

Vehicle Restraint Systems

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Arup

TII Standards Training 2021
16th April 2021

VRS - Need for Change

- 2012/2013 – substantial inventory gathering of VRS on the national road network
- Substantial issues identified
 - Inadequate designs
 - Poor installations
 - Limitations in standards
 - Lack of understanding of proper VRS design and installation
 - VRS design last thing considered



VRS - Need for Change

- Consultants tasked with designing VRS for locations identified
- DN-REQ-03034 compliant VRS could only be designed for 30% of the locations
- Remaining 70% would require a risk based approach to design solutions for VRS in **constrained locations**



VRS - Need for Change

- Issues with historical terminals
- Issues with transitions to bridge parapets
- Not CE Marked products
 - Compliance?



VRS - Need for Change

- Ground conditions
- Performance of the VRS compared to the ITT
- Chartered Engineer – Ground Testing Regime



Problem	Action	Status	Comment
Design	VRS Design Course	Ongoing	2 Day VRS Design Course developed: ~300 Candidates certified since 2016
Design	VRS in Constrained Locations	Complete	DN-REQ-03079 Design of Road Restraint Systems in Constrained Locations (Online Improvements, Retrofitting and Urban Settings) Published in May 2017 (2019)
Design	Update VRS Design	Complete	DN-REQ-03034 The Design of Road Restraint Systems (Vehicle and Pedestrian) for Roads and Bridges Updated May 2019
Design	Terminal and Transitions	Complete	DN-REQ-03080 and 03081 outlining the assessment procedure for terminals and transitions issued, compliant lists published
Design	National VRS Consultant	Ongoing	Assist LAs in designing, tendering and supervising annual repair /replacement programs
Construction	Update to Specification	Complete	CC-SPW/GSW-00400 Specification for Road Restraints Systems (Vehicle and Pedestrian) – Updated June 2020
Construction	Ground Conditions	Ongoing	CC-REQ-04009 Independent Chartered Engineer Requirements, Dynmaic Testing Research Ongoing
Construction	Framework for Installers	Complete	Framework for the installation, replacement and repair of vehicle restraint systems established in 2017

VRS Standards Update 2019

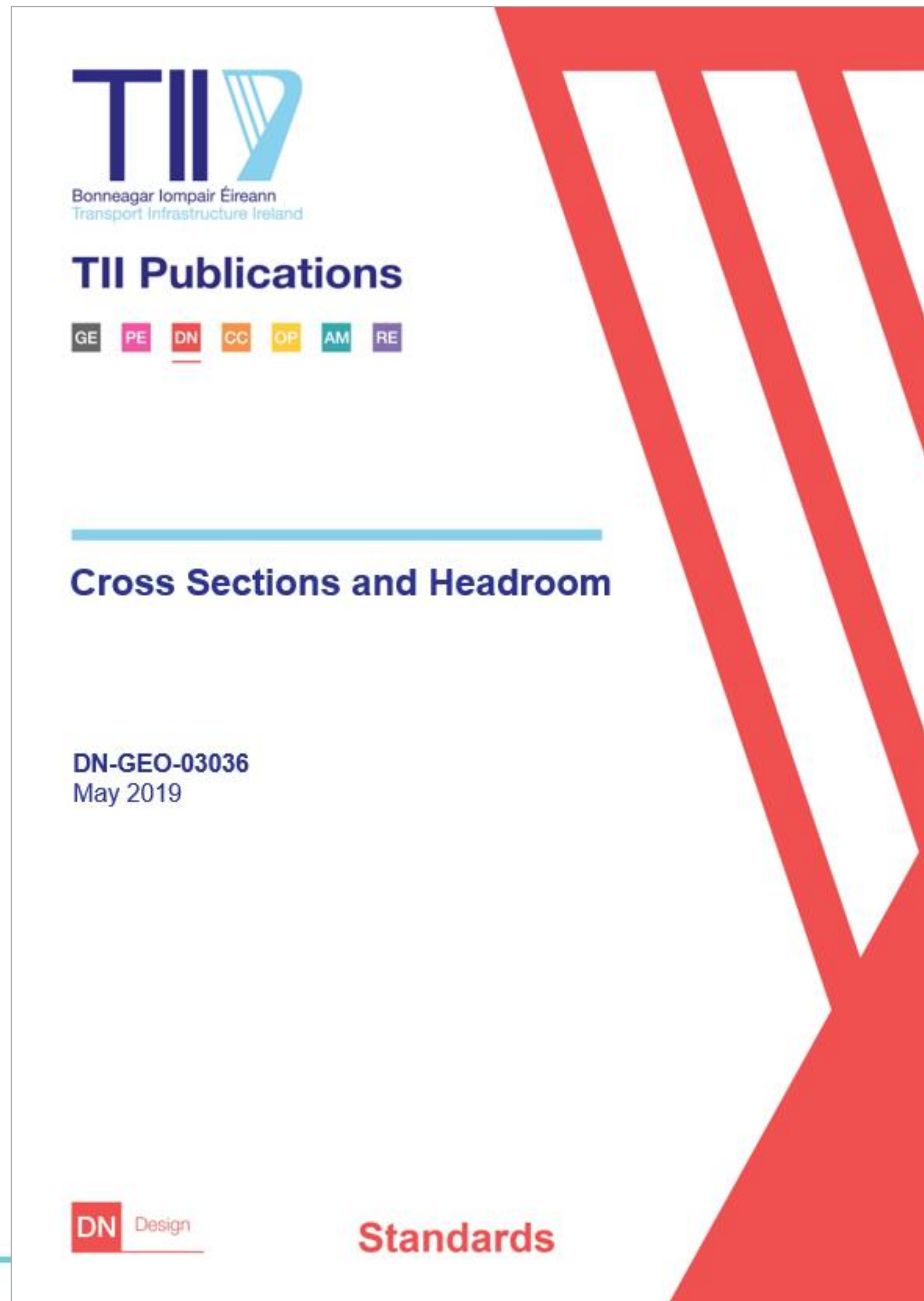
03036
Cross Sections and Headroom

03034
The Design of Road Restraint Systems...for Roads and Bridges

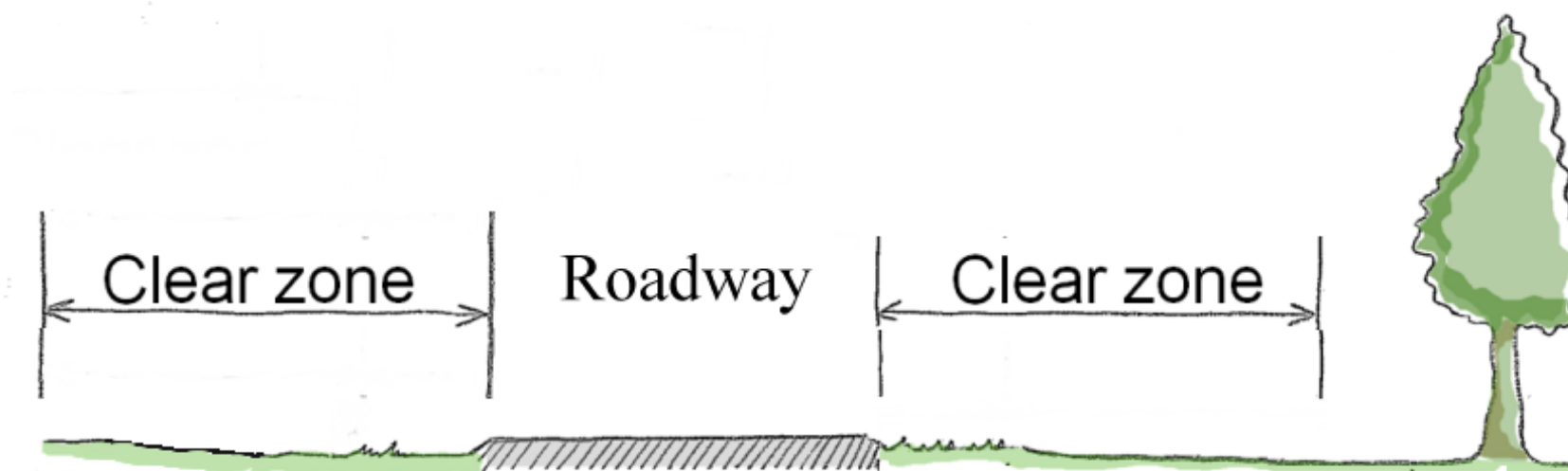
03079
Design of Road Restraint Systems for Constrained Locations...



Suite of Standards - 03036



- Principles of forgiving roadsides embedded from the outset.
- Ensures mitigation of hazards is considered early in the design and the cross section is appropriate to allow for this.
- Clear Zone Requirements.
- VRS provision is the last option – VRS Justification Sheet required.



Suite of Standards - 03034

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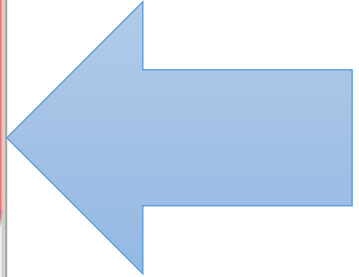
TII Publications

GE PE **DN** CC OP AM RE

The Design of Road Restraint Systems (Vehicle and Pedestrian) for Roads and Bridges

DN-REQ-03034
May 2019

DN Design **Standards**



TII Publications

Safety Barriers (Including Amendment No. 1, dated January 2016)

DN-REQ-03034
November 2015

Standards

Safety Barriers

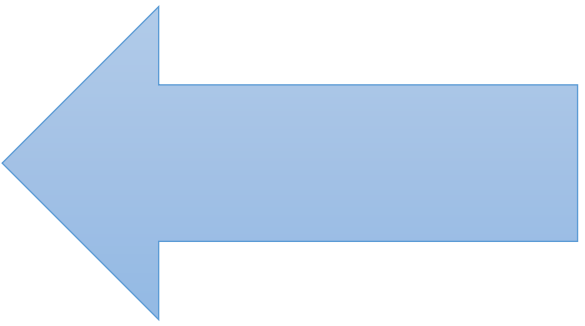


TII Publications

The Design of Vehicle and Pedestrian Parapets

DN-STR-03011
January 2016

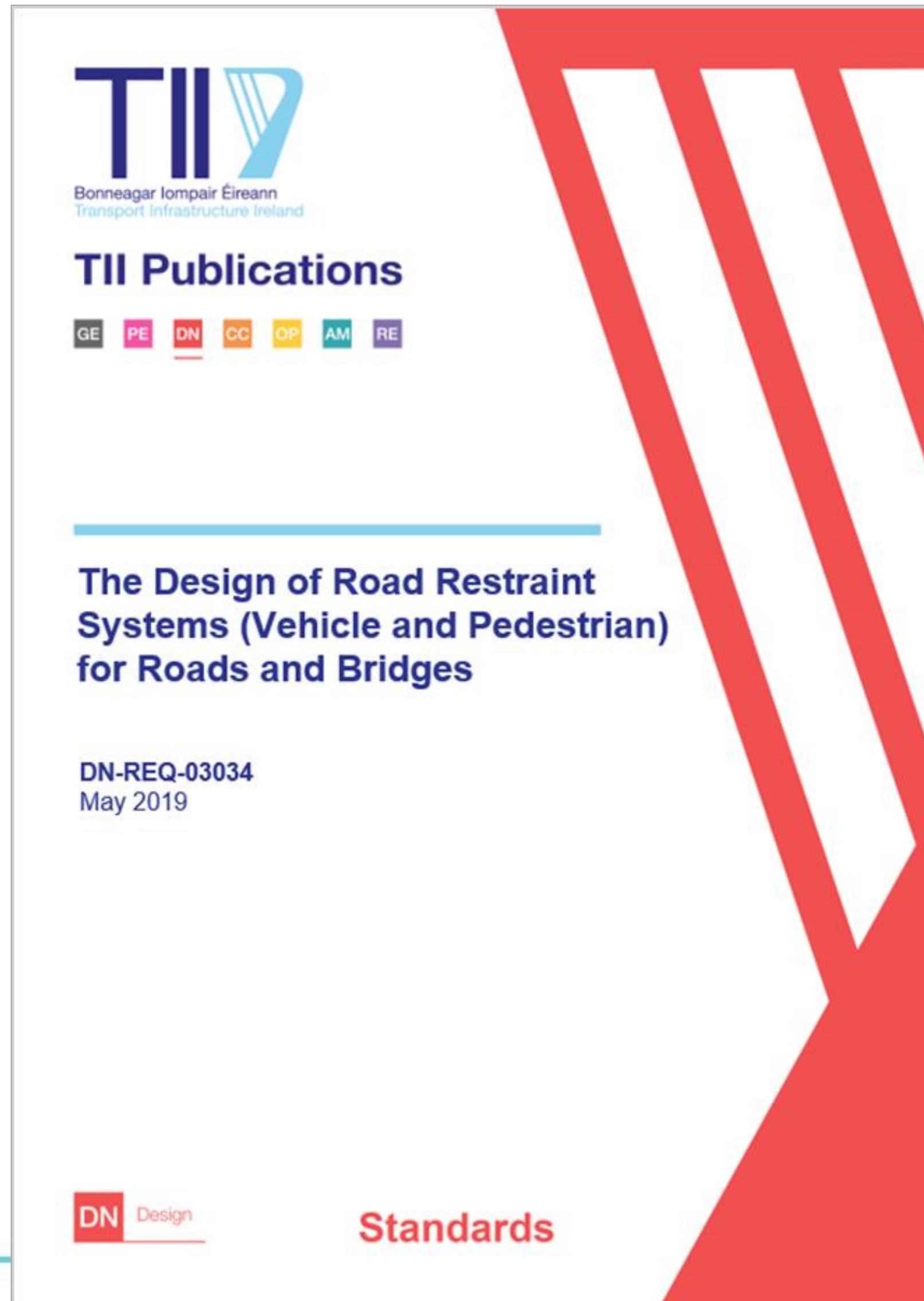
Standards



Parapets



Suite of Standards - 03034



- Roadside Hazards
- Permanent Safety Barriers
- Temporary Safety Barriers
- Terminals
- Transitions
- Crash Cushions
- Vehicle Parapets
- Bespoke Parapets
- Pedestrian Parapets and Guardrails

Suite of Standards - 03079



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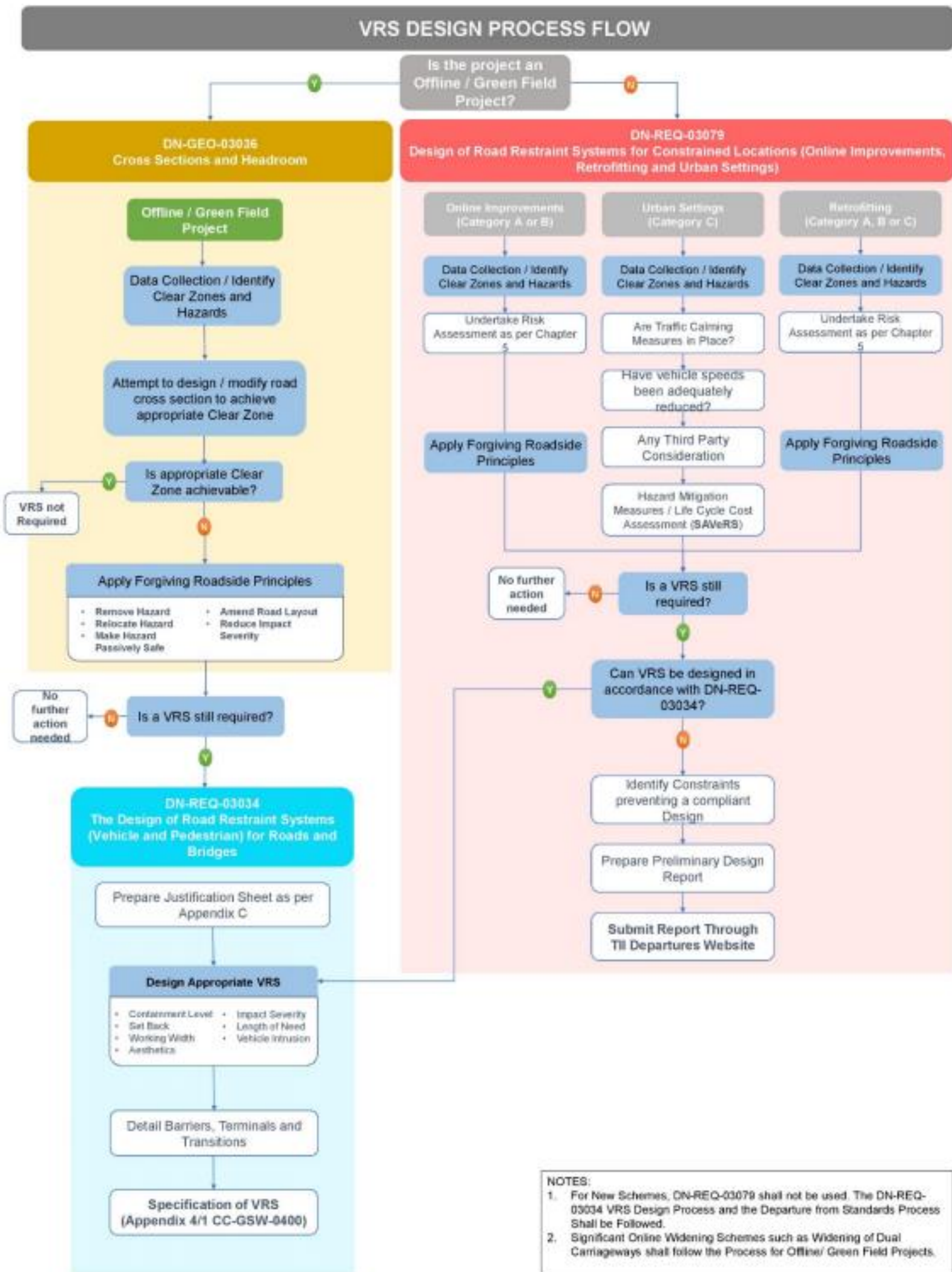
**Design of Road Restraint
Systems for Constrained
Locations (Online
Improvements, Retrofitting and
Urban Settings)**

DN-REQ-03079
May 2019

DN Design Standards

- Risk Assessment Procedure for assessing the need for VRS on online improvements.
- Risk based design process for VRS for online improvements where the design of a fully compliant VRS is not achievable.
- Retrofitting VRS on the legacy network and site constraints do not allow design compliance with DN-REQ-03034.
- Assessing the need for VRS on National Roads in urban scenarios.

Suite of Standards – VRS Design Process Flow

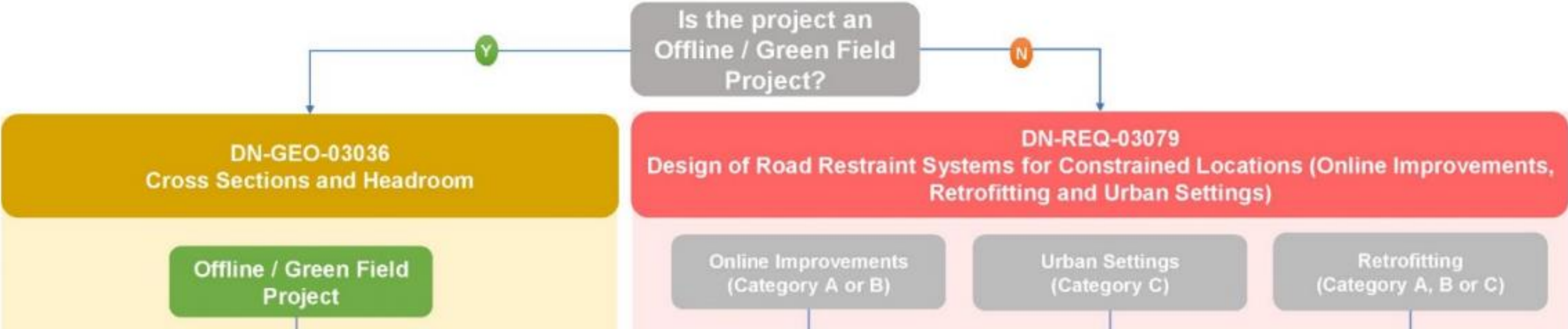


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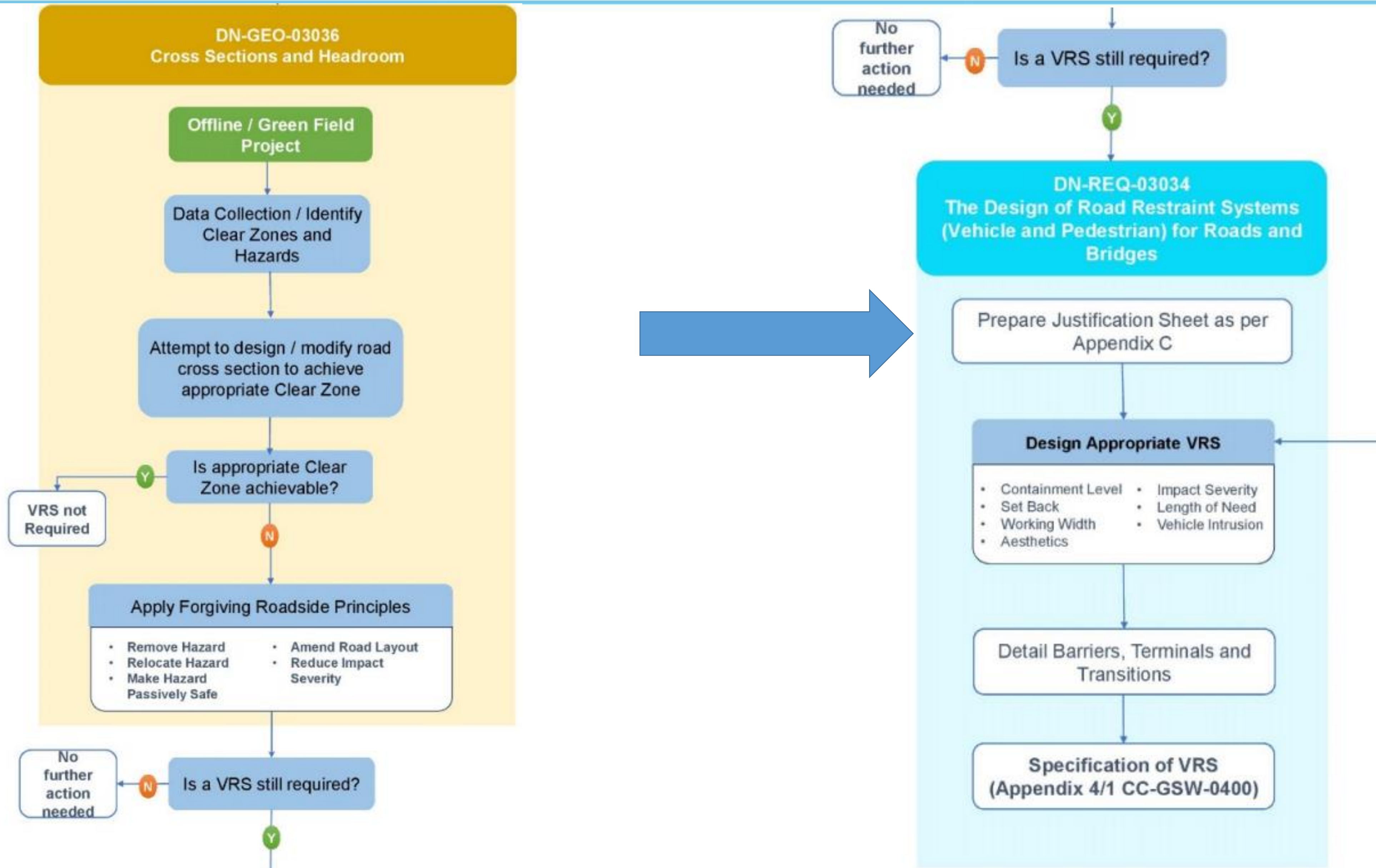
- For New Schemes, DN-REQ-03079 shall not be used. The DN-REQ-03034 VRS Design Process and the Departure from Standards Process Shall be Followed.
- Significant Online Widening Schemes such as Widening of Dual Carriageways shall follow the Process for Offline/ Green Field Projects.



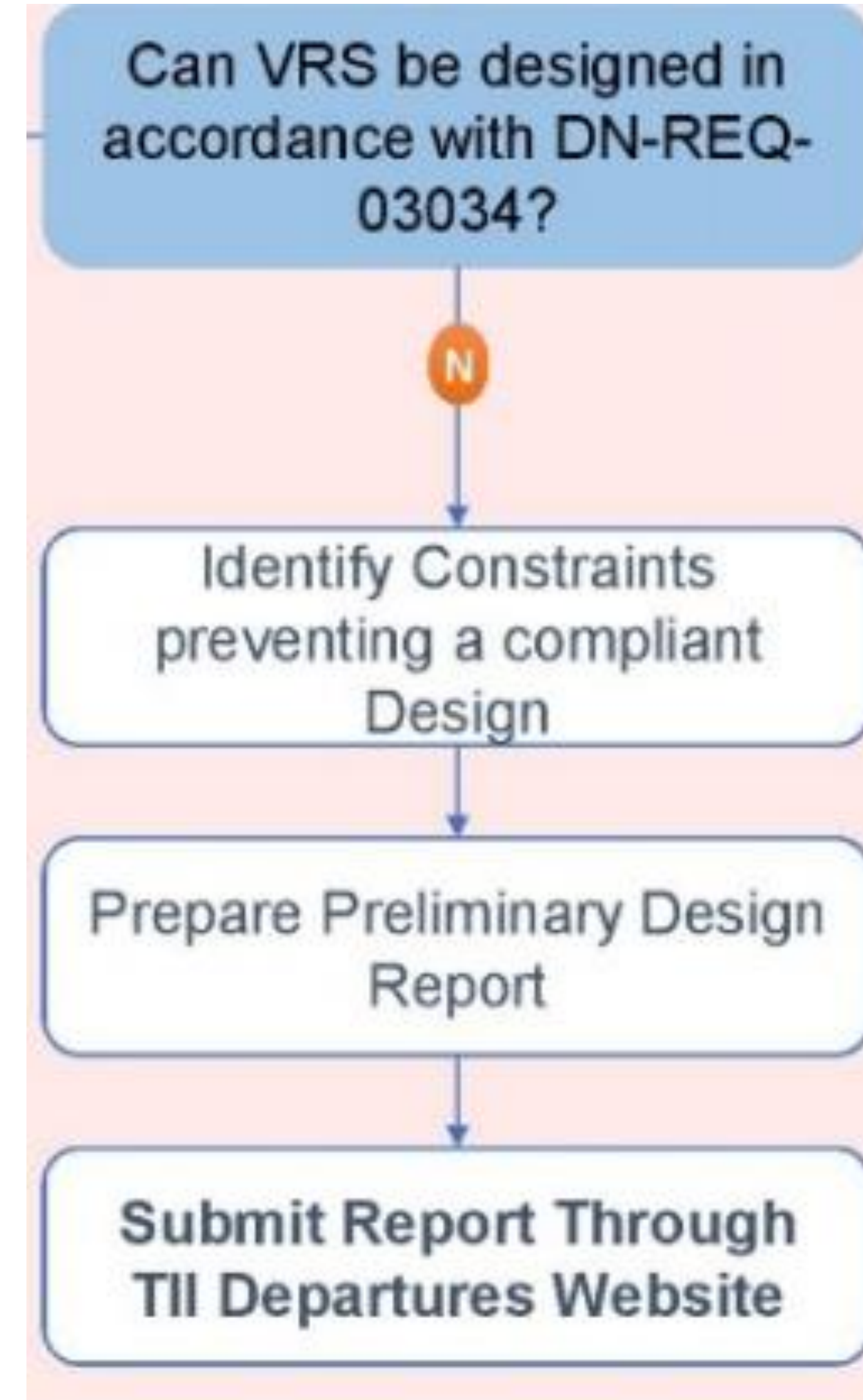
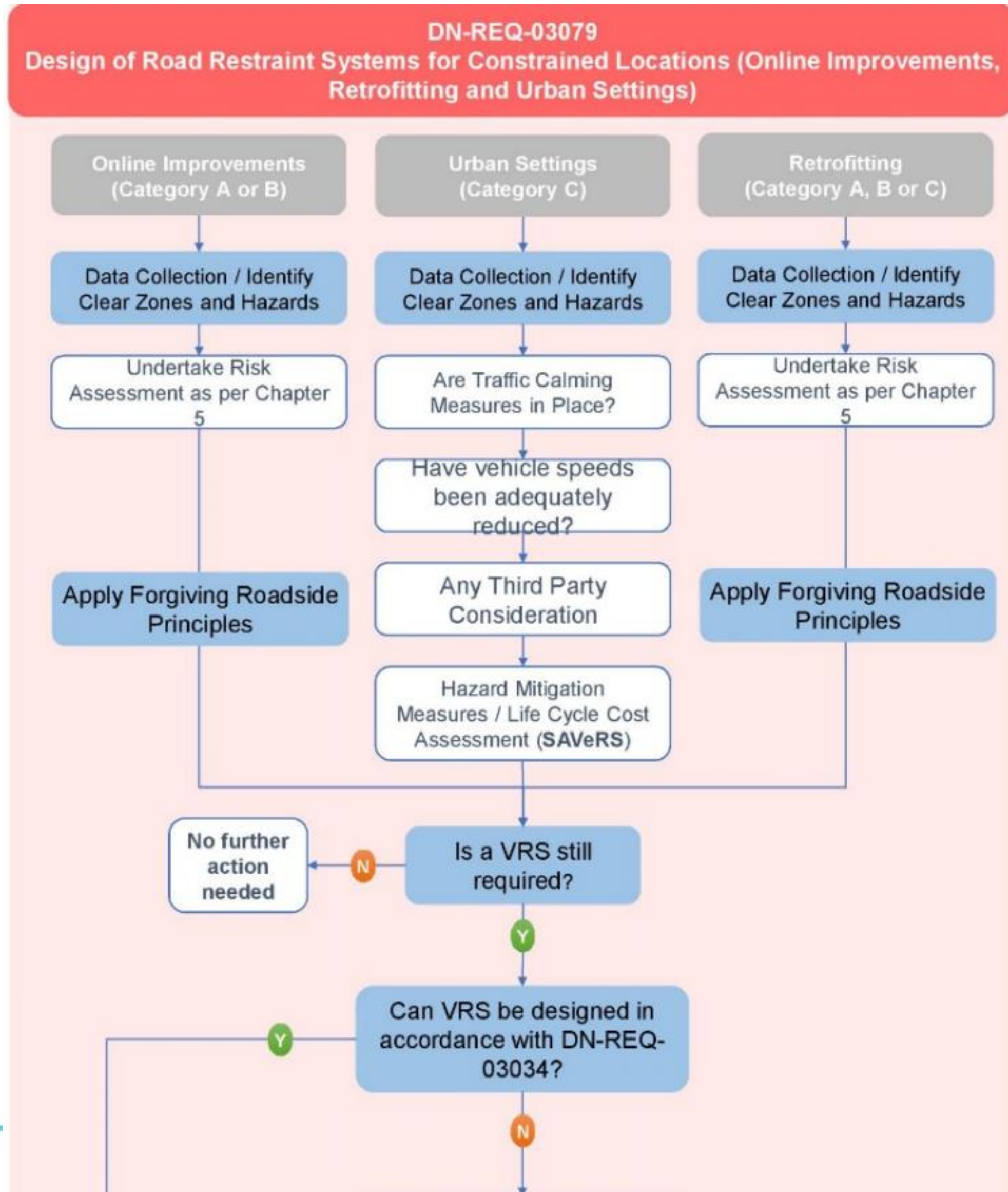
Suite of Standards – VRS Design Process Flow



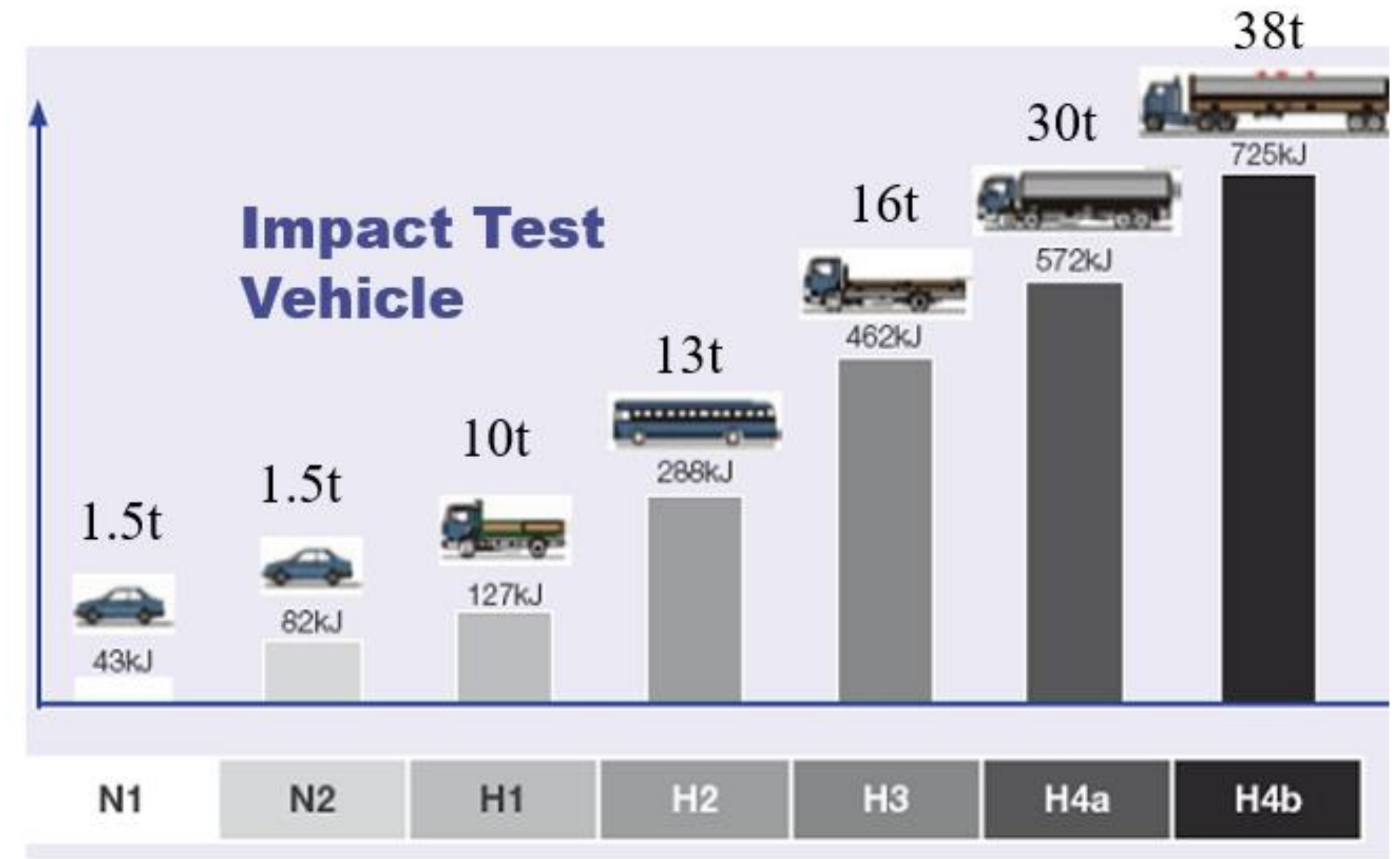
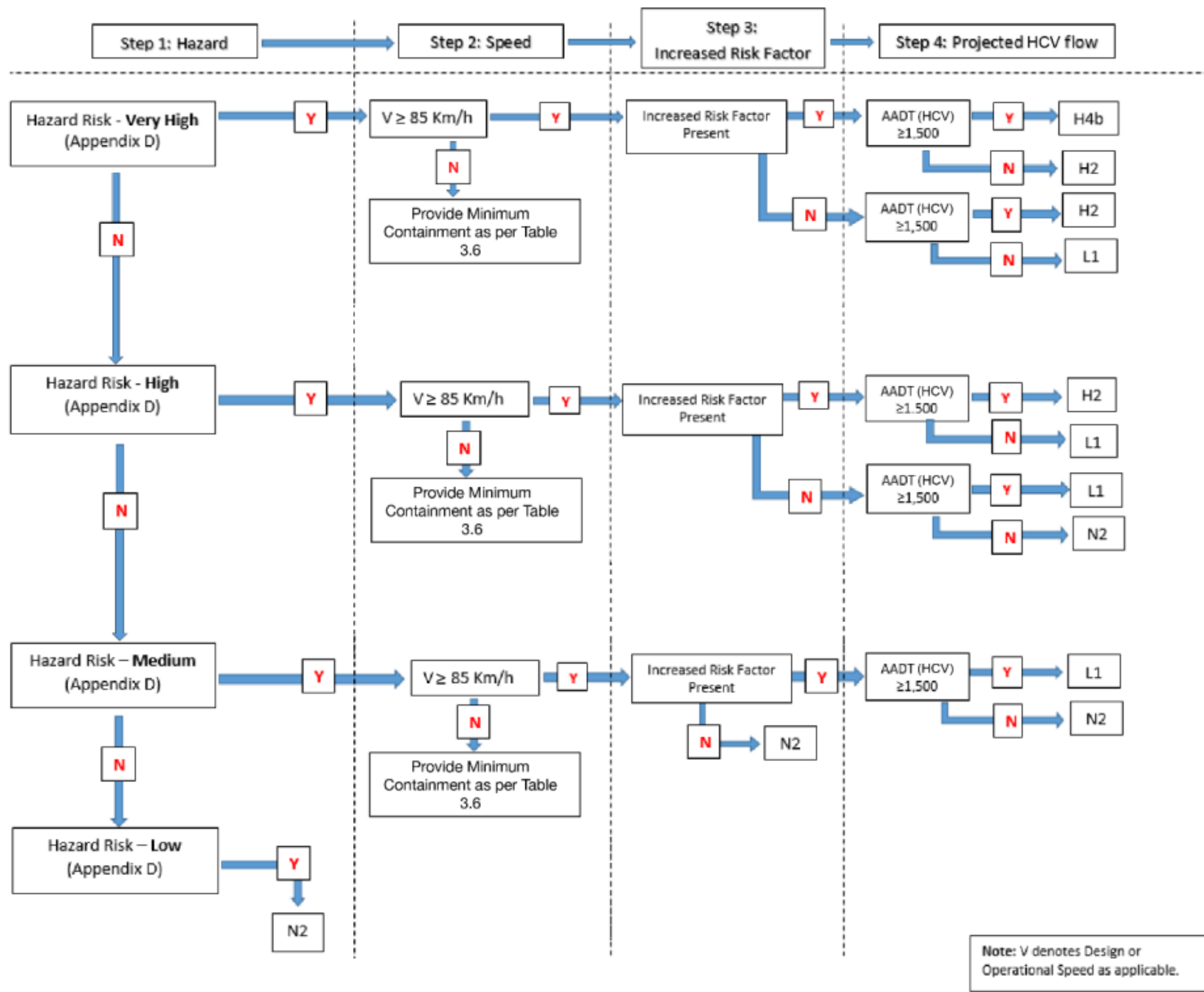
Suite of Standards – VRS Design Process Flow



Suite of Standards – VRS Design Process Flow



03034 – Key Updates, Containment Level Assessment Procedure



03034 – Key Updates

- Containment Level at Gantries – H2
- Lane Segregating VRS on Type 2 and 3 Dual Carriageways – H2
- Performance Requirements for Crash Cushions included



Table 7.1 Performance Levels for Crash Cushions

Performance Level	Design / Operational Speed (km/h)
50	≤ 50
80	≤ 80
100	≤ 100
110	> 100



Construction and Commissioning



June 2020



CC-SPW-00400 Key Updates

- Minimum training requirements
- Requirements for manufacturers installation manuals
- Requirements for the provision of information (prior to and after installations)
- Requirements for the provision of identification labels for RRS have been introduced
- Requirements for corrosion protection of reinforcement strands



CC-SPW-00400 - Ground Conditions

- Critical for safety barrier performance
- ITT Test Conditions v Site



Ground Testing Requirements for Post Foundations

- Test Procedure - Push tests in accordance with BS 7669 Part 3 Annex B
- Test Requirements – provided in the manufacturer's I.S. EN 1317-5 compliant installation manual
- Independent Chartered Engineer from TII's approved register:
 - Attends site to witness and certify the pre-installation site testing
 - Specific requirements for notifications, witnessing of testing and reporting
 - Report submitted to the Employer's Representative
 - Refers to CC-REQ-04009



CC-REQ-04009 Independent Chartered Engineer Requirements

- 5 years experience of VRS related design and installation
- Attended and successfully completed the TII VRS designers course
- Included on the TII Register of Approved Independent VRS Chartered Engineers
- Attendance at VRS training provided periodically by TII
 - Initial one-day workshop

Requirement	Evidence to be Submitted
Be a Chartered Engineer.	Engineers Ireland Membership Number.
Have at least five years' demonstrable experience of VRS related design and installation.	Curriculum vitae and cover letter clearly demonstrating the applicant meets the requirements plus a minimum of one reference for verification purposes.
Have attended and successfully completed the two-day certified VRS designers training course.	Copy of certificate of completion including Engineers Ireland reference number.

TII Standards Section – Technical Bulletin
GE-TBU-01040
TII Register of Approved Independent VRS Chartered Engineers
June 2020

Independent Vehicle Restraint Systems Chartered Engineer Requirements

CC-REQ-04009
June 2020

TII Register of Approved Independent VRS Chartered Engineers

The June 2020 publication of CC-SPW-00400 Specification for Road Restraint Systems (Vehicle and Pedestrian) includes updated requirements for Chartered Engineers involved in the certification of ground conditions for Vehicle Restraint Systems (VRS) on National Road projects. CC-SPW-00400 refers to a new document CC-REQ-04009 Independent Vehicle Restraint Systems Chartered Engineer Requirements. This document requires Independent VRS Chartered Engineers to be included on a TII Register of Approved Independent VRS Chartered Engineers prior to certifying ground conditions for VRS in accordance with CC-SPW-00400.

In order to be initially included on the TII register, suitable applicants are required to submit an application to barriers@tii.ie for consideration. Such applications shall demonstrate that applicants meet the qualifications and experience requirements contained within CC-REQ-04009. Table 1 below lists the evidence required to be submitted to support applications to be included on the TII Register of Approved Independent VRS Chartered Engineers.

Table 1 - Independent Chartered Engineer Requirements and Evidence Required

Requirement	Evidence to be Submitted
Be a Chartered Engineer.	Engineers Ireland Membership Number.
Have at least five years' demonstrable experience of VRS related design and installation.	Curriculum vitae and cover letter clearly demonstrating the applicant meets the requirements plus a minimum of one reference for verification purposes.
Have attended and successfully completed the two-day certified VRS designers training course.	Copy of certificate of completion including Engineers Ireland reference number.

In order to remain on the TII register of Approved VRS Chartered Engineers on an ongoing basis, Chartered Engineers will be required to complete further periodic training as provided by TII. TII will hold an initial one-day workshop within the next 12 months to facilitate this requirement and it will be mandatory for all those on the approved list to attend.

CC-REQ-04009 Independent Chartered Engineer Requirements

- Procured by the Contractor
- Independent of the Design Team
- Not be part of the Contractors organisation
- Template for Recording Test Results and Reporting



Looking to the Future



Dynamic Testing



Verge Construction

Looking to the Future



Assessment and Design of
Legacy Parapets



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Thank You

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