



RISK ASSESSMENT PROCEDURE FOR SCHEMES INVOLVING ONLINE REALIGNMENT ON NATIONAL ROADS

NRA TD 19/13

**Zita Langenbach
Associate
Arup**

*National Roads Authority - Standards Section
Training for New Developments
April 2013*



Updates to NRA TD19

- Prioritisation of **hazard mitigation measures** to ensure safety barriers only installed if mitigation not possible.
- Addition of new fixed objects **within the Clear Zone** which should be considered as hazards requiring mitigation.
- Update to **IS EN 1317 performance classes**.
- Update to options for **terminating barriers**.
- Introduction of a **new risk assessment procedure** for schemes involving online realignment.

IS EN 1317 performance classes - Containment Levels

Containment Level	Vehicle Impact Test				
	Test	Impact Speed (km/h)	Impact Angle (degrees)	Vehicle Mass (t)	Vehicle Type
Normal Containment	TB 31	80	20	1.5	Car
	TB 32	110	20	1.5	Car
Higher Containment					
H1	TB 42	70	15	10.0	Rigid HCV
L1	TB 42	70	15	10.0	Rigid HCV
L1	TB 32	110	20	1.5	Car
H2	TB 51	70	20	13.0	Bus
L2	TB 51	70	20	13.0	Bus
L2	TB 32	110	20	1.5	Car
H3	TB 61	80	20	16.0	Rigid HCV
L3	TB 61	80	20	16.0	Rigid HCV
L3	TB 32	110	20	1.5	Car
Very High Containment					
H4a	TB 71	65	20	30.0	Rigid HCV
H4b	TB 81	65	20	38.0	Articulated HCV
L4a	TB 71	65	20	30.0	Rigid HCV
L4a	TB 32	110	20	1.5	Car
L4b	TB 81	65	20	38.0	Articulated HCV
L4b	TB 32	110	20	1.5	Car

➤ New containment level tests to IS EN 1317 added to Table 5/1

Note: Barriers with a Containment Level of N2 or higher shall also be subjected to Test TB 11, using a light vehicle (900kg), in order to verify that satisfactory attainment of the maximum level is also compatible for a light vehicle. (Source: IS EN 1317-2)

Table 5/1: IS EN 1317 Containment Level Tests

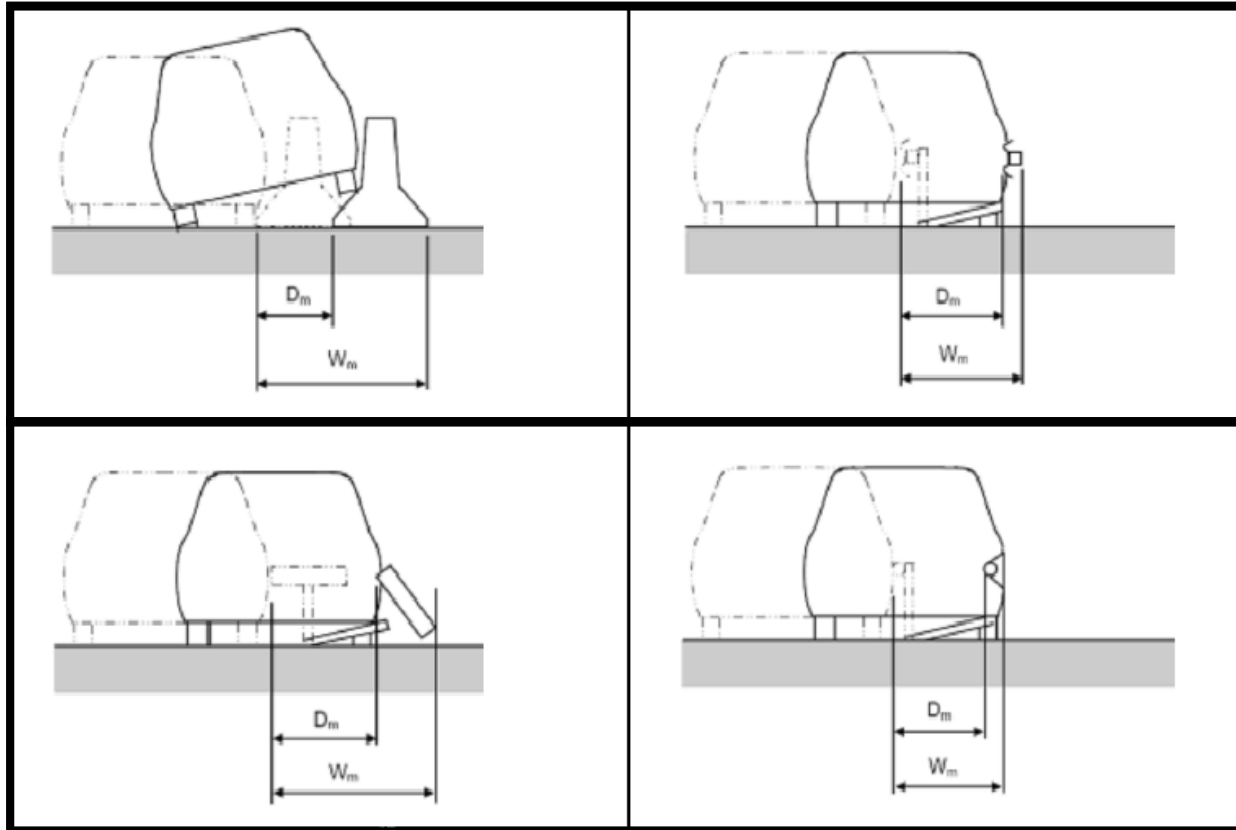
IS EN 1317 performance class - Impact Severity Level

Impact Severity Level	ASI	THIV
A	≤ 1.0	≤ 33 km/h
B	≤ 1.4	≤ 33 km/h
C	≤ 1.9	≤ 33 km/h

(Source IS EN 1317-2)

- A new Impact Severity Level C has been introduced to Table 5/2
- Removed Post-impact Head Deceleration Values (PHD)

IS EN 1317 performance classes - Working Width

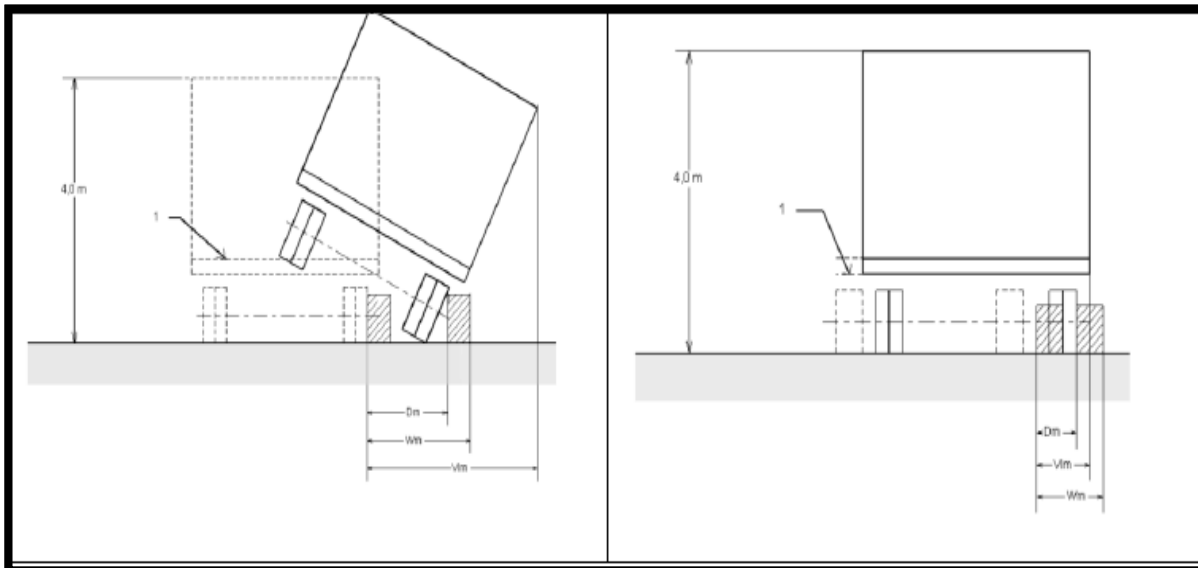


- The working width (W_m) is the **maximum lateral distance** between any part of the barrier on the undeformed traffic side and the **maximum dynamic position** of any part of the barrier.

- If the vehicle body deforms around the road vehicle restraint system so that the latter cannot be used for the purpose of measuring the working width, the maximum lateral position of any part of the vehicle shall be taken as an alternative.



IS EN 1317 performance classes - Vehicle Intrusion



- The vehicle intrusion (V_{Im}) of the Heavy Goods Vehicle (HGV) is its maximum dynamic lateral position from the undeformed traffic side of the barrier

IS EN 1317 performance classes

- No change to Working Widths
- New Table 5/4 for VI widths

Class of Vehicle Intrusion	Level of Vehicle Intrusion
VI1	≤ 0.6 m
VI2	≤ 0.8 m
VI3	≤ 1.0 m
VI4	≤ 1.3 m
VI5	≤ 1.7 m
VI6	≤ 2.1 m
VI7	≤ 2.5 m
VI8	≤ 3.5 m
VI9	>3.5m

Table 5/4 Vehicle Intrusion Classes

Departure Lengths

Departure Lengths on overtaking sections have been increased to 30m

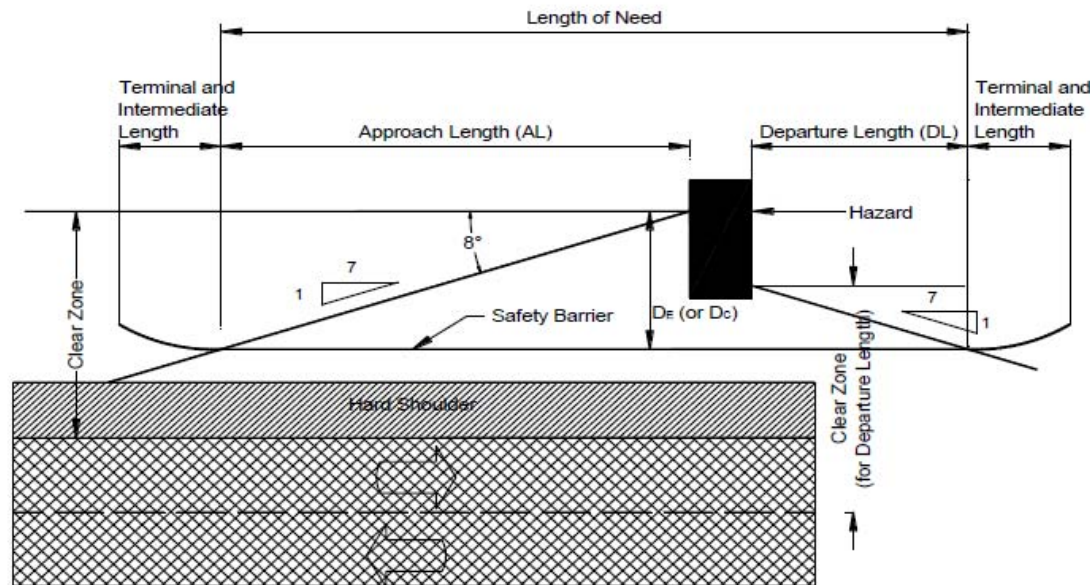


Figure 5/2: Example of Approach and Departure Lengths

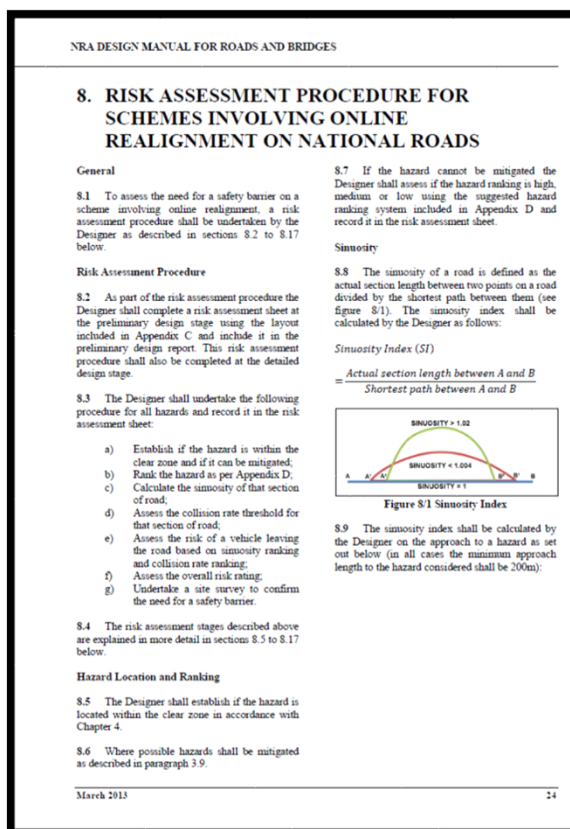
Terminating Barriers



- The order of preference for options for terminating barriers have changed
 - a) Returning the barrier such that the end is buried in a cutting face
 - b) Ramping the barrier down to ground level where the terminal is not in direct line of traffic
 - c) Terminating at a full height terminal of Performance Class P4 where the terminal is in direct line of traffic
- For options (a) and (b) terminating barriers shall have a flare of 1:20 away from the road.

Introduction of Chapter 8

- A new Chapter 8 has been added to NRA TD 19 to include a risk assessment procedure for schemes involving online realignment on National Roads.



Purpose of Safety Barrier Risk Assessment Procedure

To assess the need for a safety barrier on a scheme involving online realignment.



Risk Assessment Procedure Development

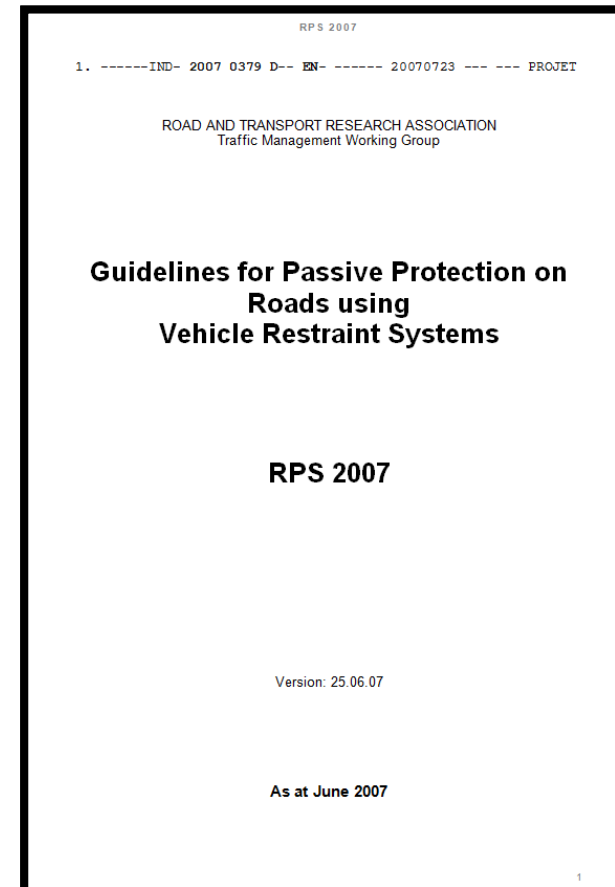
Development of Procedure

1. German Standards

- RPS 2007: Guidelines for Passive Protection on Roads using Vehicle Restraint Systems (Road and Transport Research Association Traffic Management Working Group June 2007).

2. French Standards

- Guidelines - Handling lateral obstacles on main roads in open country (Setra - service d'Études techniques des routes et autoroutes - November 2002).



Risk Assessment Procedure Steps

The Designer shall undertake the following risk assessment procedure for all hazards and **record** it in the risk assessment sheet:

- Establish if hazard **within the clear zone** and can be **mitigated**;
- **Rank** the hazard - new **Appendix D** of NRA TD19;
- Calculate the **sinuosity** of that section of road;



Risk Assessment Procedure Steps

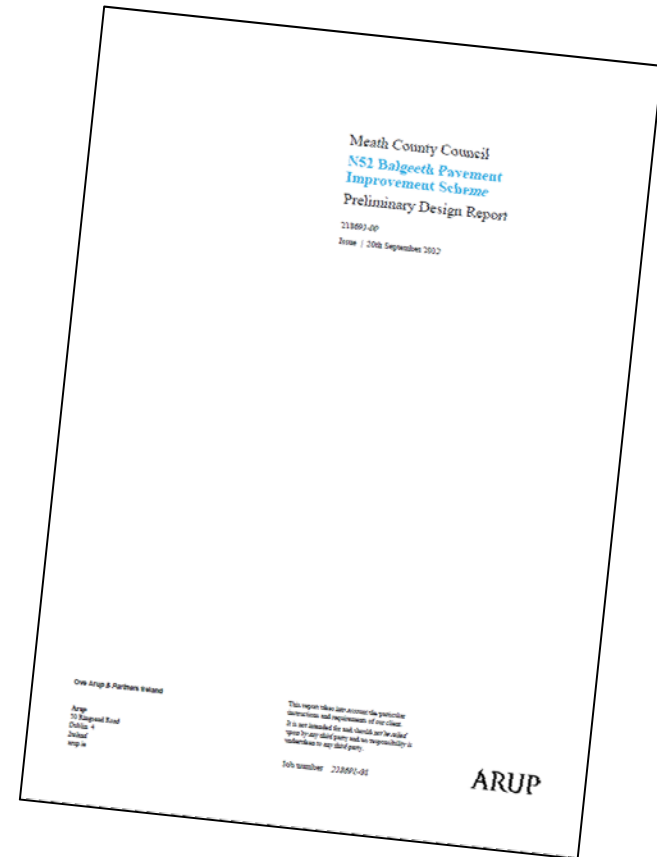
- Assess the **collision rate threshold** for that section of road;
- Assess the risk of a **vehicle leaving the road** based on sinuosity ranking and collision rate ranking;
- Assess the **overall risk rating**;
- Undertake a **site survey** to confirm the need for a safety barrier.



Risk Assessment Procedure Stages


The Designer shall undertake the risk assessment procedure at:

- Preliminary design stage - Preliminary Design Report
- Detailed design stage



Risk Assessment Sheet

The Designer shall complete a risk assessment sheet using the new layout included in Appendix C of NRA TD 19.

							Risk Assessment Sheet for Safety Barriers				Date: X/X/XX		Completed By: X	
Location ID/Description:														
Site Survey Conducted (Y/N): Y														
Hazard Type, Start and End Co-ordinates	Is Hazard within Clear Zone (Y/N)	Can the Hazard be Mitigated?	(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 to Hazard (m)	Barrier to be Installed (Y/N), Start and End Co-ordinates	Reasons for Installing / Not Installing Barrier		

Hazard Definition

A hazard is any physical obstruction which may, in the event of an errant vehicle leaving the carriageway, result in significant injury to the occupants of the vehicle.



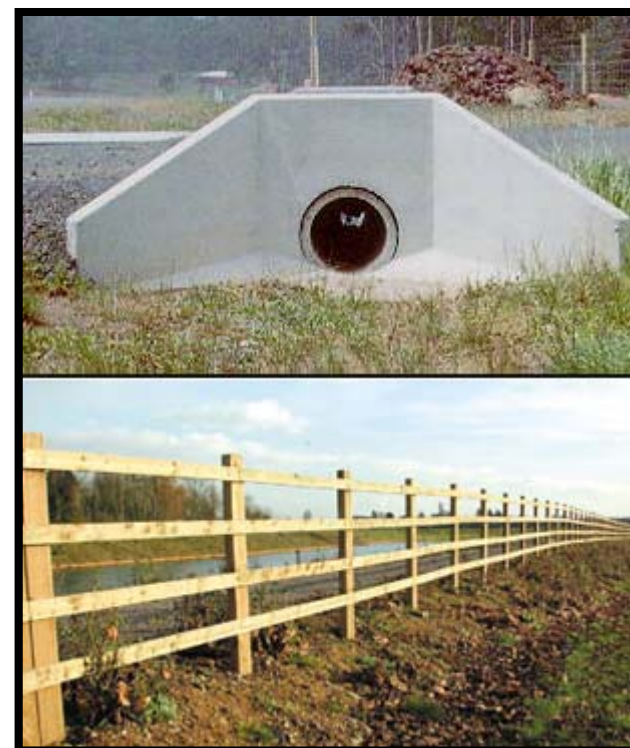
Hazard Categories

- Chapter 3 of NRA TD 19 gives the types of hazard which present a significant risk to an errant vehicle.
- Categories of hazards include side slopes, fixed objects, water and linear hazards e.g. roads, railways.



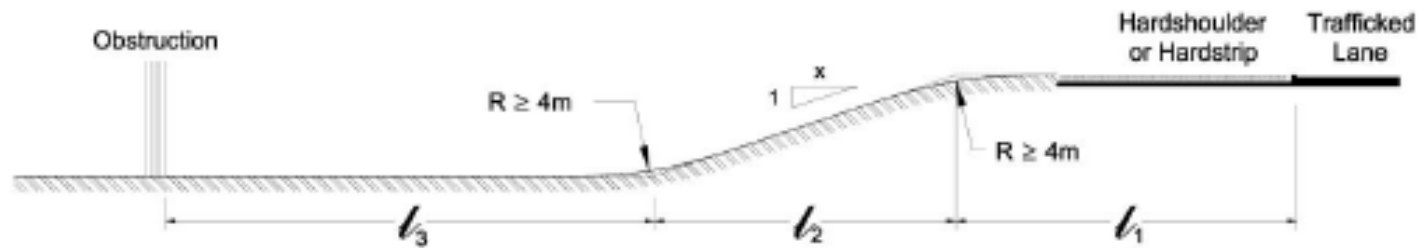
Hazard Categories

- New/Updated fixed objects within the Clear Zone considered as hazards requiring mitigation (par 3.17):
 - Wooden poles/ posts with **cross-sectional area > 25,000mm²** that do not have breakaway features
 - Timber posts and rail fences if not being used as a road boundary
 - Drainage items, such as culvert headwalls and transverse ditches that are not detailed to be traversed safely

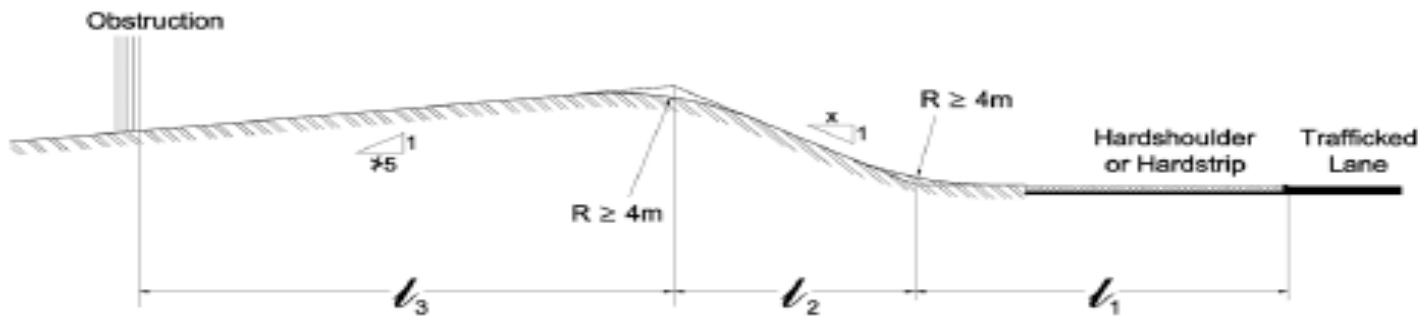


Clear Zone

Clear Zone = Total width of traversable land to be kept clear of unprotected hazards



Clear Zone for Embankment Slope



Clear Zone for Cut Slope

The Designer shall establish if the hazard is located within the clear zone in accordance with Chapter 4 of NRA TD 19.

Hazard Mitigation

Hazard mitigation measures shall be considered by the Designer **prior** to designing a safety barrier.

A safety barrier shall **only** be introduced if the hazard **cannot be mitigated**.



Hazard Mitigation

Where possible hazards shall be mitigated as follows in accordance with Par 3.9:

- Remove;
- Relocate;
- Re-design the hazard to reduce the risk to road users e.g. introducing a passively safe sign post;



Hazard Mitigation

- Revise the road layout or cross-section to lower the risk, e.g. increase the width of the hard shoulder, improve the road alignment, etc;
- Reduce impact severity e.g. by setting a culvert flush with the existing ground;
- Provide a suitable safety barrier.



Hazard Ranking

If the hazard cannot be mitigated the Designer shall assess if the hazard ranking is:

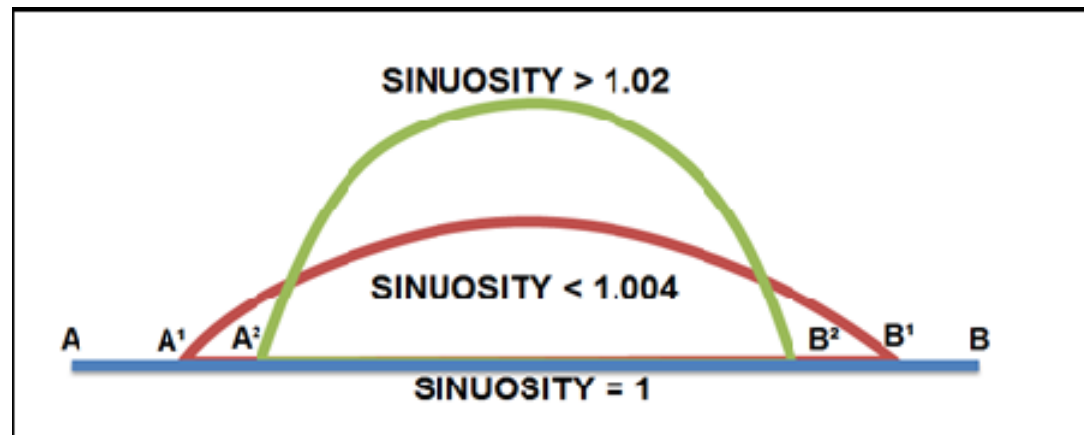
- High
- Medium
- Low

using the new suggested **hazard ranking system** included in the new **Appendix D** and record it in the risk assessment sheet.

Hazard Ranking	Hazard Description
High	<ul style="list-style-type: none">• Lighting Columns that are not passively safe.• Tubular Steel Signposts > 89mm diameter by 3.2mm thick, or equivalent strength.• Wooden Poles or Posts with Cross Sectional Area > 25,000mm² that do not have breakaway features.• Trees having a girth 175mm or more measured at 1m above the ground.• Concrete posts with Cross Sectional Area > 15,000mm².• Playgrounds/Monuments and other locations of high socio-economic value.• Water of likely depth > 0.6m.• Bridge Parapets, Bridge Piers, Abutments, Railing Ends, Gantry Legs• Locations where errant vehicle may encroach onto road/railway which crosses or runs parallel to road.• Substantial fixed objects e.g. walls extending above the ground by more than 150mm with projections or recesses > 100mm and running parallel to the road.• Underbridges 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.• Buildings in danger of collapse.• Industrial sites with potential for explosion or chemical spill.• Rock cutting with rough face.
Medium	<ul style="list-style-type: none">• Steep Embankment Slopes, steeper than 1:2 and $\geq 0.5m$ height.• Embankment Slopes between 1:2 and 1:3 (inclusive) and $\geq 2m$ height.• Slopes to ditches.• Drainage items such as culvert headwalls and transverse ditches that are not detailed to be traversed safely.• Hazardous topographical features beyond the road boundary, but within the width defined in Table 4/1.• Single cross culvert opening exceeding 1000mm measured parallel to the direction of travel.• Culvert approximately parallel to the roadway that has an opening exceeding 600mm measured perpendicular to the direction of travel.• Steep sided cuttings or earth bunds (steeper than 1:2) within the clear zone.• Multiple cross culvert openings exceeding 750mm each, measured parallel to direction of travel.• Linear V-ditches alongside the scheme.• Timber post and rail fences when not being used as a road boundary.• Environmental Barriers
Low	<ul style="list-style-type: none">• Shallow Slopes, between 1:3 and 1:3 gradient and $\geq 6m$ in height.• Substantial fixed objects e.g. walls extending above the ground by more than 150mm with projections or recesses $\leq 100mm$ and running parallel to the road.

Sinuosity

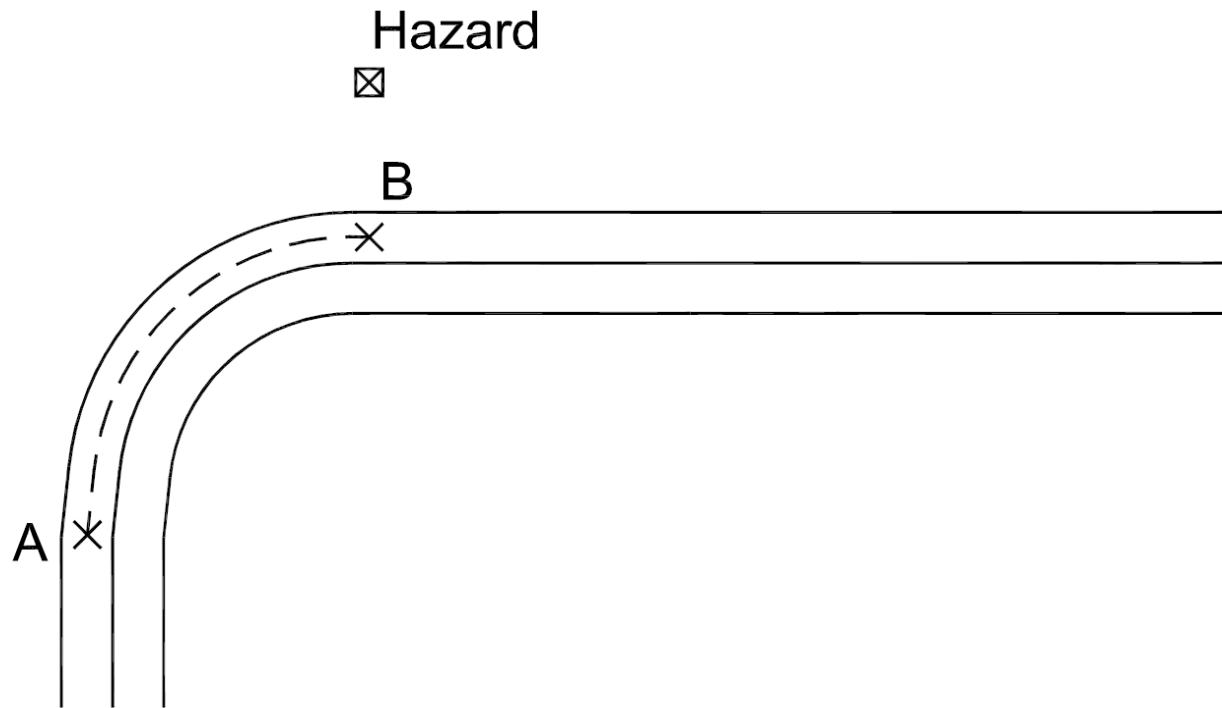
$$\text{Sinuosity Index (SI)} = \frac{\text{Actual section length between A and B}}{\text{Shortest Path between A and B}}$$



Sinuosity

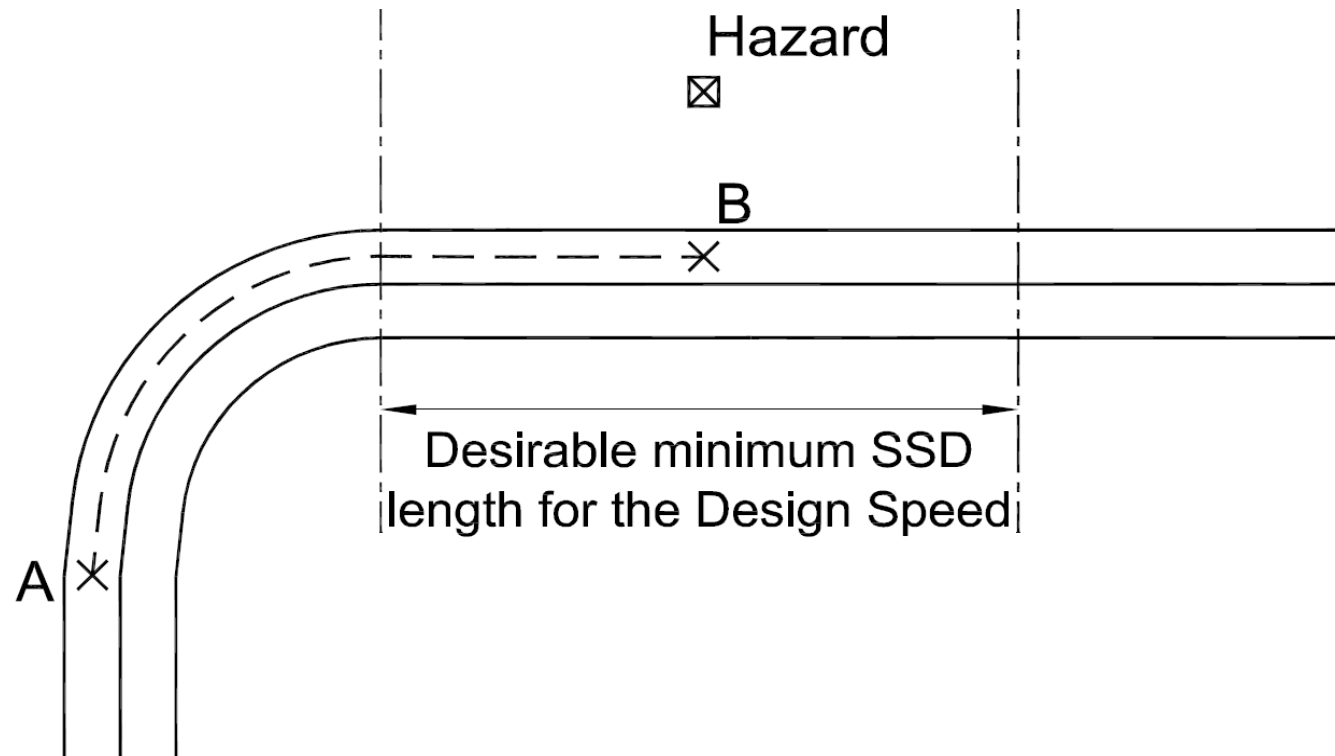
- The sinuosity index shall be calculated by the Designer **on the approach** to a hazard
- Minimum length over which the sinuosity shall be assessed = **200m**

Sinuosity



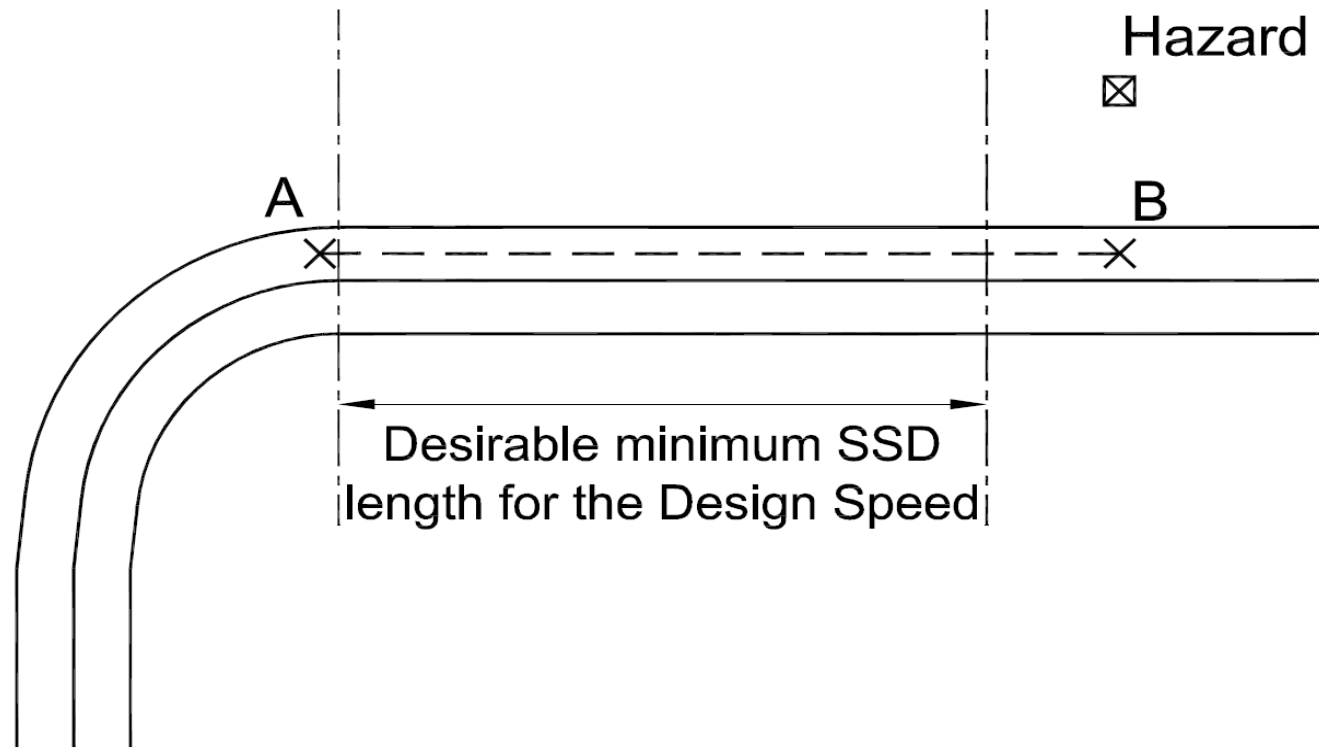
Hazard Located within or at the end of a Horizontal Curve

Sinuosity



Hazard located on a straight or nearly straight section beyond a horizontal curve

Sinuosity



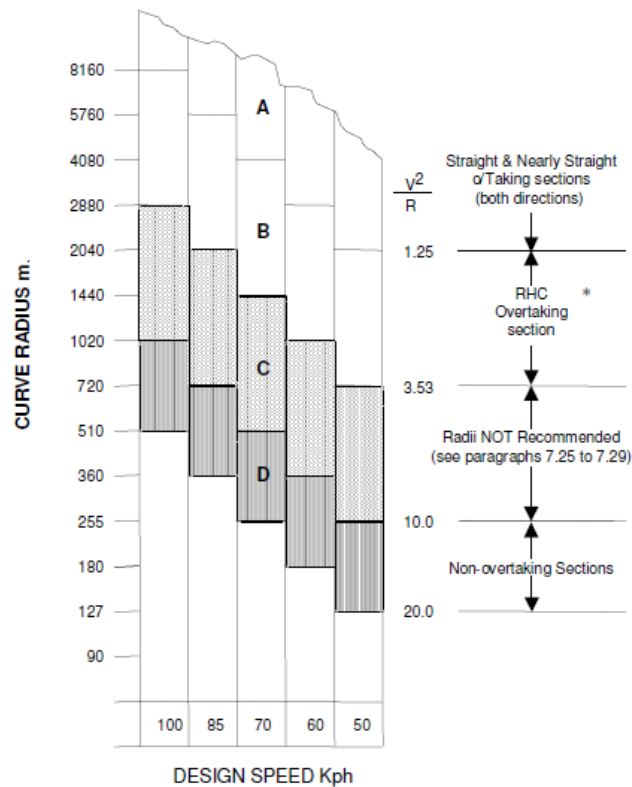
Hazard located on a straight or nearly straight section of road beyond the horizontal curve and the Desirable Minimum SSD length

Sinuosity

DESIGN SPEED (km/h)	120	100	85	70	60	50	V ² /R
STOPPING SIGHT DISTANCE m							
Desirable Minimum Stopping Sight Distance	295	215	160	120	90	70	
One Step below Desirable Minimum	215	160	120	90	70	50	
Two Steps below Desirable Minimum	160	120	90	70	50	50	
HORIZONTAL CURVATURE m							
Minimum R ⁺ without elimination of Adverse Camber and Transitions	2880	2040	1440	1020	720	510	5
Minimum R ⁺ with Superelevation of 2.5%	2040	1440	1020	720	510	360	7.07
Minimum R with Superelevation of 3.5%	1440	1020	720	510	360	255*	10
Desirable Minimum R with Superelevation of 5%	1020	720	510	360**	255**	180*	14.14
One Step below Desirable Min R with Superelevation of 7%	720	510	360	255**	180**	127*	20
Two Steps below Desirable Min R with Superelevation of 7%	510	360	255	180**	127**	90*	28.28
Three Steps below Desirable Min R with Superelevation of 7%			180	127**	90**	65*	40
Four Steps below Desirable Min R with Superelevation of 7%			127	90**	65**	44*	56.56
VERTICAL CURVATURE – CREST							
Desirable Minimum Crest K Value	182	100	55	30	17	10	
One Step below Desirable Min Crest K Value	100	55	30	17	10	6.5	
Two Steps below Desirable Min Crest K Value	55	30	17	10	6.5	6.5	
VERTICAL CURVATURE – SAG							
Desirable Minimum Sag K Value	53	37	26	20	13	9	
One Step below Desirable Min Sag K Value	37	26	20	13	9	6.5	
Two Steps below Desirable Min Sag K Value	26	20	13	9	6.5	6.5	
*** Absolute Minimum Vertical Curve Length to be used on Dual Carriageways	240	200	-	-	-	-	
OVERTAKING SIGHT DISTANCES							
Full Overtaking Sight Distance FOSD m.	N/A	580	490	410	345	290	
FOSD Overtaking Crest K Value	N/A	400	285	200	142	100	

The Desirable Minimum SSD length shall be as per Table 1/3 of NRA TD 9 for the particular Design Speed.

Sinuosity



Nearly Straight sections shall be as per Figure 7/6 of NRA TD 9.

Sinuosity

Sinuosity is divided into three sinuosity rankings as follows:

- High (H) - Sinuosity Index > 1.02 ;
- Medium (M) - $1.004 \leq$ Sinuosity Index ≤ 1.02 ;
- Low (L) - Sinuosity Index < 1.004

The Designer shall **record** the calculated Sinuosity Index and the Sinuosity Ranking in the **risk assessment sheet**.



Collision Rate Thresholds

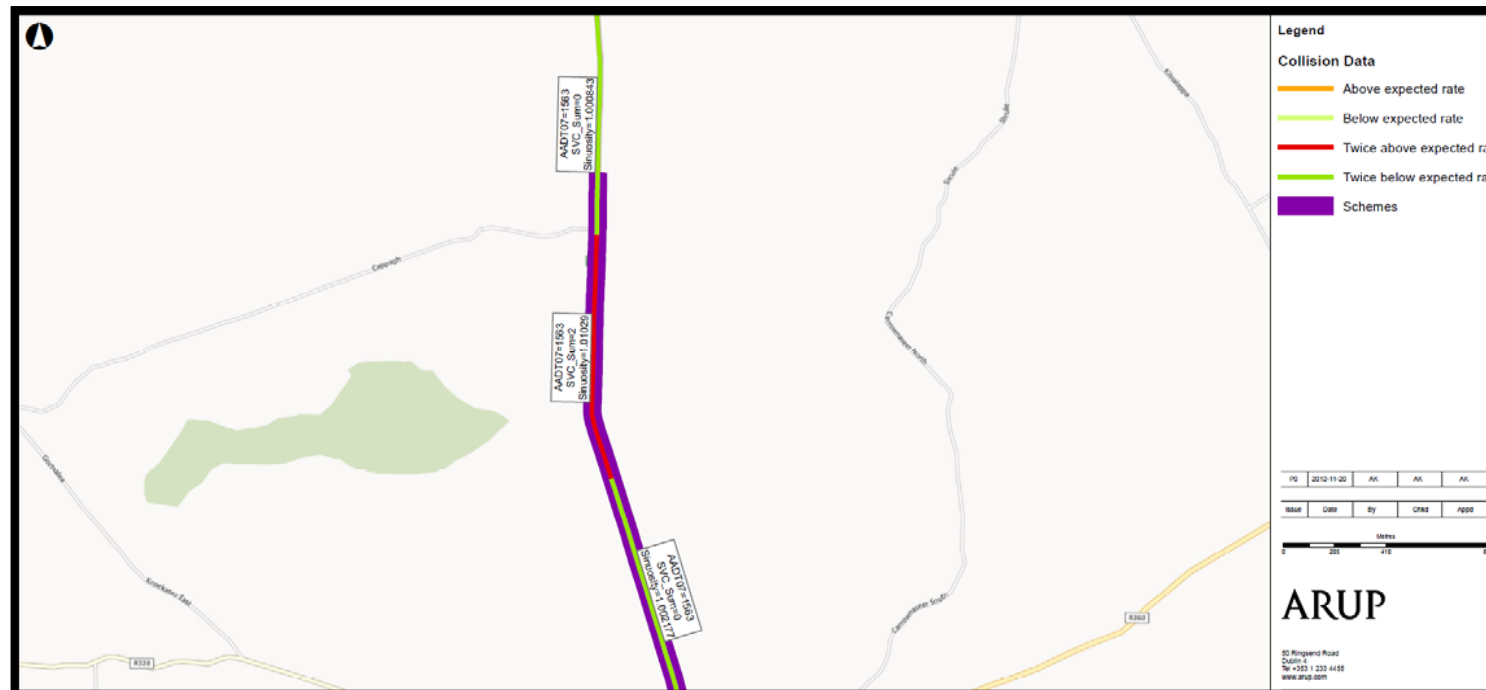
Collision rates have been calculated by the NRA using the methodology described in HD 15/12, compared with historical rates and the following thresholds established:

- Twice Above Expected Collision Rate
- Above Expected Collision Rate
- Below Expected Collision Rate
- Twice Below Expected Collision Rate



Collision Rate Thresholds

Collision Rate Threshold Data can be requested from the NRA by the Designer at infosafety@NRA.ie



Collision Rate Ranking

The Designer shall assign a Collision Rate Ranking to the Collision Rate Threshold for the section of road and **record** it in the risk assessment sheet:

- High (H) - Twice Above Expected Collision Rate;
- Medium (M) - Above Expected Collision Rate;
- Low (L) - Below Expected Collision Rate and Twice Below Expected Collision Rate.

Risk of a Vehicle Leaving the Road

Risk of a Vehicle Leaving the Road	Collision Rate Ranking		
Sinuosity Ranking	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L

** Where H=High, M=Medium, L=Low*

Overall Risk Rating

Overall Risk Rating	Hazard Ranking		
Risk of a vehicle leaving the road	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L

** Where H=High, M=Medium, L=Low*

Overall Risk Rating

For each hazard location a determination shall be made as follows:

Overall risk rating - High

- Safety barrier shall be installed or the hazard shall be mitigated.

Overall Risk Rating

Overall risk rating - Medium

- Safety barrier shall be installed or the hazard shall be mitigated if within 2m of carriageway edge.
- If the hazard is $\geq 2\text{m}$ from the carriageway edge the Designer shall assess the hazard level and the risk of a vehicle leaving the road **on site** and determine if a safety barrier is required.

Overall Risk Rating

Overall risk rating - Low

- A safety barrier is not required.

Each determination shall be **recorded** in the risk assessment sheet along with the **reason for providing or not providing the safety barrier.**

Site Survey

A site survey shall be carried out by the Designer as part of the risk assessment procedure to confirm the need or otherwise for a safety barrier at all locations.



TA85 Update - Safety Barriers

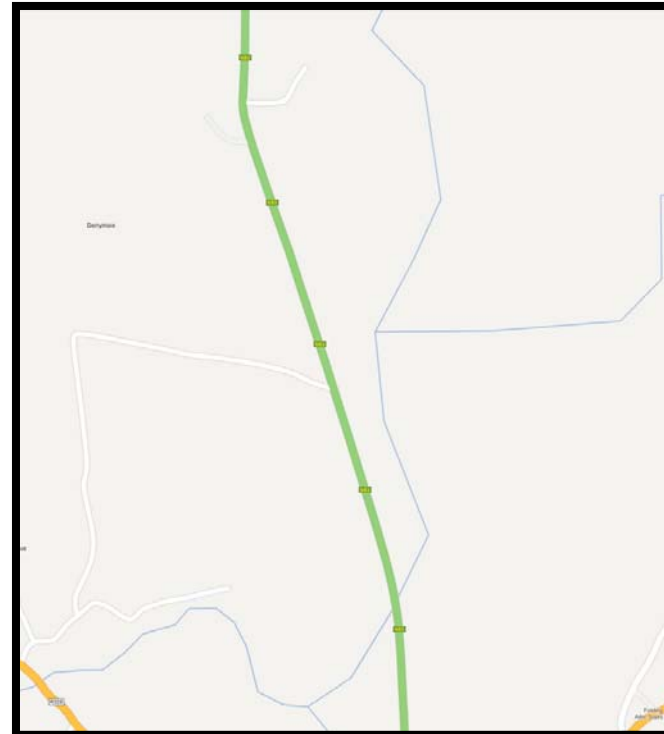
- The Design Organisation shall follow the risk assessment procedure outlined in Chap 8 of NRA TD 19 and include the risk assessment sheet in the Preliminary Design Report.
- The Design Organisation shall review the operational characteristics of any existing safety barriers for compliance with NRA TD 19 and replace those which do not satisfy the requirements of the standard.



Example Schemes

Schemes where the Risk Assessment Procedure has been considered:

1. N83 Derrymore Overlay
2. N52 Balgeeth Overlay



N83 Derrymore Overlay

Hazard - Stone Bridge Parapet



Hazard Level

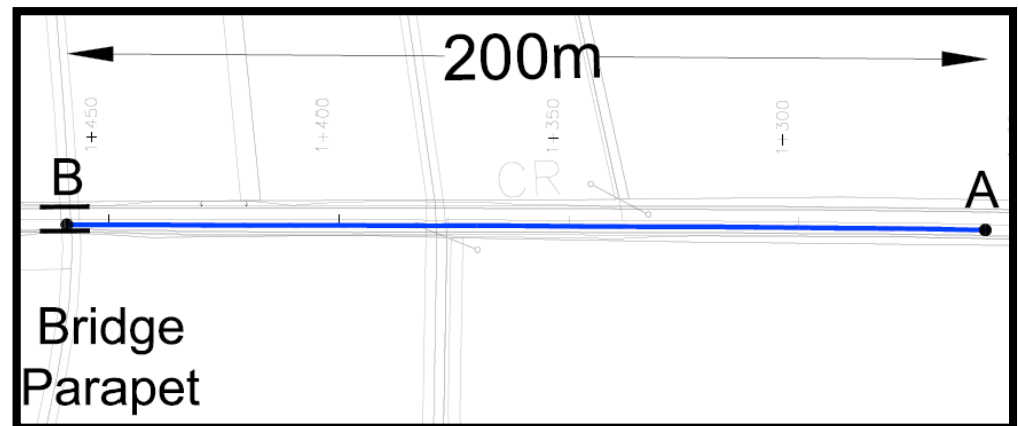
Hazard Ranking	Hazard Description
High	<ul style="list-style-type: none"> • Lighting Columns that are not passively safe. • Tubular Steel Signposts >89mm diameter by 3.2mm thick, or equivalent strength. • Wooden Poles or Posts with Cross Sectional Area > 25,000mm² that do not have breakaway features. • Trees having a girth 175mm or more measured at 1m above the ground. • Concrete posts with Cross Sectional Area > 15,000mm². • Playgrounds/Monuments and other locations of high socio-economic value.
	<ul style="list-style-type: none"> • water or likely depth > 0.6m. • Bridge Parapets, Bridge Piers, Abutments, Railing Ends, Gantry Legs • Location where errant vehicle may encroach onto road/railway which crosses or runs parallel to road. • Substantial fixed objects e.g. walls extending above the ground by more than 150mm with projections or recesses > 100mm and running parallel to the road. • Underbridges 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. • Buildings in danger of collapse. • Industrial sites with potential for explosion or chemical spill. • Rock cutting with rough face.
	<ul style="list-style-type: none"> • Steep Embankment Slopes, steeper than 1:2 and ≥0.5m height. • Embankment Slopes between 1:2 and 1:3 (inclusive) and ≥2m height. • Slopes to ditches

➤ Is Hazard within the Clear Zone?
Yes

➤ Can hazard be mitigated? No

➤ Hazard Level from Appendix D
- High

Sinuosity

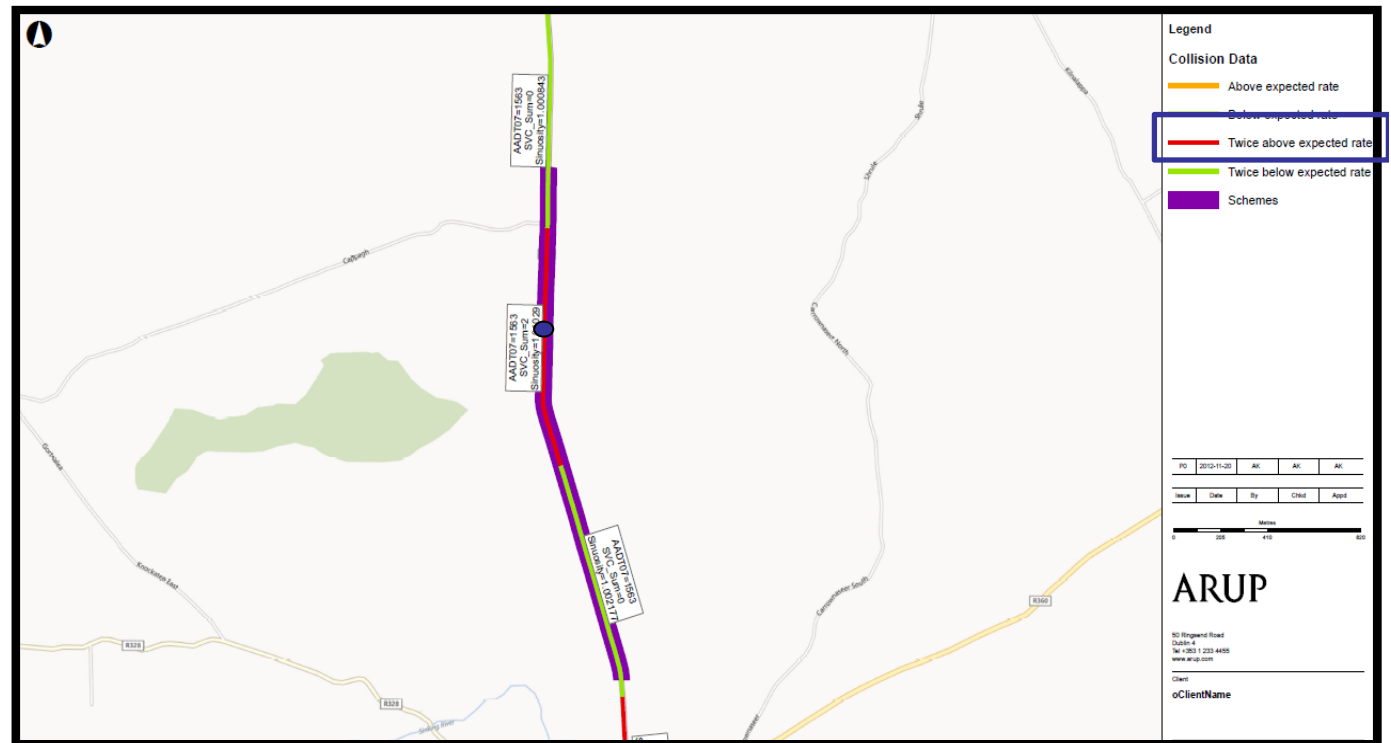


Sinuosity Index = $200\text{m}/200\text{m} = 1$
Sinuosity Ranking - Low

Collision Rate Ranking

Collision Rate
Threshold from
NRA data -
Twice above
Expected Rate

Collision Rate
Ranking - High



Risk of a Vehicle Leaving the Road

Risk of a Vehicle Leaving the Road	Collision Rate Ranking		
Sinuosity Ranking	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L

** Where H=High, M=Medium, L=Low*

Overall Risk Rating

Overall Risk Rating	Hazard Ranking		
Risk of a vehicle leaving the road	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L


** Where H=High, M=Medium, L=Low*

Overall Risk Rating

- As the overall risk rating is **high** a barrier shall be installed or the hazard shall be mitigated
- Suggested mitigation here is a P4 Terminal connected to the bridge parapet. An approach length of barrier may be necessary to protect the driver from the water hazard.



Risk Assessment Sheet

 Risk Assessment Sheet for Safety Barriers		Date: X/X/XX		Completed By: X									
		Location ID/Description: N83 <u>Derrymore</u> Overlay						Site Survey Conducted (Y/N): Y					
Hazard Type, Start and End Co-ordinates		Is Hazard within Clear Zone (Y/N)	Can the Hazard be Mitigated?	(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 to Hazard (m)	Barrier to be Installed (Y/N), Start and End Co-ordinates	Reasons for Installing / Not Installing Barrier
2	Stone Bridge Parapet Longitude 53.6374 Latitude -8.74825	Y	N	H	1.000	L	Twice Above	H	M	H		(Y) P4 Terminal Connected to bridge parapet	High Risk Location

N83 Derrymore Overlay

- Hazard - Tree of girth $>175\text{mm}$



Hazard Level

APPENDIX D: HAZARD RANKING

Hazard Ranking	Hazard Description
High	<ul style="list-style-type: none">• Lighting Columns that are not passively safe.• Tubular Steel Signposts >89mm diameter by 3.2mm thick, or equivalent strength.• Wooden Poles or Posts with Cross Sectional Area > 25,000mm² that do not have breakaway features.• Trees having a girth 175mm or more measured at 1m above the ground.• Concrete posts with Cross Sectional Area > 15,000mm²• Playgrounds/Monuments and other locations of high socio-economic value.• Water of likely depth > 0.6m.• Bridge Parapets, Bridge Piers, Abutments, Railing Ends, Gantry Legs• Location where errant vehicle may encroach onto road/railway which crosses or runs parallel to road.• Substantial fixed objects e.g. walls extending above the ground by more than 150mm with projections or recesses > 100mm and running parallel to the road.• Underbridges or retaining walls >0.5m high supporting the road, where a vehicle parapet or vehicle/pedestrian parapet of the required

- Is Hazard within the Clear Zone? Yes
- Can hazard be mitigated? Not within the landtake.
- Hazard Level from Appendix D - High

Sinuosity

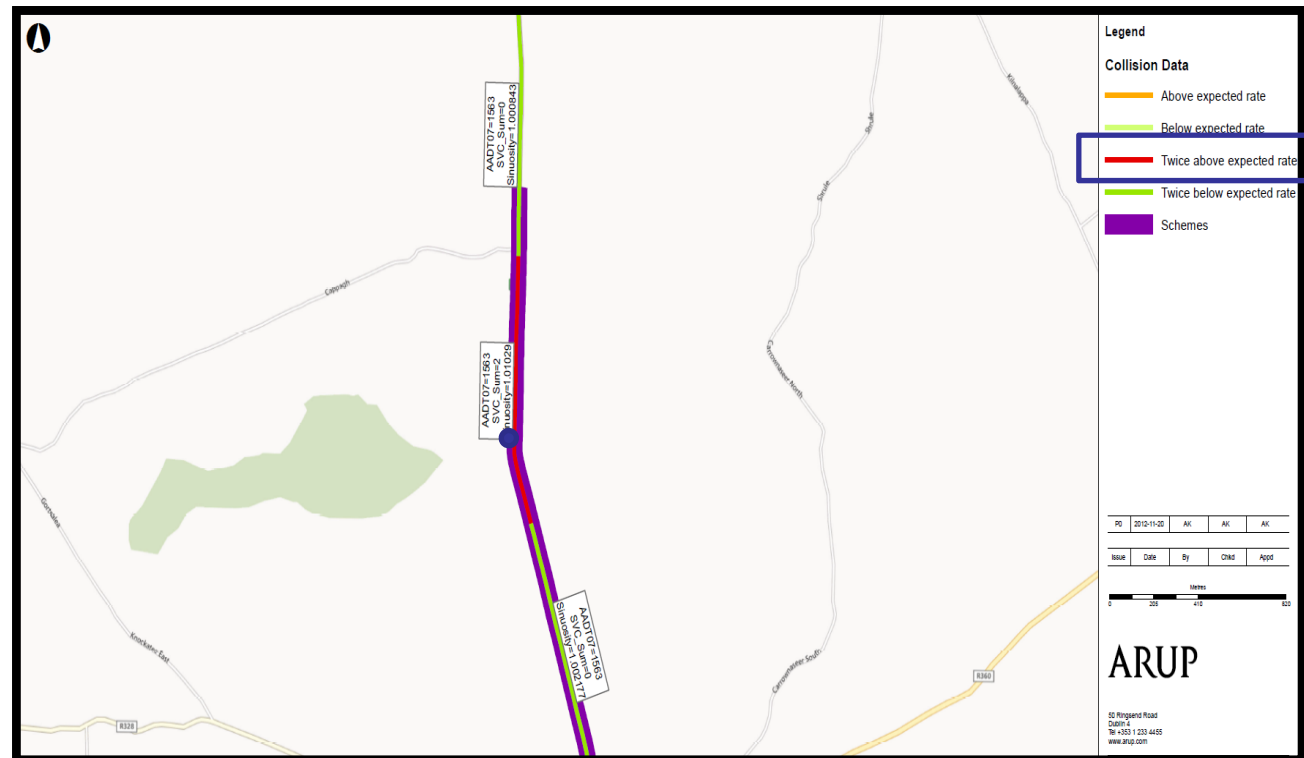


Sinuosity Index = $200\text{m}/197.843\text{m} = 1.0109$
Sinuosity Ranking - Medium

Collision Rate Ranking

Collision Rate
Threshold from
NRA data - Twice
above Expected
Rate

Collision Rate
Ranking - High



Risk of a Vehicle Leaving the Road

Risk of a Vehicle Leaving the Road	Collision Rate Ranking		
Sinuosity Ranking	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L

** Where H=High, M=Medium, L=Low*

Overall Risk Rating


Overall Risk Rating	Hazard Ranking		
Risk of a vehicle leaving the road	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L

** Where H=High, M=Medium, L=Low*

Overall Risk Rating

- As the overall risk rating is **high** a barrier shall be installed or the hazard shall be mitigated.
- Possible mitigation measure - remove the tree.

Risk Assessment Sheet

 Risk Assessment Sheet for Safety Barriers		Date: X/X/XX			Completed By: X							
		Location ID/Description: N83 <u>Derrymore Overlay</u>										
		Site Survey Conducted (Y/N): Y										
Hazard Type, Start and End Co-ordinates	Is Hazard within Clear Zone (Y/N)	Can the Hazard be Mitigated?	(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 to Hazard (m)	Barrier to be Installed (Y/N), Start and End Co-ordinates	Reasons for Installing / Not Installing Barrier
5 Isolated Tree Northbound Longitude 53.635421 Latitude -8.748403	Y	Not within Landtake	H	1.01092	M	Twice Above	H	H	H		Y Single Sided Barrier with P4 Terminal Or Remove tree	High Risk Location

N52 Balgeeth Overlay

Hazard - Eircom Pole Eastbound



N52 Balgeeth Overlay

APPENDIX D: HAZARD RANKING

Hazard Ranking	Hazard Description
High	<ul style="list-style-type: none">• Lighting Columns that are not passively safe.• Tubular Steel Signposts >89mm diameter by 3.2mm thick, or equivalent strength.• Wooden Poles or Posts with Cross Sectional Area > 25,000mm² that do not have breakaway features.• Trees having a girth 175mm or more measured at 1m above the ground.• Concrete posts with Cross Sectional Area > 15,000mm².• Playgrounds/Monuments and other locations of high socio-economic value.• Water of likely depth > 0.6m.• Bridge Parapets, Bridge Piers, Abutments, Railing Ends, Gantry Legs• Location where errant vehicle may encroach onto road/railway which crosses or runs parallel to road.• Substantial fixed objects e.g. walls extending above the ground by more than 150mm with projections or recesses > 100mm and running parallel to the road.• Underbridges 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.• Buildings in danger of collapse.• Industrial sites with potential for explosion or chemical spill.• Rock cutting with rough face.

➤ Is Hazard within the Clear Zone? Yes

➤ Can hazard be mitigated? Not within landtake

➤ Hazard Level from Appendix D - High

Sinuosity



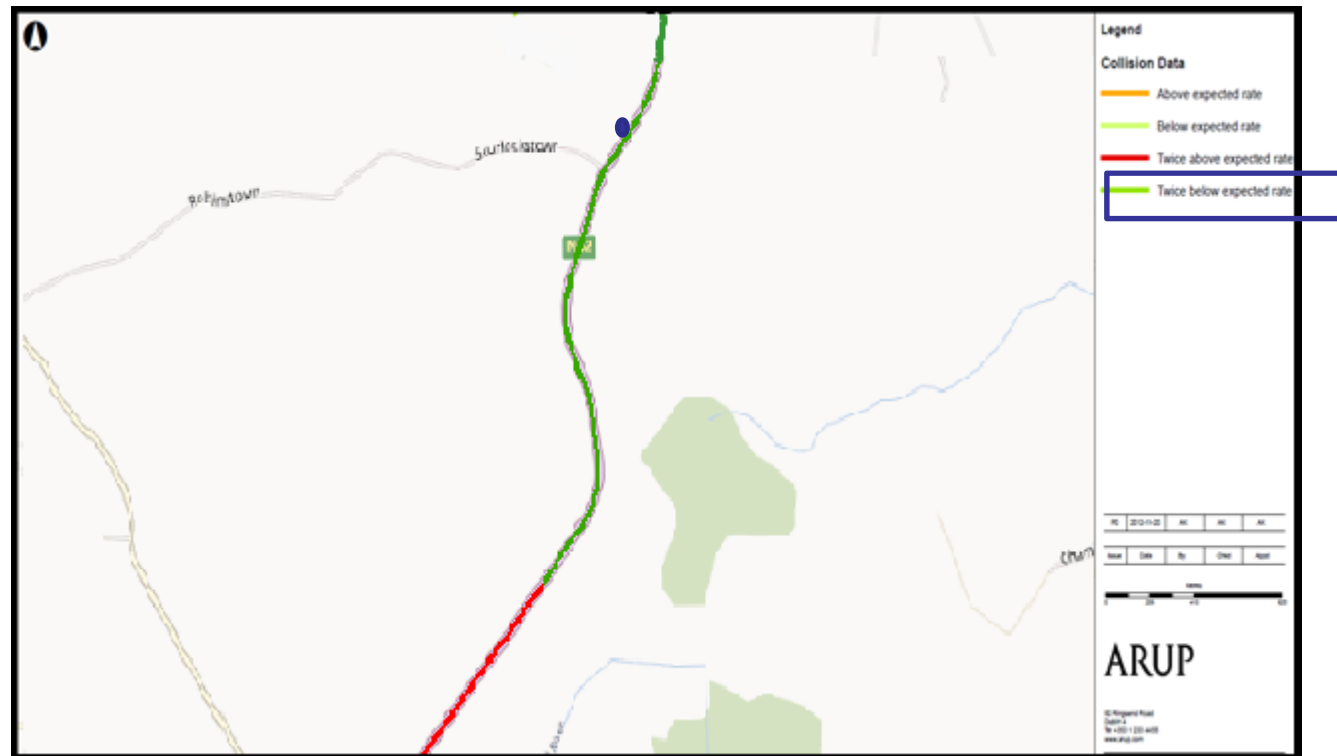
Sinuosity Index = $224.1\text{m}/222.64\text{m} = 1.00665$

Sinuosity Ranking - Medium

Collision Rate Ranking

Collision Rate
Threshold from
NRA data -
Twice Below
Expected Rate

Collision Rate
Ranking - Low



Risk of a Vehicle Leaving the Road

Risk of a Vehicle Leaving the Road	Collision Rate Ranking		
Sinuosity Ranking	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L

** Where H=High, M=Medium, L=Low*

Overall Risk Rating


Overall Risk Rating	Hazard Ranking		
Risk of a vehicle leaving the road	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L

** Where H=High, M=Medium, L=Low*

Overall Risk Rating

- As the overall risk rating is **medium** a Safety barrier shall be installed or the hazard shall be mitigated as it is within 2m of carriageway edge.
- Possible mitigation measure is to re-locate the pole.

N52 Balgeeth Overlay

 Risk Assessment Sheet for Safety Barriers		Date: X/X/XX		Completed By: X								
		Location ID/Description: N52 Balgeeth Overlay						Site Survey Conducted (Y/N): Y				
Hazard Type, Start and End Co-ordinates	Is Hazard within Clear Zone (Y/N)	Can the Hazard be Mitigated?	(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 to Hazard (m)	Barrier to be Installed (Y/N), Start and End Co- ordinates	Reasons for Installing / Not Installing Barrier
3 Eircom Pole Longitude 53.697238 Latitude -6.94411	Y	Not within Landtake	H	1.00665	M	Twice Below	L	L	M	1.9	Y Or Relocate Pole	Medium Risk Location, Hazard <2m from carriageway. Required



RISK ASSESSMENT PROCEDURE FOR SCHEMES INVOLVING ONLINE REALIGNMENT ON NATIONAL ROADS

THANK YOU

ANY QUESTIONS??

*National Roads Authority - Standards Section
Training for New Developments
April 2013*

ARUP

NRA
An tÚdarás um Bóithre Náisiúnta
National Roads Authority