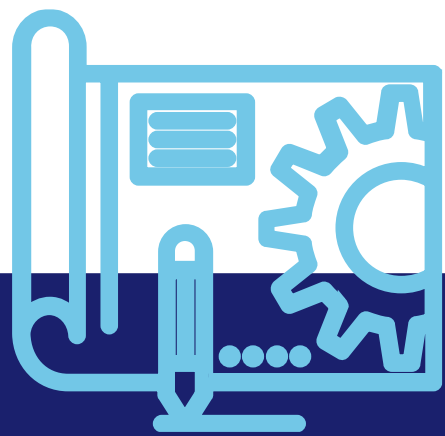


Transport Infrastructure Ireland

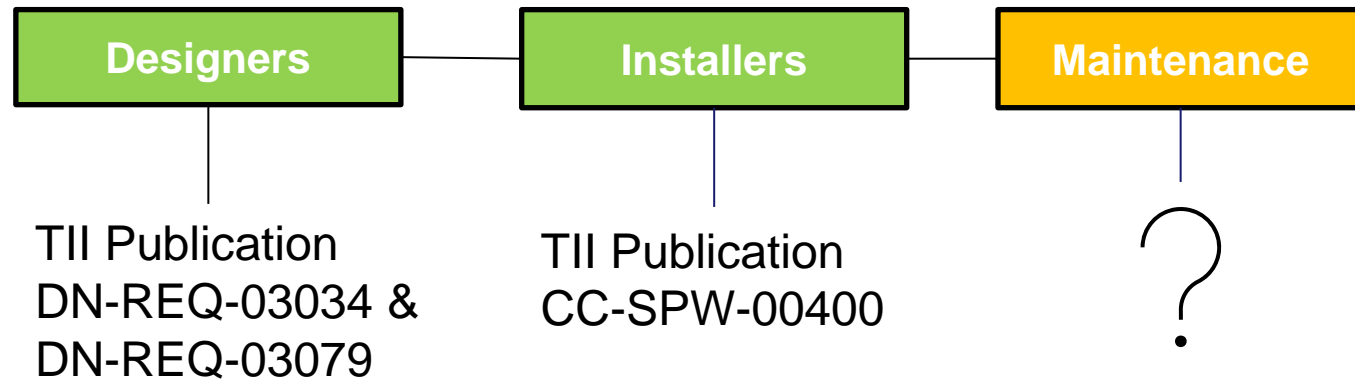
VRS Maintenance Guidance Handbook



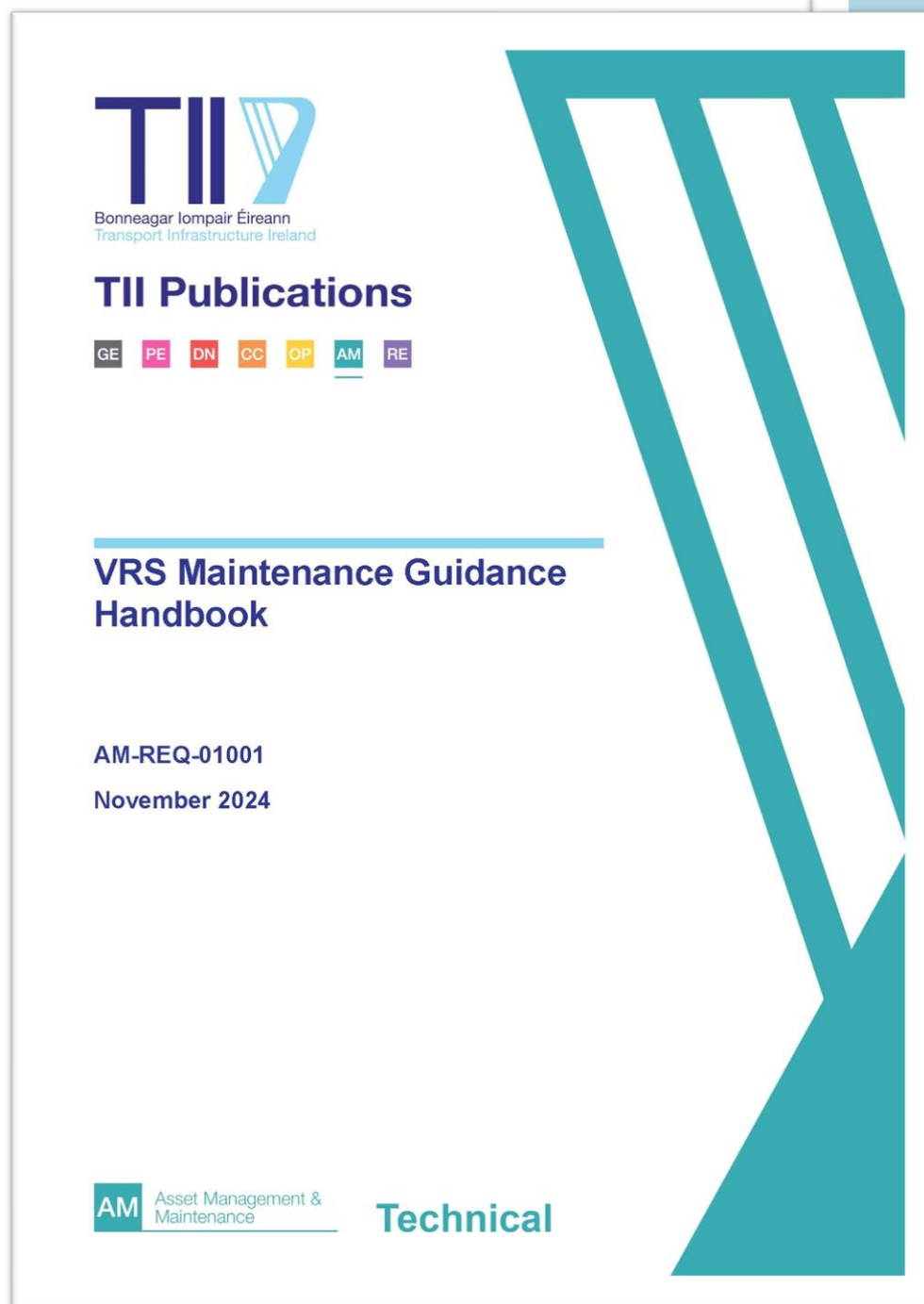
Michael Ward | RPS



Background



- Inconsistency across the network
- Lack of knowledge / guidance
- Experience gained
- International research
- Liaised with Contractors

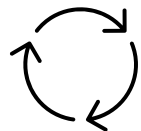


Structure

| TRANSPORT INFRASTRUCTURE IRELAND (TII) PUBLICATIONS | |
|---|-------------------------------------|
| TII Publications | |
| Activity: | Asset Management & Maintenance (AM) |
| Stream: | Road Equipment (REQ) |
| TII Publication Title: | VRS Maintenance Guidance Handbook |
| TII Publication Number: | AM-REQ-01001 |
| Publication Date: | November 2024 |
| Set: | Technical |

| Contents | |
|---|----|
| 1. Executive Summary | 1 |
| 2. Policy and General Requirements | 3 |
| 3. Repairs After Collision..... | 19 |
| 4. Planned VRS Maintenance | 39 |
| 5. Improvements..... | 58 |
| 6. Bibliography | 67 |
| 7. VRS Maintenance Flowchart | 68 |
| Appendix A - Post Installation Certificate | 69 |
| Appendix B - Safety Inspection Record Form..... | 76 |
| Appendix C - Detailed Inspection Record Forms..... | 79 |
| Appendix D - Designers Inspection Record From | 87 |

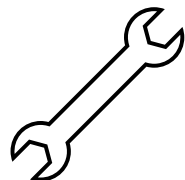
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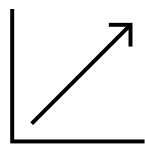
• **Maintenance:** periodic recurring measure to maintain the ‘target state’



• **Inspection:** survey to ascertain current state



• **Repair work:** measures to restore damaged VRS (e.g. refurbishment or replacement of parts)



• **Improvement work:** measures to improve an existing VRS (e.g. modification or augmentation)

Policy and Requirements

- Forgiving Roadsides
- Training and Qualifications
- VRS Asset Database
- VRS Inspections
- Certification, CE Marking and Traceability
- Health and Safety

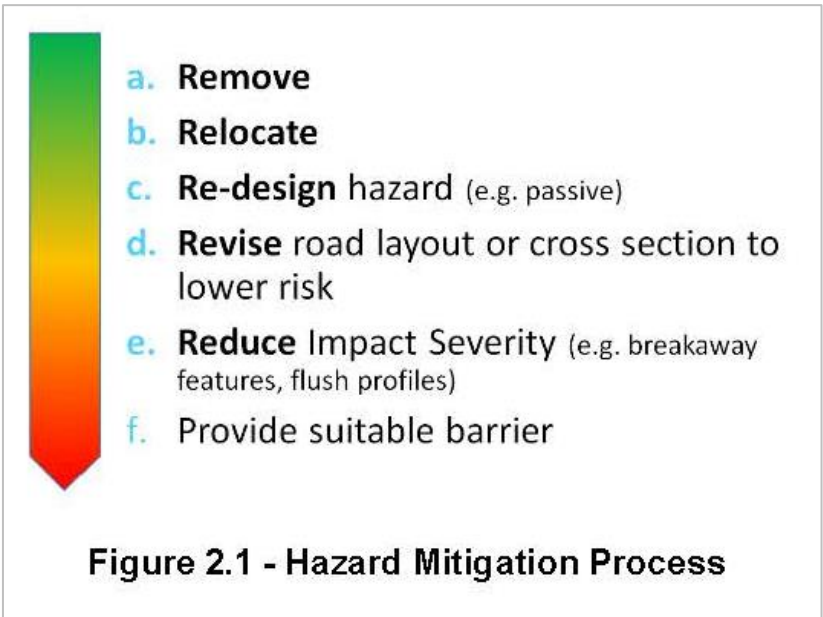
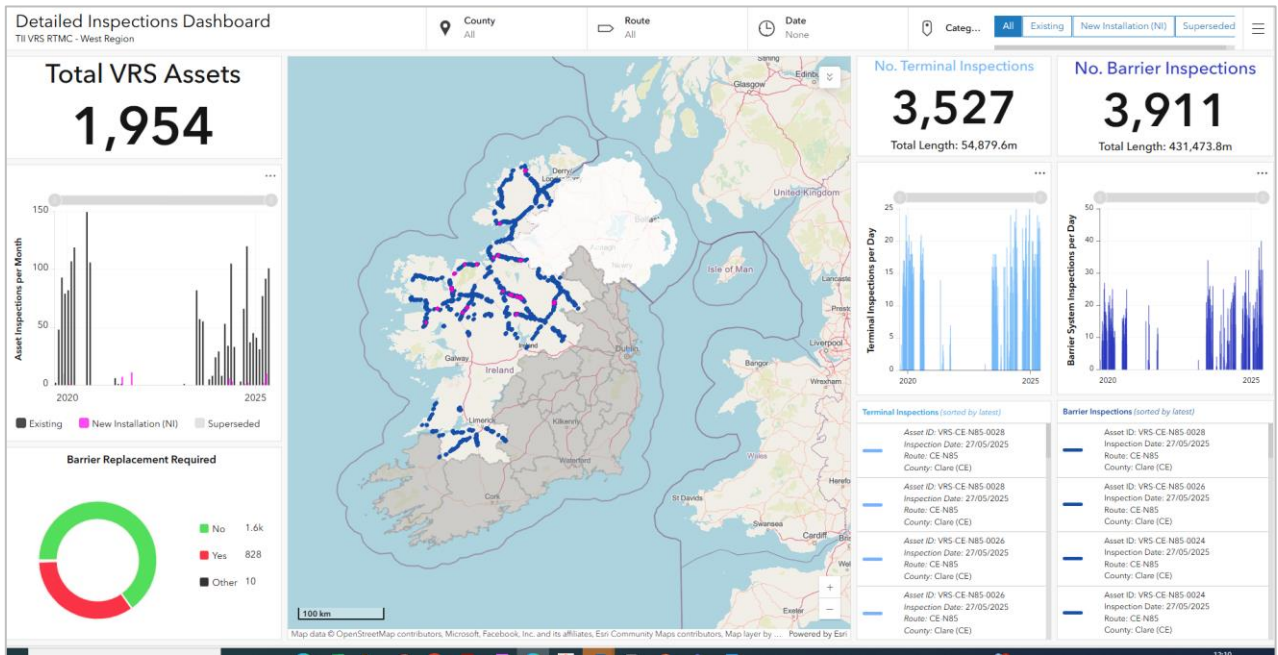


Table 2.1 - Training and qualifications requirements for those involved in VRS maintenance

| | Essential | Desirable |
|-------------------------|--|--|
| Client | | |
| Client PM | | <ul style="list-style-type: none">VRS designer training course |
| Inspection Teams | | |
| Team Lead | <ul style="list-style-type: none">VRS designer training course | <ul style="list-style-type: none">Other inspector's courseSystem specific installation training |
| Designers | | |
| Team Lead | <ul style="list-style-type: none">Chartered EngineerVRS designer training course | |
| Designer | <ul style="list-style-type: none">VRS designer training course | <ul style="list-style-type: none">System specific installation training |
| Installers | | |
| Contracts Manager | <ul style="list-style-type: none">VRS designer training course | |
| Lead Installer | <ul style="list-style-type: none">VRS designer training courseLANTRA NHSS 10h foundation courseLANTRA NHSS courseSystem specific training | |
| Installer | <ul style="list-style-type: none">LANTRA NHSS course | |

Post Installation Certificate – New Installations

| Works Details | | | | | | | | | | | | |
|----------------------------------|----------------------------|---|---------|---------------------|------------------|--------------|-------------|---------------|---------------------------|---------------------|--------------------|----------|
| Client | | | | | | | | | | | | |
| Reference Number | | | | | | | | | | | | |
| Job Number | | | | | | | | | | | | |
| Works Location | | | | | | | | | | | | |
| Installation Details | | | | | | | | | | | | |
| (A) General Checks | | (A) General Checks - continued | | (D) Other Comments: | | | | | | | | |
| Set-Back (SB) | (m) | Flares/Radius Present? | Y N | | | | | | | | | |
| Is SB consistent? | Y N | Conform to Design? | Y N | | | | | | | | | |
| SB conforms to Design? | Y N | (B) Barrier Beams | | | | | | | | | | |
| Barrier Height: | (m) | Beams overlapped correctly? | Y N | | | | | | | | | |
| Complies with System Tolerances? | Y N | Beams damaged/corroded? | Y N | (C) Site Checks | | | | | | | | |
| Reflectors Installed? | Y N | Cleaned, finished with all excess material removed? | Y N | | | | | | | | | |
| Reflectors orientated correctly? | Y N | Grass Seeded? | Y N | (D) Terminals | | | | | | | | |
| Hazards in WW? | Y N | | | | | | | | | | | |
| Type & Class | Available Displacement (m) | Comply with Design Class? | Support | Stable? | Level & In-Line? | Size & Grade | Torque (Nm) | In Compliance | All Components Installed? | Water Ponding Risk? | Visibility Issues? | Comments |
| Upstream | | Y | | Y | Y | | | Y | Y | Y | Y | |
| | | N | | N | N | | | N | N | N | N | |
| Downstream | | Y | | Y | Y | | | Y | Y | Y | Y | |
| | | N | | N | N | | | N | N | N | N | |



Repairs after a Collision

- **Process Overview**



- **Reporting Damage**

- **Making Safe a Damaged VRS**

- VRS impacted but can still perform
- VRS impacted and has suffered major damage

- **Safety Inspections**

| Reference Name | Content | Image Required |
|--|---|----------------|
| Asset ID [VRS-Route ID-Four Digit Sequential No.] (i.e. VRS-RN-N05-0001) | County abbreviation; route number and four digit unique number (e.g. VRS-RN-N05-0001) | |
| Safety Inspection Date | Insert inspection date | |
| VRS Inspector | Contractors VRS Inspector | |
| Positional Accuracy (cm) | | |
| GPS/GNSS Receiver | | |
| Route (i.e. N05) | | |
| County | Mayo (MO) / Leitrim (LM) / Roscommon (RN) / Sligo (SO) | |
| Route ID (i.e. RN_N05) | County abbreviation & route number | |
| Road Type | Motorway / Type 1 Dual Carriageway / Type 2 Dual Carriageway / Standard Single Carriageway / Non-Standard Single Carriageway / Single Carriageway | |
| Speed Limit | 50 km/h / 60 km/h / 80 km/h / 100 km/h / 120 km/h | |
| Upstream Terminal Damage | | |
| Upstream Terminal Damaged [*] | Yes / No | Yes |
| Upstream Terminal Transition Damaged [*] | Yes / No | Yes |
| Damage Description | | |
| Repair Priority | High / Medium / Low | |



Figure 3.6 - Example of Safety Inspection Report Form Template

Prioritising Repair

High



- Beam sections not continuous
- Broken or separated lap joints
- 3+ posts damaged or separated from beam
- Deflection of beam > 450mm

Medium



- Beam sections continuous
- Lap joints not separated (may be bent or partially flattened)
- 2 or fewer posts damaged or separated from beam
- Deflection of beam < 300mm

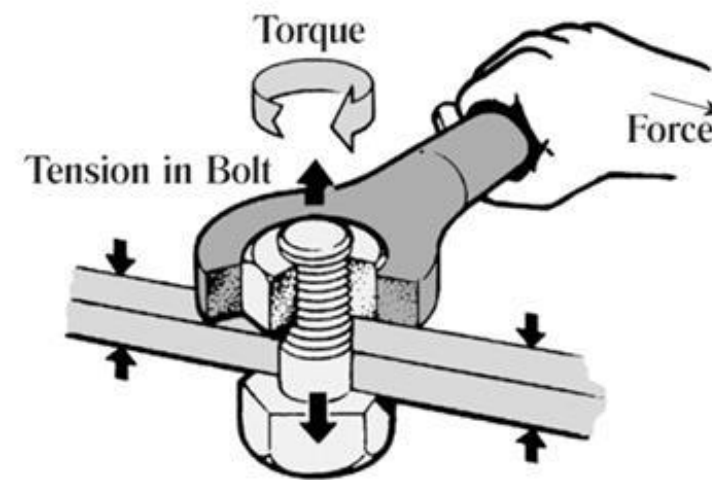
Low



- Beam sections continuous,
- lap joints have not separated (partially flattened)
- No posts damaged or separated from beam
- Deflection of beam < 150mm

Repair issues and Rule of Thumb

- Terminals/Transitions
- System Progression
- Torque and Tension
- Cutting Beams
- Re-Using Posts
- Post Driving
- Concrete Foundations
- Ground Testing for Repairs
- Replace vs Repair



Planned VRS Maintenance

Process Overview



Safety Patrols

- Safety Patrols are necessary to identify new defects or damage.
- They are ‘drive-by patrols’ conducted from a slow-moving vehicle.

Table 4.1 - Safety Patrol Frequency

| Road Type | Inspection Frequency |
|---|----------------------|
| All motorways & dual carriageways | monthly |
| Single carriageway National Primary Road | monthly |
| Single carriageway National Secondary roads | bi-monthly |
| Other roads | bi-annually |



Planned VRS Maintenance

Detailed Inspection

- Less frequent intervals than Safety Patrols
- Designed to compile VRS inventories, detect any VRS defects
- Record VRS which may be non-compliant with the current design standards DN-REQ-03034 and DN-REQ-03079 or system installation manuals.
- Should be carried out on-foot using a comprehensive Inspection Checklist.

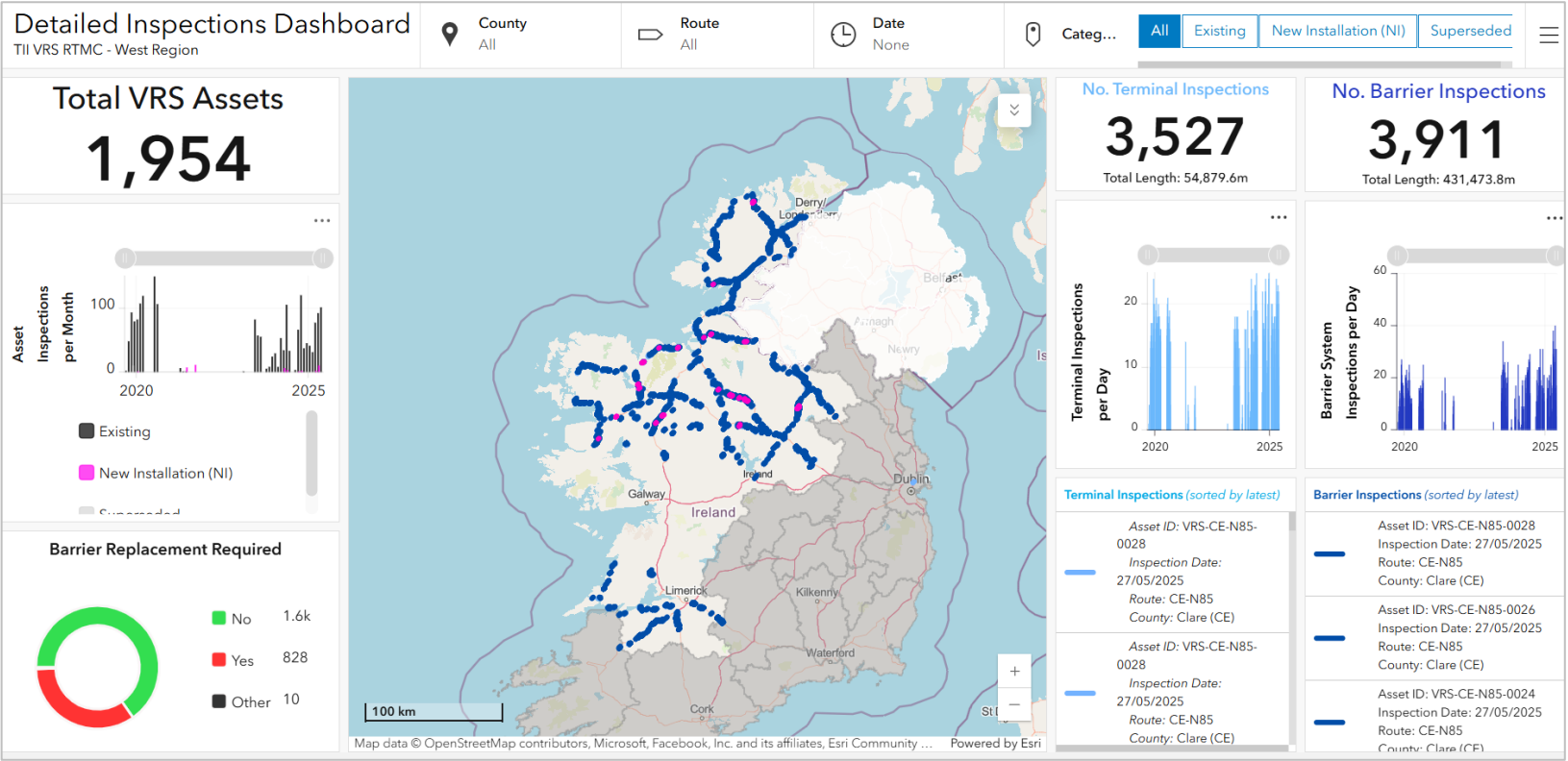
Detailed Inspection Requirements

Table 4.2 - Detailed VRS Inspection Frequency

| VRS Age | Inspection Frequency |
|---|----------------------|
| Steel < 10 years Concrete < 15 years | Every 5 years |
| Steel > 10 years Concrete > 15 years | Every 2 years |

| Reference Name | Content | Image Required |
|---|---|----------------|
| VRS Inspector | Contractors VRS Inspector | |
| Positional Accuracy (cm) | Insert worst accuracy observed while recording data | |
| GPS/GNSS Receiver | | |
| Route (i.e. N05) | | |
| County | Mayo (MO) / Leitrim (LM) / Roscommon (RN) / Sligo (SO) | |
| Route ID (i.e. RN_N05) | County abbreviation & route number | |
| Road Type | Motorway / Type 1 Dual Carriageway / Type 2 Dual Carriageway / Standard Single Carriageway / Non-Standard Single Carriageway / Single Carriageway | |
| Speed Limit | 50 km/h / 60 km/h / 80 km/h / 100 km/h / 120 km/h | |
| Lane Width [#] | Measured on site | |
| Hard Shoulder Width [#] | Measured on site | |
| Terminal Details | | |
| Terminal Location [*] | Upstream / Downstream | Yes |
| Terminal Manufacturer | Manufacturer | |
| Terminal System | System Name | |
| Terminal Performance Class [*] | Short Ramp / P1 / T80 / T110 / Unknown | Yes |
| Available Displacement in Front of Terminal (x) [#] [*] | Measured on site | Yes |
| Available Displacement Behind Terminal (y) [#] [*] | Measured on site | Yes |
| Available Exit Box in Front of Terminal (Za) [#] [*] | Measured on site | Yes |
| Available Exit Box Behind Terminal (Zd) [#] [*] | Measured on site | Yes |
| Terminal Anchor Post Stability [*] | Ok / Minor Movement / Poor Stability | Yes |
| Terminal Anchor Post Foundation Type [*] | Driven / Concrete / Socketed / Unknown | Yes |
| Terminal Connection Bolts (Size & Grade) (i.e. M16 Grade 8.8) [#] [*] | Measured on site | Yes |
| Are Terminal Bolts Tightened to the Correct Torque [#] | Yes / No | |
| Terminal Bolts Torque Description | | |
| Is the Terminal Retroreflective End Label Installed Correctly [*] | Yes / No | Yes |
| Has the Terminal Wire Rope been Installed Correctly [*] | Yes / No / N/A | Yes |
| Has the Correct Transition been Installed for the Terminal [*] | Yes / No | Yes |
| Terminal Length (m) | Automatically Calculated Field | |

Figure 4.1 - Extract from a sample Detailed Inspection checklist



Planned VRS Maintenance

Normal Service Life

- steel > 20 years
- terminals / crash cushions > 20 years
- concrete barriers > 50 years
- timber clad barriers > 10 years
- temporary safety barriers >10 years.

Procurement Options

TII Motorway Maintenance and Renewals Contracts (MMaRC):

- Term contract to carry out VRS maintenance services & inspections

Regionalised VRS Maintenance Contract:

- Similar to MMaRC, non-managed network, specialist VRS contractors – includes patrols, inspections, interventions works, repairs, replacements, etc.

Isolated Contract:

- Local Authorities can procure VRS maintenance services

Improvements

Design Considerations

- Site visit and risk assessment required
- Forgiving roadside?
- Departures required?
- Detailed schedule of works
- Design input required for all barrier replacements
- Design changes?
- VRS posts should never be driven into a filter drain
- Adjusting post centres to avoid objects.
- Post sockets
- Surface mounted posts
- Verge / ground profile
- Reinstatement



Figure 5.2 - Typical VRS Drawing



Figure 5.13 - Verge re-profiling works required at replacement terminal



Figure 5.14 - Verge re-profiling works carried out prior to VRS installation

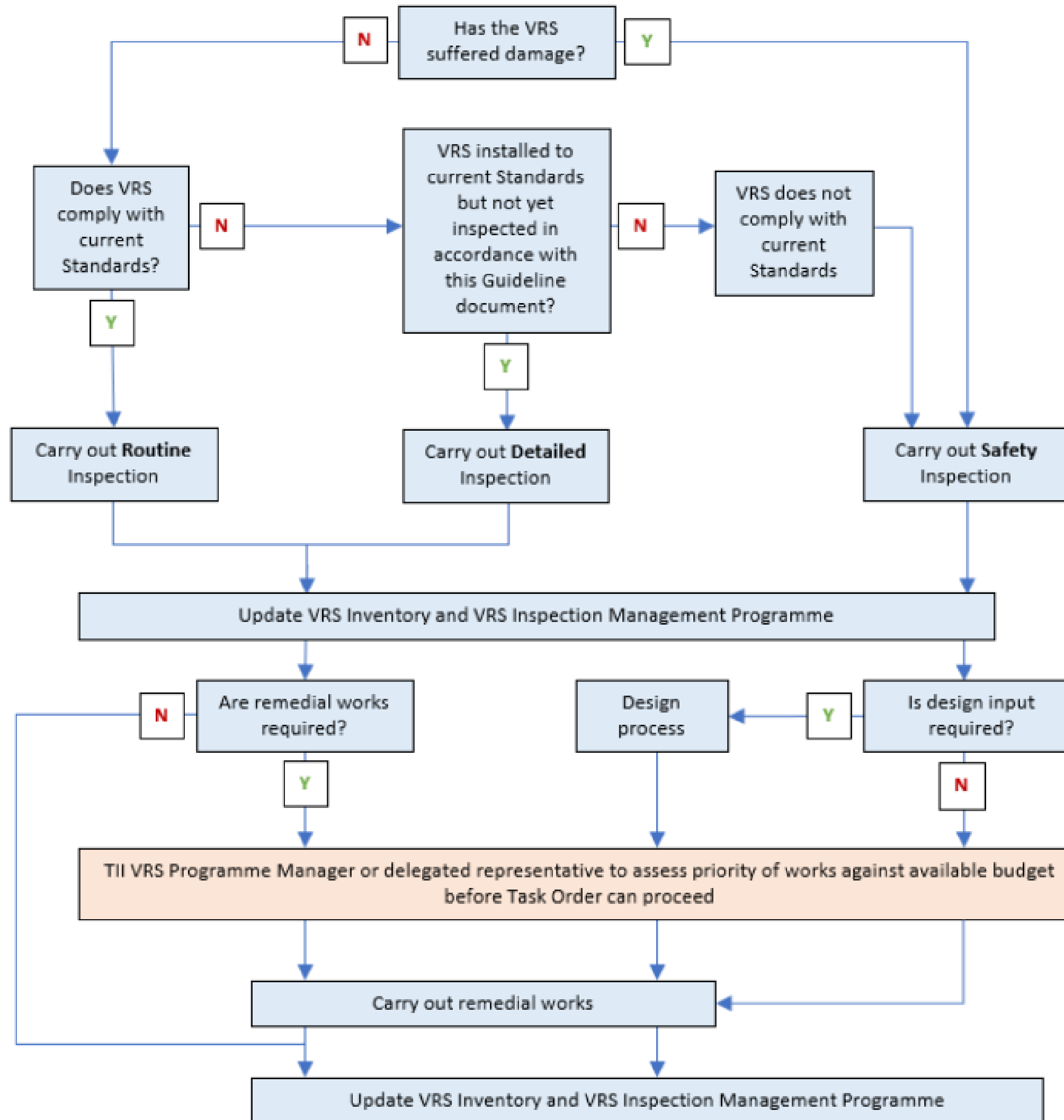


Figure 5.15 - Example of verge re-shaped and reinstated with existing topsoil

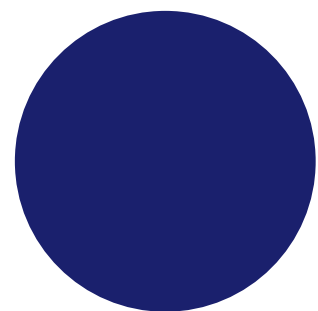
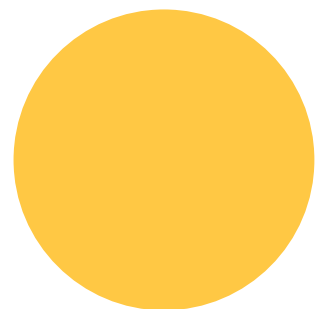
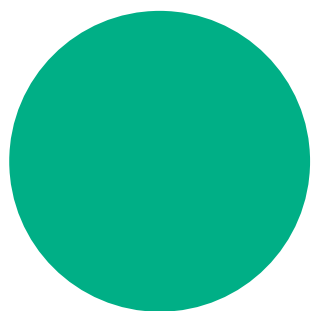
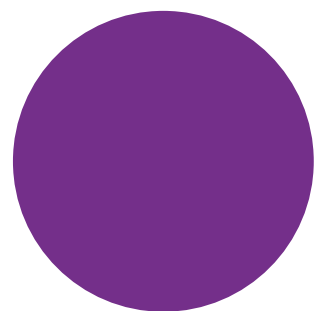


Figure 5.16 - Poorly reinstated following VRS repair works – uneven, large stones, not seeded

VRS Maintenance Flowchart



Thank you



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