

# Wrong Way Driving: Mitigation Toolkit

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## Document Control

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1.0	June 2017	Initial CHE Issue	Matthew Holt
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# 1. Introduction

## 1.1 Purpose

The purpose of this document is to provide advice on the options available to mitigate the risk of 'wrong way driving' on the Strategic Road Network (SRN) at locations where there is a higher risk of this occurring.

The advice aims to help Highways England and the supply chain prioritise sites based on risk and select appropriate mitigation measures in a hierarchical manner (starting at lower cost measures and moving up to more long-term solutions where a greater level of provision may be justified).

Following completion of site prioritisation, Step 3 (see page 6) can be used in the longer term as a general point of reference for wrong way driving mitigation measures for use on a scheme-by-scheme basis.

As part of the revision 1.2 update of this toolkit, four additional 'innovative' measures have been added (refer to Section 3), which includes a low cost 'quick win' measure in the form of full height, one sided reflective post banding.

## 1.2 Background

The term 'wrong way driving' is used to describe a vehicle being driven in the opposing direction (against the flow of traffic) along a one-way street or carriageway. In order for this to occur, the vehicle must have first turned the wrong way onto the network.

Initial research<sup>1</sup> undertaken by Road Safety Initiatives on behalf of Highways England has shown that while instances of wrong way driving on the SRN are rare, the consequences can be severe. The research reports that the average Killed or Seriously Injured (KSI) ratio for a collision on motorways and principle roads is 15%. For a collision that occurred as the result of wrong way driving, the KSI ratio is much higher at 32%.

Providing a consistent set of measures across all junctions on the SRN is unlikely to represent value for money when weighed against the overall risk of a wrong way driving collision occurring. In addition, the risk to workers involved in the construction and maintenance of new infrastructure needs to be taken into account. A safety risk assessment (in accordance with GG 104), is unlikely to support the provision of new measures if they will have a limited collision reduction benefit. A more pragmatic approach to tackling the problem is therefore required, focusing effort at locations where the risk of a motorist turning the wrong way onto the SRN is likely to be higher.

The research indicated that the majority of wrong way driving collisions occurred following the misuse of slip roads and turning the wrong way from a side road at an at-grade dual carriageway junction. Furthermore, a significant proportion of wrong way driving collisions occurred during the hours of darkness (57% compared to the SRN average of 28% for all collision types<sup>2</sup>). This information provides an understanding of where the risk of motorists turning the wrong way onto the SRN is higher and therefore where effort should be focused. The key locations are:

- 1) Unlit priority junctions on dual carriageways (including single carriageways where single lane dualling has been installed); and
- 2) At the end of an exit slip road where a priority give way arrangement is present i.e. no traffic signals.

## 1.3 Site Prioritisation and Mitigation Options

A three-step process has been developed to help guide Highways England and the supply chain through the process of identifying junctions and selecting an appropriate level of mitigation:

- Step 1 - Site Prioritisation. This involves the categorisation of sites based on the risk profile derived from the research into wrong way driving on the SRN.
- Step 2 - Junction Assessment. This involves a review of the nature of the junction to determine the likelihood of motorists misinterpreting the layout and turning the wrong way onto the SRN.
- Step 3 - Selection of Mitigation Options. This involves the selection of appropriate mitigation.

<sup>1</sup> The initial research was undertaken in February 2017 using personal injury collision data obtained from Highways England's Safety Risk Model.

<sup>2</sup> Derived from Table L.2 of the appendix to Reported Road Casualties on the Strategic Network 2015.

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## 2. Three Step Process

### Step 1: Site Prioritisation.

The first step is to categorise junctions based on the risk profile derived from the research undertaken into wrong way driving. Junctions will fall into one of three priority categories (high, medium and low). The flow chart included in Figure 1 should be followed to determine which category a particular site falls into.

In order to determine whether a site falls into the high or medium priority category, a review of historic collision data will be necessary. Detailed collision data should be used wherever possible, as determining whether collisions may have occurred as the result of wrong way driving can be difficult without the STATS19 'detailed description field' (detailed data is not typically provided by the Highways England central data team; however, it is usually available from the Local Area teams).

A review of command and control data or liaison with the local police and/or traffic officers may also assist in determining whether a collision occurred as a result of wrong way driving if this remains unclear following a review of the detailed description field. This additional information may also identify whether incidents of wrong way driving have occurred that have not resulted in a collision.

It is also important that the collision analysis captures a suitably wide area i.e. beyond the immediate vicinity of the junction. The reason for this is that a collision resulting from wrong way driving could occur some distance from the junction where a motorist may have initially turned the wrong way onto the network. The precise area to be captured will differ from junction to junction and care should be taken to ensure that the area selected for a particular junction covers a sufficiently wide area. It may be advantageous to undertake Step 1 as part of a road safety route treatment<sup>3</sup>.

#### High Priority Sites

High priority sites represent those junctions where there is likely to be the greatest risk of motorists turning the wrong way on to the SRN. Furthermore, a review of collision data will have indicated that collision(s) may have already occurred as a result of this and/or command and control data will have indicated that wrong way driving incidents have occurred that have not resulted in collisions. These sites should therefore be addressed first (before the medium and low priority sites).

#### Medium Priority sites

Medium priority sites represent those junctions where there is likely to be a greater risk of motorists turning the wrong way onto the SRN, but the collision analysis has not identified any historic collisions that may have occurred as a result of this.

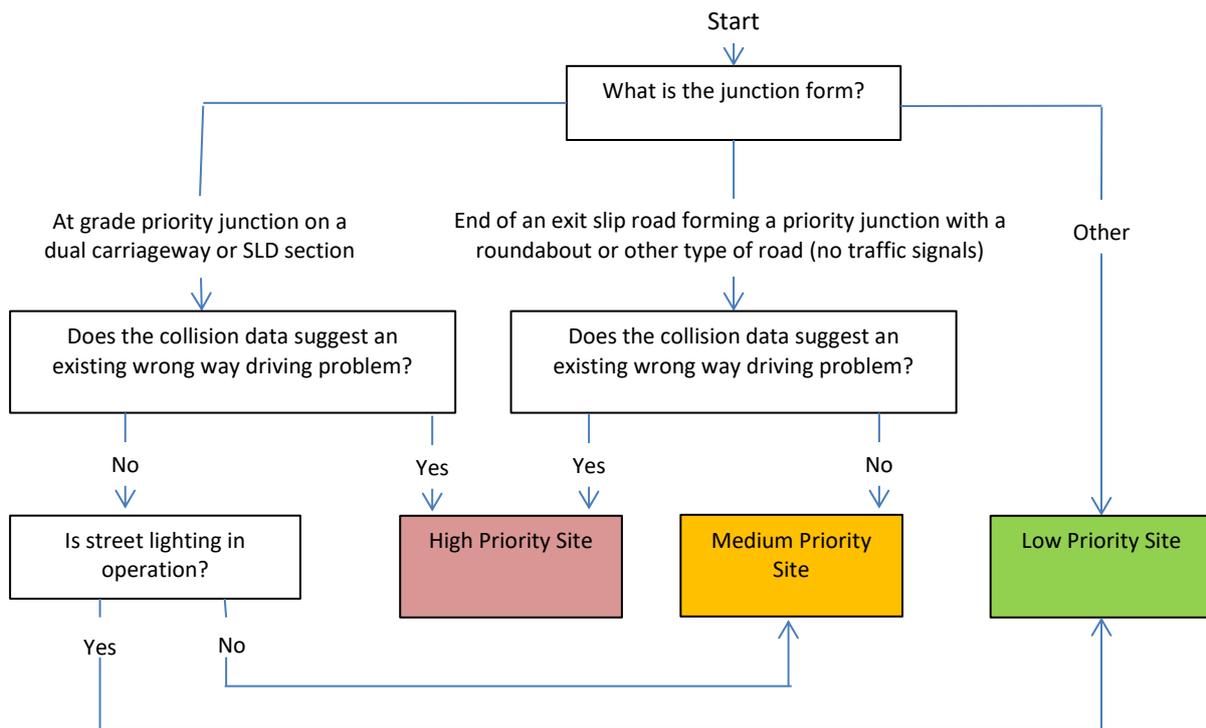
#### Low Priority Sites

At low priority sites, the risk of motorists turning the wrong way onto the SRN is likely to be low. As such, there is no immediate need to proceed to Step 2 for these junctions as effort should initially be focused on junctions that fall into the other two categories. Only when the high and medium priority sites have been addressed should low priority sites be considered further.

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<sup>3</sup> Refer to Highways England's [Guide to Road Safety Route Treatments](#) document for further information.

Figure 1 Site Prioritisation Flow Chart



## Step 2: Junction Assessment

Step 2 involves undertaking a site based review of each junction taken forward from Step 1<sup>4</sup>. This should be undertaken regardless of whether any collisions have occurred that could be contributed to wrong way driving. The purpose of this review is to gauge the actual risk of drivers turning the wrong way onto the SRN based on the physical layout of the junction in question. Specifically, the review will aim to determine what (if anything) could lead drivers to misinterpret the layout and make a wrong turn.

In order for this review to be effective, the reviewer(s) will need to have experience in the field of collision investigation and prevention. Road safety auditors would be ideal candidates to undertake the site based reviews; although this is not essential as long as the aforementioned criterion is met.

Key factors to be considered as part of the site based reviews include:

- Is the physical layout self-explanatory or is it complex, unusual and/or potentially confusing?
- Could the layout be less clear at night? As an example, a relatively featureless dual carriageway junction could be misconstrued as a single carriageway at night.
- If lighting columns are present, are they operational during the hours of darkness? If so, do they provide a sufficient level of lighting to make the layout of the junction clear?
- What are the traffic volumes? A steadier flow of traffic on the mainline will provide a better indication to turning vehicles which way they should go i.e. with the flow of traffic.
- Are features such as channelising islands present to physically direct traffic into the correct carriageway/lane?
- What is the condition of the existing features? Are they still suitable for their intended purpose?
- What is the current level of signing provision, not only at the junction but in advance of the junction (is sufficient information being provided to drivers) and are they sited correctly?
- Are there particular aspects about the location of the junction that could lend itself to a higher risk of wrong way driving e.g. a higher proportion of foreign drivers?

<sup>4</sup> As mentioned in Step 1, only the high priority or high and medium priority sites should initially be taken forward to Step 2. Only when these sites have been addressed should the low priority sites be considered further.

Following completion of this assessment, an appropriate level of mitigation (if any) can then be selected at Step 3.

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## Step 3: Selection of Mitigation Options

### Standard 'toolkit' measures

The review undertaken at Step 2 should provide a level of understanding of the risk of motorists turning the wrong way onto the SRN at a particular junction and what features (or lack of features) may be contributing to this. Alternatively, it may be that having completed the site based review, the risk of motorists misinterpreting the layout and turning the wrong way is considered very low and further intervention is not deemed necessary.

For those junctions where there is considered to be a reasonable risk of a motorist turning the wrong way onto the SRN, an appropriate level of mitigation will be necessary. Three tables have been produced outlining a variety of measures that could be introduced based on the junction form. Table 1 outlines measures for at-grade priority junctions on dual carriageways or single lane dualling sections. Table 2 outlines measures for the end of exit slip roads adjoining a non-signalised roundabout. Table 3 outlines measures for the end of exit slip roads forming a priority junction (i.e. no traffic signals) with roads other than roundabouts.

It should be noted that there are a large range of layouts for at-grade priority dual carriageway/single lane dualling junctions across the SRN. Some allow all movements in/out of the minor road while others restrict them. Table 1 includes options for all layouts and care should therefore be taken when selecting an option that it is strictly appropriate for the junction in question. For example, if motorists are able to turn left and right out of the minor road, then installing a Dia.609 turn left sign would not be appropriate, unless this was facing a dedicated left turn lane from the minor road.

In each table, the measures are presented in a hierarchical order starting with simpler and more cost effective measures (lower reference numbers), leading to more expensive, longer term solutions (higher reference numbers). In each case, the lower reference number options should be considered first and only when this is not considered adequate to mitigate the risk should the higher level options be considered. The benefits and disbenefits of each option (included in the tables) should factor into the decision making process.

For the majority of mitigation measures, a range of further enhancement options are described (column four in each table) e.g. if the base option is a traffic sign, the enhanced version could be a traffic sign with a larger x-height or a backing board. Again, whether an enhanced option may be appropriate should be considered before moving onto the higher level options<sup>5</sup>. For all options, due consideration will need to be given to competing demands such as environmental intrusion e.g. sign clutter. For example, it would not be appropriate to opt for a large sign on a backing board when a larger sign without a backing board may provide the necessary level of mitigation.

### Additional 'innovative' measures

The tables referred to above list a range of conventional mitigation options. There may be alternative options that could reduce the risk of drivers making a wrong turn onto the SRN that are equally acceptable.

With the above in mind, Highways England commissioned Pell Frischmann to undertake a study into wrong way driving mitigation measures in use across Europe and the United States of America (USA). The purpose of which was to see if there were any alternative or more innovative measures in use that could potentially be adopted in England<sup>6</sup>. From the range of measures identified, four were considered suitable for potential application in England. These measures are described in Section 3 (see page 14).

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<sup>5</sup> All the base measures and enhancements contained in the three tables fall within the remit of current DMRB standards and TSRGD 2016 (where applicable). Reference should be made to DMRB and other relevant documents (such as the Traffic Signs Manual) for detailed design requirements/advice.

<sup>6</sup> Wrong-Way Driving Assessment of Mitigation Measures – Pell Frischmann – March 2019 (report ref: RW1011852T001)

Table 1 – Mitigation options (within the remit of DMRB and TSRGD etc.) for unlit priority junctions on dual carriageways (including single lane dualing sections)

Measure	Overview	Description	Additional enhancement	Benefits	Disbenefits
<b>A</b>	Ensure Dia.606 arrow is present and in a conspicuous position.	Ensure a Dia.606 (left arrow) with 'dual carriageway' supplementary plate is located in the correct position (within the central reserve opposite the minor road entry lane).	1) A larger roundel and supplementary plate could be provided. 2) The signs could be mounted on a backing board.	A) While a Dia.606 arrow is a standard provision, an enhanced sign would be of particular benefit to older road users.	NA – provision of this sign is a minimum requirement where traffic can turn left only out of the minor road
<b>B</b>	Provide advance 'turn left' sign.	Provide an advance sign to Dia.609 back along the minor road.	As above.	A) Low cost measure. B) Can be installed relatively easily and quickly. C) Advance warning is provided, preparing motorists before they reach the decision point.	i) On narrow, rural side roads, there may be limited verge space to accommodate an advance sign. If the sign is not conspicuous it will be of limited use. ii) The location where the sign may need to be placed might be a local authority road and the relevant permission may be required.
<b>C</b>	Install 'no entry' sign	Provide a no entry sign on the mainline to the right of minor road.	1) Two signs (on each side of the carriageway could be provided). 2) A larger roundel could be provided. 3) The sign(s) could be mounted on a backing board. 4) An associated 'no entry' road marking to Dia.1046 could be provided.	A) The no entry sign is well understood and will reinforce the requirement that motorists should not proceed into the wrong carriageway. B) Low cost measure. C) Can be installed relatively easily and quickly.	i) A TRO may be required to install the no entry sign(s), which can be a lengthy process. ii) The road marking could be confusing to mainline motorists as they will not be able to read it from their direction of travel. It is also likely to wear quickly due to overrun from heavy mainline traffic flows.
<b>D</b>	Provide 'turn left' road marking	Provide 'left turn' arrow and text road marking to Dia.1036.1 in the minor road.	1) Coloured surfacing could be provided underneath the marking to enhance its conspicuity and status. 2) Complimentary lane markings to Dia.1038 (ahead arrows) could be provided on the mainline.	A) Low cost measure. B) Can be installed relatively easily and quickly.	Surface dressing could become a maintenance burden. If the quality of the surface dressing is left to deteriorate it may reduce the conspicuity of the arrow/text. This risk could be reduced by using more durable MMA surfacing, although the initial costs will be higher.
<b>E</b>	Provide regulatory ADS	Provide a map type advance direction sign that includes prohibited movements roundels.	A larger x-height could be used to improve conspicuity.	A) Relatively low cost measure. B) Can be installed relatively easily and quickly. C) The sign will provide the best possible advance warning of the junction layout ahead.	i) The ability to provide this type of sign will be limited by verge space adjacent to the minor road. If the sign is not conspicuous/legible it will be of limited use. ii) The location where the sign may need to be placed might be a local authority road.

<b>F</b>	Install traffic island(s)	Provide a traffic island (or islands) in the minor road that makes it physically difficult for motorists to turn the wrong way at the junction head (to be designed using swept path analysis).	Direction signs and additional regulatory signs could be mounted within the traffic island.	<p>A) The traffic island will physically guide motorists and make it difficult for them to go the wrong way.</p> <p>B) The traffic island provides an opportunity for additional enhancement that would otherwise not be possible.</p> <p>C) The traffic island will provide secondary safety benefits e.g. a safe haven for non-motorised users when crossing the minor road (where applicable).</p>	<p>i) Moderately expensive.</p> <p>ii) More time consuming to construct, requiring an enhanced level of design, although reduced construction time and costs could be achieved with pre-formed 'bolt down' traffic islands.</p> <p>iii) Greater level of disruption to network during construction.</p> <p>iv) If the minor road is not sufficiently wide at the junction, it may not be possible to install a traffic island within the existing cross section without widening works.</p>
<b>G</b>	Install street lighting	Illuminate the junction to provide drivers with a clearer view of the layout during darkness.	NA	<p>A) During darkness, the junction layout will be clearer, reducing the risk of drivers misinterpreting it and turning into the wrong carriageway.</p> <p>B) Street lighting is likely to have a positive impact on the wider safety performance of the junction</p>	<p>i) A wide area of street lighting would need to be installed. This will be costly and is unlikely to represent value for money, particularly when the associated costs of lighting are factored in e.g. VRS, lighting of existing signs etc.</p> <p>ii) In addition to i), if consecutive junctions are lit in isolation to the mainline, there may not be sufficient time for drivers' eyes to adjust between lit and unlit sections. This is a hazard in itself.</p> <p>iii) Likely to be viewed as an unsustainable solution, with negative environmental impact.</p> <p>iv) Ongoing maintenance implications.</p> <p>v) Connections in remote areas may be a prohibitive factor.</p> <p>vi) On national speed limit roads, the presence of a system of street lighting determines the speed limit. A defined speed limit may therefore need to be introduced which would require a TRO.</p>
<b>H</b>	Prevent right turn manoeuvre out of minor road	Upgrade or install new (as appropriate) traffic islands to direct traffic approaching the SRN to turn left only and provide associated no entry signs in the mainline gap.	<p>1) An elongated traffic island (extended back along the minor road) will deter motorists from travelling the wrong way around the island to intentionally turn right onto the SRN.</p> <p>2) Additional road markings and signing (see measures, B, D and E) could be used to enhance this</p>	<p>A) Drivers approaching the SRN are physically directed away from mistakenly turning the wrong way.</p> <p>B) The right turn out of the minor road is the most hazardous movement. Preventing it will have other significant road safety benefits.</p>	<p>i) Preventing the right turn is a high level policy decision (with cross-boundary implications) that is unlikely to be favoured by the public. It is likely to be seen as an extreme measure in relation to the risk being addressed.</p> <p>ii) Preventing the right turn will only be feasible if other suitable routes are available that will not simply 'move' the risk to another location.</p> <p>iii) Modelling would be required to understand capacity implications.</p>

			measure. This could include 'no right turn' signs (Dia.612).		iv) Very costly and disruptive to construct. Further indirect costs and associated works such as publicity, consultation and TRO(s) would be required.
<b>I</b>	Close gap in central reserve.	Close the central reserve gap to create a 'left in/left out' junction.	As measure H plus measure A	As measure H plus: A) The large traffic island can be introduced at the junction head (given there is no requirement to cater for the right turn into the minor road with this option) to further reduce the risk of motorists misinterpreting the layout. B) Unlike option 'H', it will be physically impossible for motorists to intentionally turn right from the minor road into the opposing carriageway of the major road due to the gap closure.	As measure H) but with potential further disbenefits to network capacity and greater public objection.
<b>J</b>	Convert to a left in only or right in/left in only junction.	Prevent access onto the SRN from the local road network at the junction in question to eliminate the risk of 'wrong way'.	NA	i) Full elimination of wrong way driving risk on this SRN at the junction in question. ii) Potential further safety benefits by reducing number of conflict points across SRN.	As measure H) but with potential further disbenefits to network capacity and greater public objection (over and above measure H and I)
<b>K</b>	Close access/egress to SRN	Close access entirely.	NA	As measure J but with potentially even further indirect safety benefits.	i) As measure H) but with potential further disbenefits to network capacity and greater public objection (over and above measure H, I and J) ii) This option has the greatest chance of creating a more significant road safety problem at another junction due to the displacement of all traffic flows.

**Table 2 – Mitigation options (within the remit of DMRB and TSRGD etc.) for the end of exit slip roads joining a non-signalised roundabout**

Measure	Overview	Description	Additional enhancement	Benefits	Disbenefits
<b>A</b>	Install 'no entry' sign	Provide a no entry sign at the end of the slip road.	1) Two signs (one each side of the carriageway could be provided) at the end of slip road. 2) A larger roundel could be provided. 3) The sign(s) could be mounted on a backing board. 4) An associated 'no entry' road marking to Dia.1046 could be provided.	A) The no entry sign is well understood and will reinforce the requirement that motorists should not proceed into an exit slip road. B) Low cost measure. C) Can be installed relatively easily and quickly.	i) A TRO may be required to install the no entry sign(s), which can be a lengthy process. ii) The road marking may wear quickly due to overrun as it will be placed at a location where traffic will braking / accelerating frequently (this issue could be reduced by using more durable MMA road markings, although the initial costs will be higher)
<b>B</b>	Provide enhanced deflection by introducing hatching	Introduce hatching (where possible) to deflect passing motorists away from the slip road. The hatching will make it clearer to motorists that they must not enter the exit slip.	1) Wider road markings could be used. 2) Coloured surfacing could be used to enhance the hatching.	A) Low cost measure. B) Can be installed relatively easily and quickly.	i) As the hatching will not provide physical deflection, its usefulness will rely on motorists understanding and complying with it on a voluntary basis. Its effectiveness will therefore be less than physical deflection. It will also not make intentional non-compliance any more difficult. ii) Use of surface dressing will require a greater level of ongoing maintenance. This issue could be reduced by using more durable MMA surfacing, although the initial costs will be higher.
<b>C</b>	Provide enhanced, physical deflection	Provide greater deflection (where possible) past the slip road by altering the nearside kerb line. This will make it more difficult for motorists to turn into the exit slip.	NA	i) Relatively low cost and only a small amount of network disruption during construction.	i) While relatively low cost, this measure will require an enhanced level of design.
<b>D</b>	Install street lighting	Illuminate the junction to provide drivers with a clearer view of the layout during darkness.	NA	A) During darkness, the junction layout will be clearer, reducing the risk of drivers misinterpreting it and	i) A wide area of street lighting would need to be installed. This will be costly and is unlikely to represent value for money, particularly when the

turning the wrong way into the exit slip road.  
B) Street lighting is likely to have a positive impact on the wider safety performance of the junction

associated costs of lighting are factored in e.g. VRS, lighting of existing signs etc.  
ii) Likely to be viewed as an unsustainable solution, with negative environmental impact. Check required with current Highways England Street lighting policy.  
iii) Ongoing maintenance implications.  
iv) Connections in remote areas may be a prohibitive factor.  
v) On national speed limit roads, the presence of a system of street lighting determines the speed limit. A defined speed limit may therefore need to be introduced, which would require a TRO.

**Table 3 – Mitigation options (within the remit of DMRB and TSRGD etc.) for the end of exit slip roads forming a priority junction (no traffic signals) with roads other than roundabouts**

Measure	Overview	Description	Additional enhancement	Benefits	Disbenefits
<b>A</b>	Renew existing give-way markings (where applicable)	Refresh the existing give-way markings at the end of the slip road to make the division between the mainline and slip road clearer for mainline traffic.	Wider profile markings could be introduced.	A) Low cost B) Motorists typically understand they should not pass the wrong way over a give way marking	NA
<b>B</b>	Enhance existing 'no entry' signs	Provide two no entry signs (one on either side of the slip road orientated towards approaching traffic). If there are already two existing no entry signs, ensure that they are orientated so both mainline traffic flows have a clear view of a sign.	1) A larger roundel could be provided. 2) The sign(s) could be mounted on a backing board. 3) An associated 'no entry' road marking to Dia.1046 could be provided.	A) The no entry sign is well understood and will reinforce the requirement that motorists should not proceed into the exit slip road. B) Low cost measure. C) Can be installed relatively easily and quickly.	i) A TRO may be required to install no entry sign(s) if they are not already present, which can be a lengthy process. ii) The road marking is likely to wear quickly due to overrun as it will be placed at a location where traffic will braking / accelerating frequently (this issue could be reduced by using more durable MMA road markings, although the initial costs will be higher).
<b>C</b>	Provide additional regulatory signing along the mainline	Install 'no left/right turn signs' (Dia.612/613) or ahead only signs (Dia.606) on the mainline.	1) A larger roundel could be provided. 2) The sign(s) could be mounted on a backing board. 3) An associated 'ahead only' road marking to Dia.1036.2 and/or ahead arrows could be provided on each mainline approach.	A) Low cost measure. B) Can be installed relatively easily and quickly. C) Advance warning prepares motorists before they reach the decision point.	i) The location where the sign may need to be placed might be a local authority road. ii) If there are other closely spaced junctions, advanced signing could be confusing if not designed appropriately.
<b>D</b>	Provide regulatory ADS	As an alternative or supplementary option to measure C, provide a map type advance direction sign on each mainline approach to the slip that includes prohibited movements roundels.	A larger x-height could be used to improve conspicuity.	A) Relatively low cost measure. B) Can be installed relatively easily and quickly. C) The sign will provide the best possible advance warning of the junction layout ahead.	i) The ability to provide such a sign will be limited by verge space adjacent to the mainline road. If the sign is not conspicuous it will be of limited use. This will need to be considered when deciding whether to install this measure. ii) The location where the sign may need to be placed might be a local authority road.

<b>E</b>	Install street lighting	Illuminate the junction to provide drivers with a clearer view of the layout during darkness.	NA	<p>A) During darkness, the junction layout will be clearer, reducing the risk of drivers misinterpreting it and turning the wrong way into the exit slip road.</p> <p>B) Street lighting is likely to have a positive impact on the wider safety performance of the junction</p>	<p>i) A wide area of street lighting would need to be installed. This will be costly and is unlikely to represent value for money, particularly when the associated costs of lighting are factored in e.g. VRS, lighting of existing signs etc.</p> <p>ii) Likely to be viewed as an unsustainable solution, with negative environmental impact.</p> <p>iii) Ongoing maintenance implications.</p> <p>iv) Connections in remote areas may be a prohibitive factor.</p> <p>v) On national speed limit roads, the presence of a system of street lighting determines the speed limit. A defined speed limit may therefore need to be introduced, which would require a TRO.</p>
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### 3. Additional 'innovative' measures

This section describes four additional measures that have been used in either the USA or Europe to help mitigate the risk wrong way driving. These measures can be used to complement/enhance the more conventional measures described in Tables 1 to 3 above.

#### A) Full height, one sided reflective post banding

In the USA, full height reflective post banding is sometimes added to a traffic sign post to make the overall assembly more conspicuous. While TSRGD 2016 does not permit this in England, the Department for Transport has authorised full height, one sided reflective post banding for use on Highways England's network for the purpose of mitigating wrong way driving.

The authorisation, which prescribes the conditions for use of the banding, is available via this link:

<http://assets.dft.gov.uk/trafficauths/case-4922.pdf>

#### B) Secondary pair of 'no entry' signs

This measure involves placing a secondary pair of no entry signs further down a slip road. At the point where drivers can see the secondary no entry signs, they will have already turned the wrong way onto the network, but this measure offers a second opportunity to inform drivers that they are going the wrong way.

A secondary pair of no entry signs will not prevent wrong way driving, but the measure might prevent wrong way driving from continuing. It is therefore essential that this measure is only used to complement a suite of other wrong way driving mitigation measures.

A secondary pair of no entry signs can only be provided if there are no entry sign(s) at the top of the slip road supported by a traffic regulation order. In this case, the Department for Transport has confirmed that no further or amended traffic regulation order is required to provide the secondary pair of signs.

Figure 3 - Example of a secondary pair of 'no entry' signs in Europe



Figure 2 - Example reflective post banding in use in the USA



### C) Reduced mounting height of signs

A research study undertaken in Texas, USA, found that the focus of older drivers and those impaired by alcohol/drugs tended to be lower than younger or unimpaired drivers. The study found that signs mounted at 2m or higher are generally outside of the peripheral view of older/impaired drivers.

Signs mounted lower than 2m could mitigate them being 'missed' by elderly or impaired drivers and may also prove to be more conspicuous at night due to them being more in line with a car's headlights. Notwithstanding this, reducing the mounting heights of signs is generally counterintuitive when it comes to sign conspicuity and it is recommended that reduced height signs are limited only to additional signs (over and above those mounted at conventional heights) or specific, additional measures such as the 'secondary pair of no entry' signs described above in 'b'.

In the UK, signs can be mounted at a minimum height of 900mm; however, such low mounting heights are not suitable where footways are present. Lower mounting heights may also prevent an assembly from being deemed passively safe, could be at greater risk of soiling from the spray from passing vehicles and if used in/near soft areas could be at risk of obscuration from plant growth. These factors will need to be considered when determining whether reduced mounting heights are appropriate for a given site.

### D) Refuge areas

This measure involves providing space in the verge for a vehicle that has turned the wrong way onto the network to either take refuge or turn around. This feature could be used on a slip road or within a large traffic island of a compact grade separated junction.

The inclusion of a refuge area will always need to be done in conjunction with other measures. This is because a refuge area is not a prevention measure in its own right. Measures at the top of a slip road (for example) are most important to reduce the risk of a wrong way driving incident in the first place; however, if a motorist has turned the wrong way onto a slip road, a secondary pair of no entry signs (see 'b' above) might be the measure that prevents that motorists from continuing in the wrong direction. At this point a refuge area could provide space to turn or take refuge.

A refuge area could be as simple as a providing an even and unobstructed area in the verge, or the creation of a semi-hardened verge (using grasscete for example).

Where there is continuous safety barrier, it might be possible to remove/relocate those roadside features that are being protected by the system to allow for its removal and therefore the creation of a refuge area. This may result in a 'gap' in-between an otherwise continuous barrier. Any proposals to provide a refuge area by means of modification to a barrier will therefore need ensure that the requirements of DMRB CD 377: requirements for road restraint systems are not contravened (i.e. a break in a barrier does not prevent a compliant system from being installed or specific road side hazards from being protected).

In addition to the above, the termination and recommencement of a barrier might result in the need for additional barrier terminals. Terminals are generally considered more hazardous than a continuous section of barrier; therefore, any proposal for a refuge area by means of modification to a barrier will need to ensure that there is a net safety benefit by considering site specific hazards/risk in line with GG 104: Safety Risk Assessment.

**Figure 4 - Example of reduced mounting height sign in use in the USA (note this sign type is not permitted in the UK)**

