

Vehicle Restraint Systems: Installation, Inspection and Maintenance Strategy

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1. Introduction

- 1.1 Cheshire East Borough Council currently maintains approximately 56 km of vehicle restraint systems (VRS) which are distributed across a wide range of locations on our highway network with varying road speeds and traffic flows.
- 1.2 The Council are required to maintain these assets in an effective condition to prevent vehicles from leaving the carriageway, reducing the severity of impact with roadside hazards and to protect essential roadside equipment from damage.

2. Scope of the Document

- 2.1 This document promotes the use of a risk-based approach to the installation of new vehicle restraint systems, as well as the management and maintenance of existing VRS to ensure a consistent and optimum performance across Cheshire East.
- 2.2 The implementation of this strategy will ensure that:
 - New vehicle restraint systems are only installed after all other measures have been considered.
 - New vehicle restraint systems are installed to the appropriate standard.
 - Vehicle restraint systems are recorded on the Highway Asset Management System.
 - Maintenance of vehicle restraint systems will be prioritised following a risk-based approach.
 - Where a departure from national standards or guidance is proposed this decision is fully risk assessed and signed off by appropriate personnel.
- 2.3 As national guidance on vehicle restraint systems is not collated in one place and is complex, this document is intended to be a reference document to support design and highway maintenance engineers when considering vehicle restraint systems and to set the risk-based method by which the Council prioritises detailed inspection and minor maintenance; in order to optimise the funds available whilst reducing the risk.
- 2.4 Guidance and Departure from National Standards

This code of practice has been developed with reference to:

- Requirement for Road Restraint Systems CD377
- Design & Maintenance Guidance for Local Authority Roads Provision of Road Restraint Systems on Local Authority Roads (DMG-RRS)
- Well Managed Highway Infrastructure: A Code of Practice (WMHI)
- TAL 06/03 Managing accidental rail obstructions by road vehicles (TAL 06/03)
- IAN 97/07 Assessment and Upgrading of Existing Vehicle Parapets (IAN 97/07)
- British Standards Documents - BSEN1317 and BS7669-3
- Highways Act 1980 Section 41

The Council will use the above guidance wherever it is applicable and practicable to do so. The contents and scope for each of the vehicle restraint systems guidance notes listed above is included in **Appendix A**.

Where there are proposals from a departure from national standards or guidance, this decision will only be taken after carrying out the appropriate road safety audit and/or risk assessment and will be signed off by the Council.

3. Routine Safety Inspections

- 3.1 All vehicle restraint system installations are subject to a regular basic visual inspection as part of the Highway Safety Inspection policy which prescribes the frequency of inspection, the method of assessment, recording and repairing of highway defects.
- 3.2 All safety fences and barriers are checked visually for obvious accident damage during routine safety inspections. Inspections should be undertaken on foot where appropriate. Long lengths of fence or barrier and sections on high-speed roads may be assessed by means of a slow driven inspection provided the sections to be inspected are clearly visible.
- 3.3 A proportion of our vehicle restraint systems installations are also associated with structures. In accordance with WMHI, vehicle restraint systems will be inspected as part of the highway asset, as well as part of general and principal inspections for structures, where it is practical to do so.
- 3.3 Vehicle restraint system Emergency or Category 1 defects are identified:
- If part of a section is missing from the vehicle restraint system.
- If part of a section is bent or displaced from the vehicle restraint system.
- 3.4 In accordance with the Code of Practice for Highway Safety Inspections, if a Category 1 defect is identified it must be made safe within 2 working days. If it is identified as an Emergency, we will look to make the defect safe within 1 hour during the working day and 1.5 hours outside of working hours.

Depending on the severity of the defect and location, the following measures may be put in place to protect the public from the defect:

- Displaying warning notices, coning off and fencing off the barrier.
- Installation of a concrete barrier until a permanent repair is complete.
- Reducing the speed limit and installing temporary traffic lights at the location.
- Lane closure or closure of the road.

Where a temporary repair is made to a Category 1 defect, we will take reasonable steps to make a permanent repair within one calendar month. This will be dependent on network availability, design, resource and materials to undertake the works (**Appendix E**).

4. Specific Vehicle Restraint Annual Inspections

- 4.1 A visual inspection of the VRS will be undertaken annually in a risk-based approach in accordance with Well Managed Highway Infrastructure: A Code of Practice.
- 4.2 Approximately a quarter (25%) of the VRS assets will be inspected each year.
- 4.3 Inspections will be carried out by approved contractors that hold the National Highway Sector Scheme 10B accreditation.
- 4.4 Detailed inspections are carried out on each asset and an inspection sheet completed for each location. This provides a snapshot of the key characteristics of the asset including system type, physical condition, compliance with current standards and most importantly its purpose.
- 4.5 The above factors are then assessed and applied a condition and priority rating.
- 4.6 The rating established is based upon numerous factors, including the condition of the barriers, its design compliance, its expected performance and whether or not is suitable to protect the hazard in its current location and traffic scenario.

Consideration will also be given as to whether any temporary measures are required to protect the public from defects until such time as a permanent repair is actioned. **(See Section 3.4)**

Condition and Priority Rating

Red – The vehicle restraint system is severely damaged, has significant defects present or is a non-compliant system.

High Amber – The vehicle restraint system has major defects or is non-compliant with current design.

Amber - The vehicle restraint system has isolated minor defects or design issues present but still sufficient integrity to perform as originally designed.

Green – No obvious defects present.

The information collected can then be used to combine additional data intelligence such as accident statistics and hazard ratings. This combination of factors is then risk scored to produce an overall risk rating. **See Appendix D**

- 4.7 Logically, the programmes of service inspections & tensioning should initially be constructed around the repair / upgrading works programmes and follow, as far as practicable, the hierarchy of the condition, priority rating and overall risk rating.

5. Upgrade or Repair of VRS

- 5.1 CD 227 provides guidance on when consideration should be given to upgrading existing vehicle restraint systems which do not meet current standards and exceptions to this. CD 227 also provides guidance on when like for like repairs are permitted on VRS which do not meet current standards. We will follow this guidance, particularly in the case of our 'Higher Priority Sites', wherever it is practicable to do so.
- 5.2 In accordance with the with National Highways Quality Management Sector Scheme 2B and 5B only suitability qualified personnel should be employed to install, upgrade or repair vehicle restraint systems on our road network. Prior to starting works, contractors will be required to confirm that the personnel who will be engaged to undertake work are suitably qualified.
- 5.3 Comprehensive records of the processes followed, and the decisions made should be kept and stored in line with the relevant guidance and the requirements outlined in **Section 7 – Updating the Asset.**

6. Recovery of Costs

- 6.1 Where practicable, efforts will be made to recover all costs incurred in repairing sections of accident damaged fencing or barrier from the third party causing the damage or their insurance provider. This will include the costs of traffic management, making safe, administration and repair. Information will be required from maintenance contractors, police and insurance companies and should be followed up as soon as possible after receiving notice of the damage.
- 6.2 All costs recovered from insurance companies in respect of third-party accident damage will be credited back to the Council's highways department.

7. Updating the Asset

- 7.1 After the survey is complete all data and works are logged into the Asset Management system and digitised accordingly.
- 7.2 Details of existing installations are to be passed by the maintenance teams to the Asset Management Team in order to be checked against the asset register.

- 7.3 Details of new installations are to be passed by the commissioning project manager to the Asset Management Team for inclusion to the asset register.
- 7.4 All other information/documents relating to the assessment, design, installation, inspection and repair processes should be attached as documents to the relevant record.

8. Assessment of Need for the Provision of Vehicle Restraint Systems

- 8.1 It is expected that all practical attempts should be made to prevent new hazards being created and as such hazards should be designed out, thus avoiding the need for vehicle restraint system provision. Where this is not possible, this guidance is applicable.
- 8.2 Different guidance is available, depending on the location, speed limit, traffic flow and type of hazard within the risk appraisal process of a VRS site. Table 1 at **Appendix B** provides a guide to selecting the most appropriate risk appraisal guidance and associated risk assessment based on these criteria.
- 8.3 The Design & Maintenance Guidance for Local Authority Roads Provision of Road Restraint Systems on Local Authority Roads (DMG-RRS) gives examples of the circumstances and hazard types to justify and undertake the appraisal process to determine the need to implement a vehicle restraint system.
- 8.4 In order to give a consistency of approach to the interpretation of the results of the chosen risk assessment, **Table 2 in Appendix B** converts the results of the different risk assessment methods into the risk / priority bands of 'higher', 'medium' and 'lower'.
- 8.5 The risk assessment process is only part of the appraisal process and, regardless of the risk assessment band achieved by a vehicle restraint system site, consideration should be given to suitable, cost-effective and practicable alternative options which will reduce the level of risk to a level which will avoid the need to install / continue to provide a vehicle restraint system. **Design & Maintenance Guidance for Local Authority Roads Provision of Road Restraint Systems on Local Authority Roads (DMG-RRS)** provides examples of alternative solutions for consideration of sites on local roads. Such solutions include the removal or relocation of hazard, speed control or the installation of chevrons and signs etc.
- 8.6 CD 377 requires that road safety audits must be undertaken on all highway schemes involving removal, provision or improvement of vehicle restraint system.

- 8.7 Comprehensive records of the processes followed, and the decisions made should be kept and stored in line with the relevant guidance and the requirements outlined in **Section 7 – Updating the Asset**.
- 8.8 Where, as a result of the above procedure, a decision is made to install a vehicle restraint system, **Appendix C** provides guidance on the design and installation of said system.

9. Appendix A: Summary of Key Guidance

CD377 Requirement for Road Restraint Systems (DMRB)

The Design Manual for Roads and Bridges standard CD377 – Requirements for Road Restraint Systems has been developed using accident data for routes with over 5000 Annual Average Daily Traffic (AADT) and a speed limit of 50mph or greater. Application of the risk-based approach in that standard to low speed and low flow roads is likely to result in overuse of RRSs and not represent best use of limited resources. CD377 is therefore not suitable for use on the majority of the nation's local road network.

Design & Maintenance Guidance for Local Authority Roads Provision of Road Restraint Systems on Local Authority Roads (DMG-RRS)

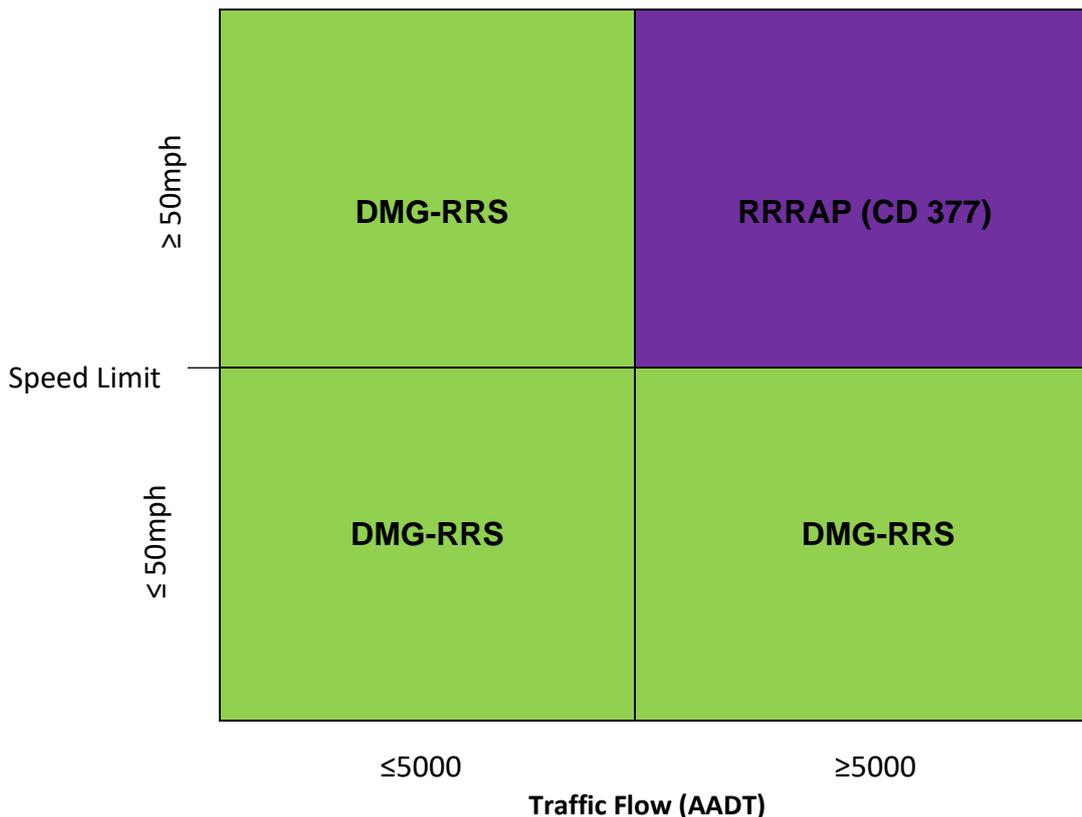
This United Kingdom Roads Liaison Group (UKRLG) Guidance Document is intended for use by highway authorities and their designers considering the introduction or replacement of vehicle restraint systems on roads with low traffic flows and/or low traffic speeds. It describes a process to assist highway authority decision making with regards to investing in a vehicle restraint system at a particular site. It includes the necessary supporting information to assist this process and takes account of risk, risk assessment methods, costs, benefits as well as further advice on performance specification and outline design. It is applicable to:

- New roads (and the adoption of roads)
- Road improvements e.g., widening, junction improvements
- Where a new hazard is introduced, or an existing roadside feature is altered e.g., the addition of roadside features
- Where the upgrade or replacement of a parapet is being considered.
- Maintenance schemes where a significant length of vehicle restraint systems is being replaced
- When the safety performance of a particular site has been questioned and risk reduction options are being assessed.

10. Appendix B: VRS Risk Appraisal

Different guidance is available for the risk appraisal process of a vehicle restraint system site. The most appropriate methodology is determined by several factors including type of road, traffic speed, traffic flows and location.

The table below provides a guide to the scheme designer for the selection of the most appropriate risk appraisal process and risk assessment type, based on these criteria.



Applicable methods for determining when a RRS is required

Table 1	Traffic Speed Limit		
	AADT	<40 mph	40 mph
<5000	VRS generally not required. (In exceptional circumstances apply DMG-RRS with Method A, B* or C))	DMG-RRS with Method A, B* or C	DMG-RRS with Method A, B* or C
≥ 5000			CD 377 with RRRAP
All sites near railway lines – regardless of traffic speed / AADT: TAL 06/03 - 'Managing Accidental Obstruction Railway Approaches'			

(* Method B of DMG-RRS is based on the risk estimation tool which forms part of TAL 06/03)

Key to Abbreviations	
AADT	Annual Average Daily Traffic
DMG-RRS	Design & Maintenance Guidance for Local Authority Roads Provision of Road Restraint Systems on Local Authority Roads
TAL 06/03	Managing Accidental Obstruction Railway Approaches
CD377	Requirement for Road Restraint Systems

To give a consistency of approach for the interpretation of the results of the chosen risk assessment, the table below converts the results of the different risk assessment methods into the risk / priority bands of 'higher', 'medium' and 'lower'.

Table 2	Risk Assessment Method			
	Risk / Priority Band	DMG-RRS - Method A	TAL 06/03 or DMG-RRS - Method B	DMG-RRS - Method C
Higher	Above the KSI return period in Table 3.1 in DMG-RRS*	Score of ≥ 100	Score of 14 or more	'Unacceptable'
Medium		Score of ≥ 70	Score of 9-13	'Tolerable'
Lower	Below the KSI return period in Table 3.1 in DMG-RRS	Score of < 70	Score of 0-8	'Broadly Acceptable'

(*DMG-RRS acknowledges that determining the upper bound of a Medium Priority Site category is difficult and needs to be determined by the individual highway authority).

11. Appendix C: Design and Installation of VRS

Whether designing a vehicle restraint system for a new motorway or an existing low speed road the fundamentals of design process remain the same. Therefore, wherever practicable, the layout of vehicle restraint systems, including those on low speed and low flow roads, should be in accordance with the layouts and design guidance given in CD377, which recommends that vehicle restraint system provision is considered at an early stage in a scheme's development (i.e. before the land footprint or land purchase is decided) and design processes to:

- ensure that all factors that are under our control including land purchase, road and cross-section geometry, and location of hazards are considered in determining the overall optimum solution
- minimise the need for 'departures from standard'
- eliminate or mitigate, as far as reasonably practicable, factors that might be detrimental to the safety of those who use and work on the road, and of others that might be affected by use of the road. For example, consideration should be given to

prevent grass from growth in front of VRS so that grass cutting operations do not require operatives to be positioned in front of safety barriers

The RRRAP is an integral part of the design process in CD377; where reference is made to the results of the RRRAP, the designer should refer instead to the results of the relevant DMG-RRS risk assessment where this is applicable. A summary of some of the key information in CD377 relating to design and installation is also provided in DMG-RRS.

The results of the RRRAP procedure for each design must be included as part of the Health and Safety documentation required under CDM Regulations.

All vehicle restraint systems are to be designed by suitably qualified engineers with a working knowledge and experience of these systems to current standards.

In addition to complying with all appropriate standards and guidance the designer must also consider the whole of life costs of the vehicle restraint systems, including the future repair and maintenance needs.

Only vehicle restraint systems conforming to EN1317 standards will be permitted. Only personnel qualified in accordance with National Highways Quality Management Sector Scheme 2B and 5B should be employed to install, upgrade or repair VRS on our road network.

Where a departure from national standards or guidance is proposed, this decision will only be taken after carrying out the appropriate road safety audit and/or risk assessment and will be signed off by the Council and the decisions made should be kept and stored in line with the relevant guidance and the requirements outlined in **Section 7 – Updating the Asset**

12. Appendix D: Vehicle Restraint Risk Scoring Matrix

Road Category	Score
Resilient Network	6
Strategic Route	5
Main Distributor	4
Secondary Distributor	3
Link Road	2
Local Access Road	1

Hazard Type	Score
Electrical/Gas utility installation	10
Railway	10
Body of water/River/Canal/flood plain	9
Bridge/retaining wall over 3m with no parapet protection	9
Structural columns/Gantries	9
Known collision hot spot	8
Embankment (>6m drop)	8
Overpass	8
Central Res	7
Lighting columns (not passively safe)	6
Large signs (not passively safe)	6
Trees (>250mm Ø)	5
Embankment (1m – 6m drop)	5
Highway boundary walls (brick > 1.2m height)	5
Slipway	5
Lighting columns (passively safe)	3

Accident Record	Multiplier
No collisions	X1
Small collisions (minor injuries, or network disruption)	X1.5
Serious collisions (major injuries or network disruption)	X2
Fatal collision	X2.5

Condition/Rating	Priority	Multiplier
Red/Repair	1	X3
High Amber	2	X2
Amber	3	X1
Green	0	X0

Example

A barrier has been assessed and has a High Amber condition. The barrier is alongside a river and prevents vehicles from exiting the road and going into the water. There has been an incident where a vehicle has mounted the barrier.

The risk score methodology:

Road Category - Resilient (6)

Hazard Type - River (9)

Base Score – 15

Condition Rating – High Amber x 2 = 15

Accident Record – Serious x 2 = 15

Total Risk Score - 45

The score would be recorded and listed along with other barriers across the Borough and used to determine which barriers present the Council with the highest risk.

13. Appendix E: Routine Inspections Flow Chart Process

