AtkinsRéalis

VRS Preliminary Design Report

Mayo County Council

May 2025

N58 STRADE RIVER BRIDGE REHABILITATION WORKS

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

Comhairle Contae Mhaigh Eo
Mayo County Council

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This document has 19 pages including the cover.

Document history

Document title: VRS Preliminary Design Report

Document reference: 0088572DG0056

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
0.0	Issued for Review	AOS	AOS	MG	MJ	22-04-2025
1.0	Issued for Approval	AOS	AOS	MG	MJ	25-04-2025
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Client signoff

Client	Mayo County Council
Project	EIRSPAN TO315 MAYO BRIDGE ASSESSMENTS AND STRENGTHENING 2023
Job number	0088572
Client signature/date	

Contents

1. Project Background

AtkinsRéalis were appointed by **Mayo County Council** as consultants for **EIRSPAN Task Order TO315 Mayo Bridge Assessments and Strengthening 2023** in liaison with **TII Eirspan Northwest.**

As part of this scheme, it has been deemed necessary to install a new **Vehicle Restraint System (VRS)** as part of the proposed works to be carried out to replace the existing structure on the **N58 National Secondary Road** at **Strade River Bridge.**

AtkinsRéalis are submitting this VRS Preliminary Design Report with details of all Departures from Standards necessary due to existing site conditions that cannot be mitigated and that preclude the installation of a compliant VRS in accordance with DN-REQ-03034.

1.1 Existing Bridge Structure

Strade River Bridge is TII structure reference number **MO-N58-001.00**. It is located on the **N58 National Secondary Road (NSR)** in the village of Strade approximately 10.0km northeast of Castlebar and 3.5km from the village of Bellavary, Co. Mayo. Straide River passes under the N58 through Strade River Bridge.

The ITM coordinates at the centre of the structure are **525,755 Easting, 797,499 Northing**.

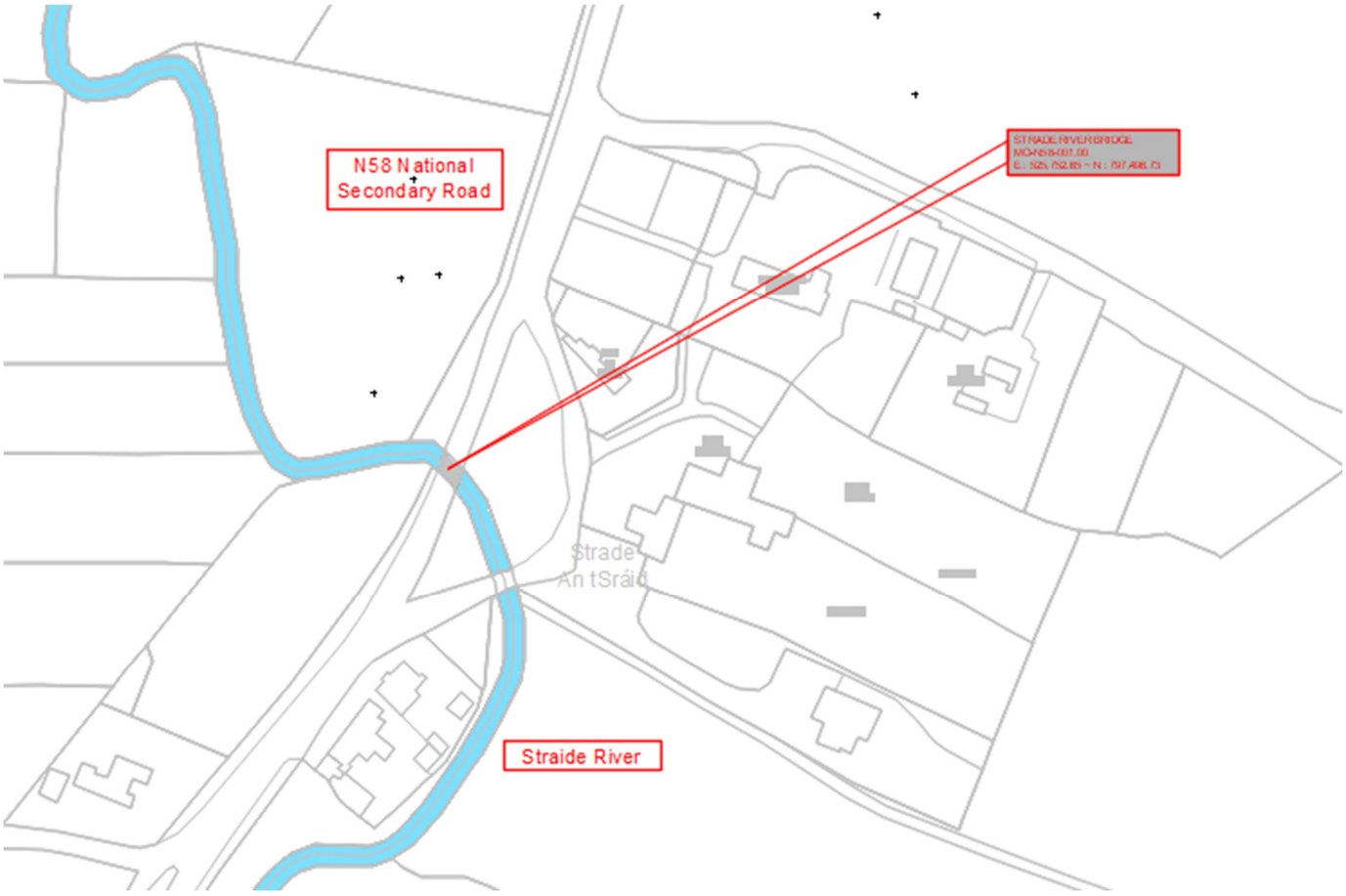


Figure 1 : Site Location Plan

Figure 2 : View looking South

Figure 3 : View looking North

1.2 Existing Carriageway Details

Strade River Bridge is located on the N58 National Secondary Road which is a Rural Two-Lane Carriageway of nominal 6.25m overall width at the bridge location. The carriageway consists of a northbound lane of 2.86m and a southbound lane of 2.78m. There are no hard strips / hard shoulders at this location. There are grassed verges on both sides of the bridge in both verges.

The Client project brief for this structure includes :

*"The Consultant shall also include……**provision of safety barrier on the approaches and departures to the structure and in compliance with EN1317 and DN-REQ-03034 and DN-REQ-03079 and corresponding referenced technical standards**."*

2. VRS Design Process

2.1.1 Design Process Flow

DN-REQ-03079 Design of Road Restraint Systems for Constrained Locations and Existing Structures – May 2024 outlines the VRS Design Process Flow

2.1.2 Reference Documents

The following TII documents have been referenced in the preparation of this Preliminary Design Report:

- **DN-REQ-03034 The Design of Road Restraint Systems (Vehicle and Pedestrian) for Roads and Bridges – May 2019**
- **DN-GEO-03036 Cross Sections and Headroom – May 2023**
- **DN-REQ-03079 Design of Road Restraint Systems for Constrained Locations and Existing Structures – May 2024**
- Sinuosity, Collision Rate Threshold Data, and Indicative Operational Speeds available from **CollisionRatesResults_2016to2018.KML** for importing into Google Earth available from the TII Portal at https://data.tii.ie/
- AADT Data available from https://trafficdata.tii.ie/

2.2 Bridge Specific Hazards

2.2.1 Existing Carriageway Data

Strade River Bridge (MO-N58-001.00) is located on the N58 National Secondary Road approximately 10.0km northeast of Castlebar and 3.5km from the village of Bellavary, Co. Mayo.

The posted speed limit on this section of road is **60 kph**. The operational speed limit at this location, based on the information as given on the Google Earth KML file noted above, which is derived from the TII National Transport Model (NTpM), is **81 kph**.

The Annual Average Daily Traffic (TMU N58 010.0 N 2024) is **6442 with 3.4% HCV (219)**.

The sinuosity of this section of road is **1.010096 (Medium)** and the Collision Threshold is **Above Average Rate (Medium)**.

The Straide River flows through Strade River Bridge from south to north under the N58 NSR.

There is an existing access to Michael Davitt Museum approximately 45m south of the bridge structure. A second access to the museum is located approximately 65m north of the bridge.

It has been determined that the existing Strade River Bridge is substandard and will be replaced with a new, raised structure over spanning the existing bridge substructure.

2.2.2 Existing Hazard Identification

As per **Table 3.1, DN-GEO-03036**, for the posted speed limit of **60kph**, the appropriate Clear Zone at this location measures **4.5m** from the edge of the carriageway lane.

As per **Section 4.1, DN-REQ-03079**, for the purposes of determining the correct Clear Zone based on the operational speed limit of 81kph, this speed needs to be rounded up to the nearest Design Speed which is **85kph**. The appropriate Clear Zone for this design speed at this location measures **6.5m** from the edge of the carriageway lane.

These Clear Zones are based the bridge being located on a short horizontal curve of approximately 250m between two straight sections of carriageway.

The existing hazards at this structure, in accordance with **DN-REQ-03034, Appendix D** within the 6.5m Clear Zone consist of the following:

- Trees having a girth of 314mm or more measured at 0.3m above ground level
- All fences and linear boundary delineations with rails
- Water of likely depth > 0.6m
- Bridge Parapets
- Under bridges or retaining walls >0.5m high supporting the road, where a vehicle parapet or vehicle / pedestrian parapet of the required performance class is not provided
- Steep Embankment Slopes, steeper than 1:2 and ≥ 1m height

- Substantial fixed objects eg walls extending above the ground by more than 150mm with projections or recesses ≤ 100mm and running parallel to the road

2.3 AtkinsRéalis Risk Assessment

The proposed works at this location consists of the removal of the existing Strade River Bridge superstructure and the lowering of the existing abutments. This is to facilitate the construction of a new bridge to over span the existing bridge abutments and pier, which will be demolished, by the provision of new abutments behind the existing. The new structure will have masonry parapet walls. The new structure will be a nominal 0.45m higher than the existing bridge due to the requirement to raise the bridge soffit to 18.32mOD Flood Level (1% AEP + 20% CC)

The new structure will have cantilevers and will be wider than the existing bridge structure to allow for the proposed VRS layout with a setback of 1.20m from the carriageway edge which, in turn, will minimise any negative and costly effects on the adjacent lands.

As the operational speed exceeds the posted speed limit, consideration was given to vulnerable road users faced with fast moving vehicles. The new VRS will be setback by 1.20m, rather than the allowed 0.60m by the posted speed limit of 60kph, which will allow some refuge for their protection.

Presently, there are no measures in place to protect the road users from these hazards.

The TII Risk Assessment Procedure outlined in **DN-REQ-03079** for the determination of the requirement for the provision of a VRS is detailed in Section 2.4 below.

2.4 TII Risk Assessment Procedure

As per **Table 1.1, DN-REQ-03079 – Categories of VRS at Constrained Locations**, this location falls under **Category B – Online Improvements / Retrofitting at Existing Structure / Bridge Locations**.

As per **Chapter 5, Section 5.2, DN-REQ-03079**, the Risk Assessment Procedure consists of seven steps in the determination of the justification for a new Vehicle Restraint System (VRS) at **Strade River Bridge**.

These steps are:

1. **Establish if the Hazard is within the Clear Zone and if it can be removed or mitigated**

   The most onerous appropriate Clear Zone dimension for this location measures **6.5m** and the hazards listed below are within this zone and not all of them can be removed or mitigated.

2. **Rank the Hazard as per Appendix C**

   The hazards are ranked as

   - **High** – Trees having a girth of 314mm or more measured at 0.3m above ground level
   - **High** – All fences and linear boundary delineations with rails
   - **High** – Water of likely depth > 0.6
   - **High** – Bridge Parapets

- **High** - Under bridges or retaining walls >0.5m high supporting the road, where a vehicle parapet or vehicle / pedestrian parapet of the required performance class is not provided

- **Low** – Substantial fixed objects eg walls extending above the ground by more than 150mm with projections or recesses ≤ 100mm and running parallel to the road

3. **Calculate the sinuousity of the section of road**

    - As per the TII website, the sinuosity of the N58 NSR at the bridge location is given as **Medium 1.010096 (≥1.004 ≤1.02)**

4. **Assess the Collision Rate threshold for the section of road**

    - As per the TII website, the Collision Rate Threshold for the N58 NSR at the bridge location is **Twice Above Average Rate – (High)**

5. **Assess the risk of a vehicle leaving the road based on the sinuosity ranking / collision rate ranking**

    - As per **DN-REQ-03079, Table 5.1**, the risk of a vehicle leaving the road is **H (High)**

6. **Assess the overall risk rating**

    - As per **DN-REQ-03079, Table 5.2**, the overall risk rating is **H (High)**

7. **Undertake a site survey to confirm the need for a VRS**

    - A site survey was carried out. There are no parapet walls or existing VRS at this structure location.

From the results of the above assessment, a new VRS is required at the location of **Strade River Bridge and approach roads.**

2.5 VRS Design Process for Constrained Locations

2.5.1 Data Collection and Assessment

1. **Apply the Principles of Forgiving Roadsides**

   The existing carriageway cross section cannot be modified and the modifications to the existing hazards, particularly on the southwestern side of the bridge, are not feasible without removing the existing fencing, blockwork masonry wall and large trees along the boundary.

   As the existing Strade River Bridge is being partially removed and a new structure is being provided, the proposed bridge layout will be wide enough to allow for the provision of a new VRS with a setback of 1.20m and a working width of 0.80m in front of the new masonry parapet walls. This will prevent unnecessary works being carried out to the southwestern boundary and significant disturbance to the surrounding lands.

2. **Risk Assessment**

   A risk assessment has been carried out as outlined in Section 1.6 above.

3. **VRS Condition Survey**

   There is no existing VRS at this bridge location.

2.5.2 VRS Preliminary Design Process

1. **Development of Preferred VRS Design Options**

The following are the existing constraints at the bridge location that were considered to determine the most beneficial layout for the VRS.

- The existing grass verge on the southwest side of the bridge are minimum 1.90m wide. The southeastern verge is a minimum 1.0m wide.
- On the southwestern verge, there is a timber post and rail fence running along the back of the verge.
- Behind this fence, there is a masonry blockwork wall of varying height extending approximately 130m with a field access gate located halfway along this boundary.
- There are also numerous mature trees along this boundary with a girth of >314mm.
- There is a vertical height difference of up to 1.0m between the carriageway and the adjacent lands.
- On the southeastern verge, there is a low masonry boundary wall running approximately 37m south of the bridge location.

While the posted speed limit at Strade River Bridge is 60kph, the operational speed is 81kph. It was noted that some provision should be made for potential pedestrian traffic at the bridge location as the existing grass verge provides refuge for vulnerable road users if faced with oncoming traffic. The minimum required setback dimension for a new VRS measures 0.60m based on the posted speed limit.

The proposed VRS will be based on the following conditions.

- The new Strade River Bridge will be constructed with cantilevers which will be a nominal 1.0m wider than the existing bridge.

- This additional width will provide enough space to facilitate a 1.20m setback and 0.80m Working Width to the new bridge parapets and over the length of the new VRS which also provides refuge for potential vulnerable road users. Due to a localised outcrop in the existing boundary line, there will be a 20m section of the VRS on the southwestern verge where the available Working Width will reduce gradually from 0.80m to a minimum of 0.50m and back to 0.80m.

- The new VRS will pass in front of the new bridge parapets which will negate the necessity to modify the existing southwestern boundary consisting of timber post and rail fencing, masonry blockwork wall and mature trees, and with a vertical level difference.

- The terminals on the northern end of the VRS will be flared away from the carriageway at a rate of 1:20 to maximise the sight distance from the existing field access and the access to the Michael Davitt Museum.

- The overall length of the proposed VRS on the southeastern verge will be constrained by the proximity of the existing southern access to Michael Davitt Museum.

- The existing masonry wall on the southeast boundary will be removed and reconstructed outside the VRS working width with the agreement of the Landowner.

2.5.3 Proposed Bridge and Carriageway Realignment

The existing Strade River Bridge has a soffit level of 18.10mOD. The proposed bridge soffit level is 18.32mOD which represents the required Flood Level (1% AEP + 20% Climate Change). To achieve this rise in bridge soffit level, the existing carriageway is required to be raised by a nominal 0.45m at the bridge location and realigned over a nominal length of 80m. The realigned carriageway will tie into existing levels approximately 30m north and south of the proposed bridge

The existing grass verges are required to be raised to align with the new carriageway level. With a setback of 1.20m and a working width of 0.80m, the new minimum verge width will be 2.0m. The maximum transverse crossfall on this verge will be 5% (0.10m), falling away from the carriageway.

The width of the existing northwest verge is wider than the minimum 2.0m required and the new verge will be graded into the existing ground level at a nominal side slope of 2 horizontal : 1 vertical. There will be no impact on the existing boundary.

The width of the existing northeast verge is wider than the minimum 2.0m required and the new verge will be graded into the existing ground level at a nominal side slope of 2 horizontal : 1 vertical in front of the existing decorative fencing to the Michael Davitt Museum. There will be no impact on the existing boundary.

The width of the existing southeast verge will be widened to provide the minimum 2.0m and the existing masonry wall will be reconstructed as required, in liaison with the landowner. The largest level difference between the existing verge and proposed carriageway level is 0.45m at the bridge location which will reduce to 0.35m with the crossfall of the new verge. The varying 0m to 0.35m increase in verge level will be retained by the reconstructed boundary wall.

The width of the existing southwest verge varies from 2.40m at the bridge location to 2.90m at the end of the proposed length of VRS with a narrowing to 1.70m over 20m approximately 8m south of the bridge. The level difference between the existing verge and back of the new verge will be regraded to match the existing ground level at the boundary wall. There will be no impact on the existing boundary.

2.5.4 VRS Preliminary Design Report (PDR)

A **VRS Preliminary Design Report** in accordance with **DN-REQ-03079 Design of Road Restraint Systems for Constrained Locations and Existing Structures – May 2024** (this report reference **0088572-DG-0056**) has been prepared for submission through the TII departures website.

Refer to Appendix A - Drawings

Refer to Appendix B – Containment (Record) Assessment Sheet

Refer to Appendix C – Risk Assessment Sheet for Vehicle Restraint Systems

Refer to Appendix D - Category B VRS Preliminary Design Report Template

2.6 TII Containment Level Assessment Procedure

As per the requirements of **Paragraph 3.11** and **Figure 3.4, DN-REQ-03034**, **Containment Level Assessment Procedure**, the Designer shall assess the minimum containment levels required at any specific location for VRS in the verges.

As per **Figure 3.4, DN-REQ-03034**, with an overall Hazard Risk Rating of **High** and a speed limit / operational speed of less than **85kph**, the provision of the Minimum Containment shall be as per **Table 3.6, DN-REQ-03034**.

Table 3.6, DN-REQ-03034, states *that "At underbridges, underpasses or at retaining walls > 0.5m high supporting the road and a vehicle parapet or vehicle / pedestrian parapet of the required performance class is not provided",* a minimum **H2** Containment level shall be provided at **Strade River Bridge** and shall be based on the condition "*For a minimum of 30m in advance of the approach end and 30m after the departure end of a vehicle parapet or vehicle/ pedestrian parapet.*"

Based on current TII guidance documents, a **H2 Containment Level** Vehicle Restraint System (VRS) is required at **Strade River Bridge and approach roads**.

Refer to **Appendix B** for the **Containment (Record) Assessment Sheet**.

2.6.1 Recommendation

An H2 Containment Level Vehicle Restraint System, including the appropriate Transitions and Terminals, with a setback of 1.20m from the carriageway edge, will be provided on both the eastern and western verges with the Departure as outlined in Section 2.7 below. Refer to Appendix A for drawings.

2.7 Departures Required

Departure Nr.1 consists of reducing the overall length of the H2 VRS on the southeastern verge due to the proximity of the junction between the southern access to the Michael Davitt Museum and the N58 NSR.

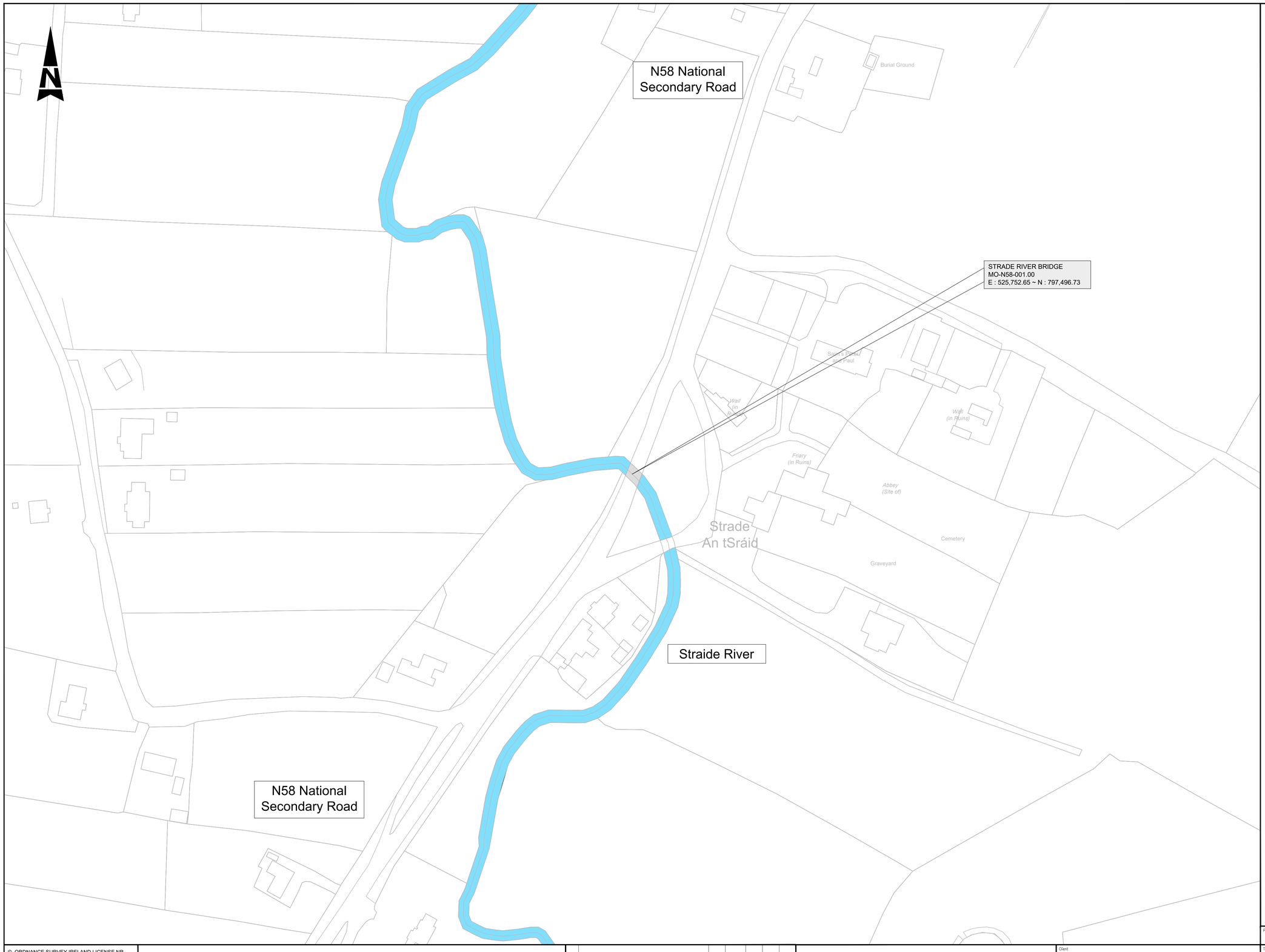
The overall length of the VRS on the southeast verge will be approximately 34m, including Terminals, and allowing for adequate sight distance from the road junction. Refer to Drawings in Appendix A

Departure Nr.2 consists of the reduction of the available Working Width on the southwestern verge due to the proximity of the existing fence / blockwork wall.

The alignment of the existing fence / blockwork wall precludes the achievement of the full Working Width for the proposed VRS of 0.80m while providing the 1.20m setback. The Working Width over a 20m length south of the new bridge parapet on the western verge will vary gradually from 0.80m to 0.50m and back to 0.80m due to a localised outcrop in the existing boundary line. As this section of the VRS is on the inside of a horizontal curve, it has been deemed preferable to varying the setback of the VRS.

APPENDICES

Appendix A. Drawings



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GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2. ONLY WRITTEN DIMENSIONS SHALL BE USED. NO DIMENSIONS SHALL BE SCALED FROM THE DRAWINGS
3. ALL LEVELS ARE IN METRES AND ARE TO MALIN HEAD DATUM
4. ALL COORDINATES ARE IN METRES AND ARE TO IRISH TRANSVERSE MERCATOR
5. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION

Risk Level		
	X	Atkins Base Line - Low Risk
		Atkins Sensitive - Medium Risk
		Atkins Private - High Risk
		Client Critical - Already Marked

Rev	Description	By	Date	Chk'd	Rev'd	Auth
P0	ISSUED FOR INFORMATION	AOS	02.24	MG	CP	MJ

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Client: Comhairle Contae Mhaigh Eo / Mayo County Council

Project: TO315 - MAYO BRIDGE ASSESSMENTS AND STRENGTHENING 2023

Purpose: ISSUED FOR INFORMATION

Title: Strade River Bridge MO-N58-001.00 Existing Site Location Plan

Original Scale	Drawn	Checked	Reviewed	Authorised
1:1000	AOS Date 02.02.24	MG Date 02.02.24	CP Date 02.02.24	MJ Date 02.02.24

Status	Drawing Number	Rev
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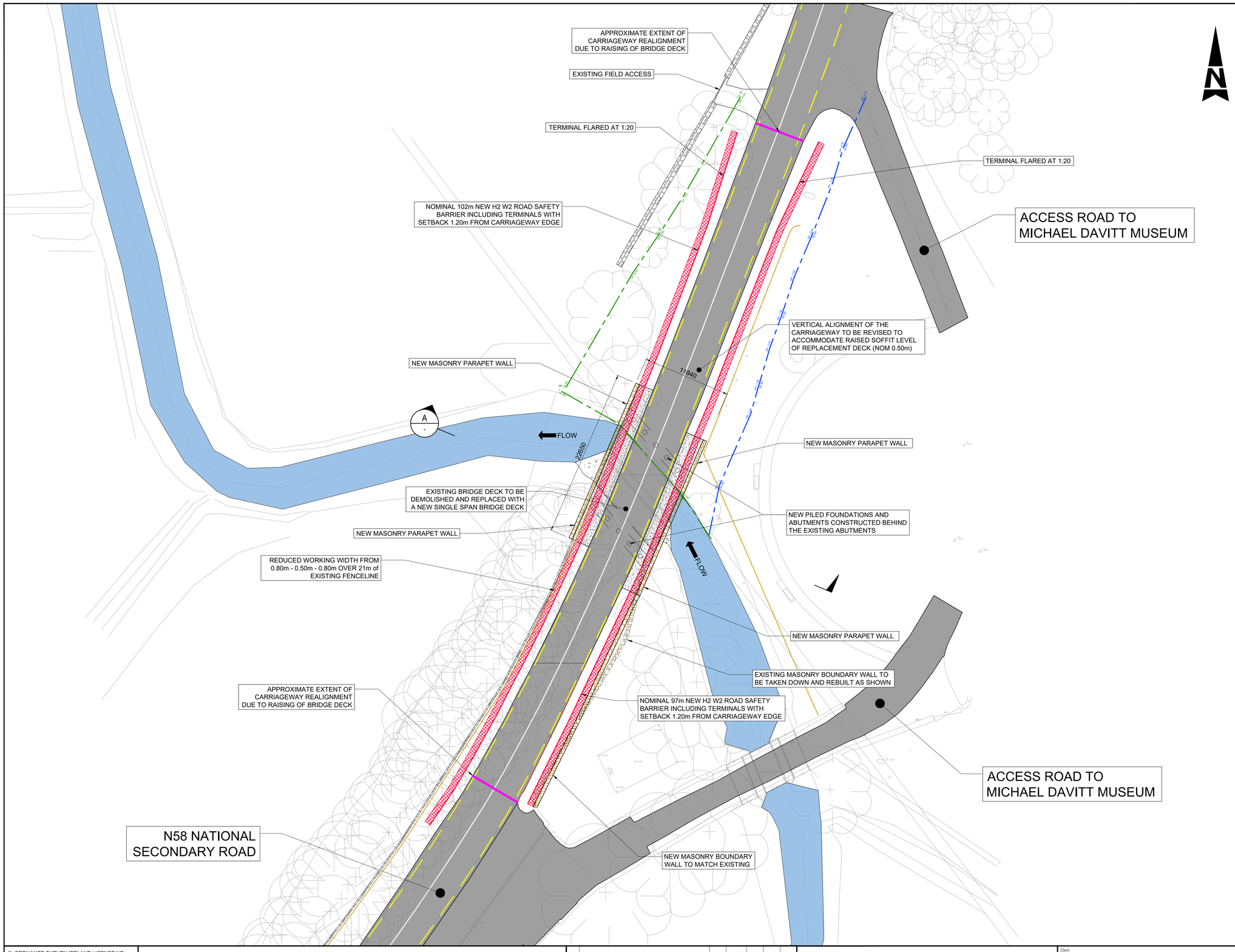

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LEGEND :

- EXISTING CARRIAGEWAY
- EXISTING CONCRETE VERGE
- EXISTING GRAVEL PATH
- EXISTING MASONRY WALL TO BE TAKEN DOWN
- NEW MASONRY WALL
- EXISTING DECK TO BE DEMOLISHED
- EXISTING FENCE
- EXISTING WATERMAIN
- EXISTING DUCT
- NEW ROAD SAFETY BARRIER AND WORKING WIDTH

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		Atkins Sensitive - Medium Risk
		Atkins Private - High Risk
		Client Critical - Already Marked

Rev	Description	By	Date	Chk'd	Rev'd	Auth
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P02	REVIEW COMMENTS INCORPORATED	AOS	04.25	MG	MJ	MJ
P01	REVIEW COMMENTS INCORPORATED	AOS	03.25	MG	MJ	MJ
P0	ISSUED FOR REVIEW	AGL	01.25	MG	MJ	MJ

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Client: Comhairle Contae Mhaigh Eo / Mayo County Council

Project: TO315 - MAYO BRIDGE ASSESSMENTS AND STRENGTHENING 2023

Purpose: PRELIMINARY ISSUE

Title: Strade River Bridge
MO-N58-001.00
Proposed Site Layout Plan

Original Scale	Drawn	Checked	Reviewed	Authorised
1:250	AOS 03.01.25	MG 03.01.25	MJ 03.01.25	MJ 03.01.25

Status	Drawing Number	Rev
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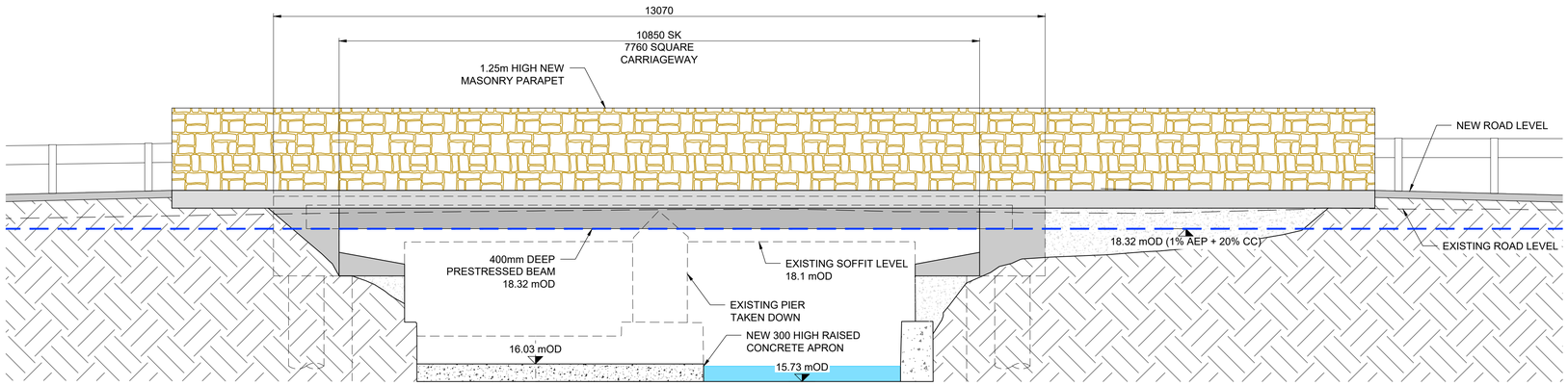

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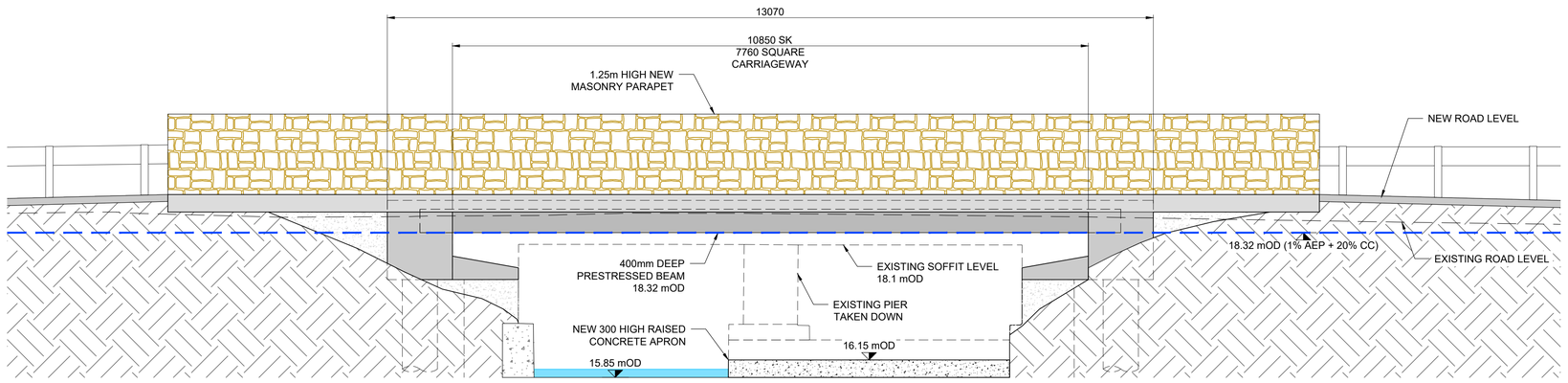

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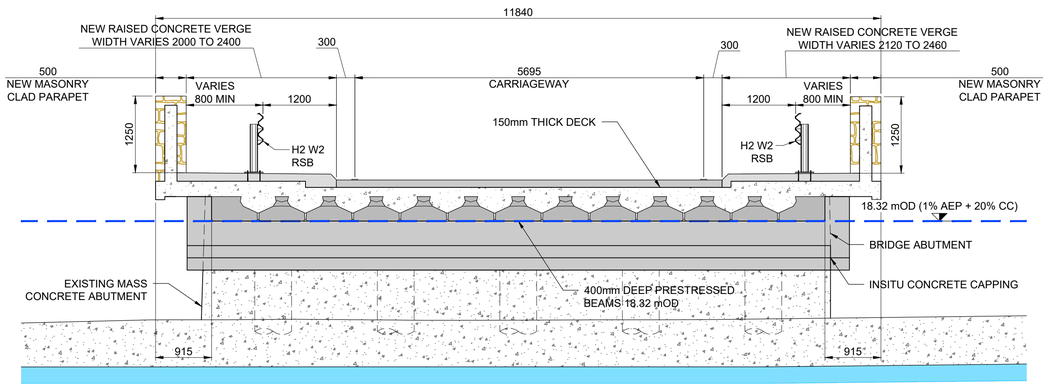

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Rev	Description	By	Date	Chk'd	Rev'd	Auth
P03	REVIEW COMMENTS INCORPORATED	AOS	05.25	MG	MJ	MJ
P02	BRIDGE WIDTH REVISED	AOS	04.25	MG	MJ	MJ
P01	REVIEW COMMENTS INCORPORATED	AOS	03.25	MG	MJ	MJ
P0	ISSUED FOR REVIEW	AGL	01.25	MG	MJ	MJ

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Client: Comhairle Contae Mhaigh Eo / Mayo County Council

Project: TO315 - MAYO BRIDGE ASSESSMENTS AND STRENGTHENING 2023

Purpose: PRELIMINARY ISSUE

Title: Strade River Bridge
MO-N58-001.00
Option 1 - Prestressed Concrete Beam and Slab

Original Scale	Drawn	Checked	Reviewed	Authorised
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	Date 03.01.25	Date 03.01.25	Date 03.01.25	Date 03.01.25

Status	Drawing Number	Rev
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Appendix B. Containment (Record) Assessment Sheet

Containment (Record) Assessment Sheet

Barrier Ref.	Design speed (km/h) *	AADT (HGV) *	Hazard description	Hazard Risk Ranking *	Lateral distance to hazard from edge of trafficked lane (m)	Required Clear Zone (m) **	Clear zone requirement satisfied up to (%)	Hazard Proximity Ranking *	Straight / Curved *	Inside or Outside of bend *	Curve radius (m)	Sinuosity Index (SI) ***	Sinuosity Ranking *	Proposed Containment Level	Comment
South Western Verge	85	6442 (219)	Trees having a girth of 314mm or more measured at 03.0m above ground level	High	2.3m	6.5m	35%	Low	Straight	N/A	N/A	1.010096	Medium	H2	
South Western Verge	85	6442 (219)	All fences and linear boundary delineations with rails	High	2.0m	6.5m	31%	Low	Straight	N/A	N/A	1.010096	Medium	H2	
South Western Verge	85	6442 (219)	Water of likely depth >0.6m	High	6.3m	6.5m	97%	Low	Straight	N/A	N/A	1.010096	Medium	H2	
Western / Eastern Verge	85	6442 (219)	Bridge Parapets	High	2.3m	6.5m	35%	Low	Straight	N/A	N/A	1.010096	Medium	H2	
Western / Eastern Verge	85	6442 (219)	Under bridges or retaining walls >0.5m high supporting the road, where a vehicle parapet or vehicle / pedestrian parapet of the required performance class is not provided	High	2.3m	6.5m	35%	Low	Straight	N/A	N/A	1.010096	Medium	H2	

Barrier Ref.	Design speed (km/h) *	AADT (HGV) *	Hazard description	Hazard Risk Ranking *	Lateral distance to hazard from edge of trafficked lane (m)	Required Clear Zone (m) **	Clear zone requirement satisfied up to (%)	Hazard Proximity Ranking *	Straight / Curved *	Inside or Outside of bend *	Curve radius (m)	Sinuosity Index (SI) ***	Sinuosity Ranking *	Proposed Containment Level	Comment
South Western Verge	85	6442 (219)	Steep embankment slopes, steeper that 1 :2 and ≥ 1m height	High	2.6m	6.5m	40%	Low	Straight	N/A	N/A	1.010096	Medium	H2	
Western / Eastern Verge	85	6442 (219)	Substantial fixed objects eg walls extending above the ground by more than 150mm with projections or recesses ≤ 100mm and running parallel to the road	Low	2.1m	6.5m	32%	Low	Straight	N/A	N/A	1.010096	Medium	H2	

'' Denotes key steps/parameters in the containment level design process that may influence the final Increased Risk Factor.*

*** Required Clear Zone as per DN-GEO-03036.*

**** As described in the Risk Assessment Procedure section of DN-REQ-03079*

Appendix C. Risk Assessment Sheet for Vehicle Restraint Systems

Risk Assessment Sheet for Vehicle Restraint Systems	**Date: 23-04-2025**	**Completed By: Adrian O'Sullivan**
	Location ID/Description:	**Strade River Bridge (MO-N58-001.00)**
	Site Survey Conducted (Y/N): Yes	

	Hazard Type, Start and End Co-ordinates	Is Hazard within the Clear Zone? (Y/N)	Can the Hazard be Mitigated? (Y/N)	(1) Hazard Ranking	Sinuosity Index (SI)	(2) Sinuosity Ranking	(3a) Collision Rate Threshold	(3b) Collision Rate Ranking	(4) Risk of a Vehicle Leaving the Road	(5) Overall Risk Rating	Distance of Hazard (m)	VRS to be Installed (Y/N) Start and End Coordinates	Reasons for Installing / Not Installing the VRS
1	Trees having a girth of 314mm or more measured at 03.0m above ground level	Y	N	High	1.0101	High	Twice Above Average Rate	Medium	High	High	2.0m	Yes	The Installation of the VRS is required as there are no other viable means of protecting the road user from the identified hazard
2	All fences and linear boundary delineations with rails	Y	N	High	1.0101	High	Twice Above Average Rate	Medium	High	High	1.7m	Yes	The Installation of the VRS is required as there are no other viable means of protecting the road user from the identified hazard
3	Water of likely depth > 0.6m	Y	N	High	1.0101	High	Twice Above Average Rate	Medium	High	High	6.0m	Yes	The Installation of the VRS is required as there are no other viable means of protecting the road user from the identified hazard

Hazard Type, Start and End Co-ordinates		Is Hazard within the Clear Zone? (Y/N)	Can the Hazard be Mitigated? (Y/N)	(1) Hazard Ranking	Sinuosity Index (SI)	(2) Sinuosity Ranking	(3a) Collision Rate Threshold	(3b) Collision Rate Ranking	(4) Risk of a Vehicle Leaving the Road	(5) Overall Risk Rating	Distance of Hazard (m)	VRS to be Installed (Y/N) Start and End Coordinates	Reasons for Installing / Not Installing the VRS
4	Bridge Parapets	Y	N	High	1.0101	High	Twice Above Average Rate	Medium	High	High	2.0m	Yes	The Installation of the VRS is required as there are no other viable means of protecting the road user from the identified hazard
5	Under bridges or retaining walls >0.5m high supporting the road, where a vehicle parapet or vehicle / pedestrian parapet of the required performance class is not provided	Y	N	High	1.0101	High	Twice Above Average Rate	Medium	High	High	2.0m	Yes	The Installation of the VRS is required as there are no other viable means of protecting the road user from the identified hazard
6	Steep embankment slopes, steeper that 1 :2 and ≥ 1m height	Y	N	High	1.0101	High	Twice Above Average Rate	Medium	High	High	2.5m	Yes	The Installation of the VRS is required as there are no other viable means of protecting the road user from the identified hazard

	Hazard Type, Start and End Co-ordinates	Is Hazard within the Clear Zone? (Y/N)	Can the Hazard be Mitigated? (Y/N)	(1) Hazard Ranking	Sinuosity Index (SI)	(2) Sinuosity Ranking	(3a) Collision Rate Threshold	(3b) Collision Rate Ranking	(4) Risk of a Vehicle Leaving the Road	(5) Overall Risk Rating	Distance of Hazard (m)	VRS to be Installed (Y/N) Start and End Coordinates	Reasons for Installing / Not Installing the VRS
7	Substantial fixed objects eg walls extending above the ground by more than 150mm with projections or recesses ≤ 100mm and running parallel to the road	Y	N	Low	1.0101	High	Twice Below Average Rate	Low	Medium	High	1.8m	Yes	The Installation of the VRS is required as there are no other viable means of protecting the road user from the identified hazard

L = Low, M = Medium, H = High

(1) Hazard Ranking as per Appendix C
High/Very High (H)
Medium (M)
Low (L)

(2) Sinuosity Ranking
High (H) > 1.02
Medium (M) = 1.004 ≤ SI ≤1.02
Low (L) < 1.004

(3a) Collision Rate Threshold
(1) Twice above Expected Rate
(2) Above Expected Rate
(3) Below Expected Rate
(4) Twice Below Expected Rate

(3b) Collision Rate Ranking
High (H) = Twice above Expected Rate
Medium (M) = Above Expected Rate
Low (L) = Below Expected Rate and Twice Below Expected Rate

(4) Risk of a Vehicle Leaving the Road		Collision Rate Ranking		
		H	**M**	**L**
Sinuosity Ranking	**H**	H	H	M
	M	H	M	L
	L	M	L	L

(5) Overall Risk Rating		Hazard Ranking		
		H	**M**	**L**
Risk of a Vehicle Leaving the Road	**H**	H	H	M
	M	H	M	L
	L	M	L	L

Appendix D. VRS PDR Summary

VRS ID / Location: Strade River Bridge (MO-N58-001.00)

VRS PDR Summary
VRS at Structures

Description: Under Task Order 315 Mayo Bridge Assessments and Strengthening 2023, the existing Strade River Bridge requires replacement. New VRS is required on both verges as part of these works.

Length: The new VRS on the western verge will measure approximately 102m including Transitions and Terminals. The new VRS on the eastern verge will measure approximately 97m including Transitions and Terminals

Consultation	Outcome
TII Bridge Management Section	**The structure is included under the Task Order 315 Mayo Bridge Assessments and Strengthening 2023**
Identify the Hazard(s)	**Summary**
Trees having a girth of 314mm or more measured at 0.3m above ground level	There are many significant trees behind the southwestern verge that would be difficult to remove from an environmental perspective
All fences and linear boundary delineations with rails	There is an existing, substantial timber post and rail fence running along the southwestern verge which seems to be well maintained by the local community
Water of likely depth > 0.6m	The existing Straide River runs through Strade Bridge
Bridge Parapets	The new bridge structure will have masonry clad parapet walls
Under bridges or retaining walls >0.5m high supporting the road, where a vehicle parapet or vehicle / pedestrian parapet of the required performance class is not provided	The existing bridge structure will be replaced with a new bridge structure therefore the hazard will remain
Substantial fixed objects eg walls extending above the ground by more than 150mm with projections or recesses $\leq$ 100mm and running parallel to the road	There is an existing blockwork wall behind the timber post and rail fence on the southwestern verge. There is also a masonry boundary wall on the southeastern verge

Analysis	
Can mitigation measures be implemented (Yes/No)?	**If "Yes" include proposals and projected life cycle costs**
No	
Can the VRS be designed in accordance with DN-REQ-03034 (Yes/No)?	**If "No" identify the constraints**
No	The overall length of the H2 VRS on the southeastern corner of the new bridge structure will be constrained by the existing junction between the N58 National Secondary Road and the southern access road to Michael Davitt Museum The required 0.80m Working Width for the new H2 VR will not be provided over a 21m length of the southwestern verge due to a localised outcrop of the existing boundary consisting of the timber post and rail fence and blockwork boundary wall
Design Speed:	**Road Cross Section & Traffic Volumes:**
The posted speed limit is **60km/h**. The operational speed limit as given by ***CollisionRatesResults_2016to2018.KML***, which is derived from the **TII National Transport Model (NTpM)** is **81km/h**	Strade River Bridge is located on the N58 National Secondary Road which is a Rural Two-Lane Carriageway of nominal 6.25m overall width at the bridge location. The carriageway consists of a northbound lane of 2.86m and a southbound lane of 2.78m. There are no hard strips / hard shoulders at this location. There are grassed verges on both sides of the bridge in both verges. The Annual Average Daily Traffic (TMU N58 010.0 N 2024) is **6442 with 3.4% HCV (219)**. https://trafficdata.tii.ie/

Design Options Considered (Attach drawings as required)	Relaxations and Departures	Observations
Option 1		
Retaining the existing layout was not feasible as the existing Strade River Bridge was deemed substandard and required replacement. There is no VRS at this location despite the existing hazards.	N/A	N/A
Option 2		
Most of the existing hazards are substantial and located on the southwestern verge, consisting of a timber post and rail fencing, blockwork masonry boundary wall and a significant number of mature trees bordering a field which is approximately 1.0m lower than the existing carriageway. The existing masonry boundary wall on the southeastern verge will be removed and reconstructed outside of the Working Width of the new VRS, with the agreement of the Landowner. The new bridge structure will be constructed a nominal 1.0m wider than the existing bridge to facilitate a new VRS on both verges. The nominal Set Back for the speed limits at this location is 0.60m but these barriers will have a nominal 1.20m Setback with a W2 (0.80m) Working Width at the pinch points of the new bridge parapet walls to maximise the space available to vulnerable road users. There will be a reduction in the Working Width on the southwest verge from 0.80m to 0.50m and back to 0.80m over a 20m length of the existing fence/wall/trees boundary due to a localised outcrop in the line of the boundary.	**Departure Nr.1** consists of reducing the overall length of the H2 VRS on the southeastern verge due to the proximity of the junction between the southern access to the Michael Davitt Museum and the N58 NSR. **Departure Nr.2** consists of the reduction of the available Working Width on the southwestern verge due to the proximity of the existing fence / blockwork wall.	

Preferred Option	Reasoning	Whole Life Cycle Cost Analysis
Option 2	As the existing bridge is being replaced by a new structure, the opportunity to provide a new VRS to protect the road users from the existing hazards while maintaining the integrity of the existing boundaries was feasible. This layout also provides refuge for potential vulnerable road users walking along this route as, while the posted speed limit is 60kph, the operational speed limit is 81kph.	N/A

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