Director of Engineering Memorandum
DEM 163/17 Roads and Structures
DEM Title: Provision of Road Restraint Systems

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Level 2 (Directorate/Owner):	Engineering Services
Level 3 (DfI or HoBU Managed Function):	ES-Procurement Branch
Level 4 (Work Areas):	Highway Design, Contracts, Development Control, Forward Planning, Traffic

1.0 Purpose

1.1 This memorandum updates the previous guidance on Road Restraint Systems (RRS) contained in DEM 109/07 and DEM 127/11. It sets out requirements for the appraisal, assessment, design, certification and installation of Road Restraint Systems on all adopted roads and roads proposed for adoption, in Northern Ireland.

1.2 Further requirements and guidance are included in the memorandum, to supplement those within the Design Manual for Roads and Bridges, Volume 2, TD 19/06 - Requirement for Road Restraint Systems and the UK Roads Liaison Group(UKRLG)/Department for Transport, Design and Maintenance Guidance for Local Authority Roads, Provision of Road Restraint Systems on Local Authority Roads (October 2011).

1.3 Compliance certification procedures are an important part of the design and construction process, template documentation is provided in Appendix 2.

2.0 Scope

2.1 The term Road Restraint Systems comprises:

Vehicle Restraint Systems (VRS)

- Safety barriers
- Terminals/transitions
- Vehicle Parapets

- Crash Cushions
- Arrester Beds

Pedestrian Restraint Systems

- Pedestrian Guardrails
- Pedestrian Parapets

2.2 This memorandum does not provide further guidance on the use of pedestrian guardrail systems; refer to DEM 90/05. Further requirements relating to pedestrian parapets are given in TD19 and BS7818. Definitions and guidance on the above systems are also provided within TD19/06 and UKRLG Guidance.

2.3 DEM 128 provides guidance and the requirements for Management of Existing Vehicle Restraint Systems (inspection, maintenance and prioritisation for replacement of existing VRS). There are linkages between this DEM and DEM 128, refer to Appendix 1(b) for references within the flowchart.

3.0 Implementation

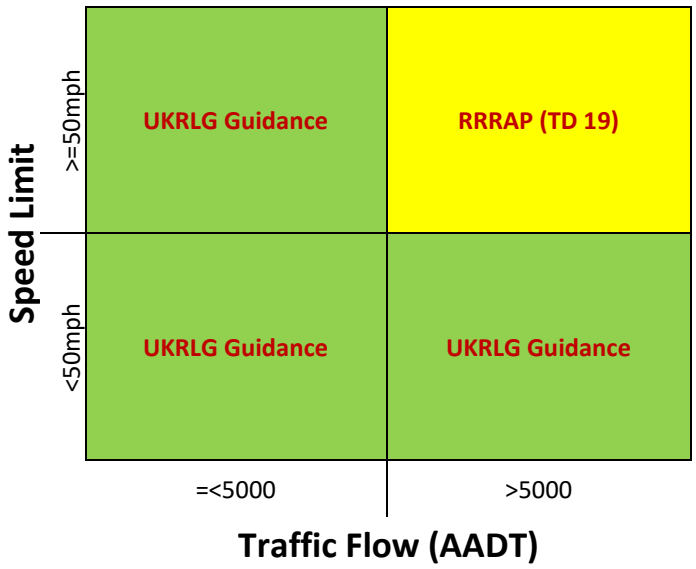
3.1 This memorandum shall take effect from 1st November 2017. The policies and procedures must be followed by all Design Organisations (External and DfI Roads), DBFO Companies and DfI Roads staff, including Development Control staff involved with developer led projects.

3.2 The procedures cover the following:

- Initial and detailed appraisal (UKRLG) for ranking of potential sites for VRS
- Replacement of existing VRS
- Production of a priority list of potential VRS sites for each Division
- Provision of RRS – Scheme Assessment and Design using TD19/RRRAP and UKRLG
- Certification

3.3 It should be noted that DEM 109/07 and DEM 127/11 are now withdrawn.

3.4 TD19/06 shall be applied to all schemes and developer led projects proposed for adoption or that affect public roads (trunk and non-trunk), with design speed or imposed speed limit ≥ 50mph and that carry in excess of 5000 vehicles per day, refer to Para 1.18 - TD 19/06. UKRLG Guidance shall be used for all roads with lower speed limits and/or traffic volumes. Refer to the diagram below.



3.5 In the majority of cases the protection of existing hazards or replacement of RRS is not required during minor maintenance or other works such as surface dressing. For resurfacing works on all roads, the relevant standards (TD 19 or UKLRG) will not apply apart from the following situations when:

- an existing RRS is life expired, has to be dismantled, or is constructed with wooden posts;
- an existing RRS incorporates a welded angle beam detail as part of the terminal detail, this component must be replaced with a standard rolled angle beam or current standard terminal;
- an existing RRS does not conform to its original specification due to the resurfacing works (e.g. carriageway overlay, kerbing, localised widening).

Clients and Designers should consider the opportunity to bring RRS up to current standards and/or consider all relevant hazards, on resurfacing schemes with an Annual Average Daily Traffic (AADT) >5000.

3.6 Clients may decide to initiate a programme (mass action) for protection and /or removal of hazards on certain classes of the road network. This memorandum provides guidance on the design standards to be used.

4.0 Ranking of Potential Sites for VRS (No scheme proposed or no existing VRS)

Refer to Appendix 1(a) for Flowchart

4.1 Potential sites for the installation of a VRS on the existing public road network may be identified through various sources, including members of the public, elected representatives, other public bodies or internally within DfI Roads.

4.2 This section provides a 2 part appraisal process for the potential introduction of VRS or other measures at locations that are not affected by planned road schemes. It is not intended for use where VRS are being prioritised as part of a road improvement scheme.

4.3 Initial Appraisal for Prioritisation

An initial appraisal for prioritisation of potential sites should be completed against two criteria:

- ***Accident History*** **-** Relevant collision history within the last 3 years (where safety barrier or other engineering measures may have reduced severity for single vehicles leaving the carriageway).

- ***Hazards*** **-** Only potential hazards located within close proximity of a running lane justify further appraisal. These hazards can be grouped into the following categories,

  Where:
  - others could be affected, such as near railways, public meeting areas or hazardous substances storage;
  - road users may fall off or into, for example embankments over 3m, water and retaining walls; or
  - roadside obstructions exist such as trees, street lighting columns and signs.

4.4 For further guidance on hazards and their proximity to the carriageway, refer to UKRLG Guidance Section 5.1 or TD19 Section 3.12, depending on road speed and AADT. In the majority of cases DfI Roads, as with other UK road authorities, do not protect hazards, e.g. obstructions (buildings, boundary walls, road lighting columns, trees and signs, etc.) in urban 30/40 mph areas.

4.5 If a hazard is identified in accordance with 4.3 and 4.4 above, a detailed appraisal for prioritisation should be undertaken, either as a specific scheme (refer to Section 6) or to facilitate input to a Divisional priority list.

4.6 If no hazard is identified, a detailed appraisal for prioritisation is not required and a written record should be made of the appraisal and decision, including an independent review by another member of staff at SPTO/PPTO level. At sites where only accident history has been identified, further discussions with and intervention by other parts of DfI Roads may be required (e.g. Network Traffic Section installing high friction surfacing and signage).

4.7 It should be noted that, unless there is a very significant risk, for instance, at a point where large numbers may congregate regularly for significant periods of time, it is not normally the case that a RRS is provided for protection of pedestrians and other Non-Motorised Users (ref Table 5.1 of UKRLG Guidance).

4.8 Detailed Appraisal for Prioritisation.

Following an initial appraisal, where hazards have been identified at a potential site, a detailed appraisal for prioritisation is to be carried out in order to place the site in a Divisional prioritised list.

4.9 The UKRLG Guidance appraisal process will be used to develop a prioritised list within each Division. Several appraisal methods are available:

- Accident Assessment (A) – This approach is only suitable for existing roads where accident data is available. This method is not suitable for road/rail interfaces nor for new construction.
- Network Rail Methodology (B) – This approach is only suitable where there is a road/rail interface.
- Risk Scoring (C) – This method is available for use on new routes where no accident data is available, this is not suitable for road/rail interfaces.

Unless agreed otherwise with Engineering Services, the Risk Scoring Method contained with Chapter 6 of the UKRLG Guidance must be used to assess the risk. If sufficient data is not available to determine any risk factor scores, a score typical of similar situations may be used. Further advice may be obtained from Engineering Services, if required.

4.10 Existing Divisional priority lists already developed using criteria based on previous guidance should also be retained and only re-assessed in accordance with guidance in this memorandum to check if a need still applies, before being developed into a scheme.

5.0 Potential Replacement of Existing Vehicle Restraint Systems

Refer to Appendix 1(b) for Flowchart

5.1 Existing VRS shall be inspected in accordance with DEM 128 and the need for intervention identified on the basis of the process for priority rating within DEM 128. When considering the replacement of existing VRS, for example, life–expired or significantly substandard barrier, or where a barrier has received significant impact damage and it is deemed financially unviable to repair, then it should be subject to appraisal for prioritisation under section 4.3-4.9 to determine where its replacement comes in the priority order for the Division.

5.2 Where the appraisal process used indicates a risk level at which a new VRS is not required, consideration must be given to the removal of the existing VRS without replacement. The removal of existing VRS without replacement will only be permitted with the approval of the Director of Engineering through Engineering Services.

5.3 Repair or replacement of VRS shall be prioritised on a Divisional basis with regard to the priority rating. The nature and location of the repair or replacement of an existing VRS site may result in the site being elevated within a Divisional priority list. This would include, for example, the repair of all defects along a stretch of safety barrier during a road closure.

6.0 Provision of RRS - Assessment for Provision (Scheme Design Development)

Refer to Appendix 1(c) for Flowchart

6.1 TD19/06 must be applied to all schemes and developer led projects proposed for adoption or which affect public roads (trunk and non-trunk), with design speed or imposed speed limit ≥ 50mph, refer to Para 1.18 - TD 19/06 and that carry in excess of 5000 vehicles per day. UKRLG Guidance shall be used for all roads with lower speed limits and/or traffic volumes.

6.2 The requirements for assessment of provision of RRS are set out in TD 19/06 and UKRLG Guidance Document. Both incorporate a risk-based approach to determine any requirement for RRS.

6.3 The introduction of a RRS does not make a situation totally safe, as injuries may occur when a vehicle collides with a barrier. RRS involve an inherent element of risk and this issue needs to be considered against the benefits afforded by a barrier in mitigating the severity and

implications of collisions. In certain circumstances, it may be better not to protect a hazard. In any case elimination or mitigation should always be considered first.

6.4 Justifying the introduction of RRS to reduce risks is a challenge for all road authorities, especially at a time when funding for maintenance and improvement schemes is already limited. Authorities must be confident that any measures taken represent good value for money. TD19/06 – Requirements for Road Restraint Systems has been developed using accident data for routes with over 5000 AADT and a speed limit of 50mph or greater. The benefits predicted for routes with over 5000 AADT and a speed of 50mph or greater may not be produced when applied on low speed and/or low flow roads. (Ref UKRLG 3.3).

6.5 TD19/06 – Requirements for Road Restraint Systems

http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol2/section2/td1906.pdf

6.5.1 TD19/06 has two parts that must be used together:

- The written standard, TD 19/06, [DMRB 2.2.8] contains mandatory requirements but gives mainly advice and guidance; and
- The Road Restraint Risk Assessment Process (RRRAP) is a computer based program that enables the Designer for each site/scheme to establish the need for vehicle restraint and, if so, its performance requirements.

6.5.2 The RRRAP software is available from the Highways England website:
http://www.standardsforhighways.co.uk/ha/standards/tech_info/rrrap.htm

6.6 Provision of Road Restraint Systems on Local Authority Roads (October 2011) (UKRLG Guidance).

UKRLG Guidance - Provision of Road Restraint Systems on Local Authority Roads

6.6.1 It is not possible to produce a prescriptive set of standards to govern the use of RRS on local roads. UKRLG Guidance provides the outline of an appraisal process to help decide when a RRS is justified. This appraisal takes account of the many diverse influencing factors including risk assessment, alternative solutions, system feasibility, cost benefit analysis and the availability of funding.

6.6.2 UKRLG Guidance takes account of the many diverse influencing factors including risk assessment, alternative solutions, system feasibility, cost benefit analysis and the availability of

funding. Where a site meets the criteria of the relevant appraisal process and a decision is taken to install a RRS the design advice within TD 19/06 can be used to ensure that the performance specification is sufficient and that the detailed design layout is fit for purpose. Where the detailed layout does not comply with UKRLG, TD 19/06 or the advice contained in this DEM, an assessment must be made by the designer and submitted to DfI Roads Engineering Services as a Departure from Standard, taking into account the local circumstances.

6.7 Key requirements that would be relevant during any form of external scrutiny or legal case are:

- The final decision to provide or omit a RRS must be taken and recorded. It must not be allowed to happen by default;
- The final decision must be taken at the correct level in the organisation (SPTO/PPTO); if necessary devolving responsibility to those who are best able to obtain and assess the evidence on which to base a decision;
- All decision takers must not be afraid of doing nothing, if to do nothing is the proper conclusion of the assessment process outlined in this Guidance.

7.0 DfI Roads Records and Compliance Certification Procedures

7.1 A fundamental element of the design procedures is the requirement to formally record all factors considered in the design process that were used to determine the need or otherwise for RRS. The risk assessment shall be retained together with a record of any additional factors considered and the final decision made.

7.2 When a RRS is provided, a Compliance Certificate will be required. The Compliance Certificate is DfI Roads' formal record certifying the Contractor designed RRS has been installed in accordance with the outcome of the risk assessment/RRRAP.

7.3 The following procedures apply to all schemes requiring safety barrier as defined in TD 19/06 paragraph 1.18, including developer led projects proposed for adoption. Where other types of RRS are provided the relevant DfI Roads procedures will apply e.g. Masonry walls as containment features will be provided in accordance with RSPPG E020.

- The **Design Organisation** shall provide to the System Designer a formal record of their RRRAP output as required in electronic format, or other risk assessment outcome as appropriate. The initial design shall include, as necessary, the length of need, departures from standard, containment level and working width, any necessary drawings/schedules and site specific details for each proposed RRS.

- For RRS schemes only the following four parties must complete the Compliance Certificate included in Appendix 2. This process must be completed before work commences on site:

    1. The **System Designer** certifies (by signature of the Compliance Certificate Part 1) that the proposed system is compliant with the risk assessment/Employers requirements as received from the Design Organisation, any site-specific requirements, the system manufacturer's installation standards and include general layout drawings/schedules with details of departures from standard.

    2. The **System Installer** certifies (by signature of the Compliance Certificate Part 2) that the proposed system is installed in accordance with the System Designer's site specific drawings, installation standards and Sector Schemes.

    3. The **Client/Project Manager/Engineer** who may either be from DfI Roads or an external Consultant/Client, will receive (by signature of the Compliance Certificate Part 3) the proposal as meeting the overall requirements, specified in the contract and therefore 'receives' the Compliance Certificate.

    4. The **Principal Engineer** (Engineering Services**)** will approve the Compliance Certificate once satisfied that all relevant Departures from Standard recorded have been granted and to monitor overall compliance with the standards.

A copy of the completed Compliance Certificate, Safety Audit and risk assessment/RRRAP will be returned to the Client/Project Manager/Engineer for inclusion within the Health and Safety File as required by the CDM Regulations.

8.0 Drainage and Kerbs

8.1 When considering the use of water drainage channels or kerbing the Design Organisation must evaluate the safety aspect in relation to the position of safety barriers, kerb show, setback etc. (see TD 19/06 paragraph 3.43 and 3.44 and the DMRB standards and advice notes referred to therein).

8.2 In addition reference should be made to **TD 27 [DMRB 6.1]** for the standard kerb show at bridges and **TA 57 [DMRB 6.3].** These examples of guidance are not exhaustive.

9.0 Parapets

9.1 The Design Organisation must ensure that the Containment Level and Working Width Class proposed will be checked as part of the detailed design process. This shall be stated on the Technical Approval documents, **BD 2 [DMRB 1.1]**, or other Structure Review Process documents. Refer also to TD 19/06 paragraphs 4.4 to 4.10 for Containment Level and paragraphs 4.13 to 4.15 for Working Width Class.

9.2 Where metal parapets are proposed, the Design Organisation must evaluate the safety aspect in relation to the plinth upstand dimension to ensure this does not affect the performance of the parapet. Refer also to TD 19/06 paragraph 4.27.

10.0 Sector Schemes

10.1 All safety barrier and parapet vehicle restraint systems installed on public roads or roads to be adopted in Northern Ireland must be installed and maintained by qualified personnel in accordance with Sector Scheme 2B and 5B where these Schemes are applicable.

11.0 Withdrawn Documents

DEM 109/07 Road Restraint Systems
DEM 127/11 Prioritisation of potential Sites for RRS

PB Doherty
Director of Engineering

10 October 2017

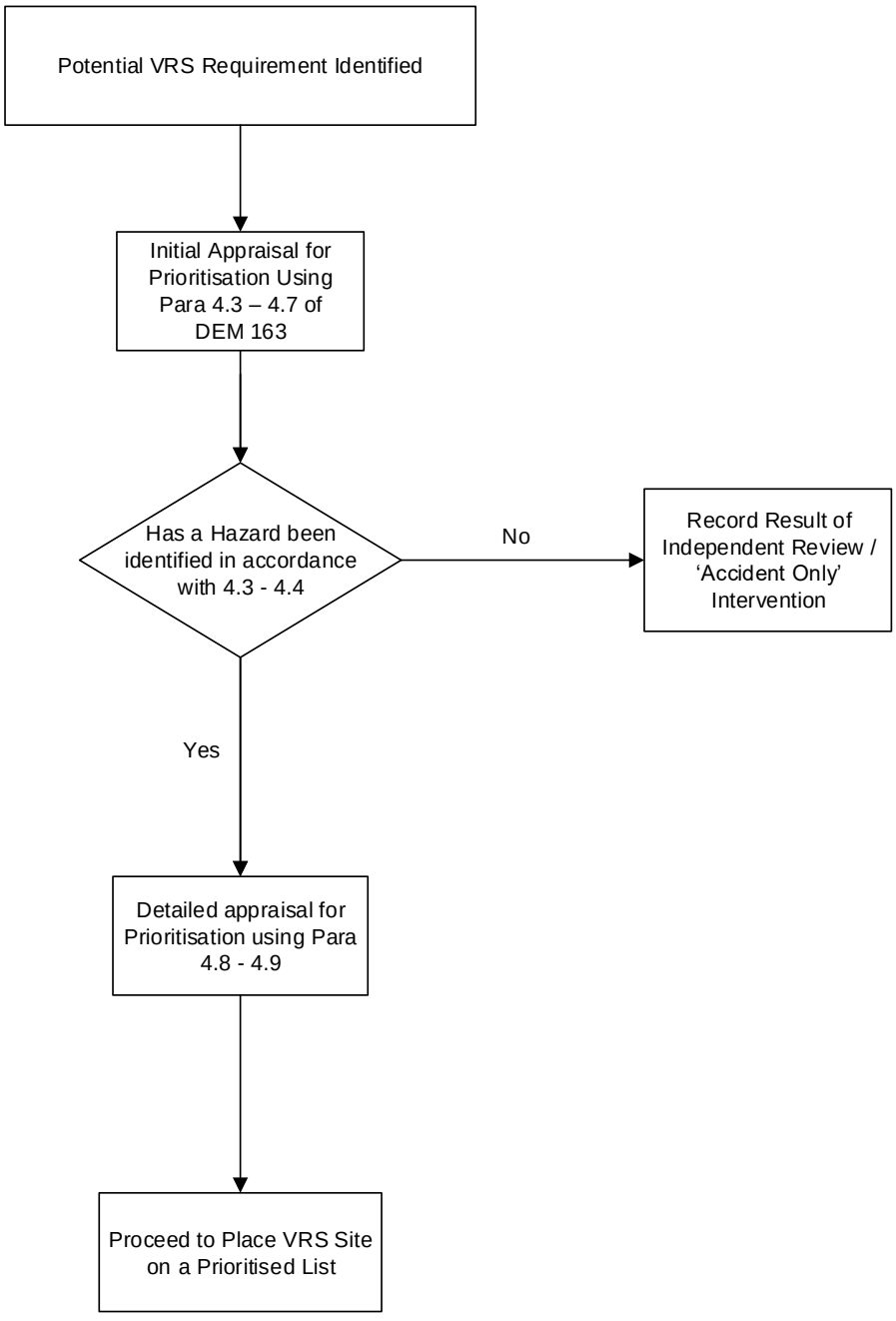
All enquires or comments to:

Stephen Bradshaw / Colin Kelly
DfI Roads - Engineering Services

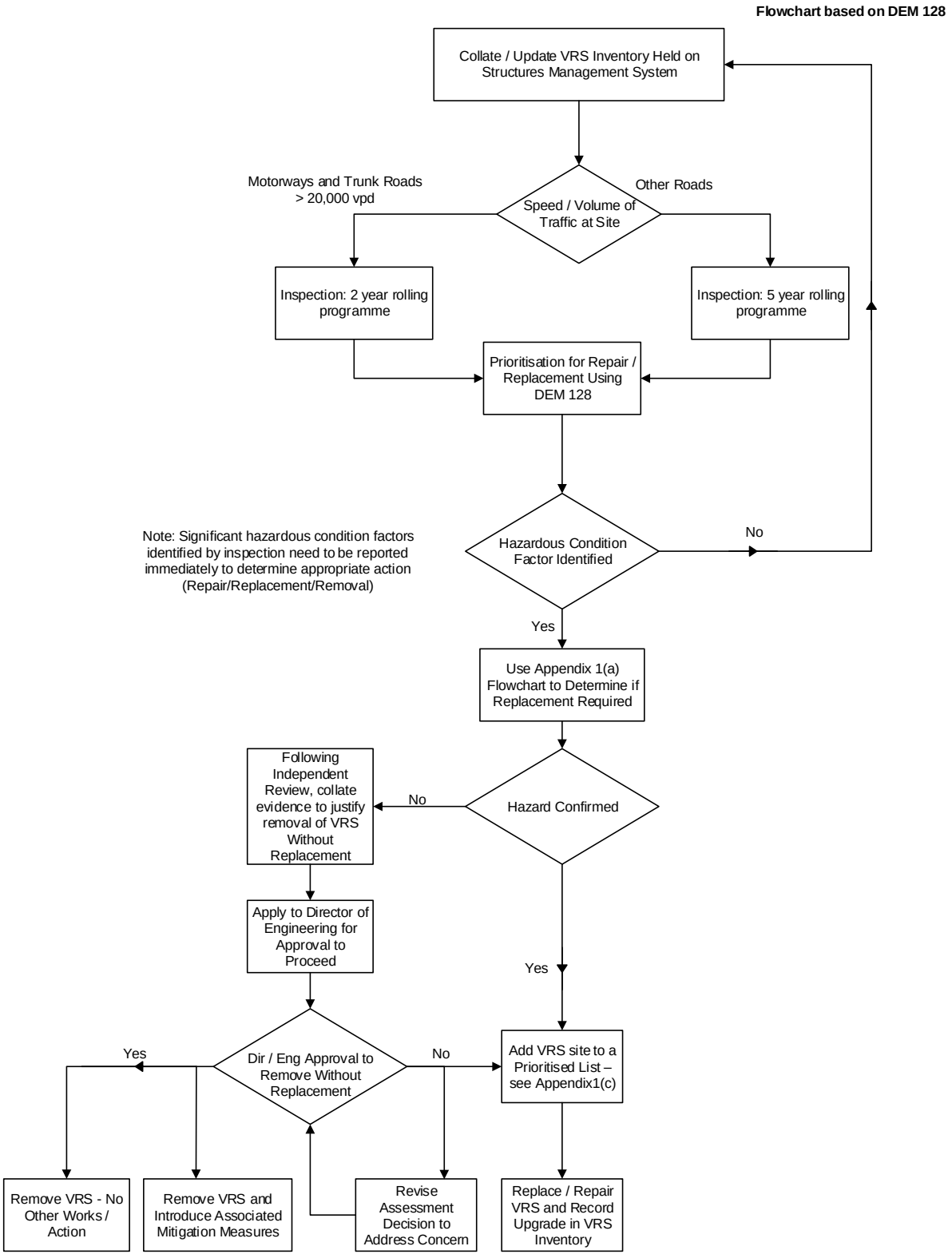
Appendix 1:

(a) Flowchart for ranking potential sites for VRS
(b) Flowchart for management and replacement of existing VRS
(c) Flowchart for provision of VRS (Scheme Development)

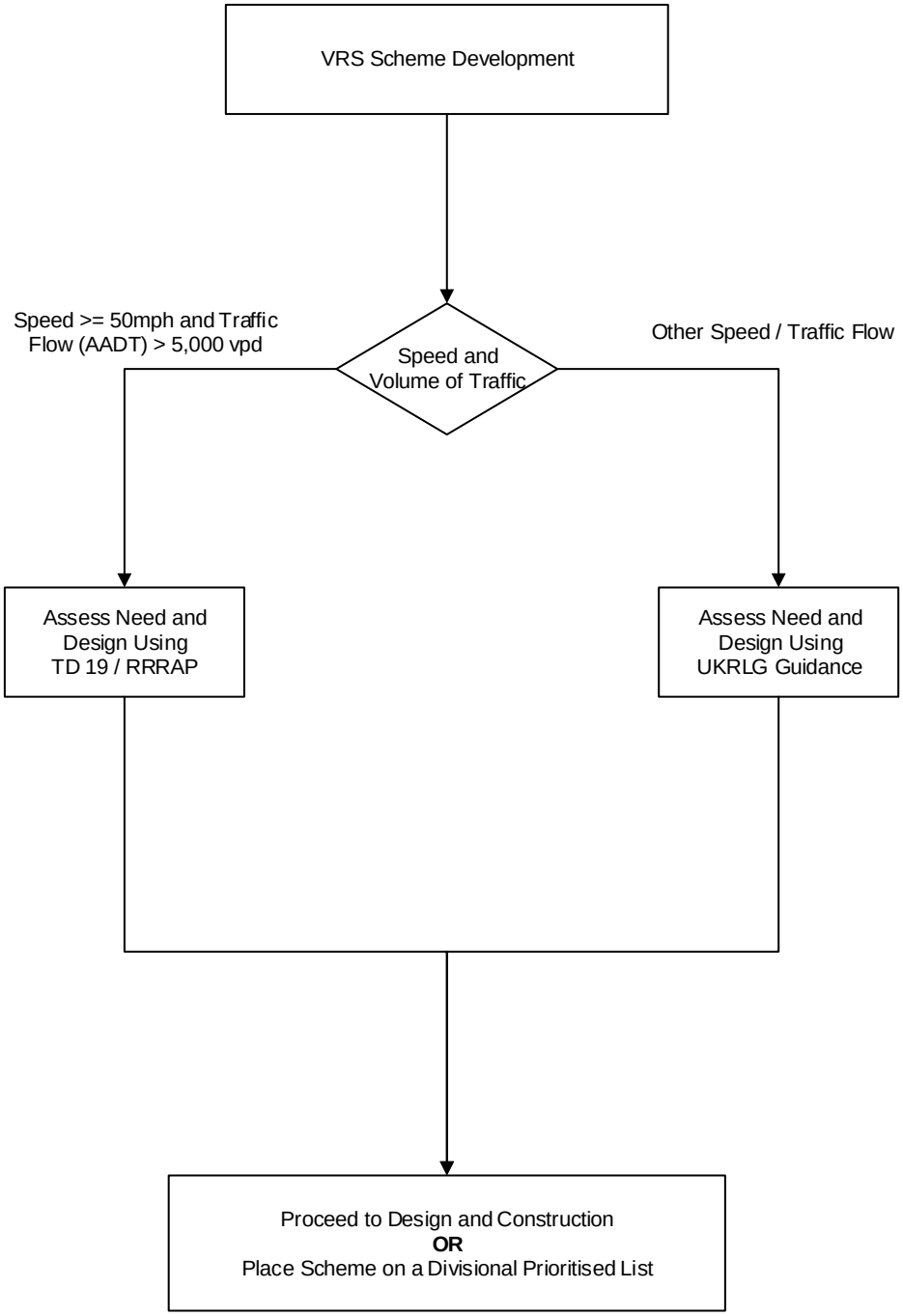
Appendix 1(a) OF DEM 163 – Risk Ranking Potential Sites



Appendix 1(b) OF DEM 163 – Management and Replacement of Existing VRS



Appendix 1(c) OF DEM 163 – Provision of VRS (Scheme Development)



Appendix 2:

Template for Compliance Certificate

DEPARTMENT FOR INFRASTRUCTURE – ROADS

Road Restraint System – Compliance Certificate

Division		**RRS Ref No**	
Name of Scheme		**DIV Ref No**	

Scheme Design Speed or Imposed Speed Limit .....

AADT.....

1. Proposed Road Restraint Systems (RRS) ……

The RRRAP/Employers requirements (delete as appropriate) provided have been accurately translated into system construction details, the unique numbers of these drawings[1] and schedules are:

Drawing No.		**Schedule No.**	

Departures from Standard[2].....

I/We certify that reasonable professional skill and care has been used in the preparation of the design of the RRS forming part of the above named scheme and that the design is compliant with the RRRAP output (if used), Employers Requirements[3], EN 1317/NPSBS (Rev1), the manufacturers Specification and Installation Standards.

An electronic copy of the RRRAP (provided by the Design Organisation as applicable) has been enclosed for record purposes in accordance with TD 19/06 Clause 1.29.

Signed _____

Name _____ **System Designer[4]**

Position held _____

Name of Organisation _____

Date _____

DEPARTMENT FOR INFRASTRUCTURE – ROADS

Road Restraint System – Compliance Certificate

……Division		**RRS Ref No**	
Name of Scheme		**DIV Ref No**	

2. System Installer

I We certify that reasonable professional skill and care will be taken in the installation of the RRS of the above named scheme, to meet the Drawing and Schedules detailed in Section 2, the employers requirements, EN 1317/NPSBS (Rev1), the Manufacturers Specification and Installation Standards, and relevant Sector Scheme.

Signed _____

Name _____ **System Installer[5]**

Position held _____

Name of Organisation _____

Date _____

3. The Compliance Certificate is received by the Project Manager/Engineer on behalf of.....

Signed _____

Name _____ **Project Manager/Engineer[6]**

Date _____

The Compliance Certificate is DfI Roads formal record certifying the Contractor designed Road Restraint Systems, therefore it must be kept by the appropriate DfI Roads Division.

4. The Compliance Certificate is received on behalf of DfI Roads – Engineering Services

Signed _____

Name _____ **Principal Engineer**

Date _____

Notes:

1. *The drawings shall include a general arrangement drawing identifying the location and type of the proposed RRS.*
2. *Departures from Standard including DfI Ref. No.; Additional information or criteria.*
3. *Reference shall be made to the relevant Appendices/Schedules in the Contract Documents.*
4. *The system designer uses the RRRAP or Client requirements as provided by the Design Organisation to produce a compliant road restraint system. As system designer this organisation must hold appropriate Professional Indemnity Insurance*
5. *Installer to be certified to Sector Schemes 2B and/or 5B. (System Designer and System Installer are often the same organisation)*
6. *Client; DfI Roads/Developer/other as appropriate.*