



Innovation in the Design & Installation of Vehicle Restraint Systems (The N58 Experience)

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27th September 2018



Agenda...

1. Intro to N58 overlay scheme

2. Finding a VRS solution

- Hazards / Constraints
- VRS Options and Innovations
- Testing
- Outcome
- Next Steps

3. Other innovations in VRS





Intro to the N58 Kilmore Overlay Scheme...



Overlay Scheme Details...



Scheme length :	3.3km
Existing pavement :	50mm to 210mm, weak subgrade, no geogrid
Proposed overlay :	170mm average, with geogrid
Works :	April to July 2017
Cost :	€1,197,000 (incl Vat)



N58 Kilmore Overlay Scheme...

(Before Overlay)



(After Overlay)



N58 Kilmore Overlay Scheme...





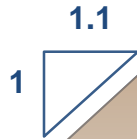
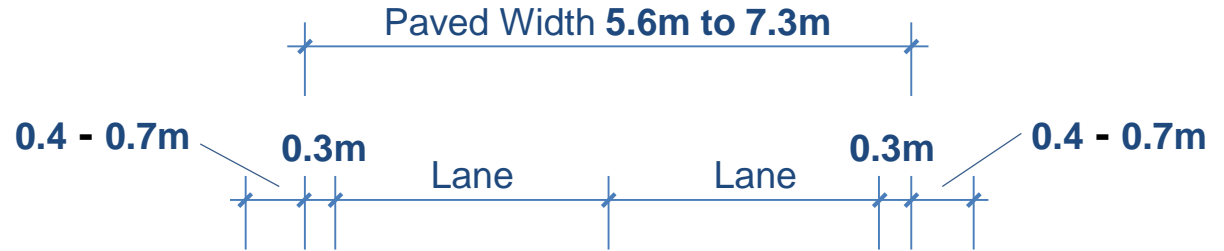
**(Before
Overlay)**



**(After
Overlay)**



Scheme Cross Section...





VRS for the Scheme...

- Mayo County Council's Roads Design Section carried out a **Safety Barrier Risk Assessment** for the scheme
- Mayo County Council sought a quote from the overlay contractor to install barrier at high risk locations
- After consultation with TII, VRS element was passed over to RPS (TII's current VRS design consultant)
- RPS tasked with:
 - assessing requirements for VRS
 - carrying out any design required
 - procuring a specialist VRS contractor to install barrier
 - oversee the works





Bonnegar Iompair Éireann
Transport Infrastructure Ireland

COMHAIRLE CONTAE MAIGH DH
MAYO COUNTY COUNCIL

Safety Barrier Risk Assessment

National Roads Authority
Design Manual for Roads and Bridges

Volume 2 Section 2
Part 8A NRA TD 19/15
(Including Amendment No. 3)

APPENDIX C: RISK ASSESSMENT SHEET

 An tÚdóras um Bóithre Náisiúnta National Roads Authority		Risk Assessment Sheet for Safety Barriers						Date: 08/06/17		Completed by: Mark McDonnell			
Hazard Type, Start and End Co-ordinates		Is Hazard within the Clear Zone (Y/N)	Can the hazard be mitigated?	(1) Hazard Ranking	Sinusity Index (SI)	(2) Sinusity Ranking	(3a) Collision Rate Threshold	(3b) Collision Rate Ranking	(4) Risk of a Vehicle Leaving the Road	(5) Overall Risk Rating	Distance to Hazard (m)	Barrier to be Installed (Y/N), Start and End Co-ordinates	Reasons for Installing/Not Installing the Safety Barrier
RHS	1	STEEP EMBANKMENT ch. 2495 to 2670	Y	No	High	1.019	Med	4	L	M	1m	Y	Approx. 1m. of Road side
RHS	2	STEEP EMBANKMENT ch. 2670 to 2980	Y	No	High	1.019	Med	4	L	M	1m	Y	
RHS	3	STEEP EMBANKMENT ch. 2470 to 2620	Y	No	High	1.001	Low	1	H	M	1m	Y	
RHS	4	STEEP EMBANKMENT ch. 2620 to 3070	Y	No	High	1.075	High	4	L	M	1m	Y	
LHS	5	STEEP EMBANKMENT ch. 2495 to 2670	Y	No	High	1.001	Low	1	H	M	1m	Y	
LHS	6	ch. 2670 to 3070	Y	No	High	1.075	High	4	L	M	1m	Y	

L = Low, M = Medium, H = High

Risk of a Vehicle Leaving the Road			
Severity Ranking	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L

Overall Risk Rating		Hazard Ranking	
Risk of Vehicle Leaving the Road	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L

(1) Hazard Ranking as per Appendix D
 High (H) = 1.001 to 1.020
 Medium (M) = 1.004 to 1.015
 Low (L) = 1.000
 (2) Sinusity Ranking
 High (H) = 1.000
 Medium (M) = 1.004 to 1.015
 Low (L) = 1.016
 (3a) Collision Rate Threshold
 High (H) = Twice Above Expected Rate
 Medium (M) = Above Expected Rate
 Low (L) = 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
 High (H) = Twice Above Expected Rate
 Medium (M) = Above Expected Rate
 Low (L) = Below Expected Rate
 (5) Overall Risk Rating
 High (H) = Twice Above Expected Rate
 Medium (M) = Above Expected Rate
 Low (L) = Below Expected Rate

November 2015

C/1

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APPENDIX C: RISK ASSESSMENT SHEET

 An tÚdóras um Bóithre Náisiúnta National Roads Authority		Risk Assessment Sheet for Safety Barriers						Date: 08/02/17		Completed by: M. McDonnell			
Hazard Type, Start and End Co-ordinates		Is Hazard within the Clear Zone (Y/N)	Can the hazard be mitigated?	(1) Hazard Ranking	Sinusity Index (SI)	(2) Sinusity Ranking	(3a) Collision Rate Threshold	(3b) Collision Rate Ranking	(4) Risk of a Vehicle Leaving the Road	(5) Overall Risk Rating	Distance to Hazard (m)	Barrier to be Installed (Y/N), Start and End Co-ordinates	Reasons for Installing/Not Installing the Safety Barrier
	1	STEEP EMBANKMENT ch. 1400 to ch. 2620	Y	No	High	1.075	High	4	L	M	H		
	2	STEEP EMBANKMENT ch. 1400 to ch. 1440	Y	No	High	1.001	Low	1	H	M	H		
	3	STEEP EMBANKMENT ch. 1400 to ch. 0	Y	No	High	1.019	Med	4	L	M			
	4												
	5												
	6												

L = Low, M = Medium, H = High

Risk of a Vehicle Leaving the Road			
Severity Ranking	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L

Overall Risk Rating		Hazard Ranking	
Risk of Vehicle Leaving the Road	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L

(1) Hazard Ranking as per Appendix D
 High (H) = 1.001 to 1.020
 Medium (M) = 1.004 to 1.015
 Low (L) = 1.000
 (2) Sinusity Ranking
 High (H) = 1.000
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 Low (L) = Below Expected Rate
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 Medium (M) = Above Expected Rate
 Low (L) = Below Expected Rate and Twice Below Expected Rate
 (4) Risk of a Vehicle Leaving the Road
 High (H) = Twice Above Expected Rate
 Medium (M) = Above Expected Rate
 Low (L) = Below Expected Rate
 (5) Overall Risk Rating
 High (H) = Twice Above Expected Rate
 Medium (M) = Above Expected Rate
 Low (L) = Below Expected Rate

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Finding a VRS solution...





The Hazards...



Constrained Location for VRS...



N2 v H2

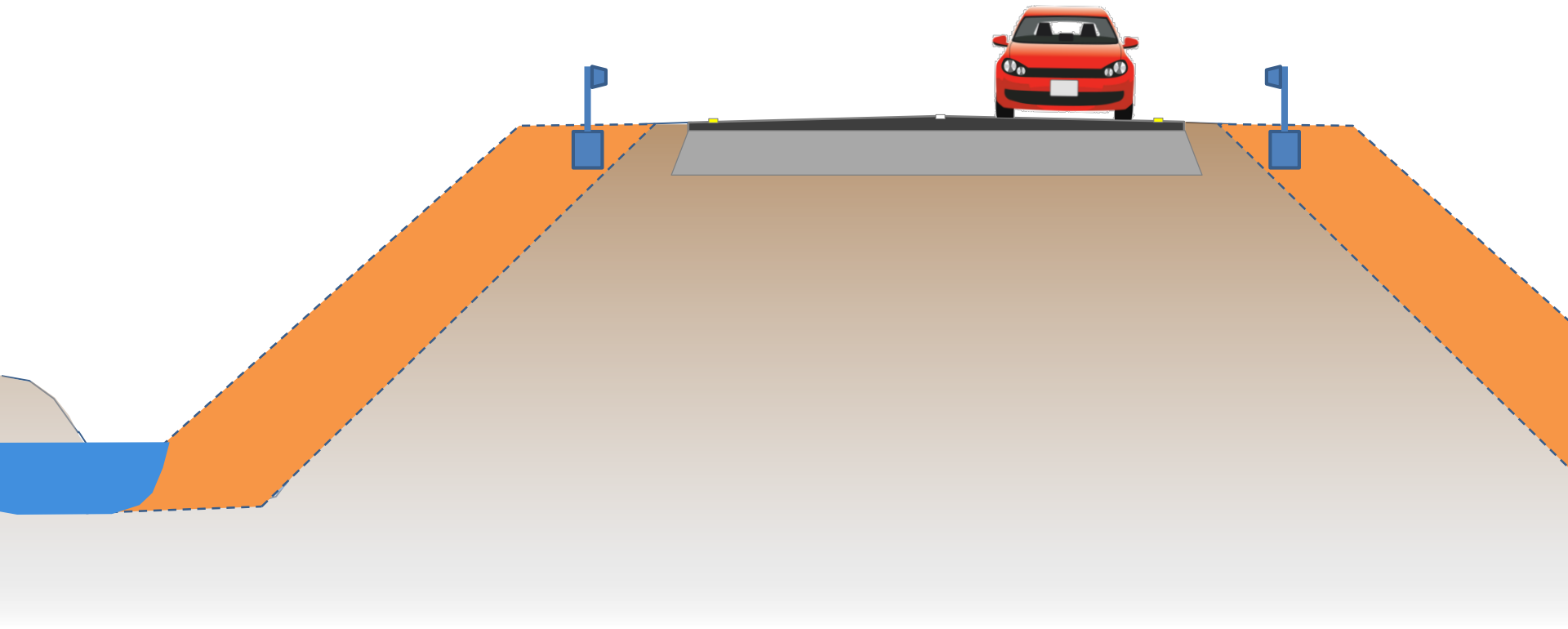


Options Considered but Ruled Out...



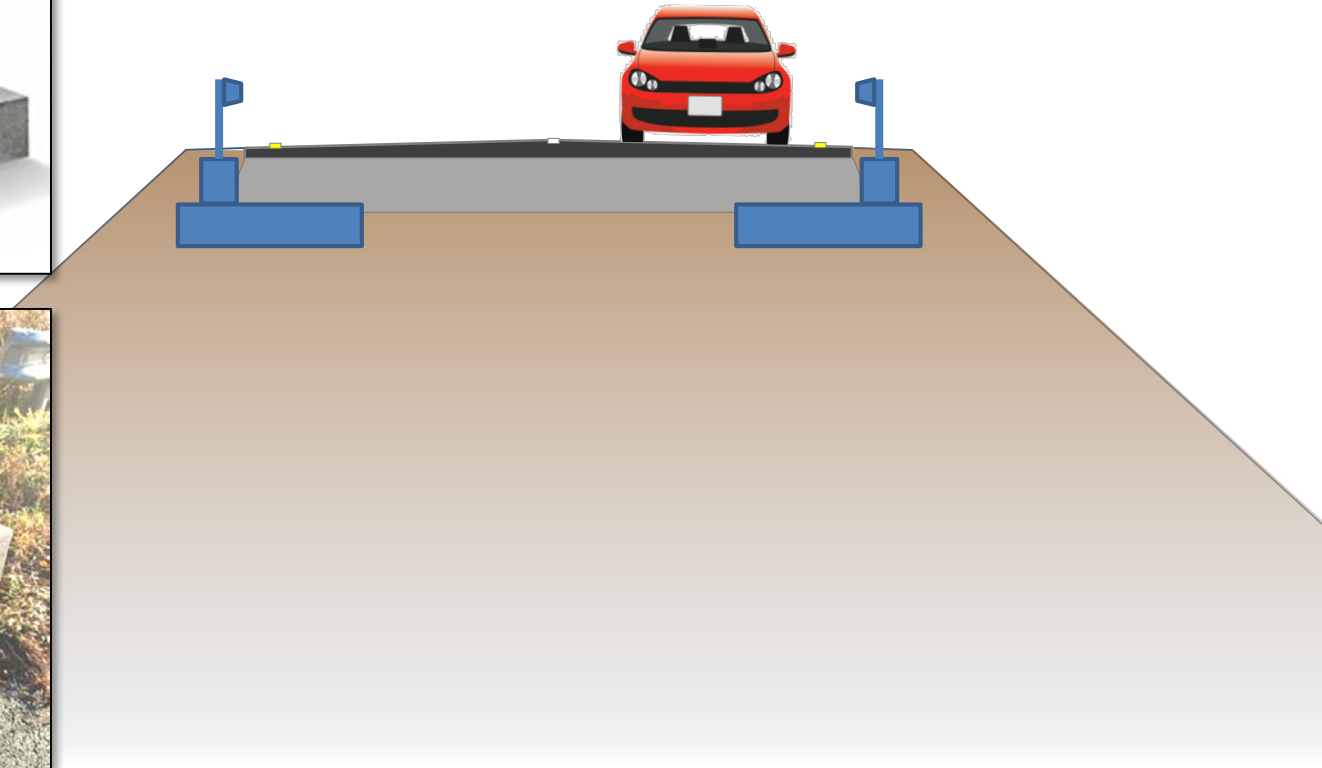


Widen Rampart Embankment...



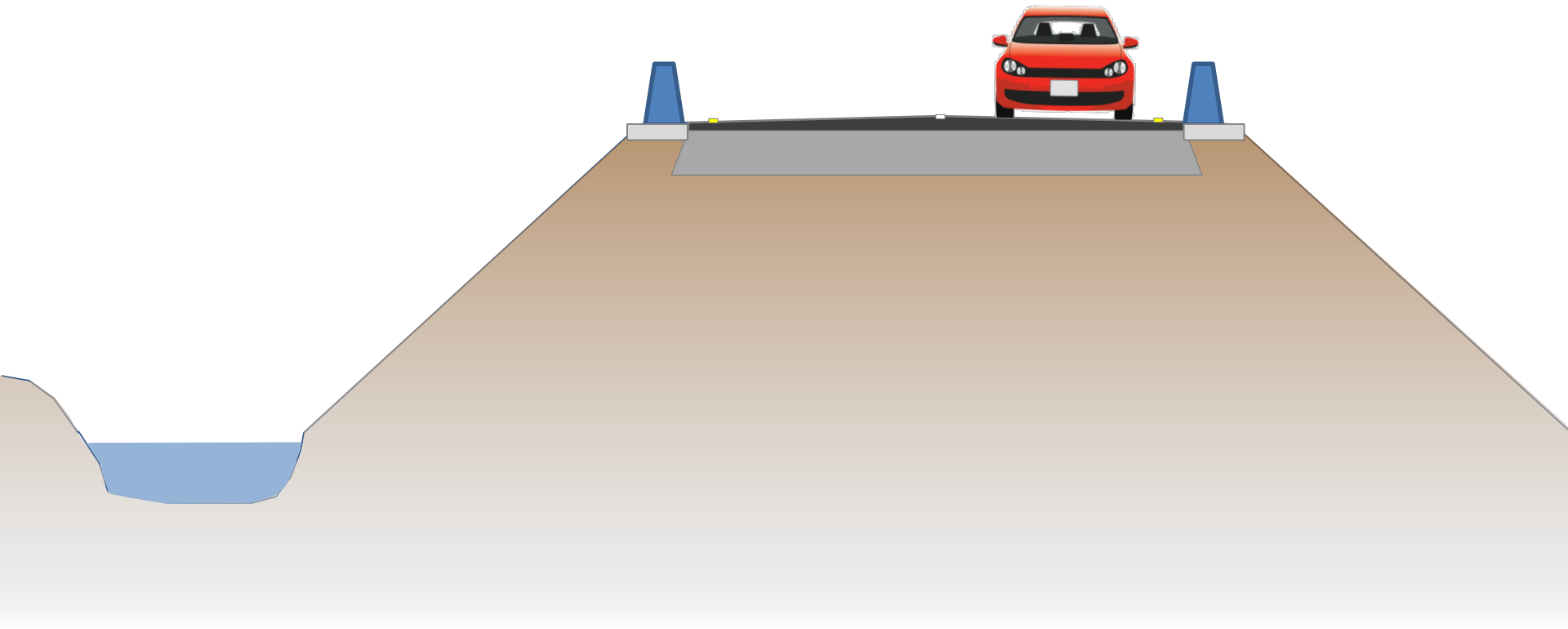


Precast Foundation Slabs...



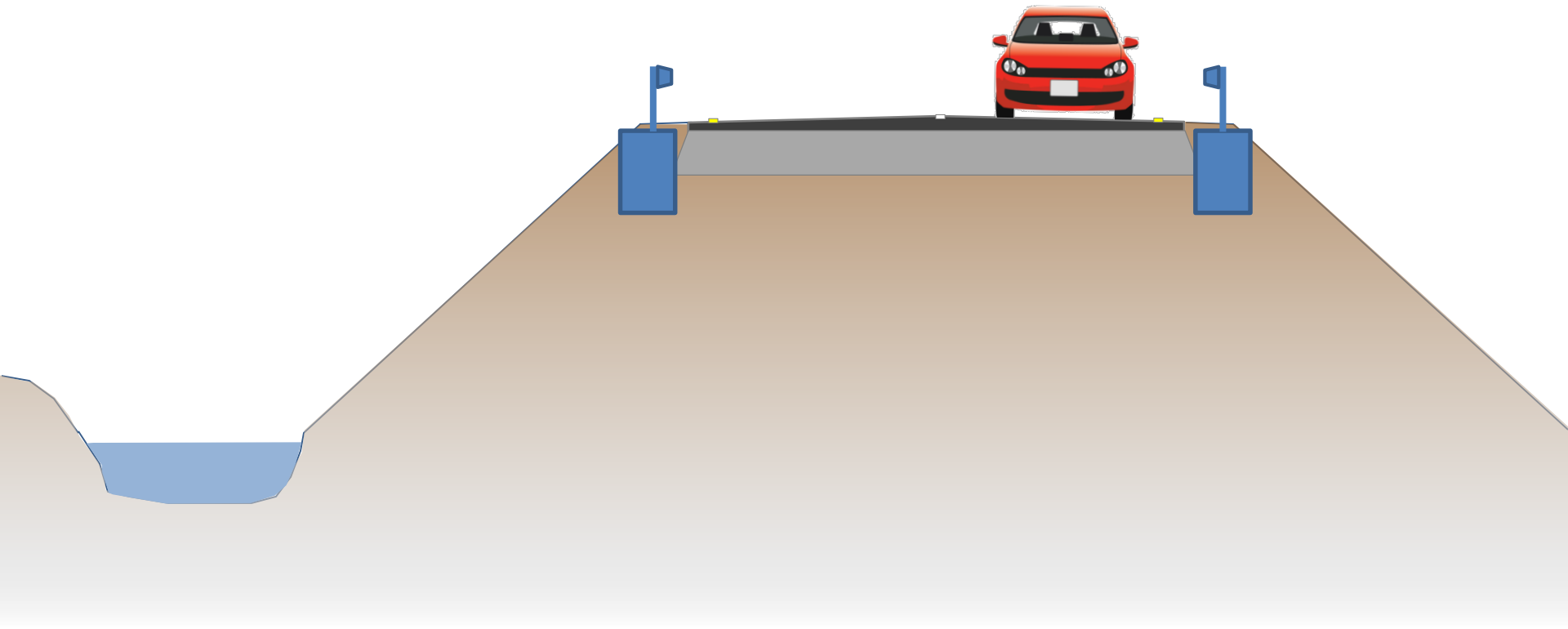


Concrete Barrier...





Barrier on Continuous Concrete Beam...



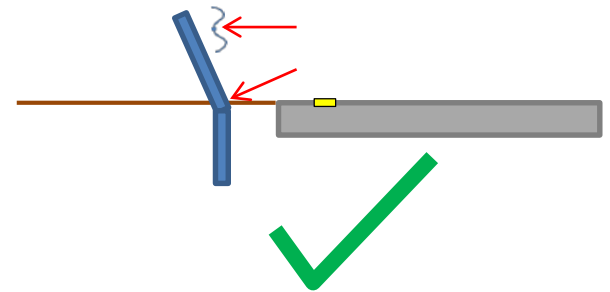
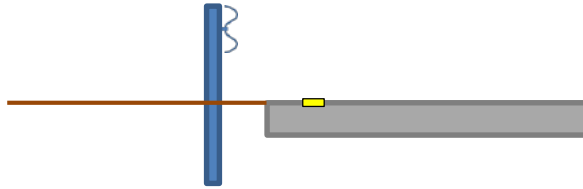


Viable Options Considered...

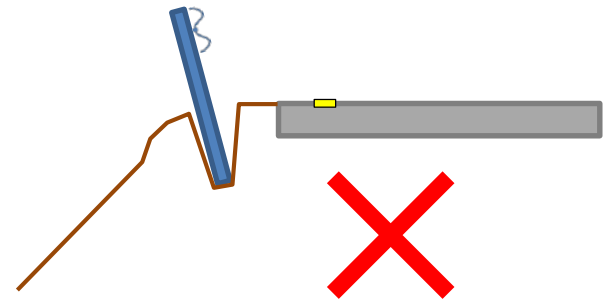
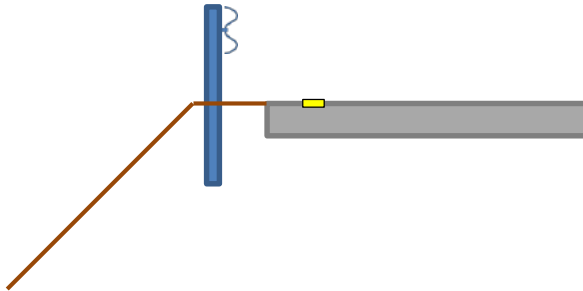


What the 'Solution' must provide...

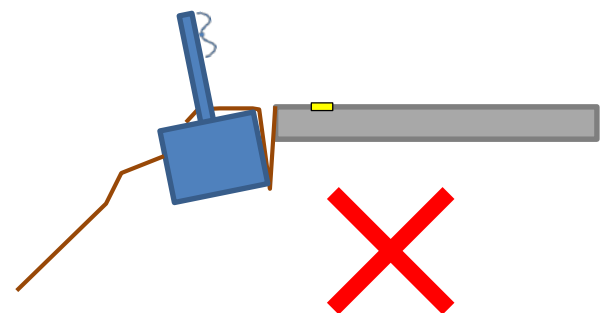
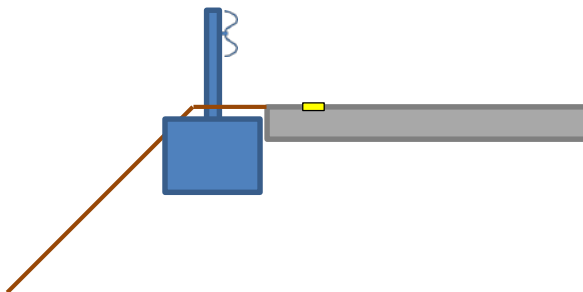
What we want to happen...



Normal Driven Post...



Normal Concreted Post...





Why do we need a Plastic Hinge?



Exploring the Options...

**Find or innovate a post solution
which could provide a plastic hinge**



**Test the solution on the N58 site
(both statically and dynamically) to
see if the plastic hinge forms and if
post performs**



**Select the most appropriate
solution for the given site and
ground conditions, with the
confidence that it will perform**

Options...

CΣO

C

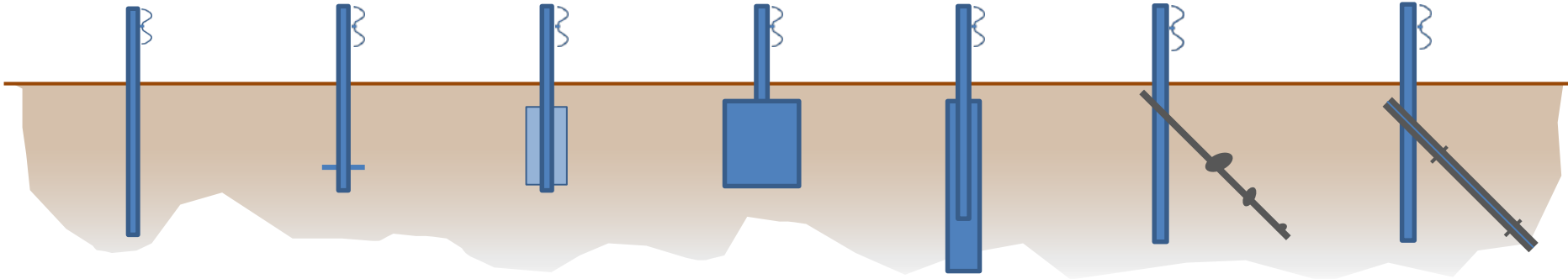
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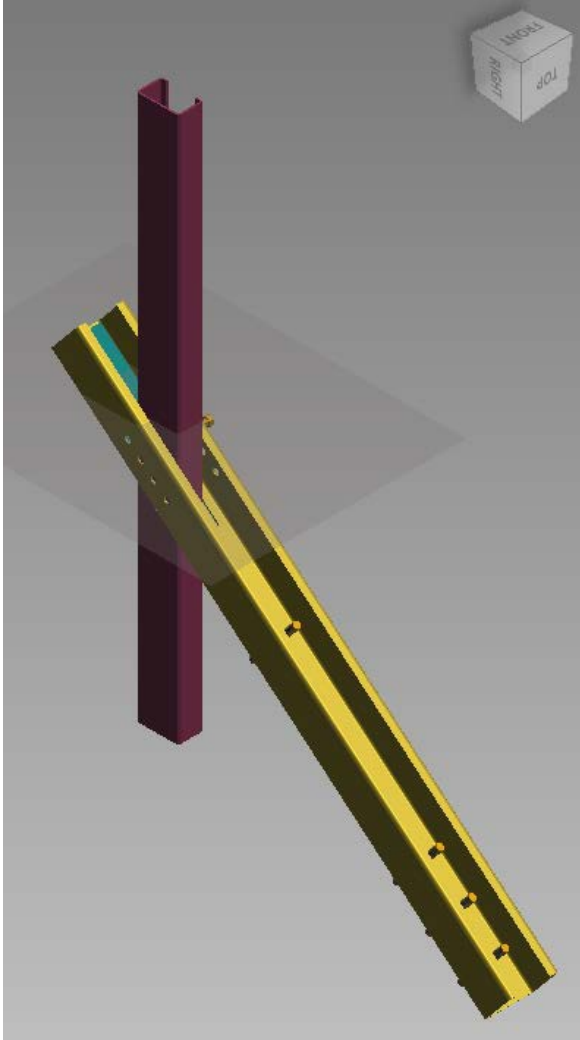




On Site...









Testing...



Push Test: Post in Concrete...





THOR: Dynamic Testing...



THOR: Long C Post Driven...





THOR: C Post in Concrete...





THOR: C Post with Pin...





Outcome from Testing...

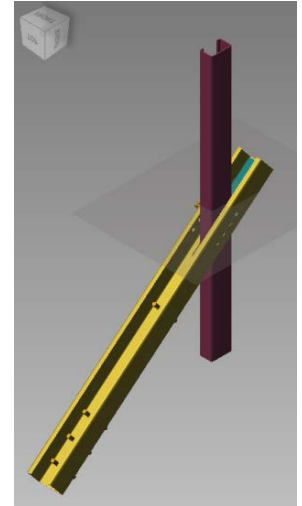
Only the **Pin**
system passed
both **static**
and **dynamic tests**
for the N58 site



Outcome : The Pin System...

Features:

- ✓ **Simple, robust, inexpensive** (once in production)
- ✓ **Versatile** - can use with N2, H2 & Terminals
- ✓ **Re-use** (easy to repair a post – slide out, slide in)
 - New system, refinements likely, no installation manual yet
 - Requires **precise installation** to line up posts, to avoid damage to sub formation or pavement (specialist plant?)
 - May be **difficult to remove**
 - **Unsuitable** where **services** are located under the pavement





Next Steps...

1. **Trial installation** of a short section of VRS on the N58
2. **Learn** as much as possible (installation issues etc)
3. Progress full installation of VRS on the N58 Kilmore Scheme using Pins





Other Innovations & Developments in VRS...





New Standards...

Already Here...

1. Terminal & Transition Assessment Procedures
2. Guidance for Retrofitting VRS on the Legacy Network

On The Way...

1. Standard for Design of VRS (Rev)
2. Standard for Design of VRS for Constrained Settings
3. Standard for Cross Section / Headroom (Rev)
4. Specification (Rev)





Training...



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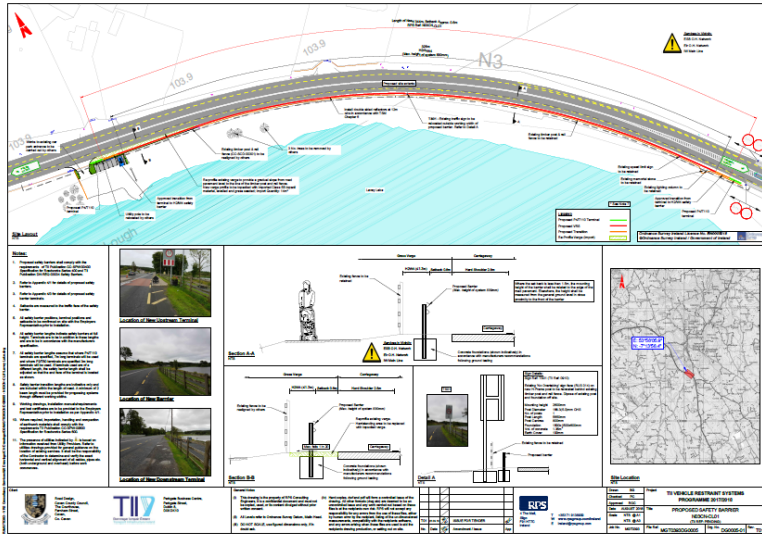
TII
Bonneagar Iompair Éireann

Vehicle Restraint Systems 1-Day Conference
Thursday, 18th October 2018
AGENDA

Time	Presentations	Sponsor
09:00 - 10:00	Registration & Exhibition	
10:00 to 10:10	Welcome and Seminar Overview	TII
10:20 to 10:40	Introduction to the Irish Barrier Association	Berry Emico, BA
10:40 to 11:00	Road Traffic Injury Data in Ireland	Des O'Connor, TII Road Safety
11:00 to 11:10 - O&A	Major Changes in DN-REQ-0004	Aidan Cleary, Arup
11:20 to 12:10	Tea & Official Exhibition	
12:30 to 12:50	Side effects of EN1327	
12:50 to 12:55	Finite Element Simulation	Óliver Freiðkússon, BarrierTech
12:55 to 13:10	Passively Safe Roadside Furniture	Joseph Morris, GD Tech
13:10 to 13:20 - O&A		Thomas McDonnell, IFL
13:20 to 14:00	Lunch	
14:20 to 14:40	Major Changes in CC-IPW-0040	
14:40 to 15:00	Improving Installation Quality	Christopher Emillion, Arup
15:00 to 15:30	The NBS Pilot Project	Patrick Cullen, BPS
15:30 to 15:50 - O&A		Riwan O'Connell, BPS
15:50 - 15:45	Closing	TII



Driving Up Quality...



TII VMS Programme 2017/2018									
Barrier ID: K738					Barrier ID: K738				
(A) General Checks		(B) Barriers		(C) Details		(D) Material		(E) Support	
Is it correct?	Y/N	Are they correct?	Y/N	Are they correct?	Y/N	Are they correct?	Y/N	Are they correct?	Y/N
Barriers installed?	Y	Barriers installed?	Y	Barriers installed?	Y	Barriers installed?	Y	Barriers installed?	Y
...
Summary					Summary				
No. of Barriers: 150					No. of Barriers: 150				



Driving Up Quality...





Creating Forgiving Roadside...



(Before)



(After)

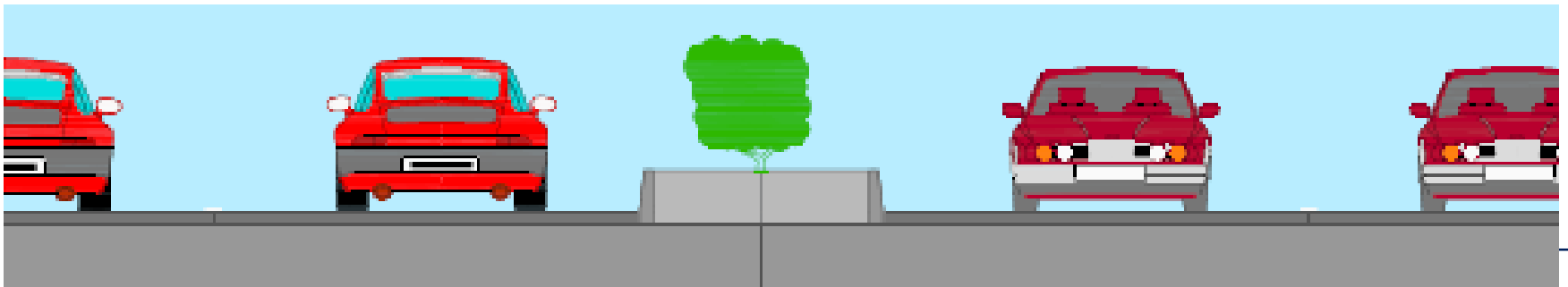


New 2+2 Median Barrier...





High Containment Kerb...



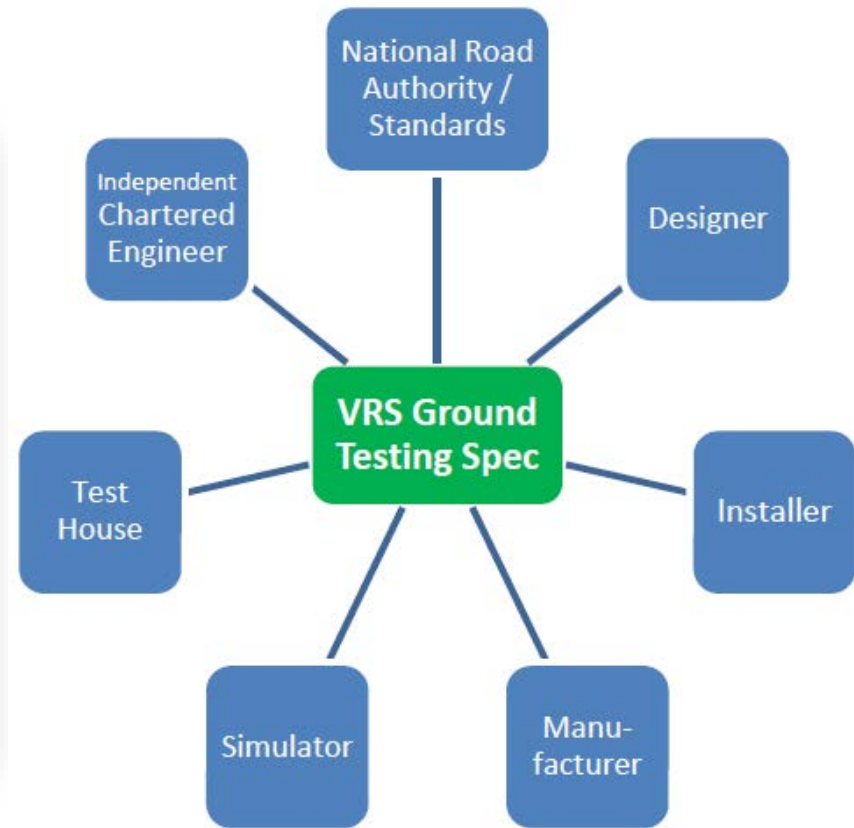


Crash Cushions...





Ground Testing...





VRS Maintenance Guidelines...





Irish Barrier Association...







COMHAIRLE CONTAE MHAIGH EO
MAYO COUNTY COUNCIL

THANK YOU

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