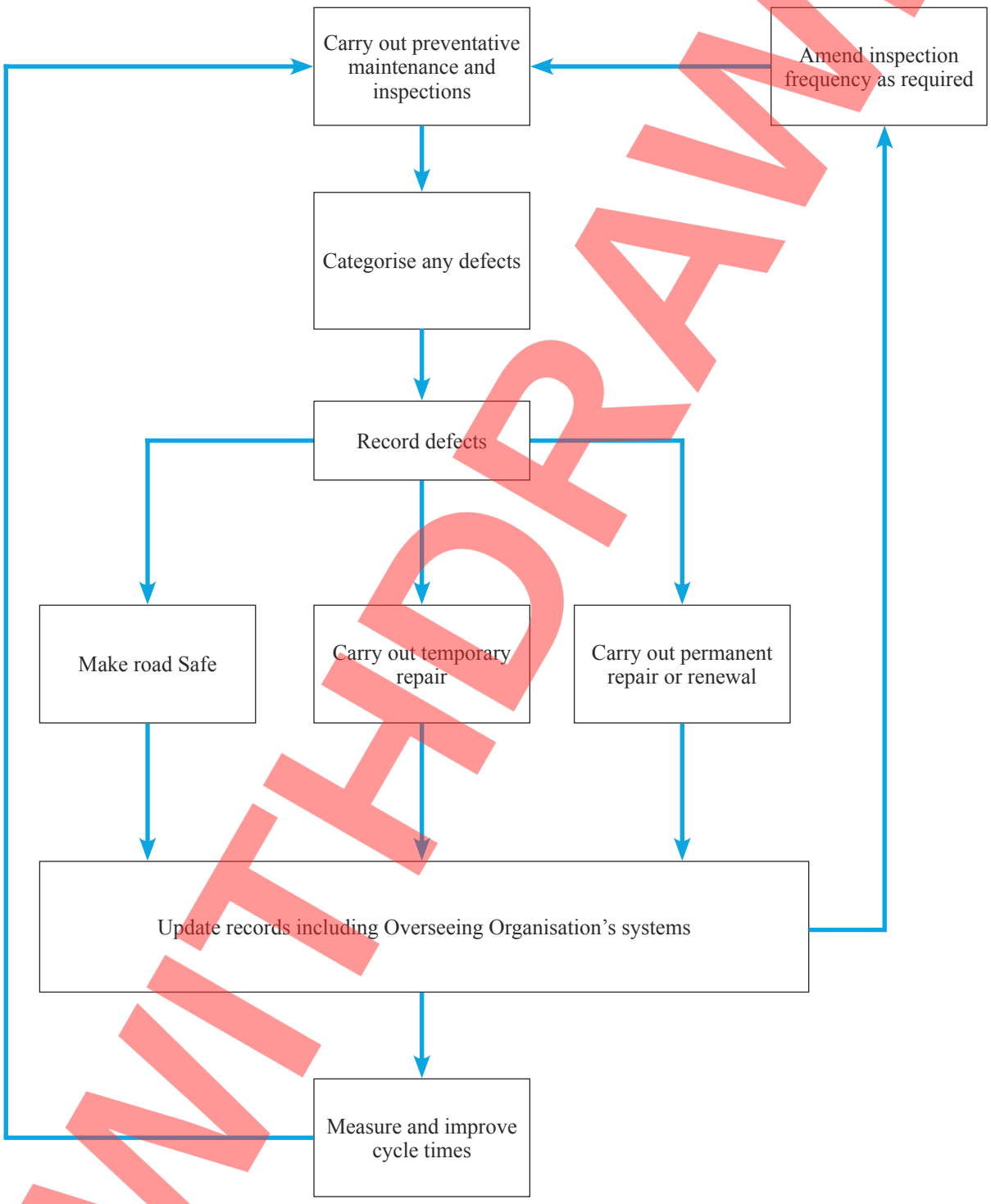
- they do not give the same results as Vehicle Mounted Devices for the same spots; and
- road closures (and associated risks for road workers) are required for taking readings.

Correlation Factors

Where hand held readings are taken, they shall be recorded over lengths no shorter than 50m for averaging purposes. Manufacturers shall be asked to provide correlation factors to convert a Vehicle Mounted Device reading to an equivalent reading by a hand held instrument.

ANNEX D: DEFECT CATEGORISATION AND MAINTENANCE

Figure D.1 Risk based repair process



Notes for Figure D.1 Risk Based Repair Process

1. The Maintaining Organisation categorises Defects in order to enable appropriate response times to be developed for inspections and make safe and repair activities.

2. For each category there shall be appropriate response times included in relevant Maintenance Requirements Plans in order to achieve the Maintaining Organisation Outcomes and provide the Overseeing Organisation with a special defence under Section 58 of the Highways Act [Ref. 12].

3. The Maintaining Organisation shall take account of the physical location of the Defect and the potential danger to users of the highway.

4. The Maintaining Organisation records awareness about Defects via the Maintaining Organisation's inspection activity, Watchman role, third party information or any other source of information.

5. The Maintaining Organisation assesses the condition of Defects to decide what is required to make safe, and whether to carry out preventative maintenance, a temporary or permanent repair.

6. Prioritisation shall be made on the basis of risk to achievement of the Maintaining Organisation Outcomes and danger to users of the highway.

7. The Maintaining Organisation ensures that on completion of making safe the Defect there is no danger to the user of the highway.

8. To avoid deterioration of the asset – this could be for economic reasons i.e. it is better value to incur cost in order to avoid a higher cost later, or more importantly for safety reasons to avoid deterioration of the Defect that could cause a danger to users of the highway.

9. The Maintaining Organisation carries out a temporary repair where they do not carry out a permanent repair.

10. The Maintaining Organisation may choose to carry out a permanent repair for economic reasons if it represents good value for money.

11. When a make safe or temporary repair has been carried out the Maintaining Organisation shall re-evaluate their inspection frequency – in effect they treat the make safe or temporary repair as the equivalent of a new Defect and monitor it accordingly depending on the nature of the repair.

ANNEX E: PHOTOGRAPHIC EXAMPLES FOR DETAILED VISUAL ASSESSMENT

Below are photographs to provide guidance on scoring the level of condition of road markings

Figure E1: Condition Score 50 – close-up

Figure E2: Condition Score 50 – close-up of profiled line designed for wet visibility

Figure E3: Condition Score 50 – long view

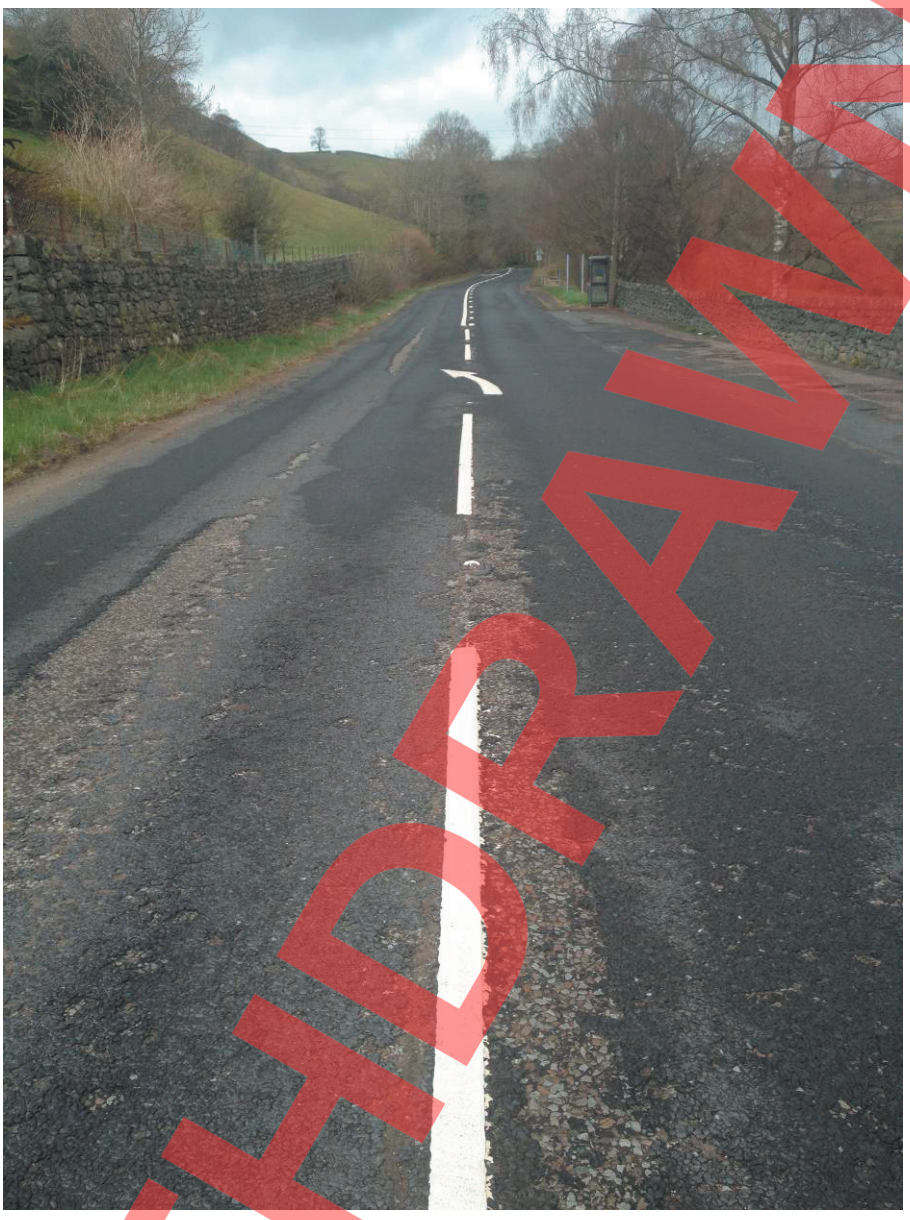


Figure E4: Condition Score 40 – close-up

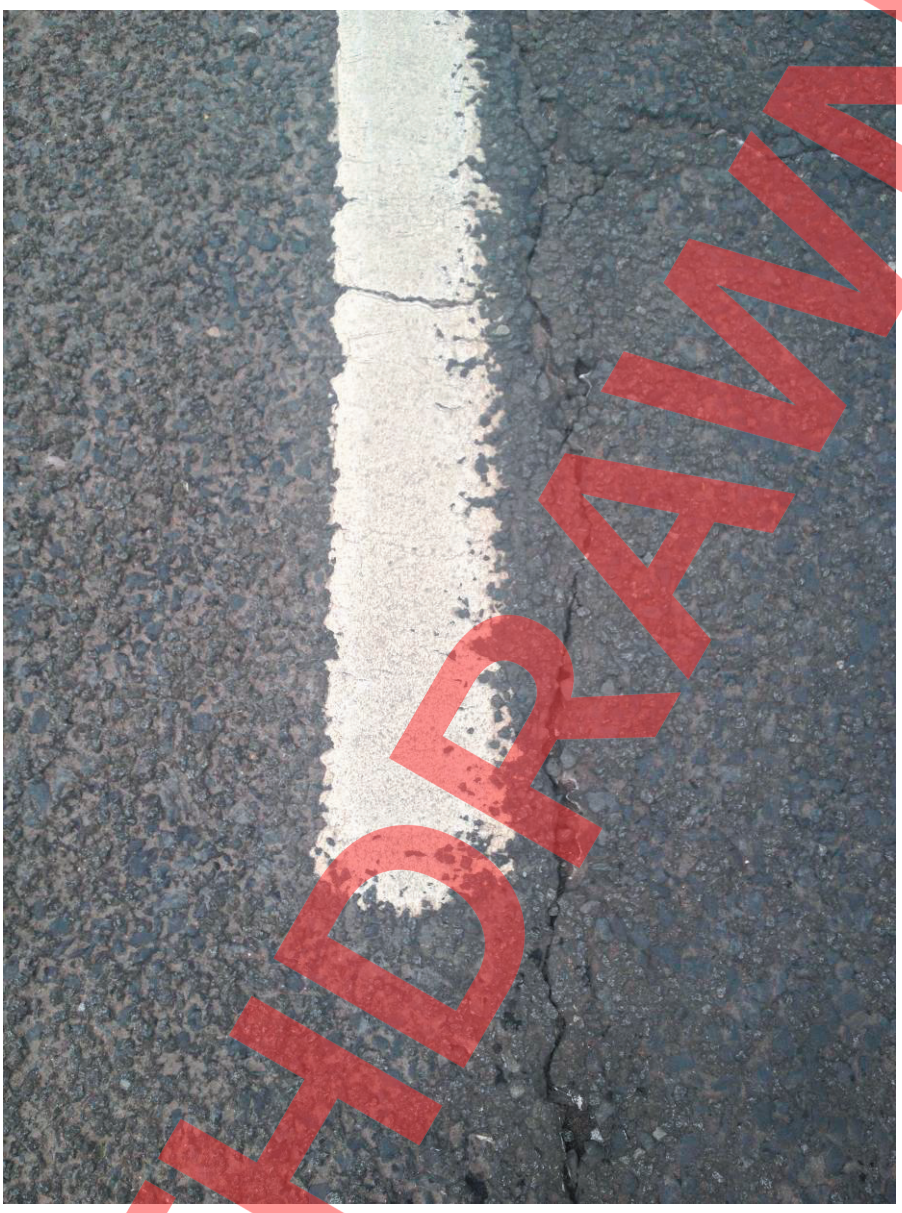


Figure E5: Condition Score 40 – long view

[Note – although not ideal, the surface patch repair being at the end of the marking will be unlikely to have an effect on road user understanding, but may in time become a surfacing hazard, particularly for motorcyclists]

Figure E6: Condition Score 30 – close-up

Figure E7: Condition Score 30 – long view

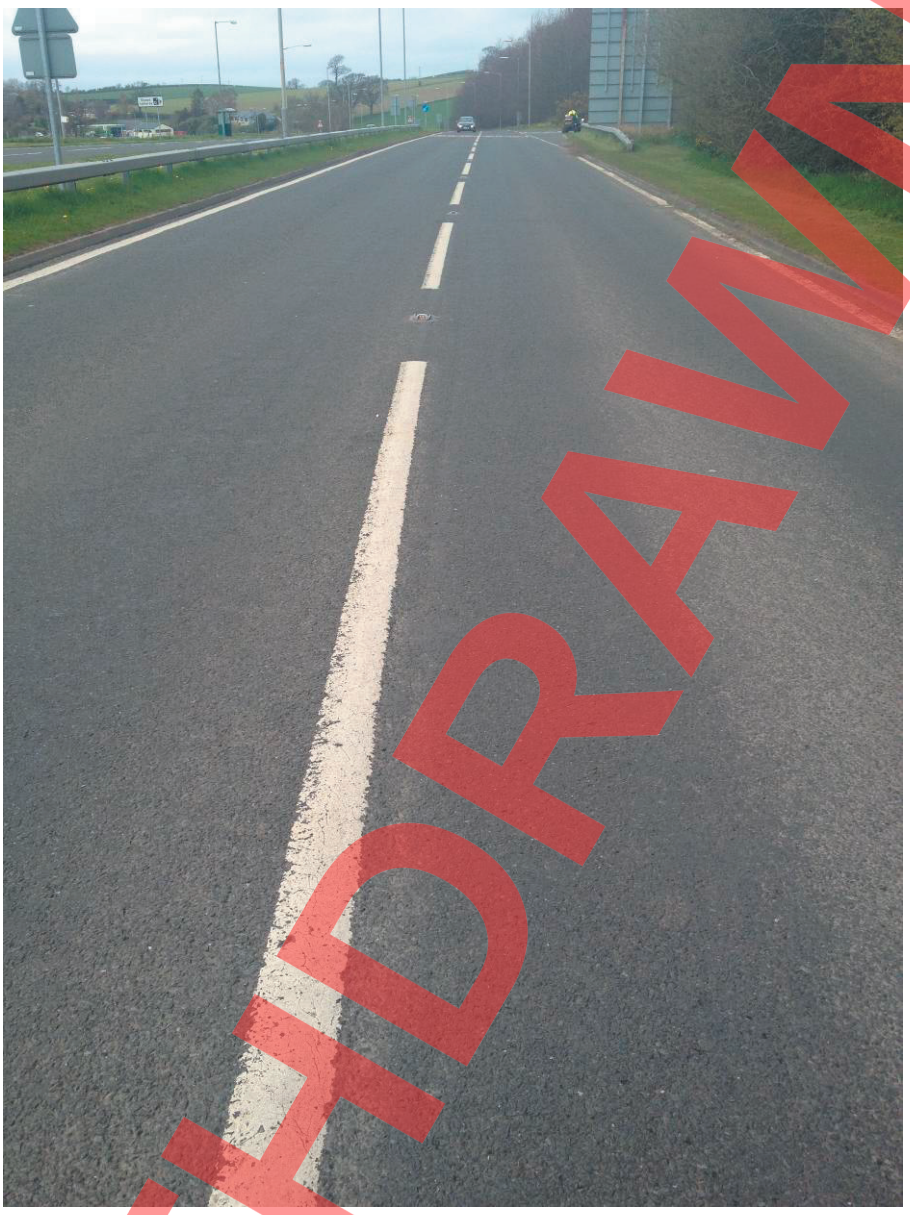


Figure E8: Condition Score 20 – close-up

Figure E9: Condition Score 20 – close-up of profiled line designed for wet visibility

[Note: groove continuity significantly disrupted by wear]

Figure E10: Condition Score 20 – long view

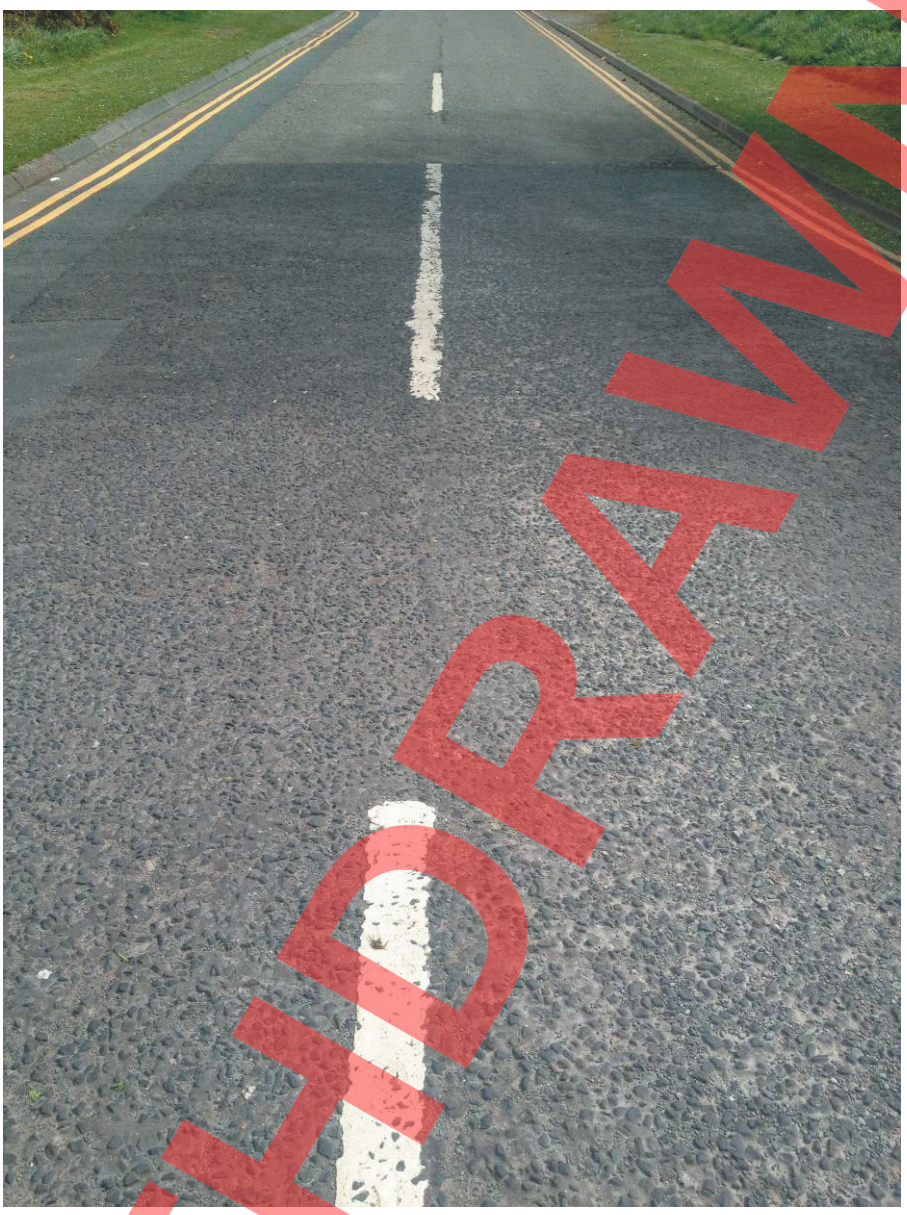


Figure E11: Condition Score 10 – close-up

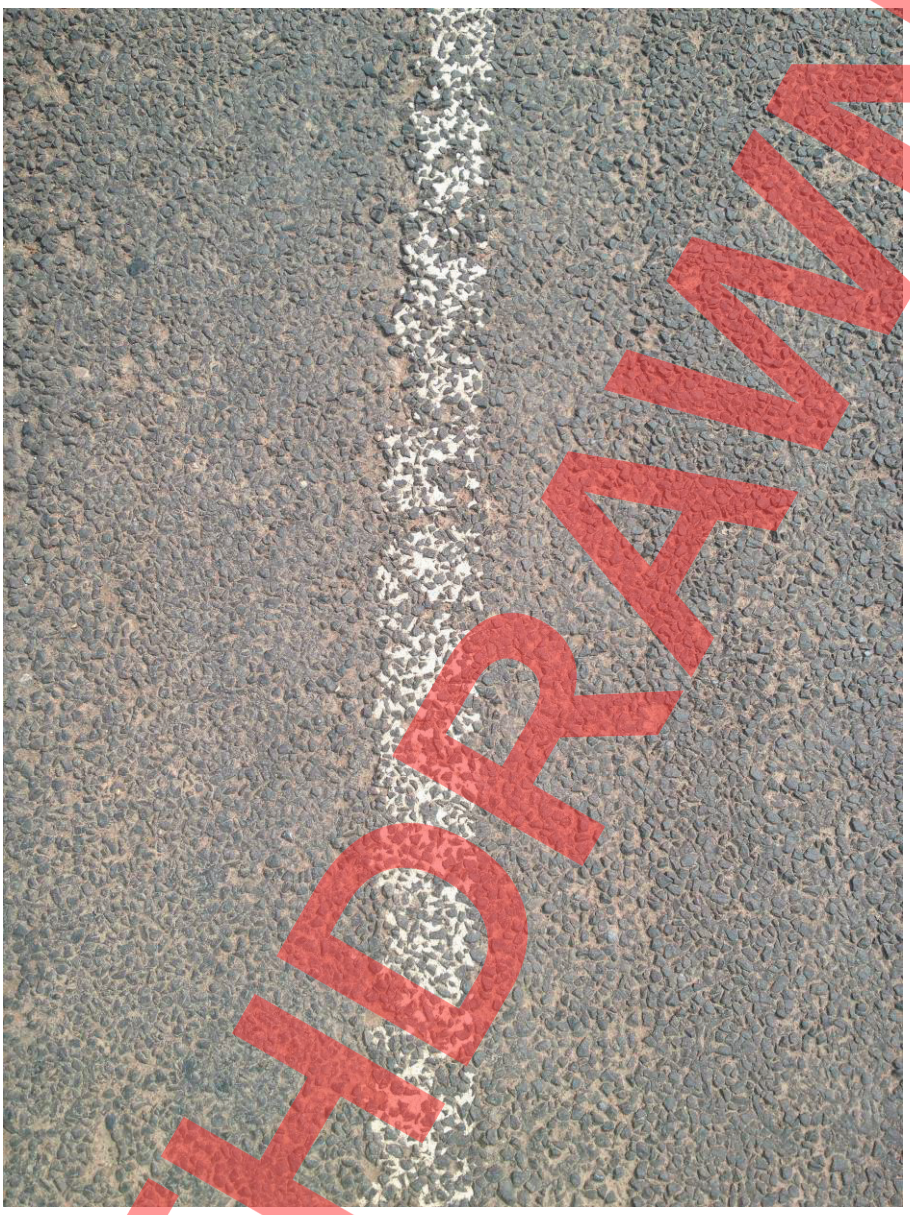


Figure E12: Condition Score 10 – long view

Figure E13: Condition Score 0 – close-up

Figure E14: Condition Score 0 – long view

ANNEX F: LIST OF AMENDMENTS FROM PREVIOUS VERSIONS

Version No	Clause No	Details of Amendment
Feb 17	Full document	The full document has been re-written: • to make it compliant with the Construction Products Regulation. References which have been superseded have been replaced with the relevant Harmonised European Standard. • to provide a less prescriptive approach, but with overarching performance requirements. This allows Maintaining Organisations greater flexibility on the choice of inspection frequencies and choice of techniques. • to provide more advice on risk based decision making. • to provide different requirements for road markings on lit and unlit roads