Design Manual for Roads and Bridges

Control & Communications Technology
Design

TD 121
Ramp metering

(formerly IAN 103/08, IAN 121/09)

Revision 0

Summary
This document contains design requirements for ramp metering.

Application by Overseeing Organisations
Any specific requirements for Overseeing Organisations alternative or supplementary to those given in this document are given in National Application Annexes to this document.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated Highways England team. The email address for all enquiries and feedback is: Standards_Enquiries@highwaysengland.co.uk

This is a controlled document.

Contents

Release notes

Version	Date	Details of amendments
0	Jan 2020	TD 121 replaces IAN 103/08 and IAN 121/09. This full document has been re-written to make it compliant with the new Highways England drafting rules.

Foreword

Publishing information

This document is published by Highways England.

This document supersedes IAN 103/08 and IAN 121/09, which are withdrawn.

This document contains relevant information from MCH 2470 and MCH 2471.

Contractual and legal considerations

This document forms part of the works specification. It does not purport to include all the necessary provisions of a contract. Users are responsible for applying all appropriate documents applicable to their contract.

Introduction

Background

Ramp metering is a traffic management technique which manages the number of vehicles joining a main carriageway at peak periods. The purpose of ramp metering is to prevent or delay the onset of flow breakdown on the main carriageway and assist with its recovery.

Ramp metering systems use part-time traffic signals on the slip road which come into operation when traffic sensors on the main carriageway indicate heavy traffic. The detectors on the main carriageway along with queue detectors on the slip road enable the system to determine the required flows from the slip to keep the main carriageway flowing close to critical occupancy.

A successful design of a ramp metering site relies on knowledge and understanding of motorway communication devices and design, traffic flows, motorway traffic behaviours and ramp metering control algorithms.

Ramp metering systems aim to control the flow of vehicles joining the motorway and all-purpose trunk road network and are recognised as being fundamentally different to traditional traffic signalling systems which manage vehicle conflicts and provide safety functionality.

Assumptions made in the preparation of this document

The assumptions made in GG 101 [Ref 1.N] apply to this document.

Abbreviations

Abbreviations

Abbreviation	Definition
HFS	High Friction Surfacing
MIDAS	Motorway Incident Detection and Automatic Signalling
RMO	Ramp Metering Outstation
TSP	Telecommunications Service Provider

Terms and definitions

Terms

Term	Definition
Configuration file	A software file which contains the settings associated with the site-specific infrastructure and operational calibration parameters.
Critical occupancy	The downstream main carriageway occupancy at which the maximum downstream traffic flow rate is achieved.
Downstream	That part of the carriageway(s) where the traffic is flowing away from the section in question.
Operational strategy document	A document which captures the traffic characteristics and road geometry to help a designer understand the network congestion and inform the site design.
Presence detector	Traffic detector used to determine the presence of a queue. The presence detector is located 2m upstream of the ramp metering stop line.
Queue detector	Traffic detector (multiple) used to indicate the length of a queue. The queue detectors are located between the presence detector and queue override detector.
Queue override detector	Traffic detector used to trigger the queue override functionality. The queue override detector is located towards the upstream end of the slip road.
Ramp metering	A traffic management technique which manages the number of vehicles joining a main carriageway in peak hour periods in response to current traffic conditions.
Ramp metering outstation	The power, communications and system equipment located in a dedicated cabinet.
Ramp metering site	The slip road, main carriageway and equipment necessary to operate a ramp metering system.
Release detector	Traffic detector primarily used to measure the slip road flow rate. The release detector is located 2m downstream of the ramp metering stop line.
Stop line	The solid white line which is located adjacent to the ramp metering signals and crosses the entry slip road.
Traffic characteristics	The speeds, flows, occupancy, congestion seed points and general behaviours of traffic in the vicinity of a ramp metering site.
Upstream	That part of the carriageway(s) where traffic is flowing towards the section in question.

1. Scope

Aspects covered

1.1 This document outlines the ramp metering design requirements that shall be implemented on all new or modified ramp metering sites.

1.2 The design of ramp metering systems shall deliver a collaborative approach across the various design disciplines and support functions to accommodate the design of power supplies and telecommunication services.

NOTE *Overseeing Organisation specific requirements related to the treatment of existing ramp metering sites can be found in the National Application Annexes.*

Implementation

1.3 This document shall be implemented forthwith on all schemes involving ramp metering on the Overseeing Organisations' motorway and all-purpose trunk roads according to the implementation requirements of GG 101 [Ref 1.N].

Use of GG 101

1.4 The requirements contained in GG 101 [Ref 1.N] shall be followed in respect of activities covered by this document.

2. General

Legislative

2.1 All electrical work must comply with The Electricity at Work Regulations EWR 1989 [Ref 4.N].

2.2 All electrical work shall comply with Requirements for Electrical Installations, IET Wiring Regulations BS 7671 [Ref 2.N].

Security

2.3 Potential physical security threats to the ramp metering equipment shall be assessed, documented, mitigated and managed in accordance with the Overseeing Organisation's security procedure.

NOTE *Examples of physical security threats to ramp metering equipment can include compromised roadside equipment and metal theft.*

2.4 Risk to the existing ramp metering equipment by the introduction of new ramp metering equipment shall be avoided.

Configuration data

2.5 Any site configuration data requirements of ramp metering equipment shall be recorded and implemented early into the design stage.

Design for maintenance

2.6 The electrical supply isolation systems shall be designed so that when a piece of technology equipment is isolated, those responsible for maintenance are not inadvertently exposed to hazards from associated equipment, for example infra-red radiation.

2.7 Where noise fences or environmental barriers are installed between a cabinet and the carriageway, access shall be provided to the cabinet whilst maintaining an effective noise or environmental barrier.

NOTE *In the case of motorways, access to the cabinet from the carriageway will be from a vehicle parked on the hard shoulder or a suitable refuge, which allows maintenance vehicles to park clear of the carriageway, or a layby in the case of all-purpose trunk roads.*

2.8 Pathways between maintenance access points and cabinets shall be continuous with areas of hard standing.

2.9 Access points at ground level shall facilitate the pulling of cables without the need for any access equipment.

2.10 The Overseeing Organisation's approval shall be sought for the acceptance of ramp metering equipment into maintenance and operation.

Functionality of ramp metering equipment

2.11 The required functionality of ramp metering equipment shall be determined by the operational requirements.

NOTE *Technology equipment needs to be deployed that is consistent with local operational requirements that are established during early stages of scheme delivery.*

2.12 The internal operating conditions of the cabinet shall not be adversely affected by the cabinet layout.

Siting of ramp metering equipment

2.13 The co-location of cabinets, ramp metering equipment and end devices shall be implemented, where design allows, to minimise whole life costs.

2.14 Any cabinets that are at risk from flooding shall be positioned above the determined flood level.

2.15 Existing infrastructure shall be re-used, in consultation with the Telecommunications Service Provider (TSP), where design allows.

Ramp metering requirements

2.16 The ramp metering design shall meet the requirements of TD 131 [Ref 3.N] Roadside Technology and Communications Section 5 Provision of electrical power.

2.17 The ramp metering design shall meet the requirements of TD 131 [Ref 3.N] Roadside Technology and Communications Section 6 Telecommunication services.

2.18 The ramp metering design shall meet the requirements of TD 131 [Ref 3.N] Roadside Technology and Communications Section 7 Infrastructure.

3. Design

General

3.1 Prior to commencing design, an operational strategy document shall be completed to assist with design decisions.

NOTE 1 The operational strategy document template is in Appendix A.

NOTE 2 Information is recorded in the operational strategy document to both assist with design decisions during detailed design of a ramp metering site and to assist with generating initial system settings used in the configuration file at the beginning of the site calibration process.

3.1.1 The operational strategy document should be completed based upon:

1) the traffic characteristics and road geometry;
2) an understanding of the cause and effect of congestion at the intended installation location;
3) an understanding of ramp metering operation.

3.1.2 The sequence of the ramp metering site design should be:

1) determine the position of the stop line and traffic signal poles;
2) determine the position of presence and release detectors;
3) determine the position of queue override detectors;
4) determine the total number and position of queue detectors;
5) determine the position of equipment cabinets and associated infrastructure;
6) determine the position / select main carriageway detector sites;
7) determine the position and design warning signs and road markings;
8) determine the extents of high friction surfacing (HFS) provision;
9) develop the site configuration file.

NOTE Fixed warning signs and HFS design can commence once the stop line and queue override detector locations are known.

3.2 The condition of the site shall be assessed to ensure that the existing pavement is capable of accommodating the ramp metering infrastructure (e.g., detectors, HFS, road markings).

3.3 Infrastructure not protected by vehicle restraint systems shall employ passively safe functionality.

NOTE Signs and signals mounted on passively safe poles typically have a minimum mounting height of 1800 mm.

3.4 Following the implementation and switch on of a site, the performance shall be evaluated to ensure it gives the optimum benefits.

NOTE On-going, periodic assessment ensures that the operational performance is maintained and that the site is not affecting traffic conditions negatively.

Stop line and traffic signal pole positions

3.5 The position of the stop line shall be determined:

1) in accordance with the operational strategy document;
2) to provide a balance between sufficient acceleration distance to enable safe merging and sufficient storage for queuing vehicles;
3) to provide forward visibility of the signal heads for vehicles approaching the stop line.

3.5.1 The main carriageway conditions adjacent to the merge should be visible from any vehicle stopped at the stop line.

NOTE 1 *The location of the stop line has an impact on safety and governs visibility for drivers approaching the signals and queue on the entry slip road.*

NOTE 2 *A stationary vehicle behind the stop line needs to accelerate to reach a suitable speed and merge safely with traffic travelling in lane 1 of the main carriageway during ramp metering operation (anticipated ramp metering switch on speed as detailed in the operational strategy).*

NOTE 3 *The greater the distance between the ramp metering site and the downstream congestion seed point, the higher the main carriageway speeds are at the upstream detector.*

NOTE 4 *If the main carriageway uses variable mandatory speed limits, speeds can be controlled/reduced as a result of unrelated control algorithms rather than an increase in traffic density.*

NOTE 5 *The impact of an incorrect switch on speed can be:*

1) the ramp metering system becomes operational too late, after flow breakdown has already occurred and does not provide the maximum benefit possible;

2) vehicles are unable to reach the necessary speed to safely merge with lane 1 of the main carriageway.

NOTE 6 *The typical distance from the back of nose to the ramp metering stop line is 40 metres +/- 20 metres.*

3.6 The ramp metering signals must be provided in accordance with TSRGD 2016 [Ref 5.N] diagram 3000 and its authorised, non-prescribed variants.

NOTE *Authorisation for implementing ramp metering schemes incorporating light signals on motorway and all purpose trunk roads are described in the National Application Annexes.*

3.7 Passively safe traffic signal poles shall be positioned 2 metres downstream of the stop line, one in the offside verge and one in the nearside verge.

3.8 The distance from each kerb for passively safe signal poles shall be 2 metres +1 metre / - 0.8 metre.

Presence and release detector locations

3.9 Presence detectors shall be provided with the trailing edge of the detector being 2 metres upstream of the stop line.

3.10 Release detectors shall be provided with the leading edge of the detector being 2 metres downstream of the stop line.

Queue override detector locations

3.11 Queue override detectors shall be positioned downstream of the adjoining network boundary to allow an area of road space which accommodates vehicles and avoids additional obstructions on the adjoining road network.

3.11.1 Queue override detectors should be positioned to provide a zone with minimum length of 39 metres in advance of the queue override detectors.

NOTE *The minimum length of 39 metres allows sufficient road space on the entry slip road for two heavy goods vehicles to approach the back of the queuing traffic (the queue override detectors) without obstructing the adjoining road network.*

3.12 Queue override detectors shall be positioned to limit the maximum queuing time on the slip.

3.13 Queue override detectors shall be positioned no more than 300 metres from the stop line.

Queue detector locations

3.14 Queue detectors shall be evenly spaced between the presence detectors and queue override detectors.

NOTE *The queue management algorithm operates most effectively when the detector spacing is evenly distributed.*

3.14.1 The queue detectors should be provided such that the distances between these detectors are as near to 25 metres as possible.

3.15 A minimum of two queue detectors per lane shall be provided on the entry slip road, with 25 metres between adjacent detectors.

3.15.1 A maximum of seven queue detectors per lane may be provided.

3.15.2 The spacing of the queue detectors should be as consistent as site conditions permit to allow the ramp metering system to operate most effectively.

NOTE *Where other existing detectors (for example those used for MIDAS) located on the entry slip road clash with the desired ramp metering queue detector locations, either the number of queue detectors can be reduced, or the other existing detectors can be relocated further upstream or downstream.*

Equipment cabinets and their associated infrastructure

3.16 Equipment cabinets shall be located in a position where safe access is permitted.

3.16.1 The ramp metering outstation (RMO) cabinet should be positioned to allow the signal heads to be observed from the cabinet position to aid commissioning and maintenance.

NOTE *Providing a safe area on site for validation of the ramp metering system (e.g. site acceptance testing, calibration and maintenance) enables the validation exercise to be carried out in a safe and convenient manner whilst avoiding the need for traffic management and a negative impact on vehicle behaviours.*

3.17 Equipment cabinets shall accommodate the RMO and provide power to the site as part of a ramp metering system installation.

3.17.1 A dedicated power supply outlet on the electrical interface cabinets should be provided to avoid the ramp metering system tripping out the local power supply unit.

3.18 A dedicated duct network shall accommodate the traffic signal cable between the RMO and each traffic signal pole.

Main carriageway detector selection

3.19 At least one downstream detector site shall be located in advance (upstream) of the area of the main carriageway where flow breakdown occurs.

NOTE *The downstream detector site is required to provide the RMO with an accurate measurement of lane occupancy in the area of the main carriageway where flow breakdown occurs. If the detector site is located beyond where flow breakdown occurs it can fail to detect the network congestion.*

3.20 The upstream detector shall be located upstream of the merge with no exit slip roads between the detector site and the merge.

NOTE 1 *The upstream detector site is required to measure the speed in lane 1 of the main carriageway prior to the point adjacent to the merge tip of nose. The closer the detector site is to the merge, the more accurate the measurement of speed on the main carriageway at the point where traffic from the entry slip merges.*

NOTE 2 *An existing MIDAS installation can be a source for upstream and downstream main carriageway detectors.*

Warning signs and road markings

3.21 The ramp metering site shall use warning signs and road markings to maintain lane discipline and to advise drivers about the hazards associated with the use of ramp metering signals and the likelihood of the presence of queues.

3.22 Where the entry slip road has multiple access points, the requirement for additional fixed signs shall be assessed.

3.23 The use of signs and road marking must be in accordance with TSRGD 2016 [Ref 5.N].

3.24 Signs and road markings shall be located in accordance with TSM Chapter 4 [Ref 6.N] and TSM Chapter 5 [Ref 7.N].

NOTE 1 *'Part-time signals' signs are described in TSRGD 2016 [Ref 5.N] diagrams 543 and 543.1.*

NOTE 2 *'Queues likely' signs are described in TSRGD 2016 [Ref 5.N] diagram 584.*

NOTE 3 *A completed operational strategy document accounts for likely queuing profiles and the movement of vehicles through the site on approach to the back of a variable queue length.*

3.25 The stop line shall be 300mm wide.

NOTE *The stop line is described in TSRGD 2016 [Ref 5.N] diagram 1001.*

3.26 Lane markings and road studs shall be provided in accordance with TSRGD 2016 [Ref 5.N] diagrams 1004.1 and 1005.1.

3.27 For sites with reduced sight lines, an assessment of the use of electronic / variable message signs to provide advanced warning of the operation of ramp metering shall be undertaken.

NOTE *Experience shows that electronic / variable signs which activate only when ramp metering is in operation can be used effectively to provide advanced warning about likely presence of queues.*

High friction surfacing

3.28 The HFS shall be provided on approach to the stop line and the queue override detectors.

3.28.1 If the queue override detectors are installed less than 50 metres downstream of the start of the entry slip road, the HFS should be installed from the start of the entry slip road to the queue override detectors.

3.28.2 Longer lengths of HFS may be provided at sites with poor sight lines (for example due to road curvature) or at sites where longer stopping distances are required (for example due to a downhill entry slip road) to enable vehicles to stop safely.

3.29 The implementation of HFS shall preserve or improve the integrity of existing lane markings and road studs.

Site configuration file

3.30 The initial software configuration necessary for the site's operation shall be defined for inclusion in the site configuration file.

NOTE *The site configuration file contains all the site specific configuration and calibration settings to allow the system to operate at a specific junction / site. This includes, for example, the main carriageway and ramp detectors, initial algorithm variables, passwords and access levels.*

4. Normative references

The following documents, in whole or in part, are normative references for this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Ref 1.N	Highways England. GG 101, 'Introduction to the Design Manual for Roads and Bridges'
Ref 2.N	BSI. BS 7671, 'Requirements for Electrical Installations, IET Regulations'
Ref 3.N	Highways England. TD 131, 'Roadside technology and communications'
Ref 4.N	gov.uk. EWR 1989, 'The Electricity at Work Regulations 1989 (SI 1989/635) (as amended) (the Regulations)'
Ref 5.N	The Stationery Office. TSRGD 2016, 'The Traffic Signs Regulations and General Directions 2016'
Ref 6.N	The Stationery Office . TSM Chapter 4, 'Traffic Signs Manual Chapter 4 - Warning Signs'
Ref 7.N	The Stationery Office. TSM Chapter 5, 'Traffic Signs Manual Chapter 5 - Road Markings'

Appendix A. Ramp metering operational strategy document

A1 Operational strategy template

Operational strategy template is shown in Table A.1.

Table A.1 Site details

Site Detail	
Motorway	Motorway number
Junction	Junction number
Direction	NB, SB, EB, WB, Clockwise or Anticlockwise
Congestion Problem Information to be taken from traffic data analysis and site observations	
Times when congestion present (from observations on site)	Approximate hours when worst congestion is experienced at the site
Downstream main carriageway flow at times of congestion (vehicles per hour)	For example data generated from MIDAS system
Entry Slip Road Flow at times of congestion	For example data generated from MIDAS system
Downstream point of flow breakdown (for example MIDAS site ID)	Taken from MTV plots
Brief description of congestion problem e.g. shockwave from downstream junction, weaving due to proximity of downstream diverge	
Geometry of Slip	
Slip entrance (free flow or signals)	How do vehicles join the entry slip road?

Table A.1 Site details (continued)

Average platoon size (signalled junction)	How many vehicles join the entry slip road at the same time?
Up or downhill entry slip road	
Up or downhill merge	
Length on entry slip road	Distance from merge tip of nose to boundary with adjoining road network
Length of Merge	Distance from merge tip of nose to end of merge area
No of lanes on entry slip road	
Notes This information is obtained from a site visit	

Table A.2 Operational strategy

Proposed Strategy of Operation	
Proposed switch on speed	Estimated from understanding of the traffic characteristics causing flow breakdown
Estimated required storage space on entry slip road	Estimated from traffic data analysis
Estimated minimum release rate (vehicles per hour)	Minimum entry slip road flow during peak hours of congestion
Estimated maximum release rate (vehicles per hour)	Maximum entry slip road flow during peak hours of congestion
Notes	
Proposed Site Layout Detailed placement of the stop line and Queue Override loops etc.	
Site Concerns	

Control & Communications Technology
Design

TD 121
England National Application Annex to TD 121 Ramp metering

(formerly IAN 103/08, IAN 121/09)

Revision 0

Summary
This National Application Annex contains the Highways England specific requirements related to ramp metering system design.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated Highways England team. The email address for all enquiries and feedback is: Standards_Enquiries@highwaysengland.co.uk

This is a controlled document.

Contents

Release notes

Version	Date	Details of amendments
0	Jan 2020	Highways England National Application Annex to TD 121.

Foreword

Publishing information

This document is published by Highways England.

This document supersedes IAN 103/08 and IAN 121/09, which are withdrawn.

Contractual and legal considerations

This document forms part of the works specification. It does not purport to include all the necessary provisions of a contract. Users are responsible for applying all appropriate documents applicable to their contract.

Introduction

Background

This National Application Annex contains the Highways England specific requirements related to ramp metering system design.

Assumptions made in the preparation of this document

The assumptions made in GG 101 [Ref 1.N] apply to this document.

Abbreviations

Abbreviations

Abbreviation	Definition
TSRGD	Traffic Signs Regulations and General Directions

Terms and definitions

Terms

Term	Definition
Ramp metering	A traffic management technique which manages the number of vehicles joining a main carriageway in peak hour periods in response to current traffic conditions.

E/1. Ramp metering signals

E/1.1 The ramp metering signals must be provided in accordance with TSRGD 2016 [Ref 3.N] diagram 3000 and its authorised, non-prescribed variants.

NOTE *Document HA 26-47-46 (TS10-61) [Ref 2.N] provides authorisation for implementing ramp metering schemes incorporating light signals on motorway and all purpose trunk roads in England to diagram 3000 in schedule 8 of the TSRGD 2016 [Ref 3.N].*

E/2. Normative references

The following documents, in whole or in part, are normative references for this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Ref 1.N	Highways England. GG 101, 'Introduction to the Design Manual for Roads and Bridges'
Ref 2.N	Highways Agency. HA 26-47-46 (TS10-61), 'Ramp Metering National Authorisation for a Traffic Sign Incorporating Light Signals'
Ref 3.N	The Stationery Office. TSRGD 2016, 'The Traffic Signs Regulations and General Directions 2016'

Department for Infrastructure
An Roinn Bonneagair

Control & Communications Technology
Design

TD 121
Northern Ireland National Application Annex to TD 121 Ramp metering

(formerly IAN 103/08, IAN 121/09)

Revision 0

Summary
This National Application Annex contains the Department for Infrastructure Northern Ireland specific requirements for the design of ramp metering systems.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated team in the Department for Infrastructure, Northern Ireland. The email address for all enquiries and feedback is: dcu@infrastructure-ni.gov.uk

This is a controlled document.

Contents

Release notes

Version	Date	Details of amendments
0	Jan 2020	Department for Infrastructure Northern Ireland National Application Annex to TD 121.

Foreword

Publishing information

This document is published by Highways England on behalf of Department for Infrastructure, Northern Ireland.

Contractual and legal considerations

This document forms part of the works specification. It does not purport to include all the necessary provisions of a contract. Users are responsible for applying all appropriate documents applicable to their contract.

Introduction

Background

This National Application Annex contains the Department for Infrastructure, Northern Ireland specific requirements related to ramp metering system design.

Assumptions made in the preparation of this document

The assumptions made in GG 101 [Ref 1.N] apply to this document.

Abbreviations

Abbreviations

Abbreviation	Definition
TSRGD	Traffic Signs Regulations and General Directions
TSRNI	Traffic Signs Regulations Northern Ireland

NI/1. Ramp metering regulations Northern Ireland

NI/1.1 The Traffic Signs Regulations Northern Ireland TSR(NI) 1997 [Ref 2.N] must be applied in Northern Ireland.

NI/1.2 Where a clause in TD 121 refers to the Traffic Signs Regulations and General Directions TSRGD 2016 [Ref 3.N], the reference shall be replaced by the TSR(NI) 1997 [Ref 2.N].

NI/1.3 The Department for Infrastructure Northern Ireland shall be contacted for advice on the sign diagram numbers and regulations equivalent to TSRGD 2016 [Ref 3.N].

NI/2. Normative references

The following documents, in whole or in part, are normative references for this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Ref 1.N	Highways England. GG 101, 'Introduction to the Design Manual for Roads and Bridges'
Ref 2.N	The Stationery Office (TSO). Department for Infrastructure (Dfl). TSR(NI) 1997, 'The Traffic Signs Regulations (Northern Ireland) 1997'
Ref 3.N	The Stationery Office. TSRGD 2016, 'The Traffic Signs Regulations and General Directions 2016'

Control & Communications Technology
Design

TD 121
Scotland National Application Annex to TD 121 Ramp metering

(formerly IAN 103/08, IAN 121/09)

Revision 0

Summary
There are no specific requirements for Transport Scotland supplementary or alternative to those given in TD 121.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated Transport Scotland team. The email address for all enquiries and feedback is: TSStandardsBranch@transport.gov.scot

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Contents

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Version	Date	Details of amendments
0	Jan 2020	Transport Scotland National Application Annex to TD 121.

Llywodraeth Cymru
Welsh Government

Control & Communications Technology
Design

TD 121
Wales National Application Annex to TD 121 Ramp metering

(formerly IAN 103/08, IAN 121/09)

Revision 0

Summary
There are no specific requirements for Welsh Government supplementary or alternative to those given in TD 121.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated Welsh Government team. The email address for all enquiries and feedback is: Standards_Feedback_and_Enquiries@gov.wales

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