Northampton Gateway SRFI
A45 corridor geometry and design standard

Introduction

1. The proposed improvements to M1 J15 associated with the Northampton Gateway Strategic Rail Freight Interchange necessitates improvements and realignment of the A45 between M1 J15 and the Grange Park junction.

2. The purpose of this technical note, appended to the Geometric Design Strategy Record, is to review the existing A45 geometry between M1 J15 and the Grange Park junction, as shown on **Figure 1** below. This is required in order to determine the design speed and design category for the improvement works.

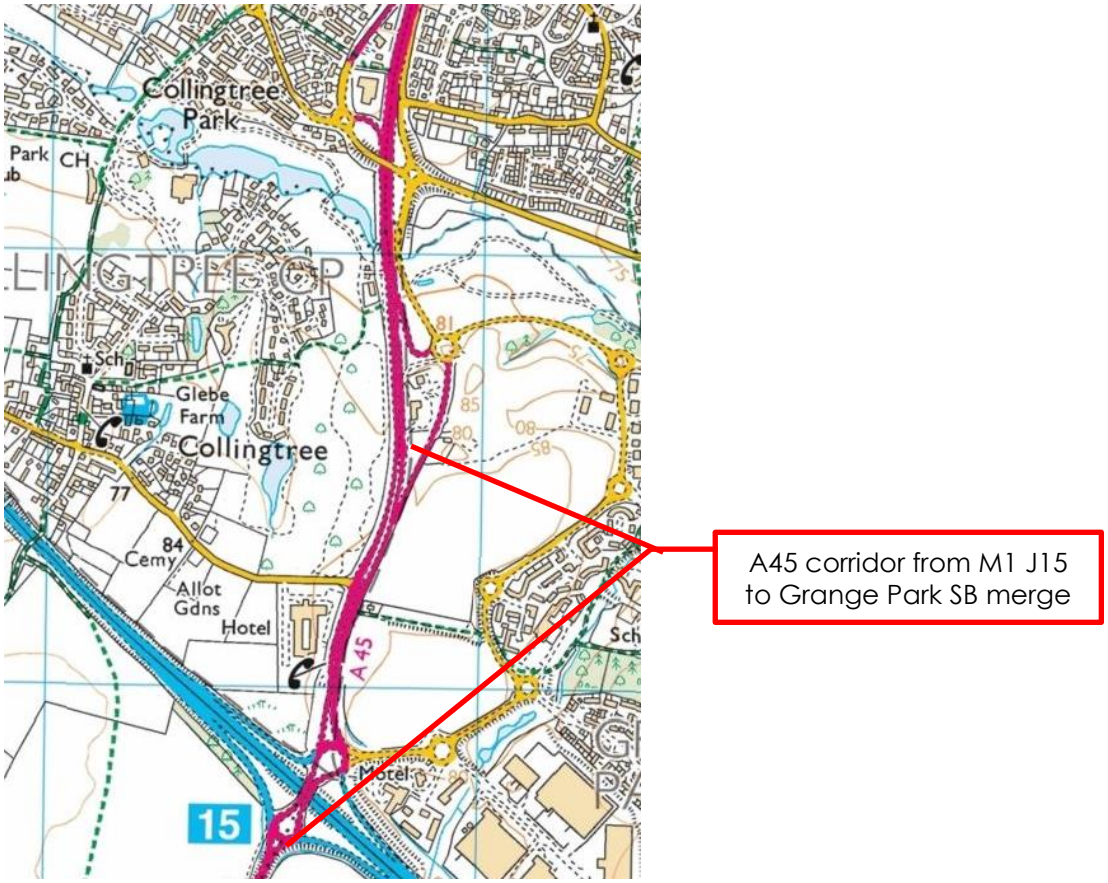


Figure 1: A45 corridor

Historical context

3. This section of the A45 was, until 2001, known as the A508 and was a County Road maintained by the local highway authority. Grange Park began to be developed in the late 1990s and as part of this work changes were made to the A508 (present A45) including reconfiguration of M1 J15 where a two bridge roundabout was replaced by single bridge dumbbell roundabout.

4. The A508 between M1 J15 and Queen Eleanor Roundabout (north of Grange Park) became a trunk road in 2001[1] and was renumbered part of the A45 at that time.

[1] SI 2001 No. 1989 "The A508 (M1 Junction 15 To A45 Queen Eleanor Roundabout) (Trunking) Order 2001"

5. This section of the A45 is an example of a historical rural A road that has seen piecemeal upgrades including dualling over many years. It thus follows that it generally does not conform to current geometric standards for a dual carriageway trunk road.

Setting

6. This section of the A45, as noted above, was originally the A508 heading south from Northampton. The area between the M1 and Northampton has seen considerable development over recent years, notably the Grange Park development constructed from the late 1990s which most recently included construction of warehousing directly adjacent to the A45. As well as Grange Park within the local vicinity there is a large hotel, a golf course and a petrol station. Taken together the corridor is now a radial route that has become built up, with some roadside development.

7. It is therefore considered that the route corridor has become more urban in character rather than the clear rural route that it was originally.

Existing Geometry

8. This section of the A45 is derestricted except for the immediate approach to M1 J15 which has a 40mph speed limit.

9. Between M1 J15 and the Grange Park junction the following significant features are present on the A45:

Northbound	Southbound
Parking lay-by	Petrol station access and merge
Junction with Watering Lane (left-in left-out)	Grange park merge
Bus stop	Bus stop

10. The existing design speed is taken to be 120kph for a derestricted dual carriageway. However, it is clear from a review of the existing geometry that this section of the A45 does not conform to this standard. 21 departures from geometric standards (DMRB TD9, TD22, TD27, TD42 and TD69) have been identified on this section of the A45, and this excludes a review of the vertical alignment. Further departures from geometric standards are present at the M1 J15 roundabout. A detailed summary of these is found at **Appendix A**.

11. Although no detailed analysis has been undertaken it is clear from a review of the road alignment north of the Grange Park merge that further significant departures from geometric standards exist such as at the SB petrol station.

Geometric Analysis

12. The proposed M1 J15 improvement scheme includes upgrading of the A45 corridor between J15 and the Grange Park junction. As part of this it would be proposed to remove the NB parking layby and both bus stops. This will remove several of the existing departures from standard on this section of the A45.

13. However, many departures relate to the general alignment and overall geometry. Of particular note are:

- Combined relaxations in stopping sight distance and horizontal alignment
- Relaxations in stopping sight distance on the approaches to junctions
- The weaving length on the A45 SB from the Grange Park merge and M1 J15

14. The alignment of the A45 is constrained by the built developments areas noted above, a golf course and several existing junctions. A significant realignment of the A45 in this location is therefore not possible.

15. The proposed improvement works would, if the design speed were to remain at 120kph and the existing geometry is to be changed, require these existing departures from standard to be assessed and formally approved by Highways England. This is an approach that could be pursued, and the broad case would be that the works would be improving this section of the A45 and such improvements would outweigh the disbenefits even with the departures from standard. However, the number of significant geometry departures and alignment generally does call into question if this section of the A45 is a rural road with a 120kph design speed.

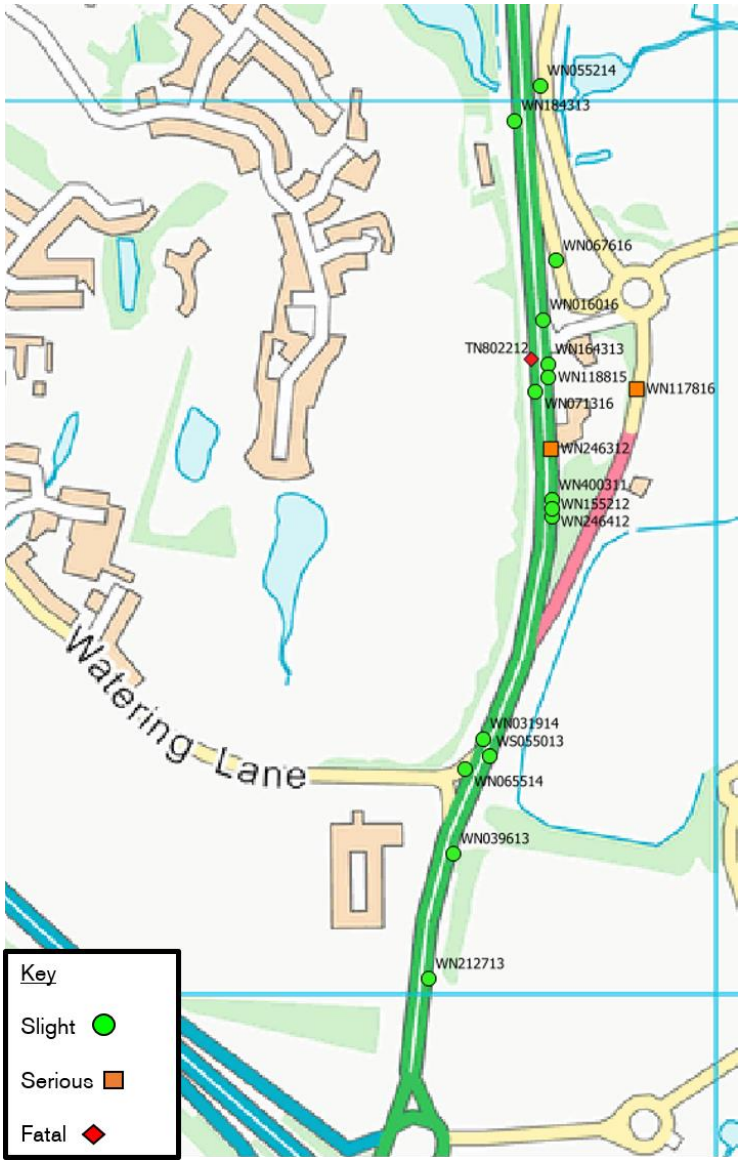
16. It is considered that the alignment does generally comply with an 85kph design speed and as such many, if not all, of the existing departures from standard would not apply if this section of the A45 were to be considered to be an urban dual carriageway with an 85kph design speed.

Accident review

17. A review of Personal Injury Accidents (PIAs) has been undertaken by ADC Consulting and is included within this report.

18. The PIA records between the M1 J15 and A45 Wootton Interchange were obtained from NCC for the five-year period between 1 November 2011 and 31 October 2016. A total of 18 accidents were recorded, 15 of which were of slight severity, two were classified as serious and the remaining accident resulted in a fatality.

19. The location of the respective accidents are shown in **Figure 2** below, which also includes a summary table and the police reference numbers of each PIA.



Severity	PIAs	Casualties
Slight	15	24
Serious	2	2
Fatal	1	1
Total	**18**	**27**

Figure 2: location and breakdown of respective accidents in study area

20. The recorded PIA categorised as fatal (TN802212), occurred northbound on the A45, near the petrol station. The accident involved a pedestrian crossing the carriageway of the A45 and causing a collision with a car. The accident happened at 04:08 in the morning and occurred in dry road conditions. Although dark, street lights were present and lit.

21. The recorded PIAs of serious nature (WN246312, WN117816) occurred along the A45 southbound; near the petrol station and on the A45 southbound merge slip, respectively. The former involved a car suddenly breaking and causing an on oncoming car travelling in the same direction to swerve and overturn. The latter involved a pedal cycle colliding with the rear of a HGV which was parked, subsequently causing a serious injury to the cyclist.

22. Of the remaining 15 PIAs of slight severity there is a cluster of three PIAs which occurred at the exit of the petrol station along the A45 southbound (WN155212, WN246412, WN400311). Therefore, in combination with the PIA of serious severity described above (WN246312), there is a trend in the location of these PIAs as they all relate to the slip road of the petrol station, including two rear end shuts. Two of the four accidents of the cluster were also potentially driver error related (WN155212, WN400311). The former was deemed to involve a driver failing to look properly whilst the latter involved a vehicle performing a poor manoeuvre.

23. There were six other accidents of slight severity, listed below, which driver error was attributed as a causal factor:

- WN212713- car travelling southbound along the A45 held up in queue and was subsequently hit by oncoming car in the rear which was deemed to be travelling too fast for the conditions.
- WN065514- incident occurred at the junction connecting Watering Lane to the A45 and involved a car colliding with the rear of another car which led to another rear shunt. The accident was deemed to be caused by a distraction in the vehicle which was attributed as a causal factor of the initial impact.
- WS055013- car travelling southbound along the A45 collides into rear of another car which was slowing for traffic ahead, hence it was deemed sudden breaking and failing to look properly were the causes of the incident.
- WN164313- car travelling southbound along the A45 collides into the rear of another car which is towing a caravan. It was deemed the driver of the first car failed to look properly and was subsequently following too closely.
- WN067616- car exiting A45 mistakes slip road for entrance into petrol garage and resulted in the car colliding with a road sign/lamppost. Therefore, it was deemed junction overshoot and a poor manoeuvre were the causal factors of the incident.
- WN184313- car which is towing a trailer, travelling northbound along the A45, commences to swerve, causing a collision with a car travelling in the same direction. The car towing the trailer then collides with the central reservation before coming to a standstill on the carriageway. It was deemed the driver of the first car was careless and inexperienced.

24. Three PIAs of slight severity, occurred in wet/damp road conditions (WN039613, WN031914, WN071316) which may have been a factor regarding the causation of the respective accidents.

25. There were three more PIAs of slight severity in the study area, listed below (WN118815, WN016016, WN055214) which did not indicate an apparent trend:

- WN118815- HGV travelling southbound along the A45, collides with kerb and results in a car breaking hard to avoid contact with the HGV before swerving to the right.
- WN016016- car travelling southbound along the A45 collides into rear of another car.
- WN055214- car travelling northbound on approach to Wootton Interchange, collides into rear of another car.

Summary

26. In summary, 18 recorded PIAs occurred in the study area between M1 J15 and the Wootton Interchange for the five-year period between 1 November 2011 and 31 October 2016, one of which resulted in a fatality.

27. Regarding possible trends of the respective PIAs in the study area, driver error was a prominent factor, notably sudden breaking, rear end shuts, and travelling too fast for the road conditions were common causal factors.

28. It is therefore considered that there is a clear link to the substandard geometry (for a 120kph design speed) and the PIAs.

Urban versus Rural

29. Whilst DMRB TD9 does provide the design standards for both urban and rural roads, very little is given by means of determining if a road is considered urban or rural in the first place. TD9 does state, however, that for Urban Roads, "*Low speed limits (30-40 mph) may be required due to the*

amount of frontage activity, but also where physical restrictions on the alignment make it impractical to achieve geometry relative to a higher Design Speed."

30. DMRB TA79 states that an Urban All-Purpose Road (UAP) is "*An all-purpose road within a built up area, either a single carriageway with a speed limit of 40 mph or less or a dual carriageway with a speed limit of 60 mph or less.*"

31. It is therefore considered that the following criteria have to be achieved for a road to be considered 'Urban':

    - The road is in a built-up area
    - Significant amount of frontage activity or physical restrictions on the alignment make it impractical to achieve geometry relative to a higher Design Speed
    - A speed limit of 60mph or less is justified

32. As noted above, it is considered that the road is now within a built-up area following the developing out of Grange Park and there is some roadside development

33. Furthermore, it is clear from the analysis of the existing geometry and the constraints on the route that physical restrictions on the alignment, generally in the form of built development, make it impractical to achieve geometry relative to a higher Design Speed.

34. The first two criteria are therefore considered to be met and a review of the speed limit follows.

Speed Limit

35. This section of the A45 is currently derestricted which means that it is subject to the national speed limit (i.e. 70mph for cars).

36. A review of the existing speed limit has therefore been undertaken in accordance with DfT Circular 01/2013.[2]

37. This circular states that 50mph limits may be used in urban areas in exceptional circumstances, and the typical use would be "*On dual carriageway ring or radial routes or bypasses that have become partially built up, with little or no roadside development*" (Table 1). As noted above the A45 now runs through a built-up area and there is some roadside development. Hence the use of a 50 mph limit is considered appropriate.

38. The speed data for this section of the A45, which is derived from permanent traffic counts located near the SB petrol station, is as follows:

	Northbound	Southbound
Average (mean) speed (mph)	49.2	47.9
85th percentile speed (mph)	57.2	52.5

39. DfT Circular 01/2013 recommends that the speed limit appraisal tool (SLAT) is used. However, this tool does not include data for analysing a speed limit reduction from 70mph to 50mph. An approximation has therefore been undertaken by considering a reduction from 60mph to 50mph but it is noted that any results should be taken as a guide only.

[2] DfT Circular 01/2013 "Setting Local Speed Limits"

40. The existing speed and accident data has been inputted into the SLAT and the results indicate that there would be a small reduction in both average and 85th percentile speeds, along with a small reduction in PIAs.

41. Based on the existing average (mean) speed being below 50mph, and the further reduction that would occur following a speed limit reduction, it is considered that a 50mph speed limit is appropriate and justifiable. It is therefore considered that the speed limit criteria is met.

42. Further analysis should be undertaken to determine the extent of the 50mph speed limit northwards to Northampton.

Conclusion

43. It is considered that this section of the A45 should be considered as an urban road for the following reasons:

    - The road is in a built-up area
    - Significant amount of frontage activity or physical restrictions on the alignment make it impractical to achieve geometry relative to a higher Design Speed
    - A speed limit of 50mph is justified

44. It is considered that the reduction in speed limit would reduce the number of PIAs.

45. As a speed limit of 50mph is justified, in accordance with DMRB TD9 Table 2 the design speed should be 85kph.

46. Based on the above, this section of the A45 should be designed as an Urban All-purpose (UAP) road with a design speed of 85kph.

BWB Consulting Ltd
12 June 2017

Appendix A
Summary of departures from standard between M1 J15 to the Grange Park SB merge (inclusive).
The following table does not include a review of the vertical alignment.

Ref	Location	Subject	Standard	Requirement	Existing situation	Removed by NGW scheme proposal in general	Removed if A45 classed as 50mph urban road in this location
A45 Southbound							
Ex1	A45 SB approach to Grange Park merge	Geometric alignment (link design)	TD9/93 para 1.24	Combinations of relaxations are not permitted (except 1 step below desirable minimum horizontal alignment and 1 step below desirable minimum SSD)	Combination of 2 step below desirable minimum horizontal alignment and 3 step below desirable minimum SSD	No	Yes
Ex2	A45 SB approach to Grange Park merge	Geometric alignment (link design)	TD9/93 para 1.26	Relaxation in SSD not permitted on immediate approach to junction	3 step below desirable minimum SSD on immediate approach to Grange Park merge	No	Yes if VRS realigned as part of scheme
Ex3	Grange Park merge	Geometric design (merge)	TD22/06 para 4.22	Merge nose to be 85m long	Merge nose is 67m long	No	Yes if amended to 40m nose length
Ex4	A45 SB between Grange Park merge and J15	Weaving distance	TD22/06 para 4.36 / 4.38	1km minimum weaving distance required	Weaving distance between Grange Park merge (lane gain designed to TD22) and J15 signal stop line is approximately 430m, some 570m below standard	No	Likely to be yes, subject to review of weaving flows
Ex5	A45 SB between Grange Park merge and bus stop	Weaving distance	TD22/06 para 4.36 / 4.38	1km minimum weaving distance required	Weaving distance between Grange Park merge (lane gain designed to TD22) and bus lay-by is 155m	Yes	n/a

Ref	Location	Subject	Standard	Requirement	Existing situation	Removed by NGW scheme proposal in general	Removed if A45 classed as 50mph urban road in this location
Ex6	A45 SB between Grange Park merge and J15	Geometric alignment (link design)	TD9/93 para 1.24	Combinations of relaxations are not permitted (except 1 step below desirable minimum horizontal alignment and 1 step below desirable minimum SSD)	Combination of 3 step below desirable minimum horizontal alignment and 3 step below desirable minimum SSD	No	Yes
Ex7	A45 SB approach to J15	Geometric alignment (link design)	TD9/93 para 1.26	Relaxation in SSD not permitted on immediate approach to junction	3 step below desirable minimum SSD on immediate approach to J15	No	Yes
Ex8	A45 SB between Grange Park merge and J15	Cross section	TD27/05 para 4.2.1	Cross section must comply with Figure 4-3a D2AP (or D3AP due to auxiliary lane)	No offside hardstrip is provided	No	Yes as cross section would be D3UAP
Ex9	A45 SB bus lay-by*	Siting of lay-by	TD69/07 para 3.7	Separation between upstream junction and lay-by to be 450m (3.75Vm)	Separation between Grange Park merge and lay-by is 156m	Yes (bus lay-by removed)	n/a
Ex10	A45 SB bus lay-by*	Siting of lay-by	TD69/07 para 3.7	Separation between downstream junction and lay-by to be 450m (3.75Vm)	Separation between bus lay-by and J15 signal stop line is 250m. (Lay-by is also located after first direction sign for junction).	Yes (bus lay-by removed)	n/a
A45 Northbound							
Ex11	A45 NB between J15 and Watering Lane	Geometric alignment (link design)	TD9/93 para 1.24	Combinations of relaxations are not permitted (except 1 step below desirable minimum horizontal alignment and 1 step below desirable minimum SSD)	Combination of 2 step below desirable minimum horizontal alignment and 3 step below desirable minimum SSD	No	Yes

Ref	Location	Subject	Standard	Requirement	Existing situation	Removed by NGW scheme proposal in general	Removed if A45 classed as 50mph urban road in this location
Ex12	A45 SB approach to J15	Geometric alignment (link design)	TD9/93 para 1.26; TD42/95 para 7.5	Relaxation in SSD not permitted on immediate approach to junction	3 step below desirable minimum SSD on immediate approach to Watering Lane and parking Lay-by	No	Yes if VRS realigned as part of scheme
Ex13	A45 NB between J15 and downstream of Watering Lane	Cross section	TD27/05 para 4.2.1	Cross section must comply with Figure 4-3a D2AP	No hardstrips are provided	No	Yes as cross section would be D2UAP
Ex14	A45 NB parking lay-by	Siting of lay-by	TD69/07 para 3.6	Lay-by must not be sited within 1km of the end of a dual carriageway	Lay-by is sited 150m from the end of the dual carriageway	Yes (lay-by removed)	n/a
Ex15	A45 NB parking lay-by	Siting of lay-by	TD69/07 para 3.7	Separation between upstream junction and lay-by to be 450m (3.75Vm)	Separation between J15 exit and lay-by is 150m, and there is no separation between private access and lay-by.	Yes (lay-by removed)	n/a
Ex16	A45 NB parking lay-by	Siting of lay-by	TD69/07 para 3.7	Separation between downstream junction and lay-by to be 450m (3.75Vm)	Separation between lay-by and Watering Lane junction is 10m.	Yes (lay-by removed)	n/a
Ex17	A45 NB parking lay-by	Design of lay-by	TD69/07 para 4.4	Type B lay-bys not permitted on dual carriageway roads	Type B lay-by provided	Yes (lay-by removed)	n/a
Ex18	A45 NB parking lay-by	Design of lay-by	TD69/07 para 4.19	2m footway to be provided	1.3m footway is provided	Yes	n/a
Ex19	A45 NB Watering Lane junction	Geometric layout of junction	TD42/95 para 7.55	Nearside diverging taper shall be 110m long	Nearside diverging taper is 55m long	Yes as amended to auxiliary lane of required length	n/a

Ref	Location	Subject	Standard	Requirement	Existing situation	Removed by NGW scheme proposal in general	Removed if A45 classed as 50mph urban road in this location
Ex20	A45 NB after Watering Lane	Geometric alignment (link design)	TD9/93 para 1.24	Combinations of relaxations are not permitted (except 1 step below desirable minimum horizontal alignment and 1 step below desirable minimum SSD)	Combination of 2 step below desirable minimum horizontal alignment and 1 step below desirable minimum SSD	No	Yes
Ex21	A45 SB bus lay-by*	Design of lay-by	TD69/07 para 3.8	Lay-bys must not be combined with a junction or access	Lay-by is combined with Watering Lane junction	Yes (bus lay-by removed)	n/a
M1 J15 roundabout							
Ex22	A508 approach	Entry path radius	TD16/07 para 7.56	Entry path radius must not exceed 100m	Entry path radius is 280m	Yes, approach signalised	n/a
Ex23	Saxon avenue approach	Entry path radius	TD16/07 para 7.56	Entry path radius must not exceed 100m	Entry path radius is 160m, ignoring subsidiary deflection island which is in itself a departure	Yes, approach signalised	n/a
Ex24	A508 approach	Forward visibility at give way line	TD16/07 para 8.9	Forward visibility to be 50m based on Table 8/1, using approx. 70m ICD in this area	Forward visibility is approximately 35m	Yes	n/a
Ex25	South side of M1	Circulatory visibility	TD16/07 para 8.9	Circulatory visibility to be 50m based on Table 8/1, using approx. 70m ICD in this area	Circulatory visibility is approximately 30m	Yes	n/a
Ex26	North side of M1	Circulatory visibility	TD16/07 para 8.9	Circulatory visibility to be 50m based on Table 8/1, using approx. 80m ICD in this area	Circulatory visibility is approximately 35m	Yes	n/a

* As per paragraph 5.7 of TD69/07, paragraphs 3.7 and 3.8 apply to bus lay-bys but there is recognition that a departure could be granted to paragraph 3.7 where justified due to the need to serve a community.