

TORBAY COUNCIL

**TORBAY SATURN MODEL UPDATE
PHASE 2 - OPTION TESTING**

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FINAL

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1 INTRODUCTION

1.1.1 Parsons Brinckerhoff have been commissioned by Torbay Council to test possible future development options for Torbay using the SATURN¹ model outlined in the Report of Surveys and Local Model Validation Report (Report No HPE91480A/1/2).

1.1.2 The calibrated base year model has been used to forecast two future development scenarios for Torbay. This study will look at different options for each development scenario and identify improvements that may be necessary, looking more specifically at the Torbay Western Corridor.

2 DEVELOPMENT OPTIONS

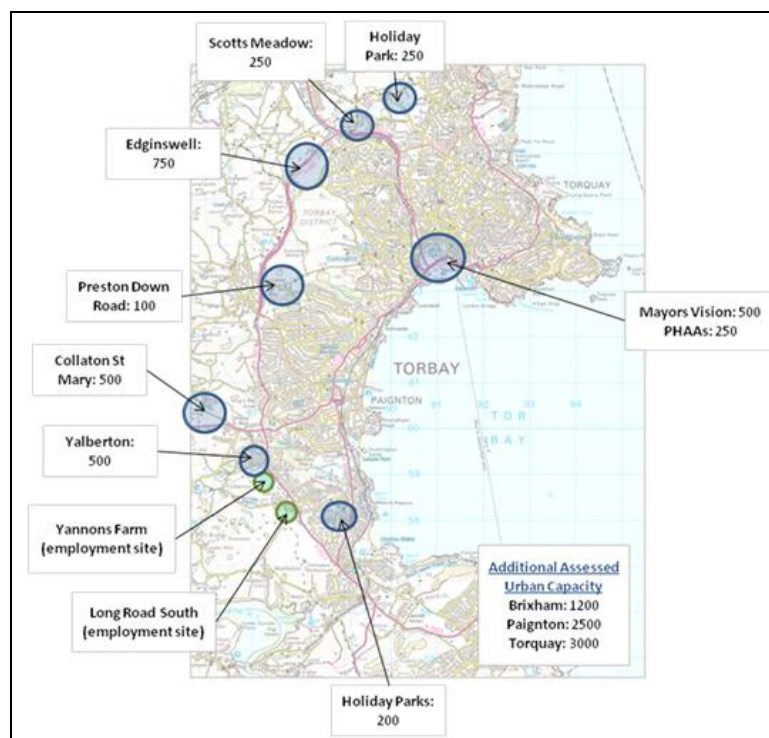
2.1 Overview

2.1.1 The draft Regional Spatial Strategy (RSS) covers the period 2006 to 2026. The assessment year for this study will therefore be 2026 as this is the final year covered by the draft RSS. Although there is some uncertainty about the future of RSS requirements, it is incumbent upon local authorities to plan for future growth.

2.1.2 Torbay Council have identified a number of possible development scenarios in the Torbay Core Strategy Development Plan Document from which two development scenarios were chosen to be assessed, these are

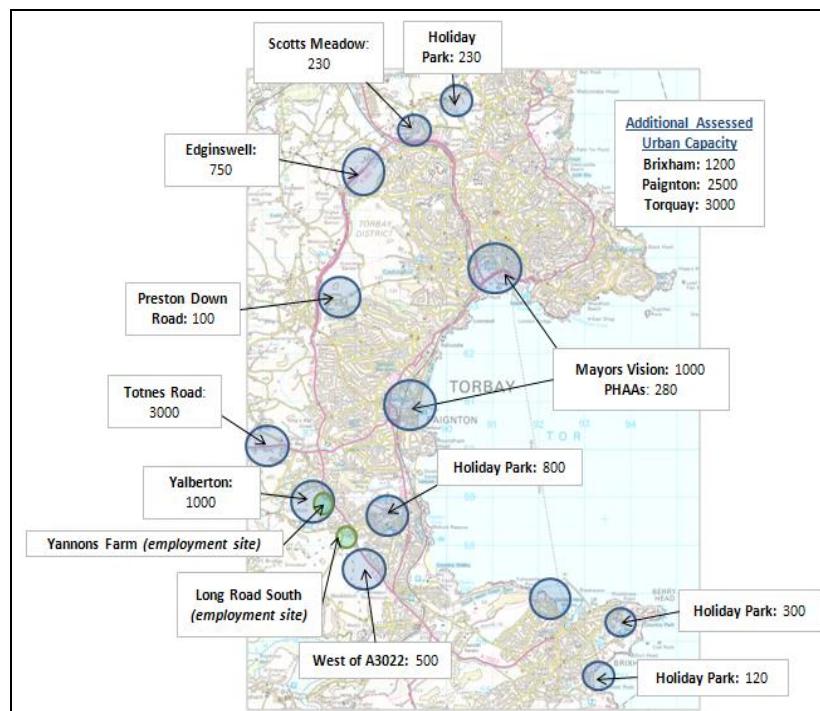
- i 10,000 dwellings – Mixed Urban Regeneration/Greenfield Approach (Figure 2.1)
- ii 15,000 dwellings – Relative Urban Focus (Figure 2.2)

Figure 2.1 – 10,000 Dwellings Development Scenario



¹ Simulation and Assignment of Traffic to Urban Road Networks.

Figure 2.2 – 15,000 Dwellings Development Scenario



2.1.3 A Strategic Housing Land Availability Assessment (SHLAA) was carried out for all of Torbay (Baker Associates, 2008). Each scenario assumes that the maximum reasonable amount of development takes place within the built up area, particularly on brownfield ‘urban capacity’ sites. The SHLAA suggests that around 6,700 dwellings can be achieved from such sources by 2026.

2.1.4 The assessed urban capacity for dwellings also includes the second phase of the Great Parks development, which is the same in both scenarios.

2.1.5 Both scenarios also assume two employment sites which have been identified in the Adopted Torbay Local Plan. These are;

- *Yannons Farm* - 16.6 hectares of B1 and B2 development
- *Long Road South* – 11.8 hectares of B1 development

2.2 Committed Infrastructure Improvements

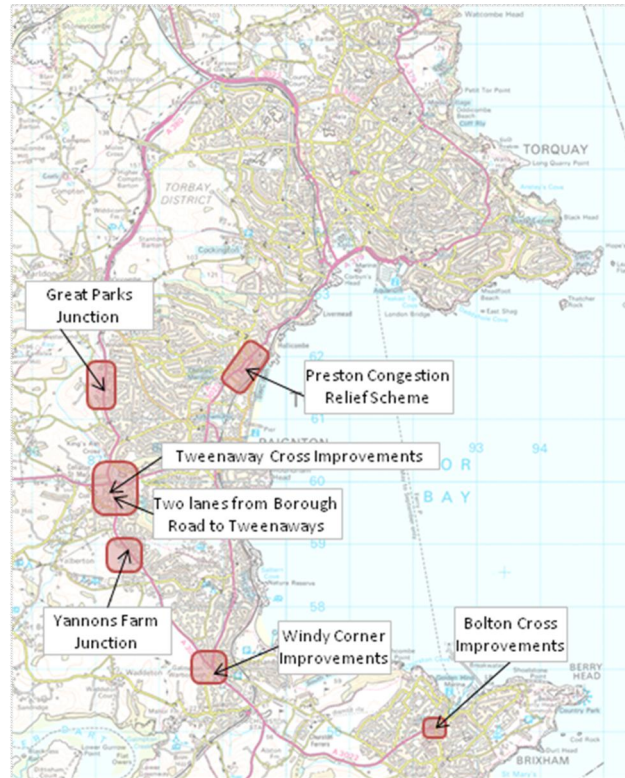
2.2.1 There are a number of infrastructure improvements which are assumed to be complete by 2026. These are;

- Windy Corner improvements
- Tweenaway Cross improvements
- Great Parks Junction
- Preston Congestion Relief Scheme
- Yannons Farm Junction
- Two lanes from Borough Road to Tweenaway Cross

- Bolton Cross Improvements

2.2.2 These infrastructure improvements will form a Do Minimum option for each development scenario; the location of the improvements is illustrated in Figure 2.3.

Figure 2.3 – Committed Infrastructure Improvements



2.3 Possible Development Improvement Options: 10,000 Dwellings Scenario

2.3.1 There are a number of different options to be assessed for the 10,000 dwellings growth scenario which will assume different infrastructure improvements. These are;

10,000 Growth Scenario – No Tweenaway Cross and No Windy Corner Improvements Option

2.3.2 This option assesses only five of the seven committed infrastructure improvements, omitting the improvements at Tweenaway Cross and Windy Corner.

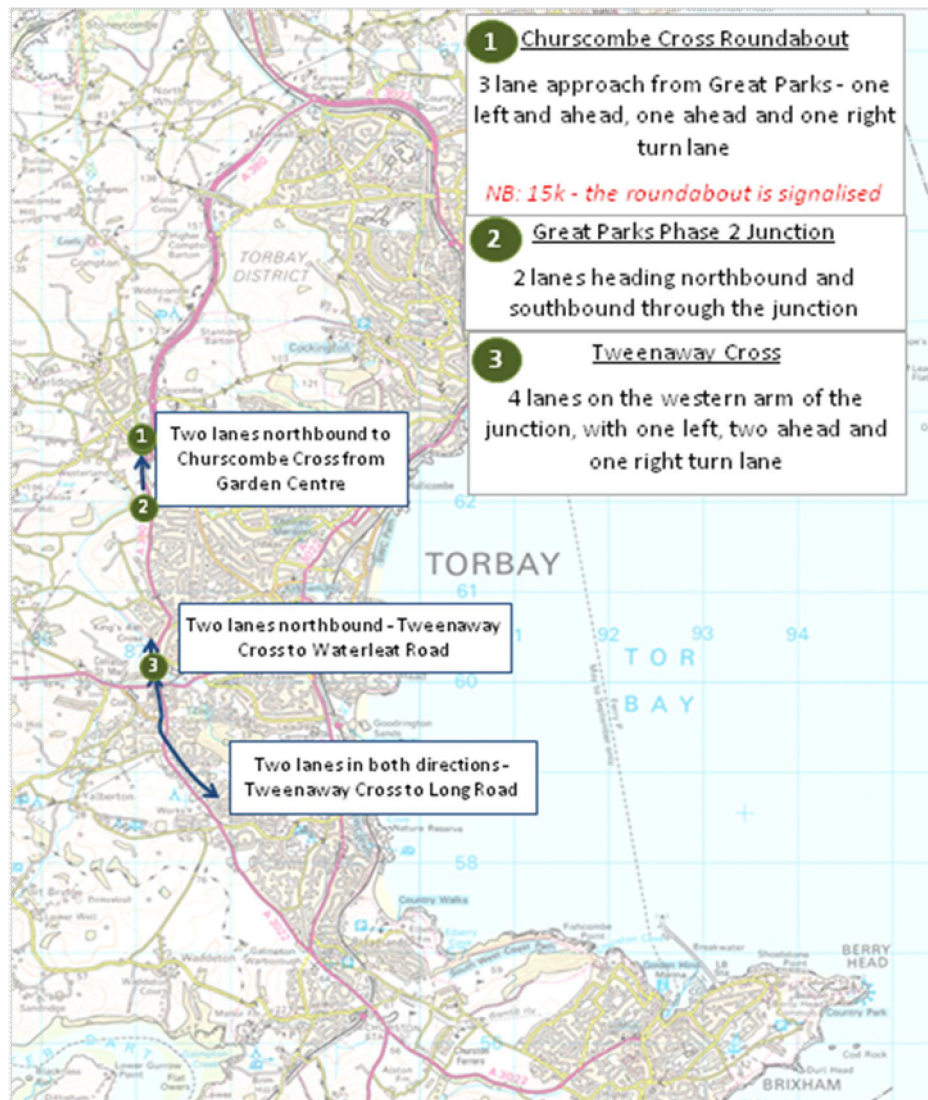
10,000 Growth Scenario – Do Minimum Option

2.3.3 This option assesses the seven committed infrastructure improvements as indicated in section 2.2.1.

10,000 Growth Scenario – Necessary Online Improvements Option

2.3.4 This option includes all seven Do Minimum improvements as well as a number of suggested improvements, all situated on the Torbay Western Corridor. The improvements are shown in Figure 2.4.

Figure 2.4 – Selected online improvements



2.4 Possible Development Improvement Options: 15,000 Dwellings Scenario

2.4.1 As with the 10,000 dwellings growth scenarios, there are a number of different options to be assessed for the 15,000 dwellings scenarios which will assume different infrastructure improvements. These are;

15,000 Growth Scenario – Do Minimum Option

2.4.2 This option assesses the seven committed infrastructure improvements as indicated in section 2.2.1

15,000 Growth Scenario – Necessary Online Improvements Option

2.4.3 This option includes all seven Do Minimum improvements as well as a number of suggested improvements, all situated on Torbay Western Corridor. The improvements are shown in Figure 2.4. In addition to these improvements selected for the 10,000 growth scenario necessary online improvements option, the roundabout at

Churscombe has been signalised in the 15,000 dwellings necessary online improvements option.

15,000 Growth Scenario – Ring Road Option

2.4.4

This option includes all seven Do Minimum improvements as well as a proposed dual carriageway ring road linking Churscombe Cross roundabout to Brixham Road (to the south of Long Road), with access to Totnes Road to the west of Tweenaway Cross.

3 METHODOLOGY

3.1.1 The 2008 base model in the Torbay SATURN Model Update project (HPE91480A) has been used. This model will be used in the forecasting assessment detailed in this report. The model covers the AM Peak hour (08:00 to 09:00).

3.2 Zone System

3.2.1 The zone system remains the same as the base model, with the addition of zones representing the potential housing developments.

3.2.2 As there are a large number of infilling developments within the three towns, dwellings located in a similar location were grouped together and added to the zone system.

3.3 South Devon Link Road

3.3.1 The South Devon Link Road was added to each option as it is assumed to be built by 2026. Some trips were added to the matrix from the Kingskerswell model to represent trips that will be attracted to the area due to this improvement in infrastructure.

3.4 Trip Generation

3.4.1 In terms of the new housing developments and assessed urban capacity, the trips for each site for the AM Peak have been calculated using TRICS², selecting sites that are similar to the proposed developments in order to calculate development trip rates.

3.4.2 TRICS (2009b) is a database of developments that have been surveyed and their impact in terms of trip generation recorded. The database allows the user to research similar developments in terms of location, land use, size, local car ownership levels, number of visitor/employee numbers and neighbouring population size. TRICS is a recognised tool for modelling trip generation and is endorsed by the TRICS Consortium, consisting of six County Councils. TRICS can be used to establish trip rates for the whole day or certain hours during a 24-hour period.

3.4.3 The residential trip rates for the AM Peak (08:00 to 09:00) using TRICS are illustrated in Table 3.1 in terms of trips per household. The trip rate for privately owned houses (inbound) is 0.139 meaning that for every 100 households, one can expect there to be 14 trips generated. Any greenfield sites are considered as private houses and any brownfield sites have been assumed to be flats.

Table 3.1 – Trip Rates assumed for development in the AM Peak.

	Privately Owned Houses		Privately Owned Flats	
	In	Out	In	Out
Trip Rate (per household)	0.139	0.412	0.068	0.211

3.4.4 TRICS was also used to calculate the trips generated by the two employment sites, Yannons Farm and Long Road South. Sites have been shown that are considered similar to these proposed sites. The trip rates assumed are shown in Table 3.2.

² Trip Rate Information Computer Systems – the national standard of trip generation and analysis in the UK: www.trics.org

- 3.4.5 To calculate the trip rate for Yannons Farm and Long Road South in the AM Peak, employment densities were used based on similar sites within the TRICS database. Information on the sizes of the developments were taken from the Torbay Local Plan and the densities were used from the document 'Employment Densities: A Full Guide'³. To calculate the trip rate for Yannons Farm, an average of trip rates based on business parks was used where the number of employees working at the site was less than 1500. For Long Road South, the same assumption was used, however only for sites that had up to 800 employees.
- 3.4.6 It should be noted that possible uses of these sites may yield different overall traffic generation. This would need to be assessed to test detailed growth options or when considering planning applications.

Table 3.2 – Trip Rates assumed for employment developments for the AM Peak

	Yannons Farm		Long Road South	
	In	Out	In	Out
Trip Rate (per employee)	0.154	0.021	0.128	0.018

3.5 Background Growth

- 3.5.1 To project the matrix to 2026, the software TEMPRO was used. TEMPRO growth factors were applied to account for background growth in traffic between 2008 and 2026.
- 3.5.2 The growth factors were calculated using the National Trip-End Model (NTM) methodology for traffic growth. To avoid double counting, the number of proposed dwellings for each scenario was removed from the alternative planning assumptions in the software.

3.6 Modelling

- 3.6.1 As a result of the considerable route choice in the model and to avoid the loss of development traffic around the network, the SATURN feature PLOD⁴ has been used. The assignment of the original development trips has been fixed and trips generated by the new developments are placed on the top of them in a separate network.
- 3.6.2 To do this, two matrices were created, one to include the trips for the original zones, with background growth applied and one to include any trips to and from the proposed developments.
- 3.6.3 These development trips were then loaded on top of the existing trips with growth added. The model can then be analysed using P1X⁵.

3.7 Windy Corner

- 3.7.1 As the updated base SATURN model was calibrated to flows along screenlines both to the south and north of Paignton, there was an unrealistic assignment of traffic to the south of Windy Corner. In terms of the straight ahead movement from Brixham to

³ Arup Economics and Planning. (2001) Employment Densities: A Full Guide

⁴ PLOD is a command in SATURN which allows the pre-loading of flows

⁵ P1X is a network analysis programme within SATURN which shows a visual representation of the modelled network.

Dartmouth Road, there were some problems assessing the junction as SATURN is not used for detailed junction assessment and traffic was getting held up at the junction with Bascombe Road. In order to accurately model the Windy Corner junction, it was decided to carry out a LINSIG⁶ junction assessment.

3.7.2 This LINSIG was carried out for each scenario, taking the demand flows from the SATURN model and using these in the assessment. The results for these LINSIGS will be shown in the following section.

⁶ LINSIG is a traffic signal modelling software package which allows for the optimisation of signal timings.

4 RESULTS

4.1 Overview

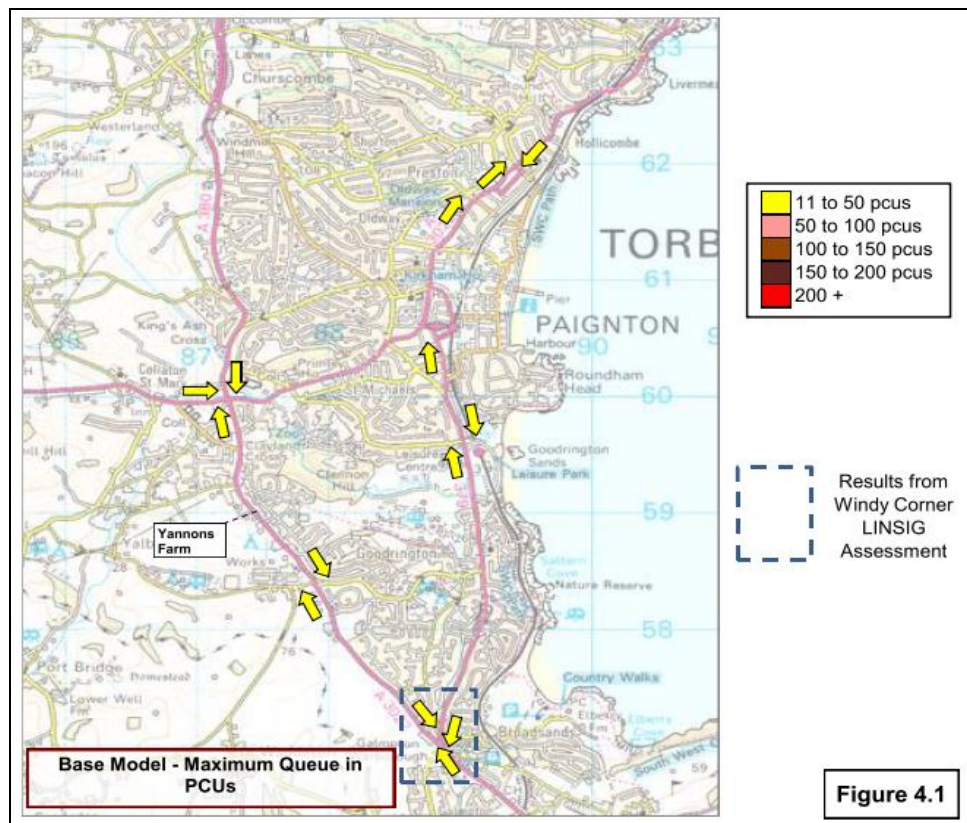
4.1.1 This section will indicate the queue totals for links within the model primarily focussing on the Western Corridor and the coastal route within the Paignton area.

4.1.2 As mentioned previously an assessment will be carried out separately for the Windy Corner junction. The results will be included and highlighted within the diagrams below with an explanation of the separate LINSIG assessment.

4.2 Base Model

4.2.1 Figure 4.1 shows the maximum queue lengths reached during the AM Peak hour for the base model (current situation, 2008).

4.2.2 The base model shows some queuing around certain junctions in the AM Peak hour, specifically the Tweenaway Cross and Long Road junctions and around Preston. The queue reaches a maximum of 50 pcus⁷ in this option. It should be assumed that 1 pcu is approximately equal to 6 metres.



Windy Corner Assessment

4.2.3 The LINSIG shows that queue lengths at the proposed junction are minimal, with the maximum queuing being experienced on Dartmouth Road (for traffic heading to Brixham) and on the Western Corridor arm, these are 21.8 and 17.0 pcus

⁷ Passenger Car Unit. This takes into account the different composition of traffic.

respectively. The Practical Reserve Capacity (PRC) of the whole junction is 16.9% therefore there is some spare capacity at the junction and it works satisfactorily.

4.2.4 It is recognised that queuing does occur at Windy Corner at present however it is considered to be more of an issue in the PM Peak period.

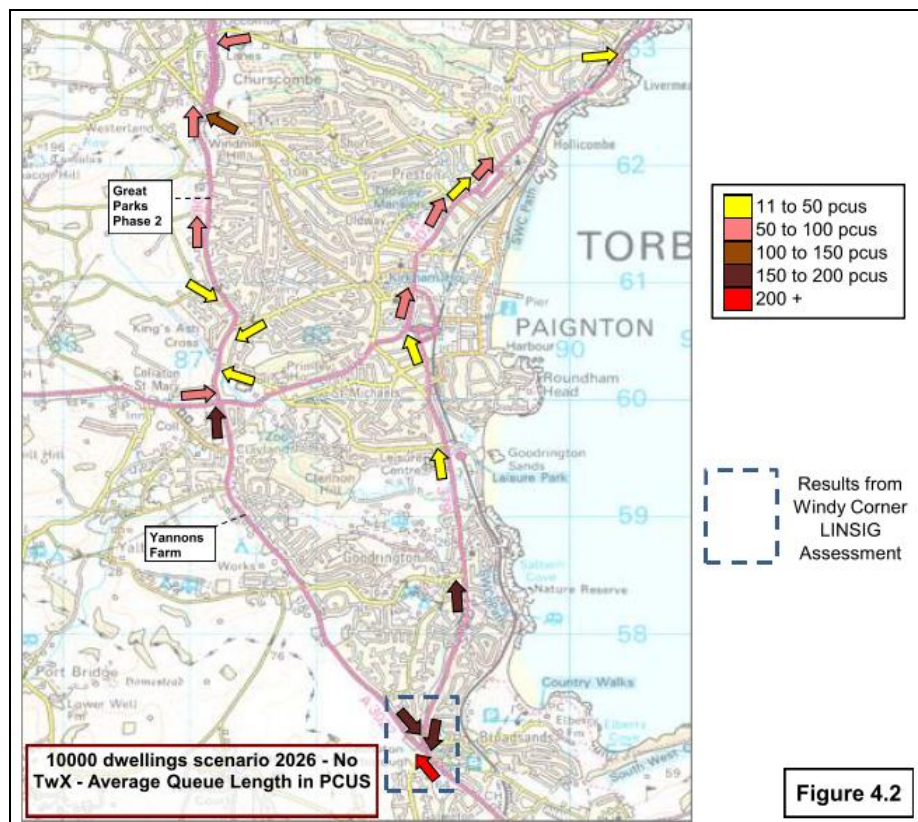
4.3 10,000 Dwellings Scenario - No Tweenaway Cross and No Windy Corner Improvements Option

4.3.1 Figure 4.2 shows the average queue lengths for links in 2026 with 10,000 dwellings and only five of the seven committed infrastructure improvements, there are no improvements at Tweenaway Cross and Windy Corner.

4.3.2 Compared to the base, there is increased queuing in many areas, especially on the Western Corridor and coastal route. There is also some more minor queuing where traffic is trying to join the two main routes. Queuing at Tweenaway Cross has increased, especially on the southern arm.

4.3.3 Churscombe Cross roundabout, to the north of Great Parks, is experiencing increased congestion, with the addition of 10,000 houses in the Torbay area. The area around Great Parks is also experiencing increased queuing.

4.3.4 Dartmouth Road is experiencing more congestion at the junction with Goodrington Road. This can be explained by the movement of vehicles heading northbound through Windy Corner. As traffic approaches Windy Corner, traffic is choosing to travel along the coastal route, to avoid the queuing at Tweenaway Cross and Great Parks, therefore causing some congestion along the coastal route.



Windy Corner Assessment

4.3.5 The LINSIG assessment of Windy Corner shows that queue lengths on the proposed junction arms have increased from the base, with the maximum queuing being experienced on the approach to the junction from Brixham heading towards the coastal route and similar levels are being experienced on the Western Corridor arm and on Dartmouth Road for traffic heading to Brixham. These are 204.1, 183.6 and 162.9 pcus respectively. The Practical Reserve Capacity (PRC) of the whole junction is -42.8% therefore there is no spare capacity at the junction.

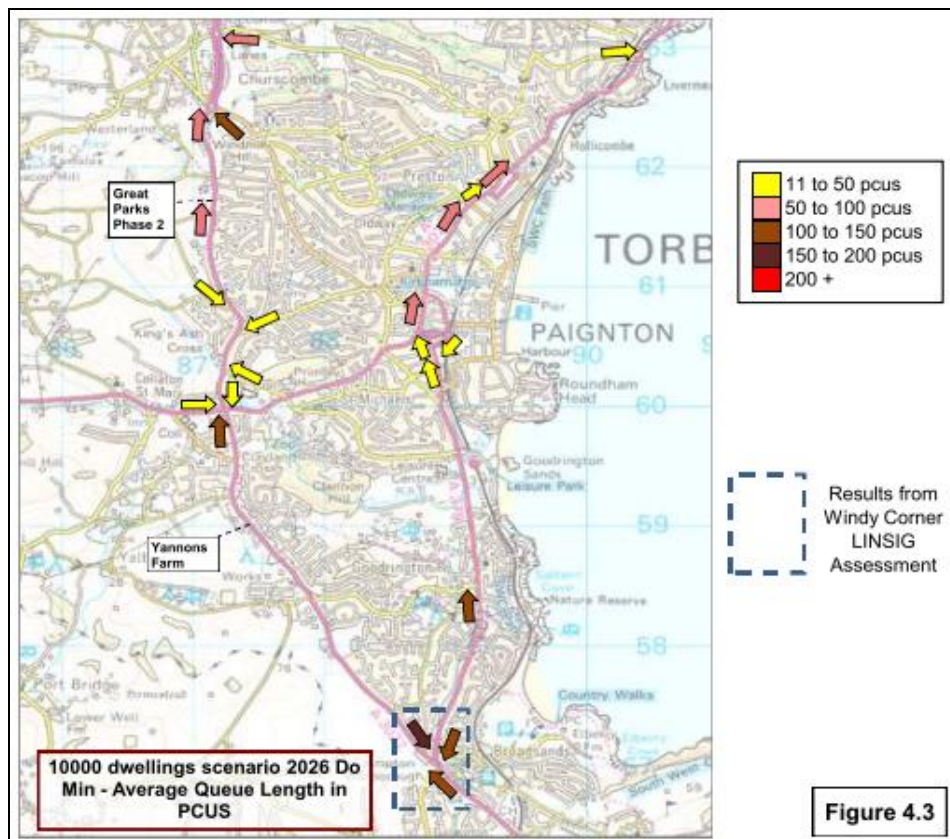
4.4 10,000 Dwellings Scenario - Do Minimum Option

4.4.1 Figure 4.3 shows the average queue total for the 10,000 dwelling scenario with all seven committed infrastructure improvements completed.

4.4.2 The improvements at Tweenaway Cross have resulted in a decrease in the length of queuing on the southern and western arm, with a slight increase in queuing on the northern arm. There are however problems of congestion around Great Parks and Churscombe Cross, due to the release of traffic around Tweenaway Cross.

4.4.3 Dartmouth Road has seen a decrease in queue length heading northbound, which would suggest that more traffic is travelling along the Western Corridor rather than heading through the centre of Paignton due to the improvements.

4.4.4 This option still experiences congestion around Great Parks, Churscombe Cross and Preston.



Windy Corner Assessment

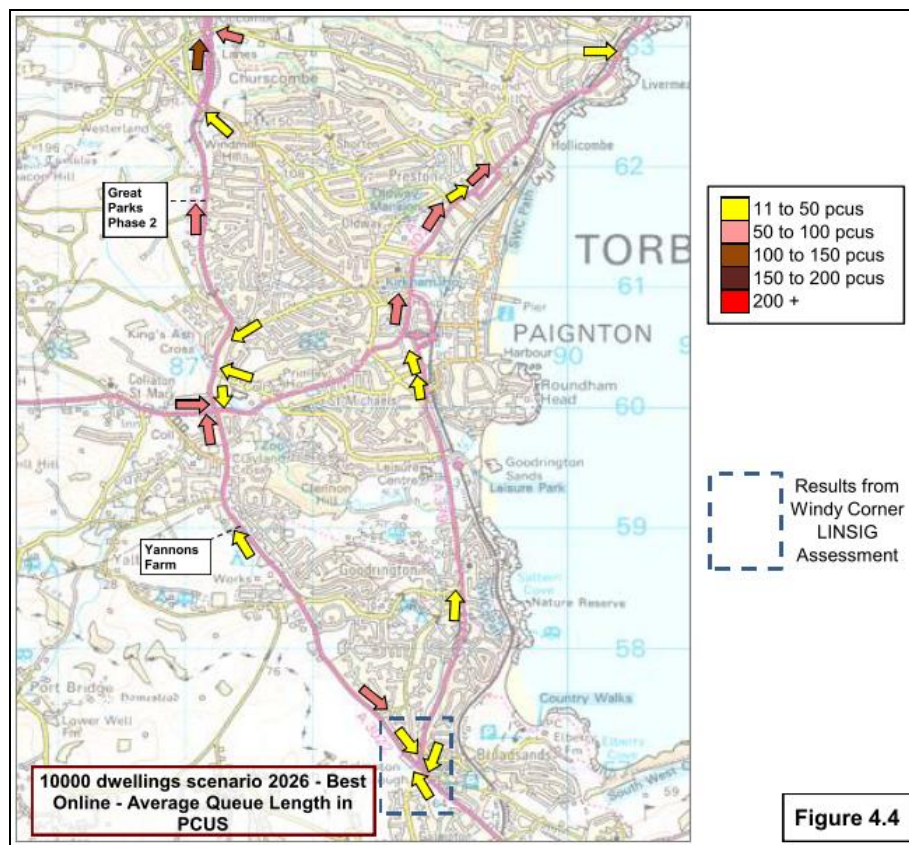
4.4.5 Queue lengths on the proposed junction arms have decreased with the additional committed infrastructure improvements. The maximum level of queuing is evident on the Western Corridor arm, with queuing also being experienced on Dartmouth Road for traffic heading to Brixham and from Brixham to the coastal route, these are 176.6, 154.5 and 106.6 pcus respectively. The PRC for the whole junction is -41.0% therefore there is no spare capacity in the junction. This has however improved slightly when compared to the No Tweenaway Cross and No Windy Corner improvement option.

4.5 10,000 Dwellings Scenario - Necessary Online Improvements Option

4.5.1 Figure 4.4 shows the average queue total for the 10,000 dwellings scenario with possible online improvements for the Western Corridor (shown in Figure 2.4).

4.5.2 With the additional trips on the Western Corridor that were previously using the coastal route, the queuing at Great Parks Phase 2 remains similar to those in the Do Minimum.

4.5.3 There is a reduction in queues along Dartmouth Road heading northbound in this option, showing that the addition of these improvements makes the Western Corridor more attractive for traffic, rather than the coastal route.



Windy Corner Assessment

4.5.4 Using the demand flows from the 10,000 growth scenario with the Necessary Online Improvements option, the LINSIG results show improvements when compared with

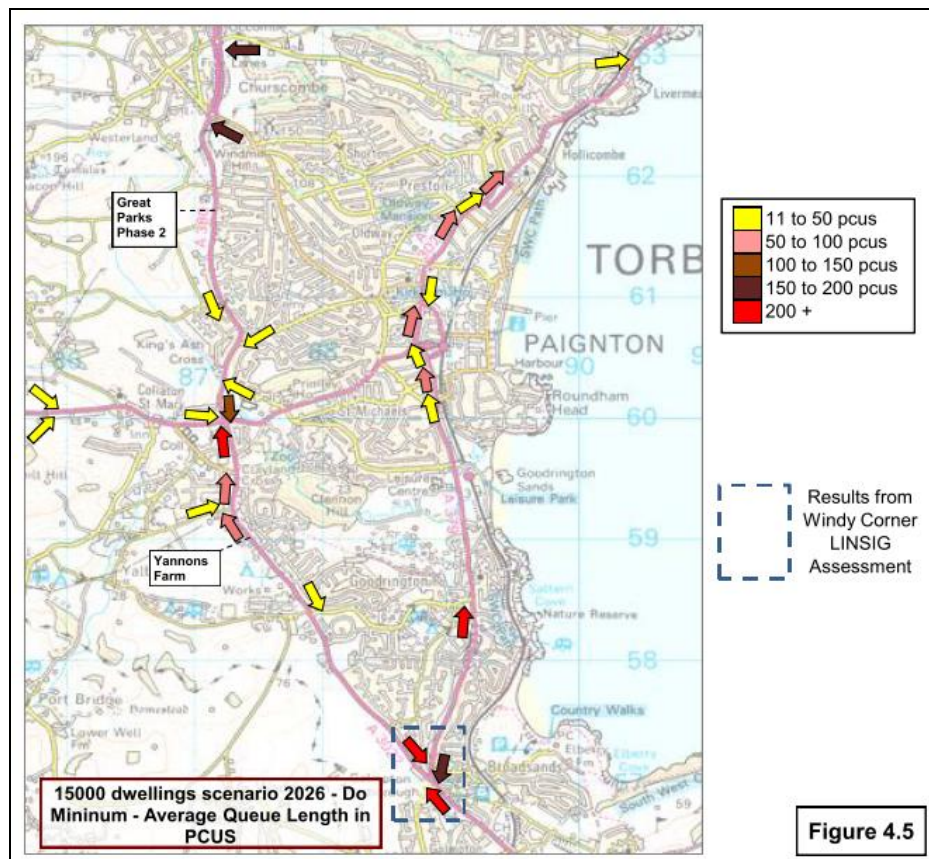
the Do Minimum option. Queue lengths on the proposed junction arms have decreased significantly; the maximum queuing at the junction does not exceed 35 pcus. Windy Corner is operating satisfactorily with a PRC of 2.1%, although close to capacity.

4.6 15,000 Dwellings Scenario - Do Minimum Option

4.6.1 Figure 4.5 shows the average queue totals for junctions in the 15,000 Do Minimum option with all seven committed infrastructure improvements completed.

4.6.2 Queues around Tweenaway Cross, Yalberton Road and Paignton town centre have increased with 15,000 dwellings compared to the 10,000 scenario. Also, Churscombe Cross roundabout experiences increased congestion. The increase in the number of vehicle trips due to the increase in the number of dwellings results in increased queuing at Tweenaway Cross. Traffic is therefore choosing to use the alternative route through Paignton town centre, therefore increasing queuing on Dartmouth Road and increasing the pressure on this junction.

4.6.3 The new development located to the west of the Western Corridor (3000 dwellings) is also experiencing queuing when accessing Totnes Road.

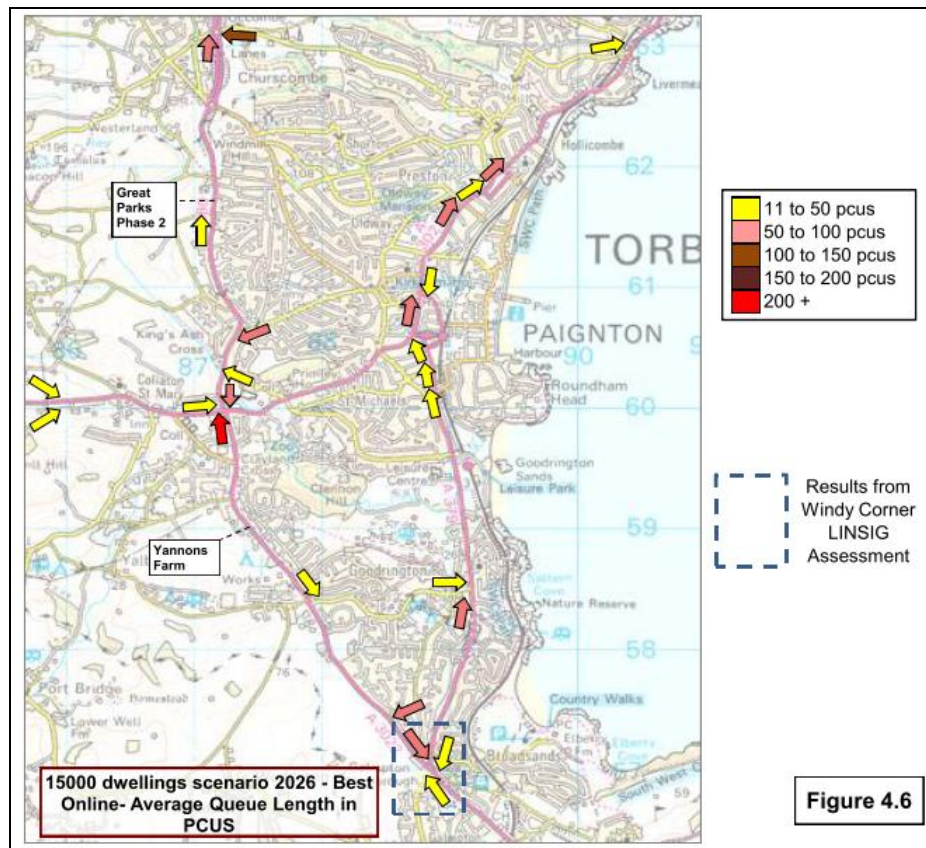


Windy Corner Assessment

4.6.4 The LINSIG assessment shows considerable queue lengths are experienced for three of the movements, these are on the Western Corridor arm (464.9 pcus), from Brixham to Dartmouth Road (457.2 pcus), and from Dartmouth Road to Brixham (158.5 pcus). Windy Corner is operating unsatisfactorily with a PRC of -93.8%.

4.7 15,000 Dwellings Scenario - Necessary Online Improvements Option

- 4.7.1 Figure 4.6 shows the average queue totals for the 15,000 dwellings scenario with necessary online improvements.
- 4.7.2 Queuing along Dartmouth Road has reduced compared with the Do Minimum option, as the Western Corridor becomes more attractive with the improvements on this route. The necessary online improvements have relieved congestion around Yannons Farm and Yalberton; however this has caused more congestion at Tweenaway Cross.
- 4.7.3 The queuing at Tweenaway Cross southbound has reduced; more traffic is therefore being released and is reaching the Long Road junction more quickly. Increased queuing is therefore evident at the Long Road junction.
- 4.7.4 Queuing is also evident in this option on the access to a development zone to the north of Windy Corner. An increase in trips in this area makes it increasingly difficult to exit this zone.



Windy Corner Assessment

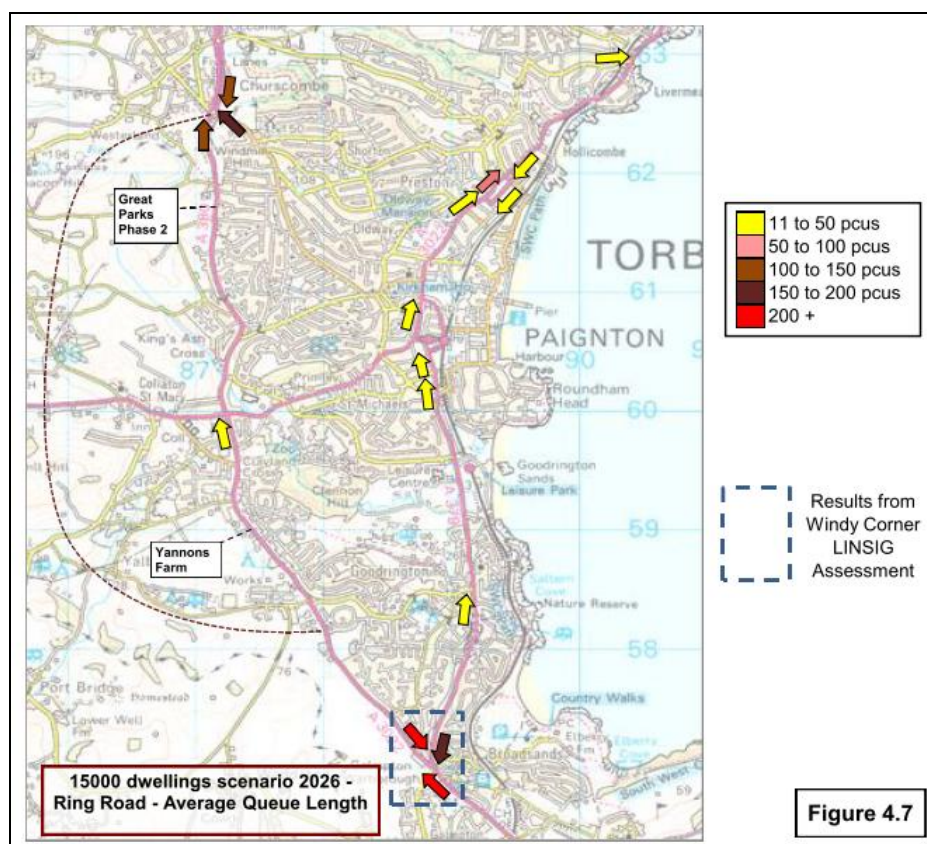
- 4.7.5 The LINSIG results show a significant reduction in queuing compared to the 15,000 dwellings Do Minimum option. Maximum queue lengths have reduced on all arms to below 60 pcus, with the Western Corridor experiencing the largest queue length at 59.3 pcus. The PRC for the junction is -15.1% showing an improvement from the previous option. Even though the PRC is negative, it is only just operating below capacity.

4.7.6 Windy Corner is working better than in the 15,000 dwellings Do Minimum option due to the reallocation of green times to improve the capacity at the junction.

4.8 15,000 Dwellings Scenario - Ring Road Option

4.8.1 Figure 4.7 shows the average queue total for the 15,000 dwellings scenario with an additional dual carriageway ring road running from Churscombe Cross roundabout to join onto Brixham Road south of Long Road. The ring road also connects to Totnes Road, west of Tweenaway Cross.

4.8.2 The ring road has relieved most of the congestion along the Western Corridor. Churscombe Cross roundabout becomes a pinch point in this option, as traffic is not queuing elsewhere, therefore reaches this junction more quickly. Queues along Dartmouth Road and the coastal route are lower than the other 15,000 dwellings scenario options, as traffic prefers to use the Western Corridor with the Ring Road in place.



Windy Corner Assessment

4.8.3 The LINSIG results show that the maximum queue lengths on the proposed junction arms have increased from the 15,000 dwellings Necessary Online Improvements option, with the Western Corridor experiencing the worst queuing with 455.8pcus. The movement from Brixham heading to the Western Corridor is experiencing queues in the order of 308.5 pcus. The PRC of the junction is -72.7%, therefore the junction is operating over capacity.

4.8.4 The main delays are observed on the Western Corridor arm of the junction, and heading from Brixham to the Western Corridor. The addition of the new road means

that this route becomes more attractive, placing more demand on the left turn heading northbound from Brixham. As the ring road is getting more traffic to Windy Corner more quickly, there is also an increased demand on this arm.

5 MODAL SHIFT ASSESSMENT

5.1.1 In order to see what affect possible improvements in public transport and encouraging more sustainable modes will have on the Torbay network; two junctions located on the Western Corridor have been assessed. These are Great Parks Phase 2 junction and Yalberton Road junction. These have been chosen due to the queue lengths evident in the option analysis.

5.1.2 To assess this, there has been a comparison between the Necessary Online Improvements for both scenarios and these options with a 20% reduction in vehicle trips to account for modal shift. The 20% reduction rate has been considered reasonable, with the appropriate provision of alternative travel modes.

5.1.3 This has been applied to the new development trips at Great Parks and Yalberton to identify the impact on these junctions.

5.2 10,000 Dwellings Scenario – Great Parks Phase 2

5.2.1 Table 5.1 shows the difference in queuing between the Necessary Online Improvements and the options with a 20% reduction in vehicle trips in the AM Peak hour.

5.2.2 The table shows that with the reduction of trips to and from the Great Parks Phase 2 development there is a 17% decrease in queuing overall at the junction. There is a 22% decrease in queuing on the Kings Ash Road North arm and a 25% decrease on the Great Parks development arm of the junction.

Table 5.1 – Modal Shift Assessment – 10,000 Dwellings Scenario Great Parks Phase 2

	<i>Reduction in Queuing</i>	<i>Overall</i>
<i>Kings Ash Hill North</i>	-22%	-17%
<i>Kings Ash Hill South</i>	-5%	
<i>Great Parks</i>	-25%	

5.3 15,000 Dwellings Scenario – Great Parks Phase 2

5.3.1 Table 5.2 shows the reduction in queuing resulting from the reduction of vehicle trips entering and leaving the development in the AM Peak Hour for 15,000 dwellings scenario.

5.3.2 There is a 13% decrease in queuing overall at the junction, with the greatest reduction being experienced on the Great Parks arm (25%)

Table 5.2 – Modal Shift Assessment – 15,000 Dwellings Scenario Great Parks Phase 2

	<i>Reduction in Queuing</i>	<i>Overall</i>
<i>Kings Ash Hill North</i>	-8%	-13%
<i>Kings Ash Hill South</i>	-6%	
<i>Great Parks</i>	-25%	

5.4 10,000 Dwellings Scenario – Yalberton Road

5.4.1 Table 5.3 shows the decrease in queuing at the Yalberton Road junction in the 10,000 dwelling scenario by assuming a 20% reduction in vehicle traffic accessing or leaving the new developments on Yalberton Road.

5.4.2 The table shows that there is a 15% decrease in queuing overall at this junction in the AM Peak hour. The largest reduction in queuing is evident on Brixham Road North, with a 22% decrease in queuing on this arm.

Table 5.3 – Modal Shift Assessment – 10,000 Dwellings Scenario - Yalberton Road

	<i>Reduction in Queuing</i>	<i>Overall</i>
<i>Brixham Road North</i>	-22%	-15%
<i>Brixham Road South</i>	-17%	
<i>Yalberton Road</i>	-7%	

5.5 15,000 Dwellings Scenario – Yalberton Road

5.5.1 Table 5.4 shows the reduction in queuing in the AM Peak Hour when applying a 20% reduction to traffic levels at the Yalberton Road development site on the 15,000 dwelling scenario.

5.5.2 The table shows that with the reduction in trips leaving and accessing the new Yalberton Road developments, there is an overall decrease of 13% in the level of queuing at the junction. The largest decrease is evident on the Brixham Road South (15%).

Table 5.4 – Modal Shift Assessment – 15,000 Dwellings Scenario - Yalberton Road

	<i>Reduction in Queuing</i>	<i>Overall</i>
<i>Brixham Road North</i>	-13%	-13%
<i>Brixham Road South</i>	-15%	
<i>Yalberton Road</i>	-12%	

6 CONCLUSION

6.1.1 The results show that there will need to be improvements made to the Torbay road network in order for it to cope with the increased trips from new developments. In both development scenarios, the Do Minimum options experience significant queuing on the two main routes around Torbay; the coastal route and the Western Corridor.

6.1.2 It is difficult to suggest an acceptable level of congestion in terms of the number of PCU's in a queue. This is essentially a political decision and will be dependant on issues such as the policies being promoted and the specific location of the queues. It is important to note however, that the length of the queue is determined by the number of lanes in a location. If, for example, congestion is experienced on an approach to a junction with three lanes, the queuing is split between the three lanes.

6.2 10,000 Dwellings Scenario

6.2.1 In terms of the 10,000 dwelling scenario, the necessary online improvement option reduces average queue totals to below 100 PCUs along the Western Corridor in the AM Peak hour. It is considered that the online improvements would provide an acceptable approach to improving the Torbay road network to cope with the increased number of dwellings.

6.2.2 Windy Corner works with the addition of the online improvements as traffic heading northbound is being attracted to the Western Corridor rather than the coastal route. Optimisation of the green times results in satisfactory operation of the junction.

6.3 15,000 Dwellings Scenario

6.3.1 The 15,000 dwellings scenario adds further trips onto the network. Even with the necessary online improvements in place, pinch points occur in the network such as at Tweenaway Cross where congestion still occurs in the AM Peak hour. The hypothetical dual carriageway ring road provides a relief to the congestion on the majority of the Western Corridor. It does however result in congestion at Churscombe Cross.

6.3.2 In the 15,000 dwellings scenario, Windy Corner is operating above capacity with both the establishment of the online improvements and the ring road.

6.4 Possible Further Assessment

6.4.1 It is suggested that further work could be carried out to assess how bus priority measures could affect, and possibly reduce, traffic on the Torbay network. This would require the assessment of specific junctions and these assessments could be carried out and funded by the developer of the relevant development sites at a later date.