

Guidelines for Assessing Locations for New Roadside Utility Poles in Rural Areas

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Abstract

This document describes the process and the technical guidelines for selecting the locations to site NBI poles on certain public roads and the site-specific data set to be assembled to support an application for a Section 254 licence for the placement of a pole.

NBI Reference Documents

- SDMG_NTD_001_Technical_Design_Rules
- SDMG_NTD_002_NBI_LLD_Design_Data_Model
- PRG_NTD_001_NBI_Physical_Logical_Inventory_Naming_Convention
- WIG_NTD_001_Design_Survey_Scope

Sign-Off

Name	Role	Sign-off	Date
Emmet O'Connell	Director of Network Technology	EO'C	17/6/21
Pat O'Toole	Director of Network Deployment	PO'T	17/6/21
John Holland	Director of Network Operations	JH	17/6/21
John Power	Director of Information Technology	JP	17/6/21
Donald Fagan	Design Production Manager	DF	17/6/21

Distribution

Network Technology (NBI-I), Network Operations (NBI-I), Information Technology (NBI-I), Design team (NBI-D), Build team (NBI-D), Design Contractors, Build Contractors.

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Document Control

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1 Introduction

1.1 Document Purpose

Objectives

This document considers the road safety aspects of the erection of poles within the existing roadside verge in the context of National Broadband Ireland's (NBI) design, deployment and operation of its telecommunications network under the National Broadband Plan (NBP).

This document has been prepared by NBI for the purposes of setting out a guideline methodology for its survey and design teams to assist in assessing the suitability of a location at which a new pole is proposed.

The document is intended to inform the selection and evaluation of pole locations which are submitted to Local Authorities as part of an application for consent to erect above ground infrastructure.

NBI is appreciative of the assistance provided by the RMO, LGMA, CCMA and Local Authorities in the development of this document to support the Government objectives set out in the National Broadband Plan.

Scope

The guidelines relate to rural roads of non-National classification only, with posted speed limits of up to 80km/h.

1.2 National Broadband Plan

The NBP rollout programme is a key enabler of government strategy across a number of policy areas. Covering 96% of Ireland's land mass, the Intervention Area includes over 544,000 premises including newly built premises in the Intervention Area since the contract was awarded. It will bring high-speed broadband with a minimum download speed of 500Mbps to around 23% of Ireland's population, including 69% of farms, through approximately 140,000 km of fibre cable, 1.6 million poles, and over 15,000 km of underground duct networks.

The NBP will ensure that all people and businesses have access to high-speed broadband, no matter where they live or work. Once completed, all parts of Ireland will have access to a modern and reliable broadband network, capable of supporting the communications, information, education and entertainment requirements of current and future generations.

The Covid pandemic has reinforced the need for access to high speed-broadband in rural areas and so has brought an increased imperative for the rapid rollout of the NBP network. Long-term working and living arrangements are being altered as a result of the Covid pandemic, including in ways that will

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facilitate more balanced regional development. The positive benefits of these changes will, however, only be fully realised if high-speed broadband services are available in the areas to which people wish to move.

1.2.1 Project Phases

From an infrastructure perspective the NBP consists of two distinct phases.

The **Network Deployment phase** is expected to take up to seven years and comprises the Design and Construction of the fibre network to facilitate the availability of high speed-broadband to the 544,000 premises in the Intervention Area (i.e. those premises which are served by the NBP).

The **Network Connections phase** of the project commences as soon as the first premises is passed by the NBP network and is available for customer connections. This phase runs for at least the 25 years of the NBP contract and provides for the connection of customers and the operation & maintenance of the network.

1.2.2 Infrastructure Preference

The NBP has been designed as a fibre-to-the-home (FTTH) network, meaning that each premises within the Intervention Area will be connected with individual, directly connected fibre-optic cables. The NBP has been designed to achieve its objectives in a cost-effective manner, as the State is providing funding to the project through the provision of significant levels of public subsidy. Because of this, a key objective of the project is to manage the cost to the State by using the most cost-effective network deployment strategies.

This value-for-money imperative drives key design principles underpinning the NBP network deployment. In particular, it requires, where available, the re-use of existing infrastructure and, in situations where new infrastructure must be deployed, that the most cost-effective deployment solutions are employed.

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1.2.3 Reuse of existing infrastructure

Under State Aid rules, the use of existing infrastructure is mandated where such infrastructure is available. Additionally, making the maximum possible usage of existing infrastructure in rolling out new high-capacity broadband networks was specifically envisioned by the European Commission in its Broadband Cost Reduction Directive (BCRD), which was transposed into Irish law as the Broadband Cost Reduction Regulations (SI No. 391 of 2016).

The NBP network design makes substantial use of existing telecommunications infrastructure assets including overhead infrastructure (poles) and underground infrastructure (ducts) currently owned or managed by Open eir and or enet. The high-level design undertaken by NBI suggests that up to 90% of the network route can be constructed using existing infrastructure during the Network Deployment phase.

In terms of pole infrastructure, while approximately 1.6 million poles are required to complete the project, including the Network Deployment phase during years 1-7 and the subsequent Network Connections phase over the full 25 years, only 17% of the total pole infrastructure are new poles. The split between new and existing pole infrastructure is shown in Figure 1 below.

It is worth noting that a significant percentage of the new Network Connection poles will be located in private property where they serve a single premises, reducing the number of instances of new pole infrastructure being located in the verge of public roadways.

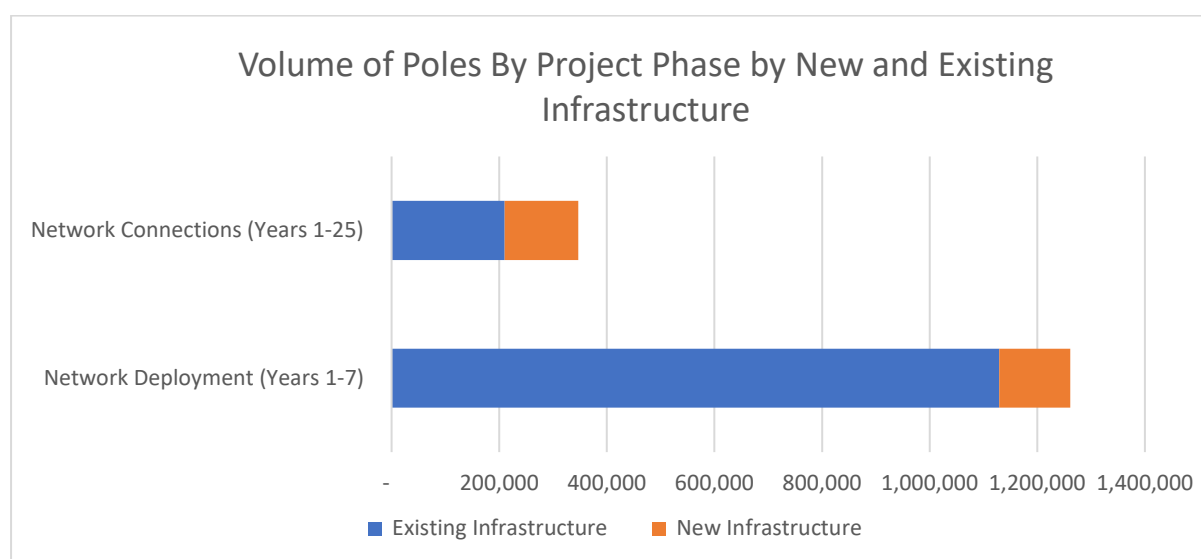


Figure 1 Volume of Poles By Project Phase by New and Existing Infrastructure

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1.2.4 Cost-effective deployment of new infrastructure

A key driver of cost within the project is the installation of new infrastructure where existing poles and ducts are not available. The construction of overhead infrastructure is significantly more cost-effective than the installation of new underground infrastructure. It is at least five times more expensive to install underground infrastructure per metre of route than it is to deploy a new pole route, with the potential to add in excess of €300 million to the project costs. Such use of public funds would not be in line with the required value-for-money principles that underpin the NBP project. For this reason NBI has prioritised the placement of new overhead infrastructure relative to the construction of new, more expensive underground routes.

The figures below highlight the percentage splits between overground and underground infrastructure during both the Network Deployment and Network Connections phase of the project. This reflects the significant above ground infrastructure which is already in-situ across rural Ireland today and which is available for re-use by NBI.

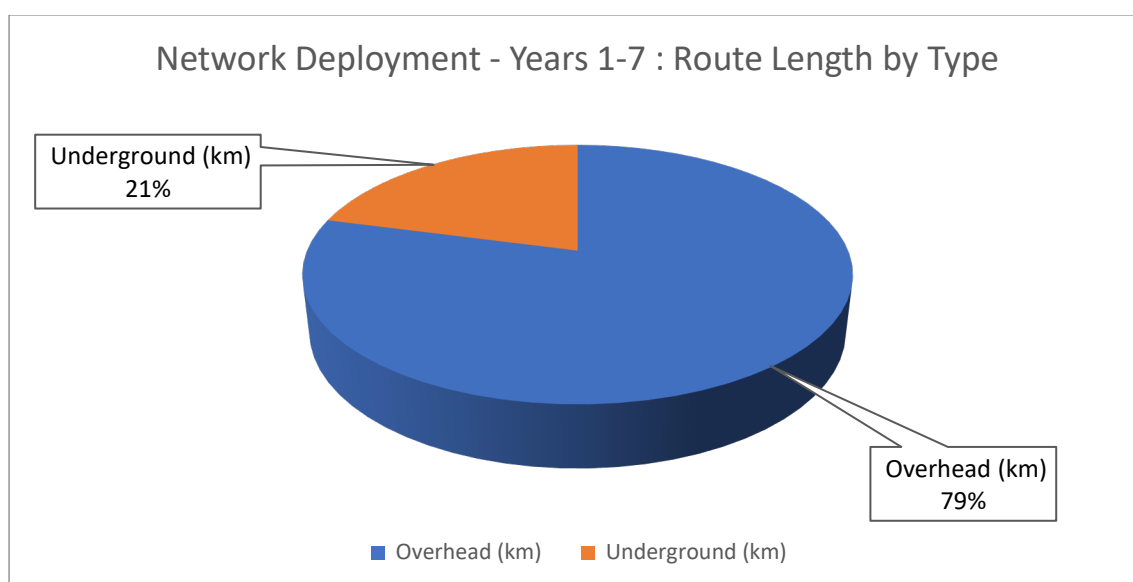


Figure 2 Network Deployment (Years 1-7) Route Length by Type

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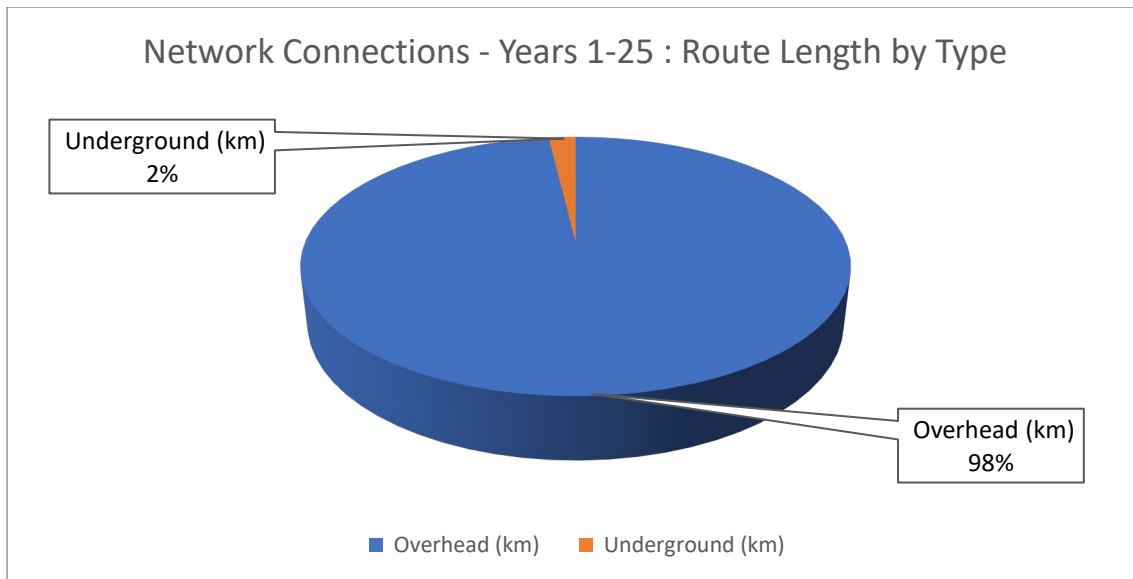


Figure 3 Network Connections (Years 1-25) Route Length by Type

1.2.5 Road Safety

The established preference for utilities is to locate any infrastructure serving more than one customer in a public space (i.e. the roadway verge) to facilitate access for operations and maintenance purposes. Having regard to the principles described above - Reuse of Existing Infrastructure and the Cost-Effective Installation of New Infrastructure - NBI has developed these Guidelines to ensure that road safety is the primary driver of the actual placement of overhead infrastructure when placed within the verge of public roadways and that its designers have taken account of all necessary road safety aspects of pole placement in their design choices. In doing so, the object has been to strike a balance between the required value-for-money objectives of the NBP project (i.e. deploy overground infrastructure where possible) and other appropriate policy aims relating to the installation of overhead infrastructure.

The purpose of these Guidelines is to clarify NBI's proposed design choices from a road safety perspective for the placement of overhead infrastructure and to inform local authorities and other interested parties in this regard.

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1.2.6 Rural Network

The NBP project is predominantly but not exclusively a rural initiative. These Guidelines relate to rural roads of non-National classification only.

1.2.7 Infill

In the majority of cases NBI pole placements are in-fill in nature. That is, they comprise singular or short runs of single digit pole placements required to transition between existing pole infrastructure or to secure an end customer connection in a situation where no existing overhead infrastructure is in place. Figure 4 Sample Deployment Area - Existing and Proposed Pole Infrastructure below illustrates the in-fill nature of a typical deployment area pole placement. In assessing any proposed new pole location, the existence of the existing pole infrastructure will be considered and whether the proposed alternative location introduces a new hazard.

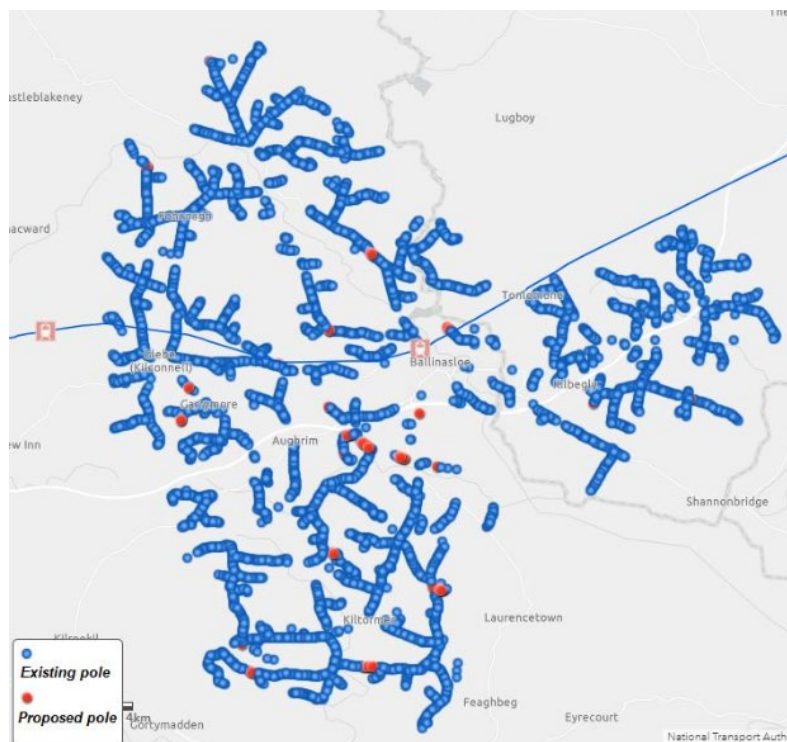


Figure 4 Sample Deployment Area - Existing and Proposed Pole Infrastructure

1.2.8 Other Considerations

While other considerations, including those relating to planning and the environment, are considered in choosing a pole location, they are outside the scope of this document.

Any safety or traffic control issues related to construction works are excluded from this document and compliance with statutory obligations as well as local authority licence conditions and directions will be required.

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2 NBI Pole Location Methodology

2.1 Development of the Methodology

The established preference for utilities is to locate any infrastructure serving more than one customer in a public space to facilitate access for operations and maintenance purposes. Applications for licences for above ground infrastructure fall under the Planning and Development Act 2000, specifically Section S254 which provides for the ‘licencing of appliances and cables, etc.’ on public roads.

Following engagement with local authorities in relation to the issue of road opening licences for the initial Deployment Areas being constructed by NBI it was found that there was a need to develop a nationally applicable, scalable and repeatable methodology which could facilitate the volume of above ground licence applications required under the NBP on an equivalent basis to the process for seeking road licences for below ground infrastructure via the Road Management Office’s online MRL system.

This methodology – including the selection by NBI and subsequent review by the relevant local authority – is intended to be as objective and repeatable as possible given the scale and the required speed of deployment of the NBP network. It is also intended to facilitate a desk-based assessment using available information and resources to objectively determine the suitability of a proposed location for a new pole.

It is intended that the road safety considerations in relation to pole locations would form part of the proposed S254 licence application and ensure a consistent licencing regime across all participating local authorities.

Facilitated by the RMO and LGMA, an initial draft of these Guidelines was presented to the CCMA’s Land Use & Transport working group for review in September 2020. In addition to considering the feedback from the working group a trial was initiated with Cavan County Council to cover NBI’s deployment area reference No. 25 which covers an area to the North-East of Cavan.

The purpose of the trial was threefold:

- 1) To validate the application of the guidelines in the field,
- 2) To provide real world learnings for the process in terms of issues encountered in the field, and
- 3) To inform the nature and extent of the information required by a Local Authority in any subsequent licence application.

Following the trial in Cavan, further applications were made in early 2021 and a number of S254 Licences issued across Local Authority Areas including Counties Cork, Galway, Clare, Monaghan, Roscommon and Limerick.

This document is a working document and is intended to be updated on foot of learnings over the course of NBI’s Network Deployment and subsequent Network Connections.

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2.2 Methodology

The NBI process for assessing the suitability of locations for new NBI poles is set out in Figure 5 below.

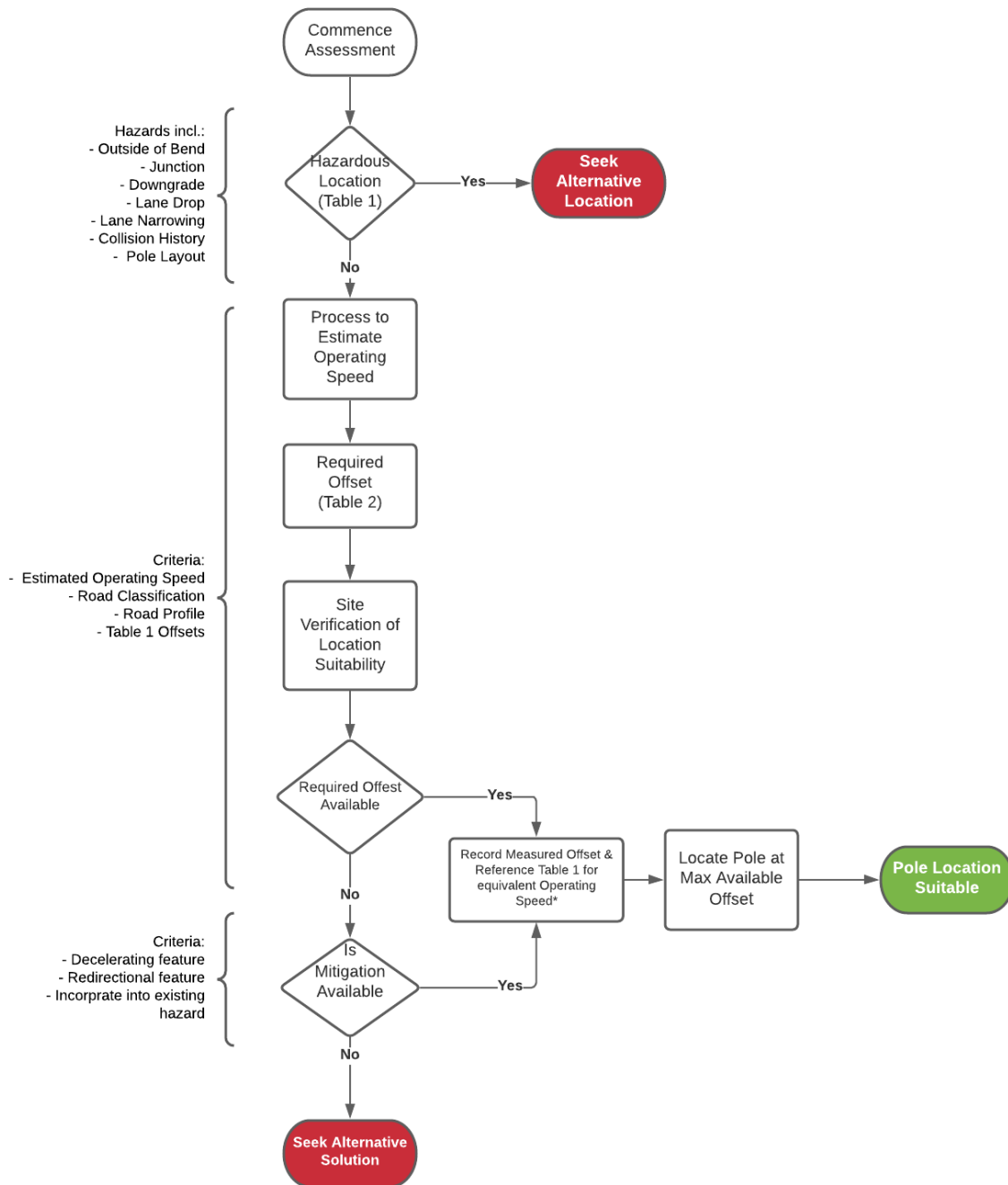


Figure 5 Flowchart for Assessing Suitability of Locations for New NBI Poles

The following approach is taken when assessing the suitability of a location for the placement of new pole infrastructure:

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1. Designers should assess the suitability of a location based on **Table 1 Assessment Methodology for Locations of NBI Poles** which seeks to avoid the placement of poles at hazardous locations.
2. NBI calculates the estimated Operating Speed¹ as set out in **Appendix 3 Estimating Operating Speed and Offset**.
3. The required offset for a pole from the edge of the carriageway shall be determined by reference to **Table 2 Offsets for Locating Poles** utilising a combination of estimated Operating Speed, Road Classification and Road Geometry
4. For the avoidance of doubt **Table 2 Offsets for Locating Poles** is limited in its application to Regional and Local roads only in a rural setting. It does not apply to National roads or urban areas.
5. Poles should be erected at the maximum available offset available where this is greater than that highlighted in **Table 2 Offsets for Locating Poles**.
6. An onsite verification of the offset and appropriateness of pole the location is conducted.
8. The measured offset is recorded.
9. If during site verification the measured offset is found to be less than the required offset the pole location shall be deemed unsuitable unless mitigations exist which would reduce the required offset.
10. Notwithstanding note 5 above and recognising the in-fill nature of the NBI new pole infrastructure, where a new pole is being added to an existing line of poles the new pole may be located in line with these poles such that the spatial relationship of the existing pole network to the road profile is not altered.
11. Poles spacings should be maximised where possible to limit their number.
12. Where the guidelines indicate that the location of a pole is not feasible, alternative solutions will be required, which may include underground infrastructure or use of private wayleaves.

Photographs

1. To assist in the assessment of Local Authority licence applications photographs of each proposed pole location are to be taken. A minimum of two photographs are to be provided showing 1. the pole location from the driving direction and 2. the proposed location.
2. Where relevant the photograph should also provide sufficient visibility of the pole surroundings to provide a context for the location.
3. The pole location should be marked by a cone at the roadside and a 2-metre red/white ranging rod at the proposed offset location.

¹ "Operating Speed" is the speed at which drivers are observed operating their vehicles. The 85th percentile of a sample of observed speeds is the most frequently used descriptive statistic for the operating speed associated with a particular location or geometric feature. *Fitzpatrick et al., 1995*

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Table 1 Assessment Methodology for Locations of NBI Poles

Ref	Overall Description	Sub-Description 1	Sub-Description 2	Action	Rationale	Comments
1	Hazardous Location Check	Outside of bend	Bend of radius below des. min. in TII Standards	Move poles to inside of the bend	40% of collisions on curves	In an in-fill situation consider consulting with road collision database
2		Junctions		No poles within 10m of a junction Avoid T-junctions Maximise sight lines	30% of collisions at intersections	
3		Down grade	Steep roads with gradients > TII standard	Poles on upgrade side of the road only		
4		Road narrowing	Where carriageway narrows or shoulder / strip ends	No poles at narrowing's		A narrowing is not the roadway / verge either side of an entrance
5		Lane drop	e.g. end of acceleration lane or end of climbing lane	No poles at lane drop		
6	Collision Location	One or more collisions of any type at the location		Avoid location if possible (consult if not).	Drivers exposed to collision risk take evasive actions leading to increased likelihood of pole collisions.	If omitting poles at the location seems unwarranted, confer with the Local Authority.
7	Pole Layout	Poles on both sides of the road		Poles on one side of road only	One side of the road should be free to allow the driver to take safe evasive action.	
8		Pole spacing		Maximise pole spacing / cable span		40-50m is the standard spacing between poles. Pole span can be increased up to 70m if required
9		Guy wires		Avoid use of guy wires		Further assessment of guy wires is required

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Ref	Overall Description	Sub-Description 1	Sub-Description 2	Action	Rationale	Comments
10	Offset	Verge width exceeds the Table 2 offset		Subject to the minimum offset erect the pole at the boundary.	This deals with second (random) 50% of collisions	Offset measured from road edge. Example of boundary positioning: where Table 2 offset is 2m but boundary is 3.2m, pole located at boundary, not 2 m.
11		Verge width is less than as set out in Table 2 of these Guidelines	Pole can be incorporated within an existing permanent hazard of equal severity ranking such that it does not increase risk	Subject to the minimum offset (adjusted by up to 50%) erect the pole where shielded by or aligned with the existing hazard	Direct impact mitigated by integration with existing hazard of equivalent or greater risk	Consideration to be given to likelihood of existing hazard being removed in due course
12			Pole can be incorporated behind or in a permanent feature including a bank that would re-direct or decelerate an errant vehicle such that it would mitigate a direct impact with the pole	Subject to the minimum offset (adjusted by up to 50%) erect the pole behind or within (as appropriate) the re-directional or deceleration feature	Errant vehicle will be redirected or decelerated prior to a pole collision	Consideration to be given to likelihood of existing hazard being removed in due course
13	Other options if standard pole within verge is not feasible	Passive pole		Erect at boundary	Risk reduction	Passive pole unavailable at reasonable cost
14		Undergrounding			Risk removal	
15		Wayleave / easement			Risk reduction by relocation	Subject to landowner consent
16	Operational Check					If poles are struck, safety should be reviewed, and pole relocated if advisable

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Table 2 Offsets for Locating Poles

Operating speed	Road Classification	Offset based on Road Cross Section Assessment with No		
		Flat[2]	Fore slope (FILL)	Backslope (CUT)
Up to 40 km/hr	Local Tertiary	1.2 m	1.5 m	1.2 m
	Local Secondary	1.5 m	2 m	1.2 m
	Local Primary	2 m	2.5 m	1.5 m
	Regional	-	-	-
40 to 49 km /hr	Local Tertiary	1.5 m	2 m	1.5 m
	Local Secondary	2 m	2.5 m	1.5 m
	Local Primary	2.5 m	3 m	2 m
	Regional	3 m	3.5 m	2.5 m
50 to 59 km/hr	Local Tertiary	2 m	2.5 m	2 m
	Local Secondary	2.5 m	3 m	2 m
	Local Primary	3 m	3.5 m	2.5 m
	Regional	3.5 m	4 m	3 m
60 to 69 km/hr	Local Tertiary	2.5 m	3 m	2.5 m
	Local Secondary	3 m	3.5 m	2.5 m
	Local Primary	3.5 m	4 m	3 m
	Regional	4 m	4.5 m	3.5 m
70 to 80 km/hr	Local Tertiary	3 m	3.5 m	3 m
	Local Secondary	3.5 m	4 m	3 m
	Local Primary	4 m	4.5 m	3.5 m
	Regional	4.5 m	5 m	4 m
>80 km/hr	Local Tertiary	3.5m	4m	3m
	Local Secondary	4m	4.5m	3.5m
	Local Primary	4.5	5m	4m
	Regional	5m	5.5m	4.5

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As set out in Section 4.4 – Offset, ADT information is generally not available for the class of roads within scope of this document. In a situation where ADT information is available the following *Table 2 Road Classification / ADT Matrix* provides a guide to the correlation between the Road Classification in Table 2 and ADT.

Table 3 Road Classification / ADT Matrix

Road Classification	ADT
Local Tertiary	< 750
Local Secondary	750 - 1500
Local Primary	1500 - 6000
Regional	> 6000

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3 Road Safety Risk

3.1 Collision Likelihood

The following infographics provide information on the likelihood of pole collisions.

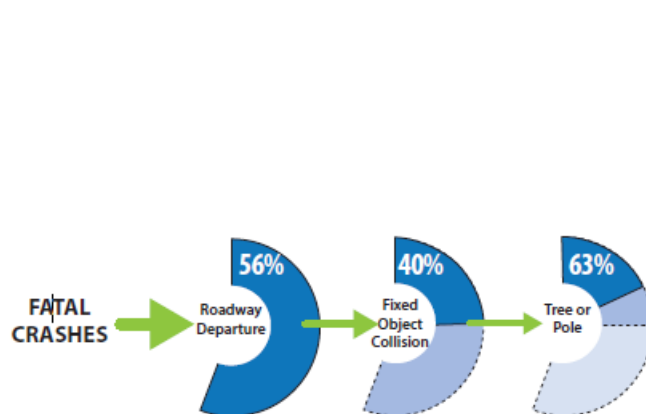


Figure 6 Relationship of roadside tree and utility pole crashes to all fatal crashes (US)

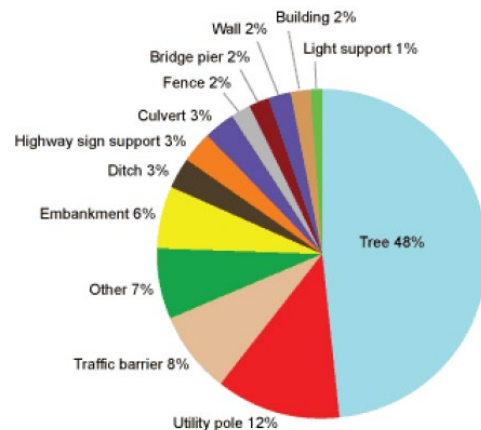


Figure 7 Percentage distribution of fixed object crash deaths (EU)

A report for the National Roads Authority of Ireland, *Contributory Factors Analysis for Road Traffic Collisions*, November 2012², states that pole collisions in the period 2007 to 2010 accounted for 117 out of a total of 6,934 injury collisions, i.e. 2% approximately. These figures relate to National roads and should be considered in the context of wider margins, designated clear zones in many cases but also higher speeds and traffic volumes.

The factors that affect the likelihood of pole collisions are:

- The number of roadside poles
- The lateral offset to the poles
- Roadway factors such as alignment, cross-section and gradient
- Traffic speed

² <https://www.tii.ie/tii-library/road-safety/Road%20Safety%20Research/Collision-Contributory-Factors.pdf>

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A collision rate for poles can be predicted by use of the US nomograph shown in Figure 8 Nomograph to Determine the Number of Pole Crashes per Mile per Year Based upon the Average Daily Traffic, Pole Density and Average Pole Offset.

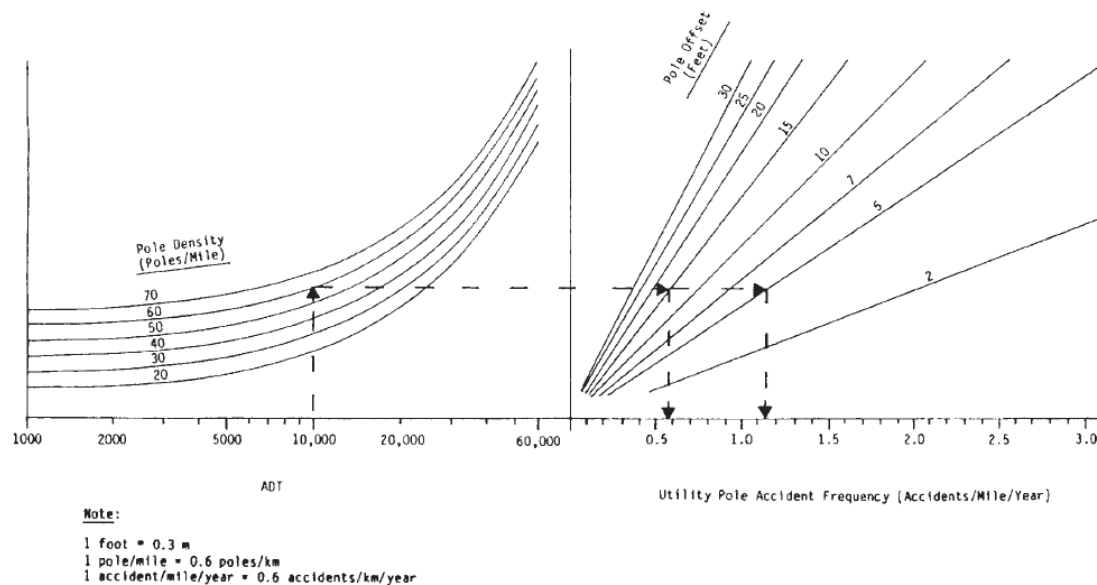


Figure 8 Nomograph to Determine the Number of Pole Crashes per Mile per Year Based upon the Average Daily Traffic, Pole Density and Average Pole Offset.

For example, given an ADT of 10,000 vehicles per day, a pole density of 60 poles per mile, and an average pole offset of 5 feet, the expected number of crashes is 1.15 pole crashes per mile per year, or a crash every 50 years or so with any one pole.

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3.2 Collision Severity

Because of the structural strength and small vehicle contact area of utility poles, these crashes tend to be severe.

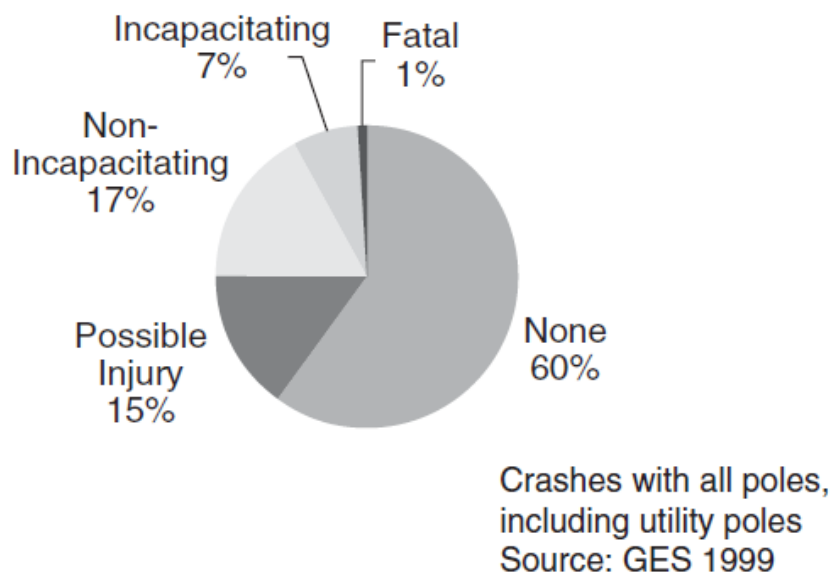


Figure 9 Distribution of Maximum Severity for Pole Crashes (US)

The NRA 2012 report *Contributory Factors Analysis for Road Traffic Collisions* records an Average severity of 0.16 FWIs (Fatalities plus Weighted Injuries) for pole collisions in the period 2007 to 2010 (the severity range was 0.118 to 0.416). FWI = Fatalities + (0.1 x serious injuries) + (0.01 x minor injuries)

In Ireland in 2011, 2% of all recorded injury collisions on the network, and approximately 5% of all fatal collisions, were with poles.³ Pole collisions are therefore more severe than the average collision.

The factors that affect severity of pole collisions are:

- Stiffness of the pole
- Traffic speed
- Lateral offset
- Whether front or side impact collision.

³ Reference required.

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3.3 Collision History

While the collision history of a road section is not in itself a risk factor, it may still be indicative of the potential for increased road safety risk and it might suggest that the location may not be suitable for new poles. Collisions on the non-national road network are much less frequent than on the National Road network, however any location that has a history of repeated injury collision should be avoided where possible. Where the designer is in doubt as to the suitability of a location because of collision history they should consult with the relevant Local Authority.

A collision history of Irish roads is available at the Road Safety Association website.⁴ An example of a Road Collision query is shown in *Figure 10* below.

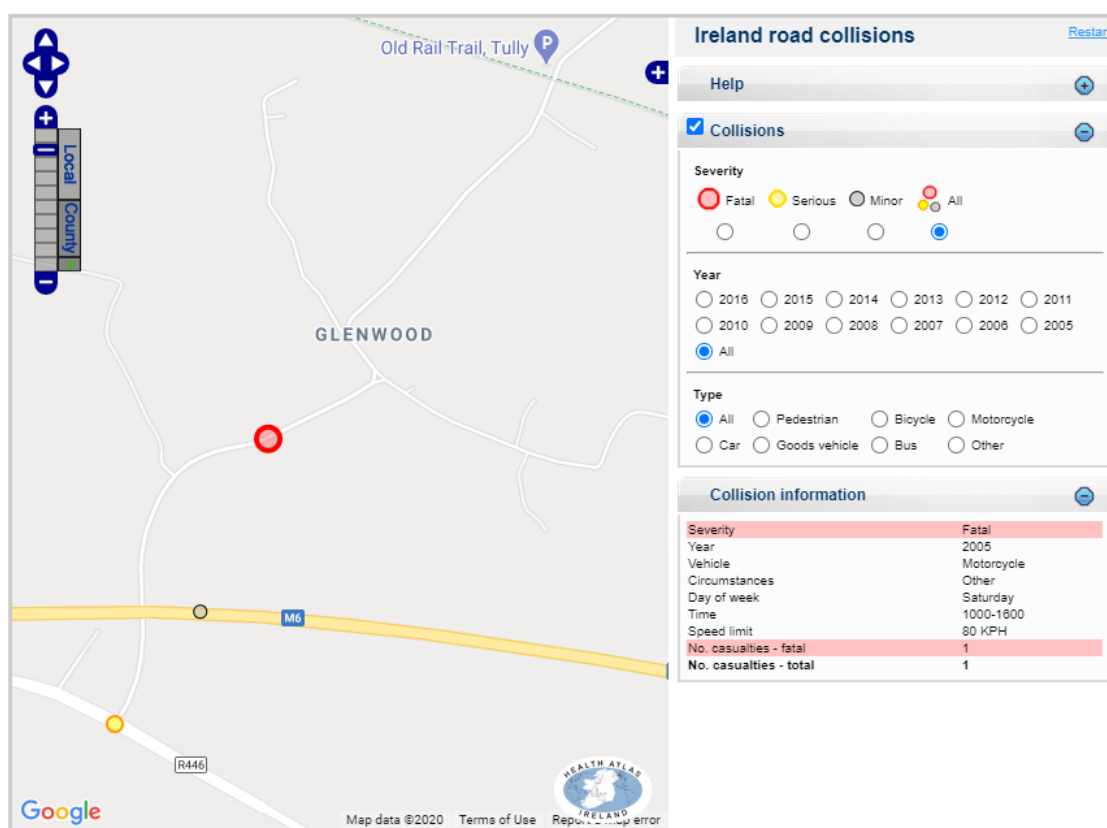


Figure 10 Sample RSA Road Collision Search

⁴ <https://www.rsa.ie/RSA/Road-Safety/RSA-Statistics/Collision-Statistics/Ireland-Road-Collisions/>

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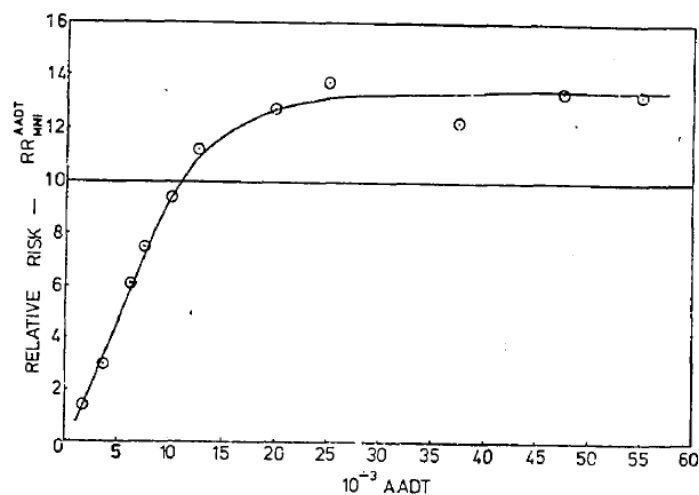
3.4 Traffic Speed

The increase in crash severity as speed increases is since energy increases in proportion to speed squared. Higher severity outcomes are related to higher speeds as highlighted in the US data below.

Speed Limit	Percent
50 Km/h or less (30 mph or less)	12%
55 – 60 Km/h (35 – 40 mph)	19%
70 – 80 Km/h (45 – 50 mph)	17%
90 Km/h or greater (55 mph or greater)	48%
No Limit or Unknown	4%
Total	100%

Table 4 Deaths in Roadside Crashes, 2003 (US)

3.5 Traffic Volume



In the volume range that relates to non-National roads the relationship between pole collisions and AADT was found by this Australian study⁵ to be linear.

Figure 11. Unweighted relative risk versus AADT-MNI data group

⁵ https://www.infrastructure.gov.au/roads/safety/publications/1979/pdf/Coll_Ut_Poles_pt1.pdf

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4 Road Layout Risk Factors

While many recorded pole collisions are random, a large portion are associated with features such as bends, junctions and other locations of increased hazard. Just 10% of road factors are common to 50% of pole collisions. In developing these Guidelines NBI has sought to identify the significant hazards which should be avoided when assessing a location for new pole infrastructure.

4.1 Bends

Studies suggest that curved roadways accounted for 38% of utility pole crashes and 59% of the fatalities.⁶

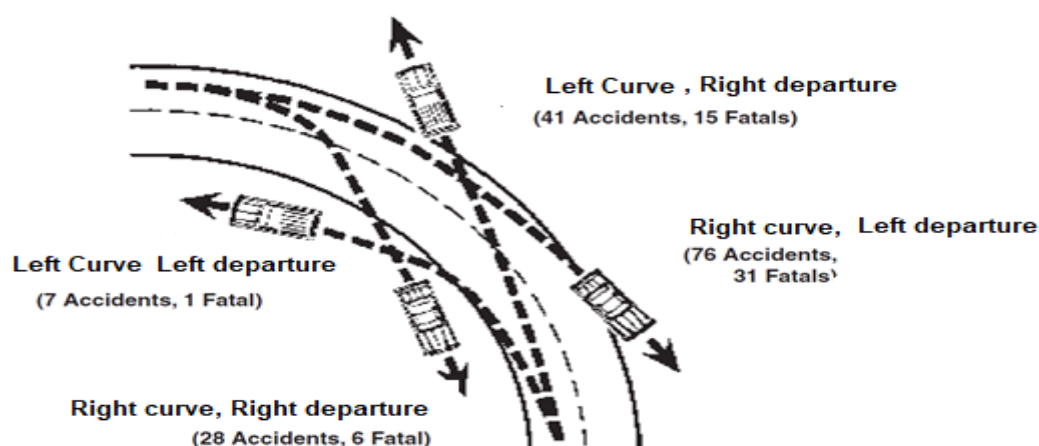


Figure 12 Curve Direction and Crash Frequency. Source: O'Day, 1979 (adapted)

⁶ Reference Required

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The outside of the bend is the greater hazard in the study shown in *Figure 12 Curve Direction and Crash Frequency*. Source: O'Day, 1979 (adapted) while the inside of a bend experiences fewer collisions.

An initial assessment of placing a pole on the outside of a bend would indicate that a pole placement should be avoided. However, in the majority of cases NBI pole placements are in-fill in nature. That is, they comprise singular or short runs of single digit pole placements required to transition between existing pole infrastructure or to secure an end customer connection in a situation where no existing overhead infrastructure is in place.

In assessing any proposed new pole location, the following elements should be considered by the Designer:

- 1) The operating speed of the road approaching the bend.
- 2) The collision history database and whether the location presents a pattern of relevant accidents⁷.
- 3) The existence of the existing pole infrastructure and whether the proposed alternative location introduces a new hazard.

4.2 Junctions



The area within 8 metres of a junction has a disproportionate number of roadside collisions. An Australian study recorded 32% of pole collisions at intersections.

Secondary collisions with poles can occur at junctions where the primary collisions are associated with turning manoeuvres at the junctions.

It is recommended that new poles are not located within 10 metres of a junction.

Location of poles opposite the intersection at T-Junctions is to be avoided.

Sight lines leading up to junctions is also represents a road safety issue. Where a pole is located leading to a junction then the pole should be located at the maximum available distance from the junction and at the maximum available offset.

Sightlines should also be considered in the context of entrances to properties when assessing the maximum available distance from the entrance and at the maximum available offset.

⁷ <https://www.rsa.ie/RSA/Road-Safety/RSA-Statistics/Collision-Statistics/Ireland-Road-Collisions/>

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4.3 Road Narrowing

Poles are hazards in situations where drivers are required to brake due to a sudden reduction in the width of the cross-section. Lane drops and lane narrowings are two such examples. Such locations should be avoided when considering pole placements.

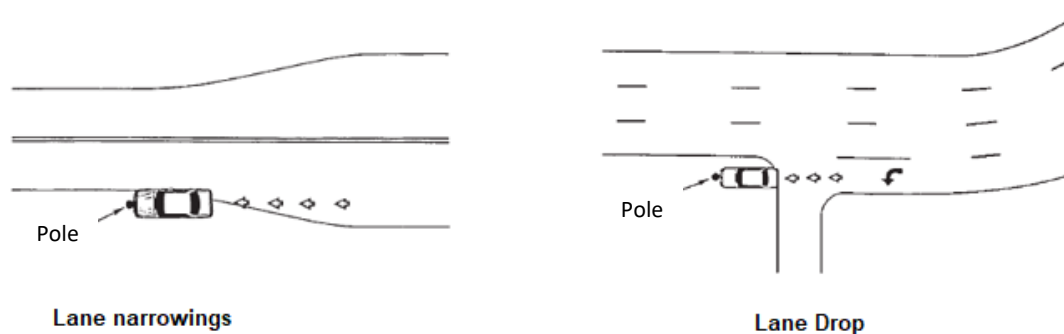


Figure 13 Lane Narrowing and Lane Drop

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4.4 Offset

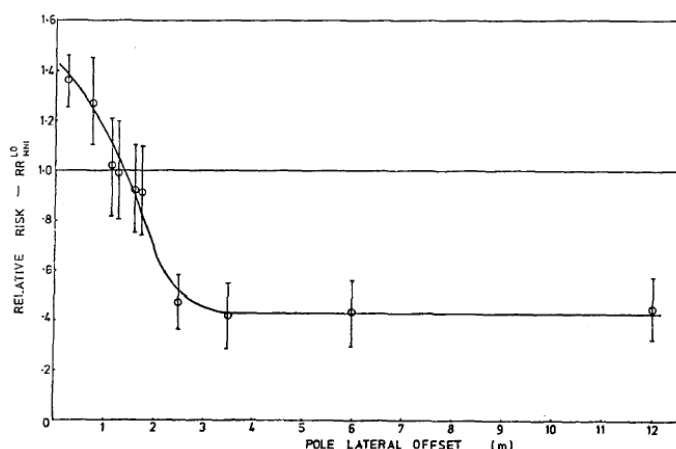


Figure 14 Relative Risk Versus Pole Lateral Offset

Lateral offset of poles is a major determinant of the frequency and severity of pole crashes.

The graph shown in Figure 14 Relative Risk Versus Pole Lateral Offset based on an Australian⁸ study indicates significant benefit in achieving an offset of more than 3m on major routes (generally higher speed).

The US document “BARRIER GUIDE for Low Volume and Low Speed Roads - Publication No. FHWA-CFL/TD-05-009 November 2005” provides the following guidance.

“Low speed conditions, defined as 70 km/h or less, are not commonly associated with roadside crashes. In fact, the risk of death or serious injury in roadside crashes drops significantly as vehicle speeds are reduced. The probability of serious crashes can be estimated by the energy expended in a crash. The energy expended in a crash is an exponential relationship to velocity or speed. Significantly less energy is expended in low speed crashes compared to high speed crashes. Also, drivers in low speed situations are more likely to regain control of their vehicle and avoid a roadside crash than in a high-speed situation.”

Table 2 in the US publication⁹ (‘US Table 2’) includes a range of offsets, depending on the nature and extent of hazard and road conditions to be used to determine what potential hazards should be considered for barrier warrants. While not a design standard it provides a useful guide to the minimum offsets to be considered.

The ‘US Table 2’ uses increasing Average Daily Traffic figures (ADTs) coupled with Operating Speed as the basis for increasing offsets. In adapting the US methodology for use in a desk-based assessment of offsets under the NBP, the use of Road Classifications rather than ADT has been proposed. The use of ADT information as the basis for assessing the increasing probability of road safety issues was deemed to be impractical as this information is not available for many of the roadways which NBI will be assessing.

⁸ https://www.infrastructure.gov.au/roads/safety/publications/1979/pdf/Coll_Ut_Poles_pt1.pdf

⁹ BARRIER GUIDE for Low Volume and Low Speed Roads - Publication No. FHWA-CFL/TD-05-009 November 2005 <https://flh.fhwa.dot.gov/resources/design/library/FLH-Barrier-Guide.pdf>

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5 Mitigation

Section 3.2 above (Collision Severity) highlights the contribution of the small vehicle impact area of utility poles to the severity of collisions. Mitigation from a direct impact with a pole can reduce this factor significantly and facilitate a reduced offset requirement from those set out Table 2 above. Mitigation can be achieved by locating the pole within/beside an existing roadside feature (which may itself be an existing hazard such as wall pier) or by locating the pole within a bank or similar which provides a re-directional or deceleration opportunity in the event of a collision.

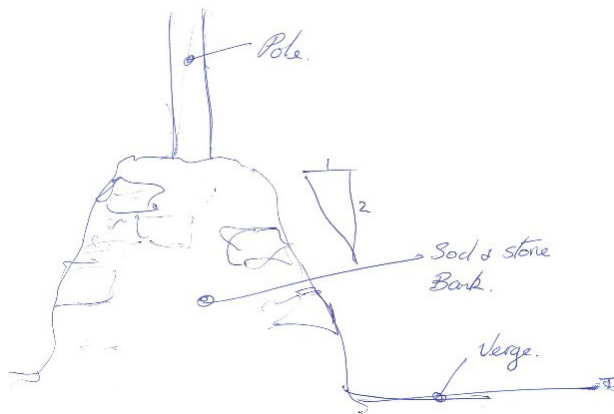


Figure 15 Cross Section of a Pole Incorporated into a Re-directional Feature

Figure 15 Cross Section of a Pole Incorporated into a Re-directional Feature illustrates a situation in which a utility pole can be incorporated within an existing roadside re-directional feature such that an errant vehicle would not be expected to collide directly with the pole.

In practice these features relate to roadside banks into which a pole could be integrated.

Learning from the trial conducted in Cavan highlighted some situations where mitigation did not apply, including:

- 1) placement of a pole directly in front of a wall did not qualify as a mitigation, unless protected by a pier or similar.
- 2) placement of a pole within a hedge did not constitute mitigation as the vegetation was not sufficient to alter the direction of travel of a vehicle or decelerate the vehicle.
- 3) Re-directional or deceleration was typically via roadside banks rather than stand-alone features.

Where mitigation is provided by an existing hazard, the potential removal of the hazard in the near future should be considered as this may also necessitate the relocation of the pole location. The nature of the hazard and the traffic conditions at the specific location will determine the likelihood of the hazard having to be moved at a future date.

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6 Alternative Options

On a section of road for which use of the methodology would suggest that new poles should not be erected, alternative options may include:

- Redesign to avoid the need for the route;
- Relocating to private property;
- Installation of new underground infrastructure.

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7 Other Design Standards

Transport Infrastructure Ireland (TII) standards are applicable to National Roads and are also used in the assessment and design of rural non-national road schemes.

Standard DN-GEO-03036: Cross Sections and Headroom of May 2019 describes the principles of Forgiving Roadsides and the requirements for Clear Zones to be provided in the design of new road schemes so that a driver who leaves the carriageway can stop safely or regain control of the errant vehicle. New roads are therefore provided with wide verges.

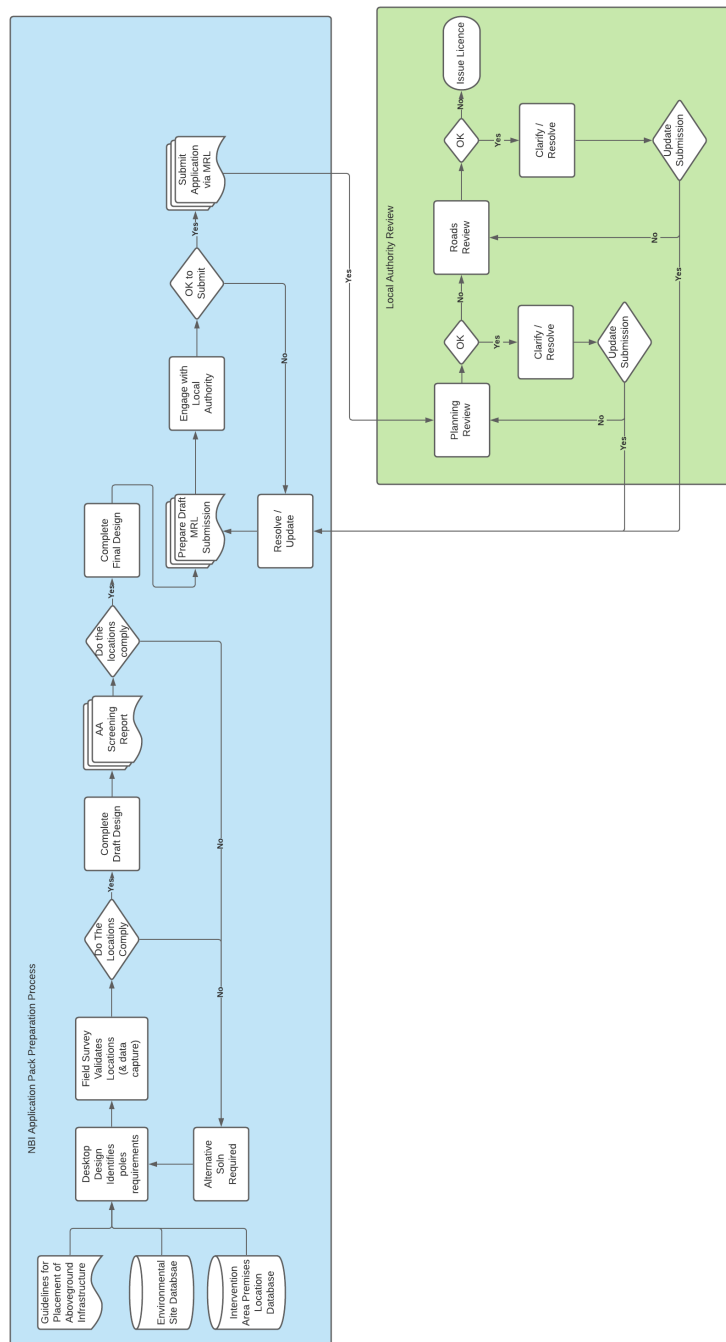
However, most non-national roads, and indeed many national ones, have not been designed to modern standards and do not have wide verges. TII publication DN-REQ-03079, Design of Road Restraint Systems for Constrained Locations (Online Improvements, Retrofitting and Urban Settings) recognises this fact and provides guidance on the situations in which road restraints systems should be provided to protect motorists from existing hazards.

This standard contains a risk assessment methodology, and a pole (i.e. wooden poles or posts with a cross-sectional area of $> 25,000\text{mm}^2$) is classified as a high-risk hazard. However, the standard recognises that protecting an existing pole entails cost and, given that poles are not frequently struck, the expenditure might not be warranted. Under the standard, a pole located within 2m of the carriageway edge of a 100km/h national road does not require protection when the risk of collision is low, even though the corresponding Clear Zone dimension is 8m.

The standard relates to the retrofitting of barriers but does not specifically provide guidance on the insertion of new hazards into existing verges and it has little detail relating specifically to low speed low volume roads.

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Appendix 1 Application Process Flow





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Appendix 2 Sample Locations



The following images represent sample of pole locations encountered during the course of NBI's survey and S254 application process. They should be referenced as guidelines in the field.

Ref	Photo	Narrative
1		<ul style="list-style-type: none"> This regional road carries more traffic at a greater operating speed. The location qualified on all measures. The location achieved its required offset 4.0m from the running edge of the carriageway. The actual pole location is set to the maximum available to not introduce a point hazard.
2		<ul style="list-style-type: none"> The location qualified on all measures. The location achieved its required offset 2.0m from the running edge of the carriageway.



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Ref	Photo	Narrative
3		<ul style="list-style-type: none"> • The location qualified on all measures. • The location achieved its required offset 2.0m from the running edge of the carriageway. • To not introduce a point hazard or interfere with the improved sight lines the pole is set to the maximum offset.
4		<ul style="list-style-type: none"> • The location qualified on all measures. • The location achieved its required offset 2.0m from the running edge of the carriageway. • The running edge of the carrigeway is defined by the Tii as the yellow line (if available or from the nearest edge of the trafficked lane).



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Ref	Photo	Narrative
5		<ul style="list-style-type: none"> Note the pole integration into the existing hedge row. Note the existing pole in the background. The new cable network will have to cross diagonally at this location.
6		<ul style="list-style-type: none"> This example is a typical “in fill” location where at a point in the past a pole stood and was left decay. Note the existing pole location at a reduced offset.

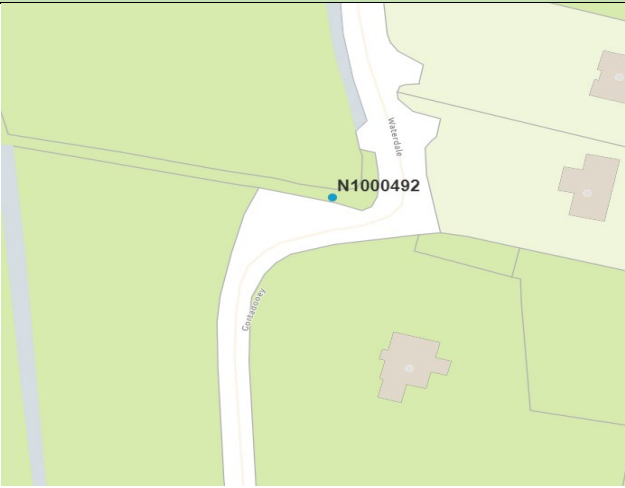
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Ref	Photo	Narrative
7		<ul style="list-style-type: none"> • The operating speed was measured here at 74 kph • That determined an offset of 4.0m (cross section in backslope) • 2m was available to a buildable location • Appropriate mitigation was available by locating the pole in the existing roadside bank • The bank is determined to provide a re-directional or a deceleration opportunity in the event of a collision.
8		<ul style="list-style-type: none"> • The operating speed was measured here at 68 kph. • That determined an offset of 3.5m. • 3m was available to a buildable location. • Appropriate mitigation was available by locating the pole in the existing roadside bank. • The bank is determined to provide a re-directional or a deceleration opportunity in the event of a collision.

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Ref	Photo	Narrative
9		<ul style="list-style-type: none"> • The operating speed was measured here at 65 kph. • That determined an offset of 3.0m. • 2.7m was available to a buildable location. • Appropriate mitigation was available by locating the pole in the existing roadside bank. • The bank is determined to provide a re-directional or a deceleration opportunity in the event of a collision.
10		<ul style="list-style-type: none"> • The pole location presented as good at the survey stage. • On feedback from applications it has been determined that these locations – setbacks at entrances to improve sight lines are predominantly private and thus need a private wayleave opposed to following the s254 application process.

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Ref	Photo	Narrative
11		<ul style="list-style-type: none"> • The example given shows a pole on the outside of the bend travelling northerly • This would suggest it should be avoided • On assessment it is determined that speed has reduced to navigate the bend • The location is mitigated in this zone as it is not directly in the run off path.

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Appendix 3 Estimated Operating Speed & Offset

Measured Operating speeds for the rural locations being assessed by NBI as pole locations are generally not readily available. NBI has developed a process for estimating the operating speeds utilises the database of driver behaviour collected by Google and presented through their navigation tool as average driving speeds based on aggregated journey-times. NBI has compared this average driving speed with published speed surveys where available with the result that the application of a factor $(1.25)^{10}$ to the average speed produces an estimated Operating Speed that correlates strongly with measured Operating Speeds at the sample locations.

NBI continues to validate the accuracy of its estimated Operating Speed relative to actual speed survey data where this data is available from individual Local Authorities as well as NBI commissioned research. The result of this analysis is set out in Appendix 4 and shows that NBI's methodology outputs a slightly higher estimated Operating Speed relative to that measured by Local Authorities.

NBI will audit sample locations to provide further data to support the development of the process.

¹⁰ See Appendix 4 for details regarding the factor that is applied to convert average speeds to estimated operating speeds.

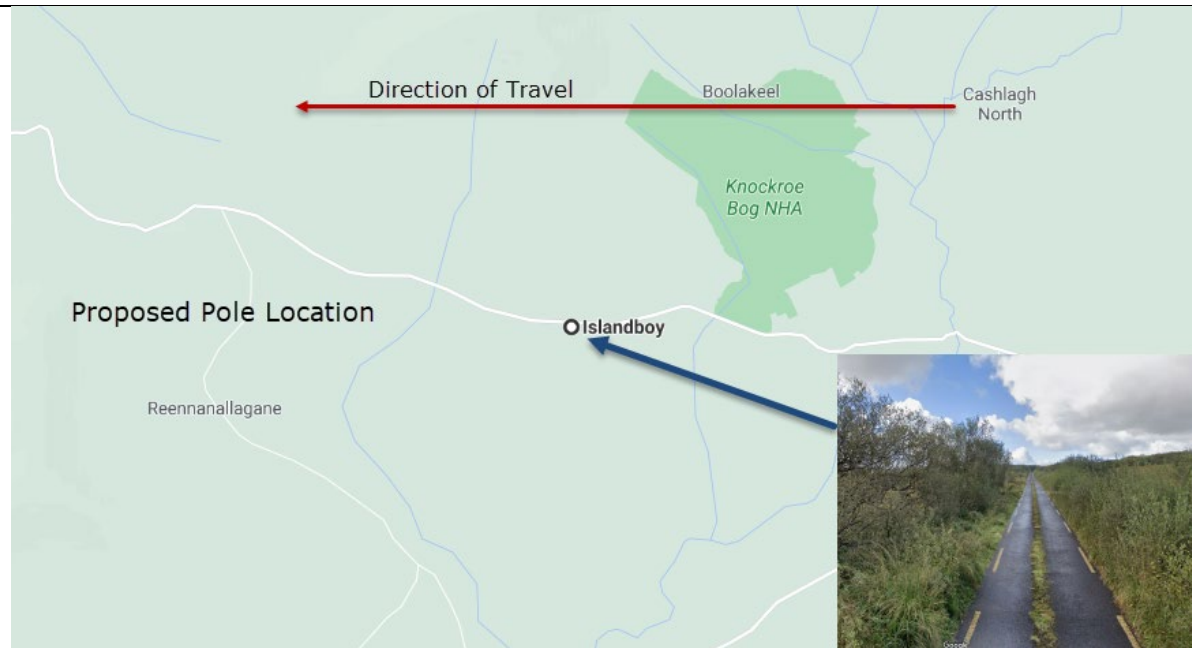
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Methodology for Estimating Operating Speeds

The following sample illustrates the process for estimating the Operating Speed and how it compares to published Speed Survey Date.

Step 1 – Select Pole Location

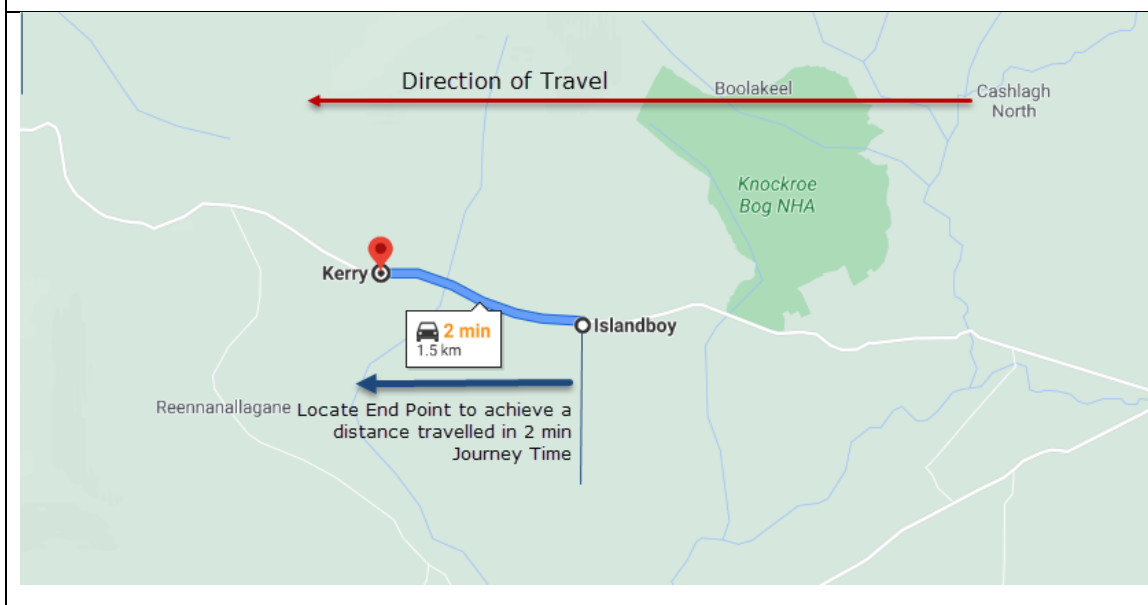
The proposed pole location is identified on a Google map in navigation mode as the starting point.



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Step 2 – Navigate to Two Full Minutes Journey Time Upstream

2. Navigate in the DIRECTION OF TRAVEL relevant to the pole location to the point at which the Journey Time is 2 Min. This is the point at which the journey time changes from 1 min to 2 min.

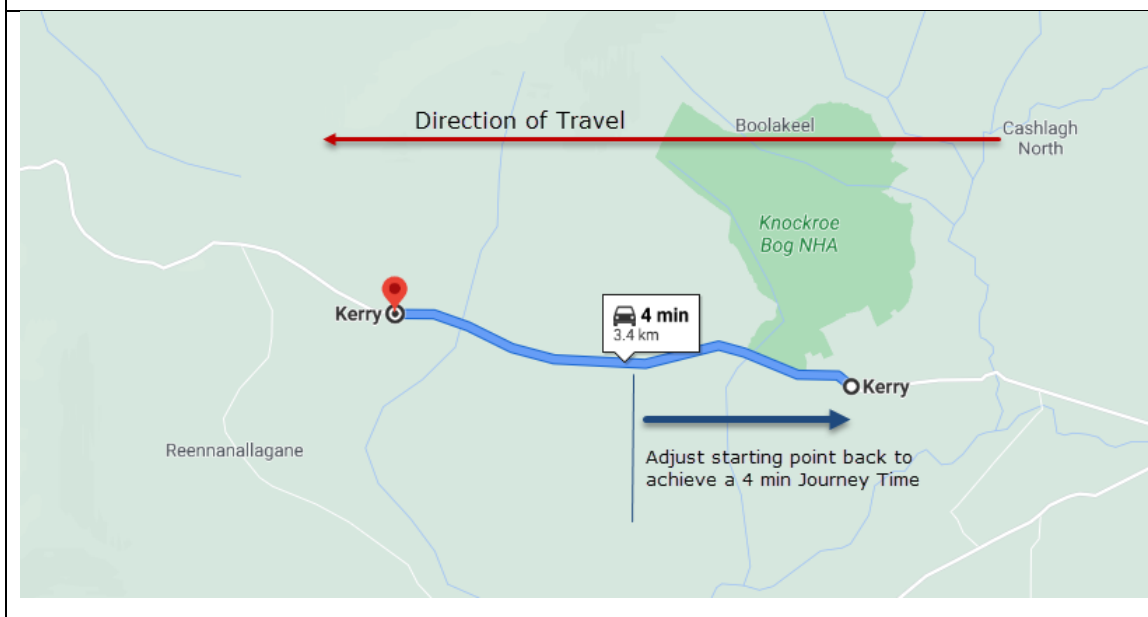


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Step 3 – Add Two Full Minutes Journey Time Downstream To Achieve Four Full Minutes Driving Time

3.a) Adjust the starting point back from the pole location to the point at which the Journey Time becomes 4 Min by moving the original starting point. This is the point at which the Journey Time changes from 3 Min to 4 Min.

The four-minute Journey Time is now comprised of two minutes before the pole location and two minutes after the pole location.



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Step 4 – Calculate the Estimated Operating Speed

Table 5 sets out the conversion of the Google data into the Estimated Operating Speed.

Distance Travelled (D)	Journey Time (T)	Average Speed $Av.S = (D * 60) / T$	Factor (f)	Estimated Operating Speed (Av.S x f)	Upper band of equivalent Operating speed based on measured offset (table 2)
3.4 km	4 Minutes	51 km/hr	1.25	64 km/hr	69 km/hr

Table 5 Estimated Operating Speed calculation sample.

The resulting estimated Operating Speed is placed into the appropriate speed band used in *Table 2 Offsets for Locating Poles* to determine the required offset, together with Road Classification and Road Cross Section.

Notes:

1. The measured route should be reduced (shorter journey time) to avoid for example urban areas as these will artificially lower the estimated Operating Speed.
2. Journey times of less than 2 mins and / or short road lengths such as cul de sacs and lanes are automatically assessed in the 'Up to 40km/hr' band for the purposes of Table 2.
3. Appendix 4 provides the results of several comparisons between the NBI process outlined above for estimating Operating Speeds and actual Speed Survey data provided by Local Authorities. This sample data supports a strong correlation between the NBI estimated Operating Speed and the Operating Speed identified via a physical speed survey.
4. Table 6 below provides a sample of how the data is utilised to info whether a pole location is suitable to be presented as part of an s254 application. Poles which fail the NBI assessment do not form part of any subsequent application. The sample below is for illustrative purposes only.

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Table 6 Sample Pole Location Assessment based on Offset Requirement.

Barcode	Road name	Estimated Operating Speed (KM/H)	Road Category	Required Offset (Table 2) (m)	Measured Offset (m)	Reduced Offset due to Mitigation	Upper band of equivalent Operating Speed based on measured offset (ref Table 2)	Is the pole location acceptable	Assessment Notes
N100xxx	Location, Location	49	L-Secondary	2	3	No	69	Yes	Measured Offset GREATER THAN Required Offset
N100xxy	Location, Location	49	L-Secondary	2	2	No	49	Yes	Measured Offset EQUAL TO Required Offset
N100xxxz	Location, Location	49	L-Secondary	2	1.5	Yes	49	Yes	Measured Offset LESS THAN Required Offset But Mitigations Apply
N100xxxc	Location, Location	49	L-Secondary	2	1.5	No	N/A	FAIL	Measured Offset LESS THAN Required Offset But Mitigations Apply

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Appendix 4 Speed Assessment Samples

NBI Commissioned Research

NBI commissioned research into the correlation between the Google distance/time average speed result and Operating Speed (rather than average). Roadplan/IDASO undertook a comparative study of the Google generated data and existing measured operating speed survey data.

The study showed a consistent relationship between the average speed output from Google and measured operating speed survey data. This relationship was represented by a factor of 1.25, where the Google generated average speed is multiplied by 1.25 to provide an estimated Operating Speed for the specific pole location.

Methodology to Derive Design Speed from Google API Free-Flow Speed

The following text and figure is extracted from NRA TA 43/00.

Figure 17 below shows the typical distributions of vehicle speeds obtained from speed studies (TRRL 1979 /1980) at three different classes of road. These are free speeds, that is, speeds occurring where there is effectively no interference from other traffic.

The $^4\sqrt{2}$ relationship: Figure 2 shows the mean, 85th %ile and 99th %ile speed levels for rural single carriageways, rural dual carriageways and rural motorways. For practical purposes, the following ratios can be assumed constant and equal to the $^4\sqrt{2} = 1.19$.

$$\frac{99^{\text{th}} \text{ \% ile speed}}{85^{\text{th}} \text{ \% ile speed}} = \frac{85^{\text{th}} \text{ \% ile speed}}{50^{\text{th}} \text{ \% ile speed}} = ^4\sqrt{2}$$

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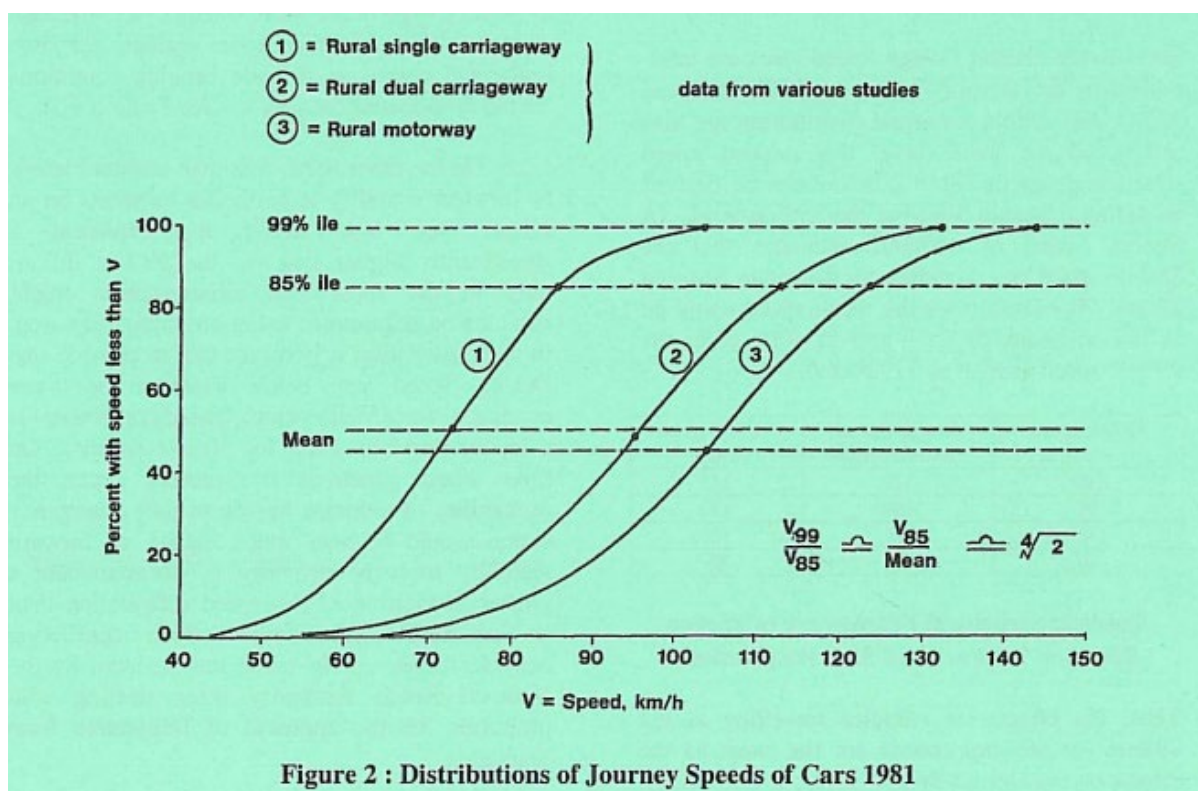


Figure 16 NRA TA 43/00 Extract

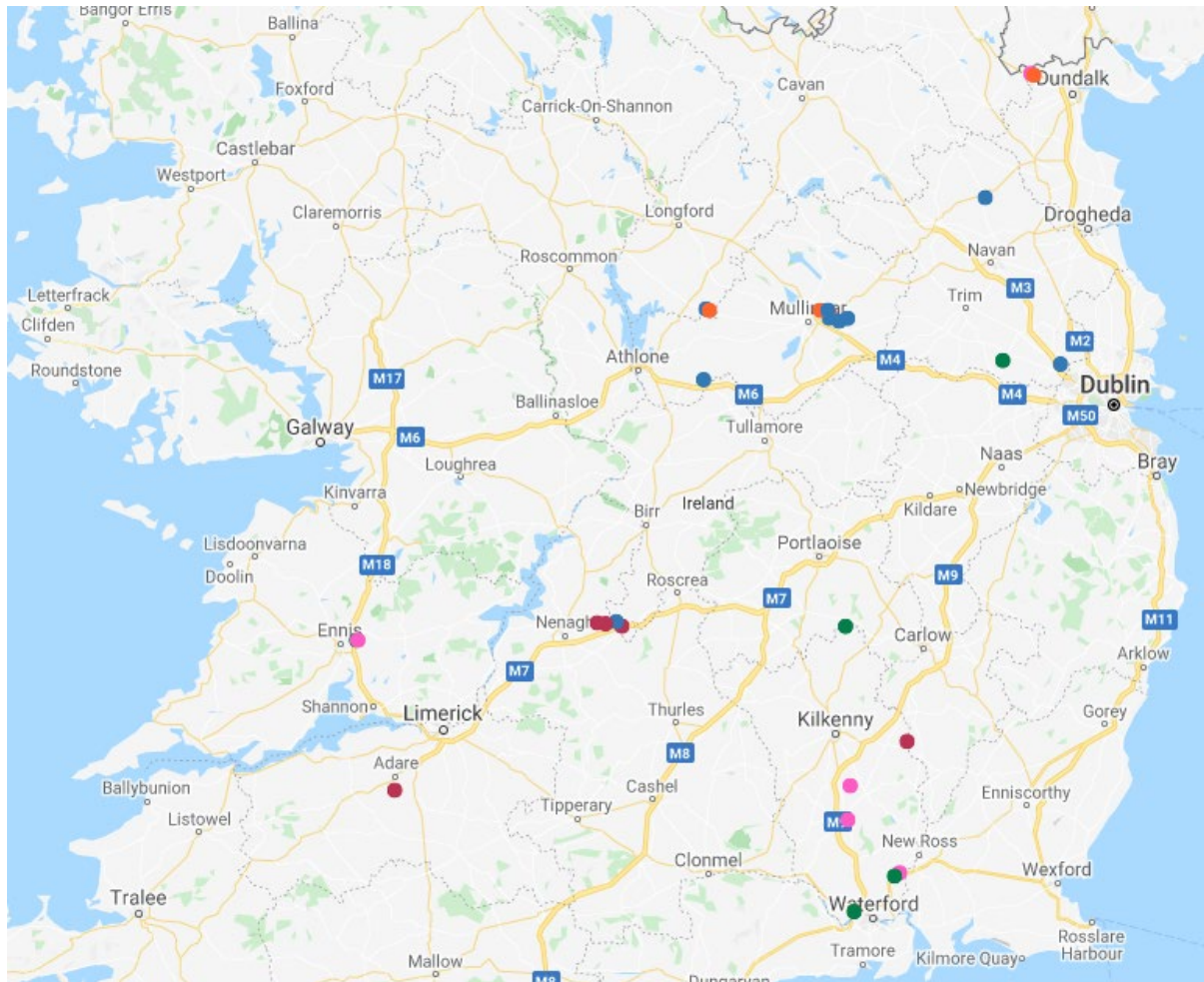
The 85th percentile speed is generally regarded as the most appropriate choice for design speed, but its primary significance and purpose is to be the identifier of an overall speed distribution.

The Google Directions API contains time and distance data free flow mean speed. Surveyed mean and 85th %ile speeds on selected roads were compared against the speeds determined from the Google API in order to determine if there appears to be a consistent factor to convert Google API free-flow speed to Design Speed (85th %ile speed)

The data is presented in Table 7 below.

The general locations of the surveys are shown on the following map:

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The entries struck out of the table are ones where the road layout might interfere with traffic speed: locations on the approaches to stop junctions and locations subject to urban speed limits. Such factors might distort the speed relationships and have therefore been removed from the calculations.

The table shows a reasonably consistent relationship between Google API FFS and 85th %ile speed (Design Speed). It indicates that Google API FFS is slightly less than surveyed mean speed. Although there is some variability, it is not high, and the factor is considered reasonable consistent across the speed bands.

The recommended factor to be used is 1.25 : 85th %ile speed of a road can be derived by multiplying Google API FFS by that factor.

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Table 7 Comparative Data

Sample	Survey Reference	Location	Speed Survey				Google API			Comment		
			50th Percentile	85th Percentile	Ratio 85/50		FFS	Ratio 85/FFS				
1	ATC 1	52.2751058555866, -7.17896050773561	33.92	38.86	1.15	1.24	28.8	1.35	1.21			
2	ATC 2	54.0351250210811, -6.5460678935051	23.00	31.00	1.35		19.44	1.59		ATC too close to the junction		
3	ATC 3	53.5472288794346, -7.68909126520157	31.00	37.00	1.19		25.2	1.47		ATC too close to the junction		
4	ATC 4	53.547468902803, -7.29862946250161	28.00	34.00	1.21		30.6	1.11				
5	ATC 5	53.5430575008495, -7.26662378187275	27.00	35.00	1.30		30	1.17		Is it a public road?		
6	ATC 6	52.2744822084001, -7.17956132255495	37.00	42.00	1.14	1.18	40.5	1.04	1.14	Beside ATC1.		
7	ATC 7	52.3507355313038, -7.03724073290687	42.00	47.00	1.12		42.3	1.11				
8	ATC 8	52.8538706716424, -8.93201082511992	37.00	47.00	1.27		39.6	1.19		Within 50km/h zone, but okay		
9	ATC 9	52.8830012423598, -7.20979592757797	37.00	45.00	1.22		31.05	1.45				
10	ATC 10	53.4426535070182, -6.65566255666061	40.00	46.00	1.15		49.5	0.93				
11	ATC 11	52.5440798485412, -7.19322851859033	48.00	56.00	1.17	1.19	54	1.04	1.20			
12	ATC 12	54.0385443283305, -6.55706486664712	47.00	57.00	1.21		45.49	1.25				
13	ATC 13	52.4711029104175, -7.20128548700325	46.28	56.57	1.22		40.32	1.40				
14	ATC 14	52.8538022725571, -8.92744364948923	44.00	52.00	1.18		44.22	1.18				
15	ATC 15	52.3578138621058, -7.01906464062631	48.00	56.00	1.17		50.4	1.11				
16	ATC 16	52.8929229630212, -8.01728895865381	53.96	63.89	1.18	1.18	54.86	1.16	1.19			
17	ATC 17	53.4351370238224, -6.45246062172087	57.00	66.00	1.16		51.4	1.28				
18	ATC 18	53.4025455811595, -7.70952774603272	53.00	63.00	1.19		56.4	1.12				
19	ATC 19	53.7818723314621, -6.71770136239632	53.00	65.00	1.23		49.5	1.31		Within 50km/h zone		
20	ATC 20	53.550209059055, -7.70111849467217	57.00	66.00	1.16		43.92	1.50		ATC too close to the junction		
21	ATC 21	52.8905085501364, -8.08421543799341	62.22	72.86	1.17	1.18	51	1.43	1.28			
22	ATC 22	52.8885313856014, -8.05478083795606	63.84	78.26	1.23		55.2	1.42		Speed high for single lane road		
23	ATC 23	52.8833949480861, -7.99728803976913	64.00	77.00	1.20		63.35	1.22				
24	ATC 24	52.6385054294108, -6.99311426840723	67.00	78.00	1.16		58.8	1.33				
25	ATC 25	52.5344972055826, -8.79754221998155	67.56	77.84	1.15		68.4	1.14				

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Local Authority Sample Data

Working with speed survey data provided by Local Authorities for rural roads similar to those being assessed by NBI as suitable locations for placement of new poles, NBI has undertaken further comparative assessments of the results of NBI's methodology for estimating the Operating Speed of a rural road and the results of actual speed surveys undertaken by Local Authorities. This work is intended to validate the appropriateness of the NBI methodology and the validity of the Factor used to convert the online average speed to an estimated Operating Speed.

Table 8 below sets out a sample of 80 data points provided by Local Authorities. Additional analysis is being undertaken as more speed survey data is shared with NBI by Local Authorities. The data supports the use of the NBI methodology and the 1.25 factor.

Table 8 Comparative Data - NBI estimated and Local Authority measured Operating Speeds

Sample #	Road name	Location	Distance Travelled (km)	Journey Time (Min)	Average Speed (km/hr)	Factor	Estimated Operating Speed (km/hr)	Upper band of equivalent Operating speed based on measured offset (table 2) (km/hr)	Local Authority Speed Survey Output	NBI Estimated Operating Speed as a % of LA Speed Survey Output
9	R241	Click	3.4	4	51	1.25	64	69	65	106%
13	R238	Click	2.9	4	43.5	1.25	54	59	53	111%
8	L-1845-	Click	3.4	4	51	1.25	64	69	65	106%
4	L1613	Click	3.3	4	49.5	1.25	62	69	67	103%
20	R2636-1	Click	4.5	4	67.5	1.25	84	89	84	106%
18	R236	Click	3.8	4	57	1.25	71	79	76	104%

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21	R252-1	Click	4.4	4	66	1.25	83	89	87	102%
12	R245	Click	1.3	2	39	1.25	49	49	42	117%
19	R265-1	Click	4.2	4	63	1.25	79	79	79	100%
23	R240-4	Click	5	4	75	1.25	94	99	99	100%
15	L3004	Click	1.4	2	42	1.25	53	59	60	98%
5	L-2091-	Click	3.5	4	52.5	1.25	66	69	72	96%
17	L2031	Click	3.2	4	48	1.25	60	69	72	96%
10	R241	Click	1.7	2	51	1.25	64	69	38	182%
11	L10064	Click	0.9	2	27	1.25	34	39	41	95%
22	R250-1	Click	4.5	4	67.5	1.25	84	89	94	95%
14	R238	Click	3.1	4	46.5	1.25	58	59	58	102%
2	L3044	Click	4.2	4	63	1.25	79	79	85	93%
6	R-240-4	Click	4.5	4	67.5	1.25	84	89	98	91%
7	R-238	Click	1.8	2	54	1.25	68	69	69	100%
16	R236	Click	2.9	4	43.5	1.25	54	59	66	89%
1	L-1125	click	3.2	4	48	1.25	60	69	62	111%

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