5. With-Intervention Case

5.1. Introduction

5.1.1. The proposed SBL scheme was assessed using the SBL Demand Modelling system using the same Reference Case and generalised cost assumptions (as previously defined in Sections 2 and 3 respectively) and previously used to produce the Without Intervention case described in Section 4.

5.1.2. In this section, the changes made to the SBL modelling system to develop the With Intervention case are described followed by a summary of the forecast impact of the SBL scheme on the transport network.

5.2. Scheme Details

5.2.1. The proposed development comprises the construction of a section of highway 4.45 kilometres in length from the A370 Long Ashton bypass within North Somerset to the Hartcliffe (Cater Road) Roundabout within the Bishopsworth area of South Bristol. This incorporates the minor realignment of sections of existing highway at Highridge Green, King George's Road and Whitchurch Lane. The entire route is to be classed as an Urban All-Purpose Road (UAP) in accordance with TA 79/99.

5.2.2. The route includes the construction of new junctions with the A370, Brookgate Road, A38, Highridge Road, Queens Road and Hareclive Road. New bridges will be constructed to cross Ashton Brook, Colliter's Brook and to pass under the Bristol to Taunton Railway Line. The route corridor will incorporate a bus-only link to connect with the Ashton Vale to Temple Meads (AVTM) spur into the Long Ashton Park and Ride site, and dedicated bus lanes between the railway and the new A38 roundabout junction. New bus stops and shelters, and a continuous shared cycleway and footway will be provided along the route corridor. Associated proposals include drainage facilities, landscaping and planting.

5.2.3. The route will form part of the West of England rapid transit network (Metro Bus) and will be used by buses and other motorised vehicles. The route will link with the AVTM at the Long Ashton Park and Ride site, and within the South Bristol section, once buses have reached the Hartcliffe Roundabout, services will follow existing roads via Hengrove Way to Imperial Park and onwards to Whitchurch Lane and Hengrove Park.

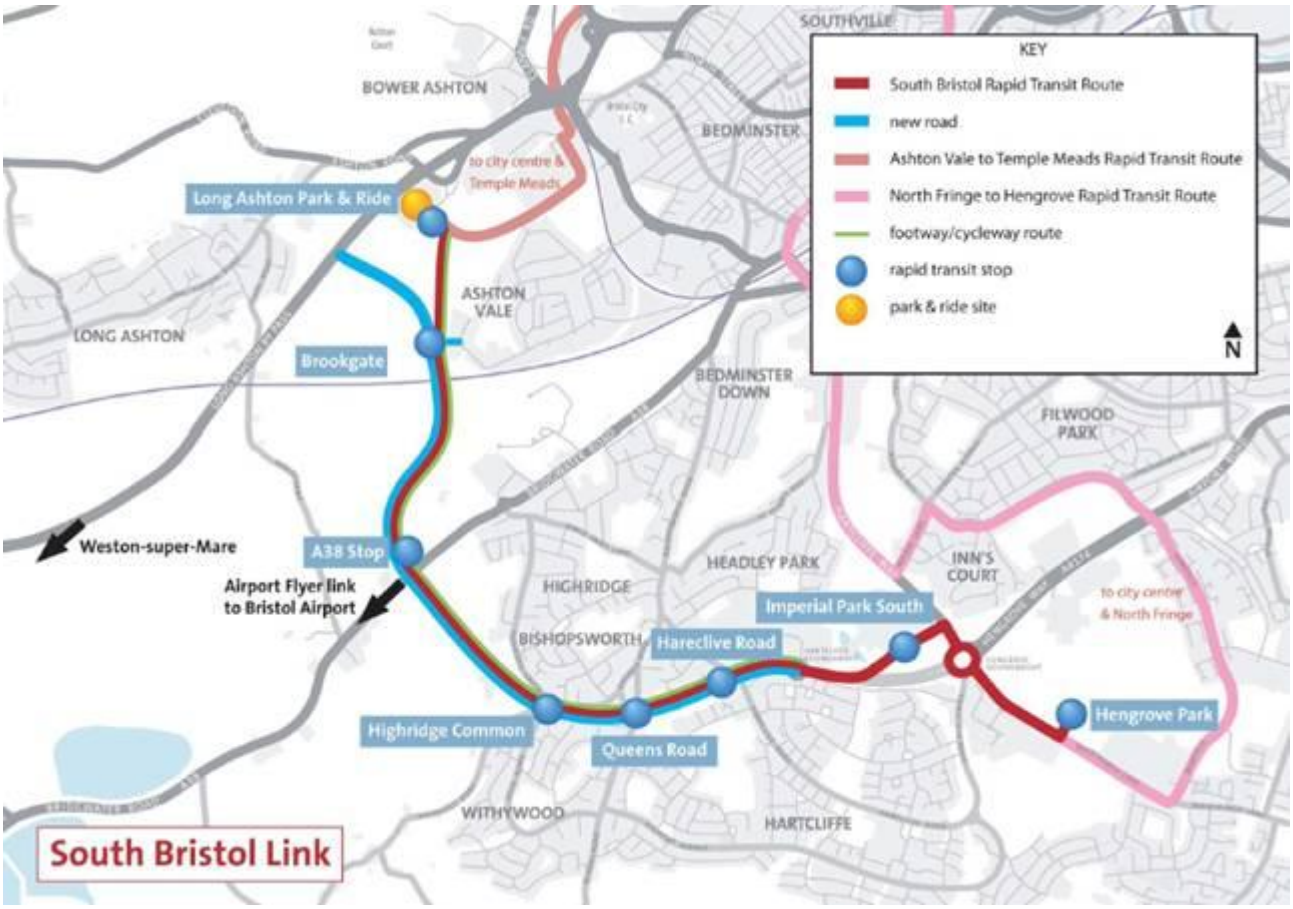
5.2.4. In addition, the Bristol Airport services have been adopted based upon the S106 agreement in 2031 (assuming 10mppa by this date) as follows:

- Eight flyer services per hour;
- Enhanced 121 service (every 30 minutes);
- Weston flyer service (every 30 minutes); and
- Bath service via Bristol city centre and then A38 (hourly)

5.2.5. Once SBL opens we assume the following changes

- Six Flyer services an hour into the city centre via SBL;
- Two services an hour into the city centre via Bedminster (as existing); and
- Bath service re-routed via Hengrove and SBL.

Figure 21 - Overview of the SBL Scheme



5.3. Model Outputs

5.3.1. The standard set of model reports was produced to assess the impact of the proposed SBL scheme. The outputs from the SBL model system for the 2016 and 2031 forecast years are separately summarised in the remainder of this section and compare the Without and Without Intervention cases using the following performance measures:

- the changes in travel demands forecast by the SBL Demand model;
- the changes in the travel conditions on the highway network; and
- the changes in the performance of the Public Transport network including examination of the Metro Bus service and airport buses.

5.4. 2016 Forecast Year

Demand Model

Overall Mode Share

5.4.1. For 2016, there is very little shift in overall mode shares (across the larger modelled area), shown in Table 21 below.

Table 18. Travel by Mode (2016 With Intervention)

	Without Intervention		With Intervention		Change in	
	Trips	Mode Share	Trips	Trips	Trips	Mode Share*
AM Peak						
Car	136,300	86.4%	136,400	86.4%	100	0.02%
Park and Ride	900	0.6%	900	0.6%	-	0.00%
Bus	13,600	8.6%	13,600	8.6%	-	0.00%
Rail	6,900	4.4%	6,900	4.4%	-	-0.02%
Total	157,800	100.0%	157,800	100.0%	-	0.00%
Inter-peak						
Car	115,700	90.4%	115,600	90.4%	-100	0.00%
Park and Ride	400	0.3%	400	0.3%	-	0.00%
Bus	10,000	7.8%	10,000	7.8%	-	0.00%
Rail	1,900	1.5%	1,900	1.5%	-	0.00%
Total	128,000	100.0%	127,900	100.0%	-100	0.00%
PM Peak						
Car	145,600	87.8%	145,600	87.8%	-	0.00%
Park and Ride	800	0.5%	800	0.5%	-	0.00%
Bus	11,700	7.1%	11,700	7.1%	-	0.00%
Rail	7,600	4.6%	7,600	4.6%	-	-0.01%
Total	165,800	100.0%	165,800	100.0%	-	0.00%

Note: (i) Numbers may not sum due to rounding; (ii) * change in percentage points

Highway Mode

5.4.2. The impact of the SBL scheme on the highway mode for the 2016 forecast year is summarised by comparisons of the:

- overall network performance in terms of the total number of trips, travel distance, travel time and delay;
- node delays across the Fully Modelled Area; and
- changes in traffic volumes across the Fully Modelled Area.

The comparisons are presented below.

Overall Network Performance

5.4.3. Table 19 summarises the overall performance on the highway network in the 2016 forecast year. Across all three time periods, the overall change in total number of highway trips, travel distance and time are small with differences of less than 0.2% between the With and Without Intervention Cases. There is a decrease in travel delays which is marginally higher with an decrease of 100 pcu-hours (1%) for the PM peak hour.

Table 19. Travel by Road (2016 With Intervention Case)

	Without Intervention	With Intervention	Difference	%Difference
AM Peak				
Trips (pcus/hr)	128,600	128,700	100	+0.1%
Travel Distance (pcu-kms)	4,320,400	4,323,300	2,900	+0.1%
Travel Time (pcu-hrs)	63,100	63,100	0	+0.0%
Delay (pcu-hrs)	9,800	9,800	0	+0.0%

	Without Intervention	With Intervention	Difference	%Difference
Inter-Peak				
Trips (pcus/hr)	105,500	105,400	-100	-0.1%
Travel Distance (pcu-kms)	4,111,600	4,112,500	900	+0.0%
Travel Time (pcu-hrs)	54,100	54,000	-100	-0.2%
Delay (pcu-hrs)	5,500	5,500	0	+0.0%
PM Peak				
Trips (pcus/hr)	120,100	120,200	100	+0.1%
Travel Distance (pcu-kms)	4,142,100	4,143,400	1,300	+0.0%
Travel Time (pcu-hrs)	61,400	61,300	-100	-0.2%
Delay (pcu-hrs)	10,300	10,200	-100	-1.0%

Flow Differences

5.4.4. Figures 25 to 27 show the forecast changes in traffic flows on the highway network occurring with the introduction of the SBL scheme in the 2031 forecast year. There are approximately 1100 pcus northbound on the SBL in the AM peak hour, rerouted from the surrounding roads with similar patterns in the Inter-peak and PM peak.

Figure 25 - Changes in Traffic Flows on the Highway Network (2016 AM Peak)

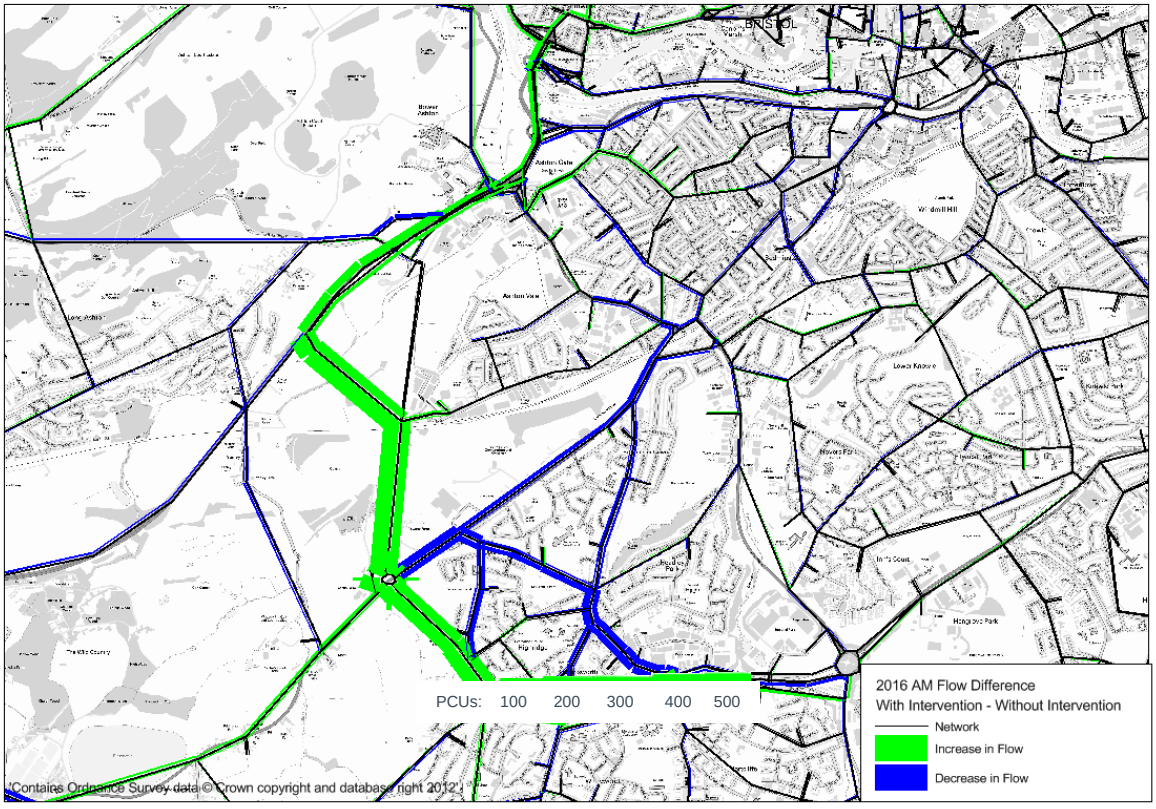


Figure 26 - Changes in Traffic Flows on the Highway Network (2016 Inter Peak)

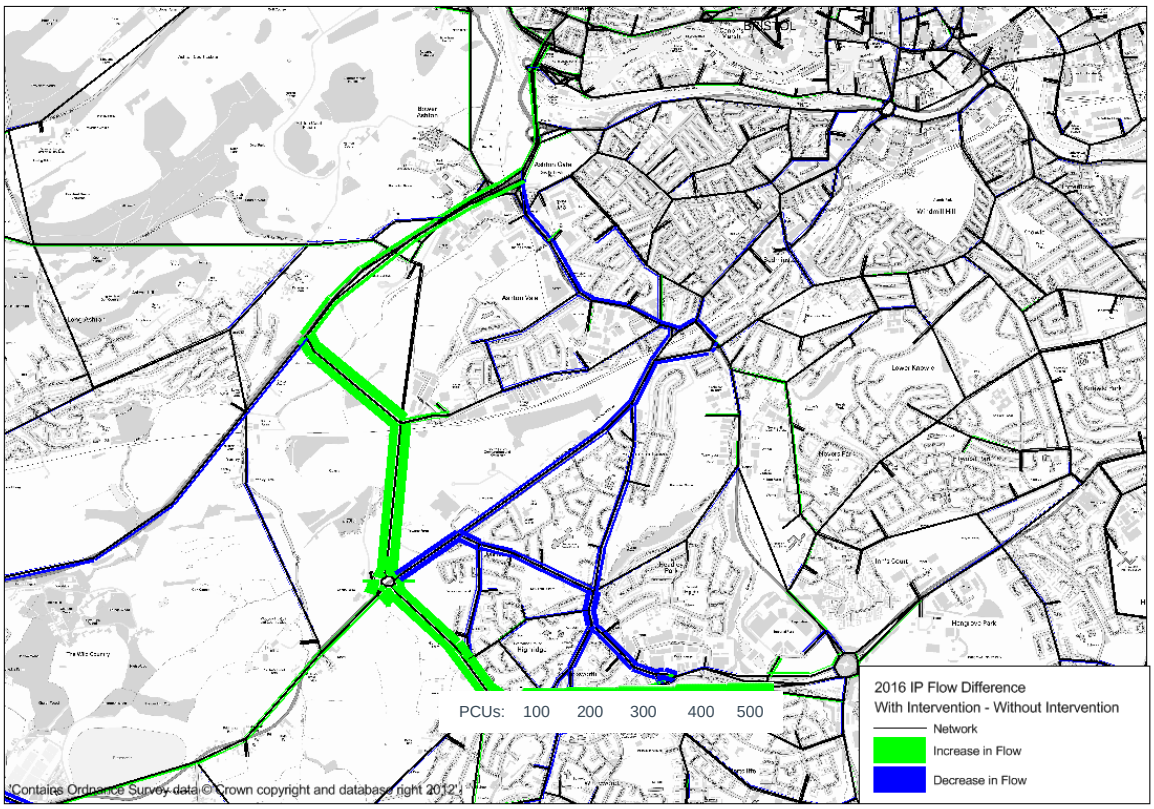
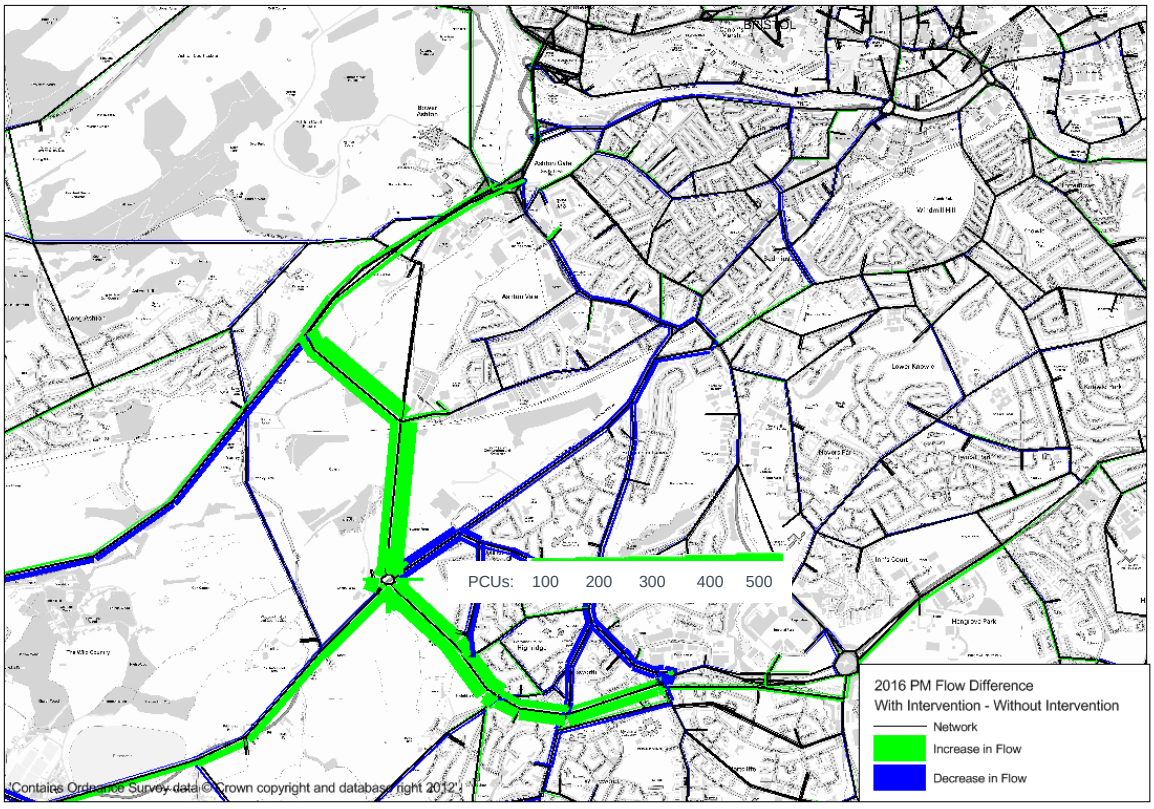


Figure 27 - Changes in Traffic Flows on the Highway Network (2016 PM Peak)



Junction Delays

5.4.5. Figures 28 to 30 show the delays at junctions in each of the time periods within the vicinity of the SBL scheme for 2016. Similarly to the Without Intervention scenario the AM and Inter-peak hours delay at junctions in the area surrounding the SBL scheme is restricted to between 1 and 2 minutes, with the exception of the A37/A4174 junction which is slightly higher at between 2 – 3 minutes in the AM peak. The more congested PM peak has more junctions that have a 3 or more minute delay.

Figure 28 - Junction Delays on the Highway Network (2016 AM Peak)

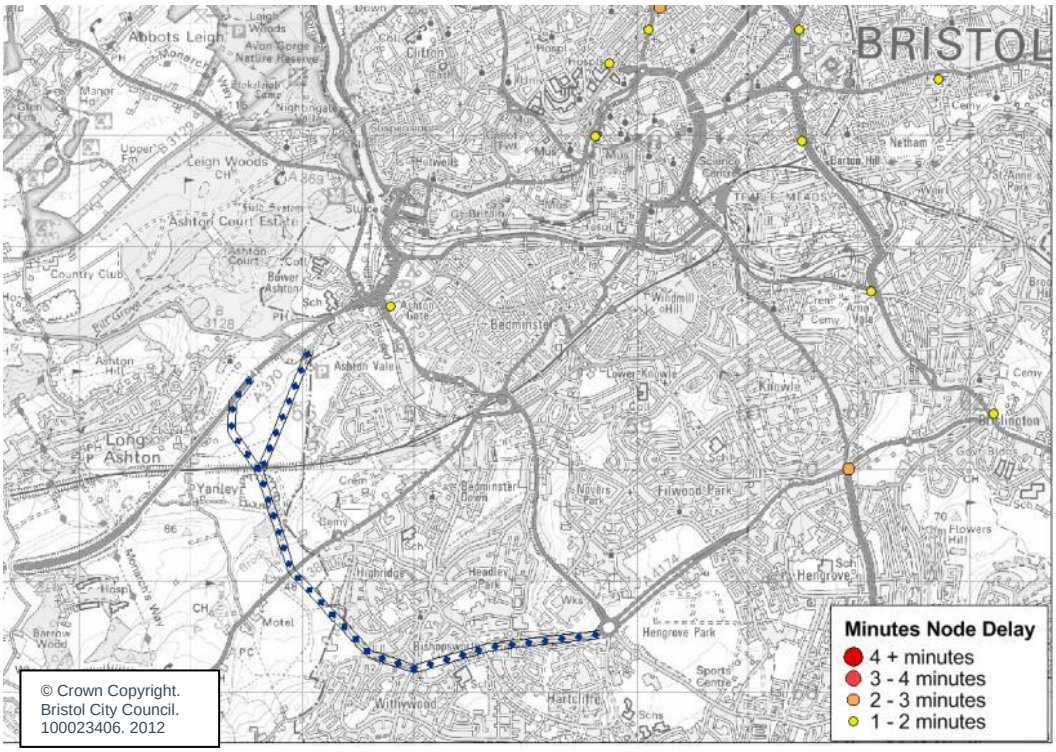


Figure 29 - Junction Delays on the Highway Network (2016 Inter Peak)

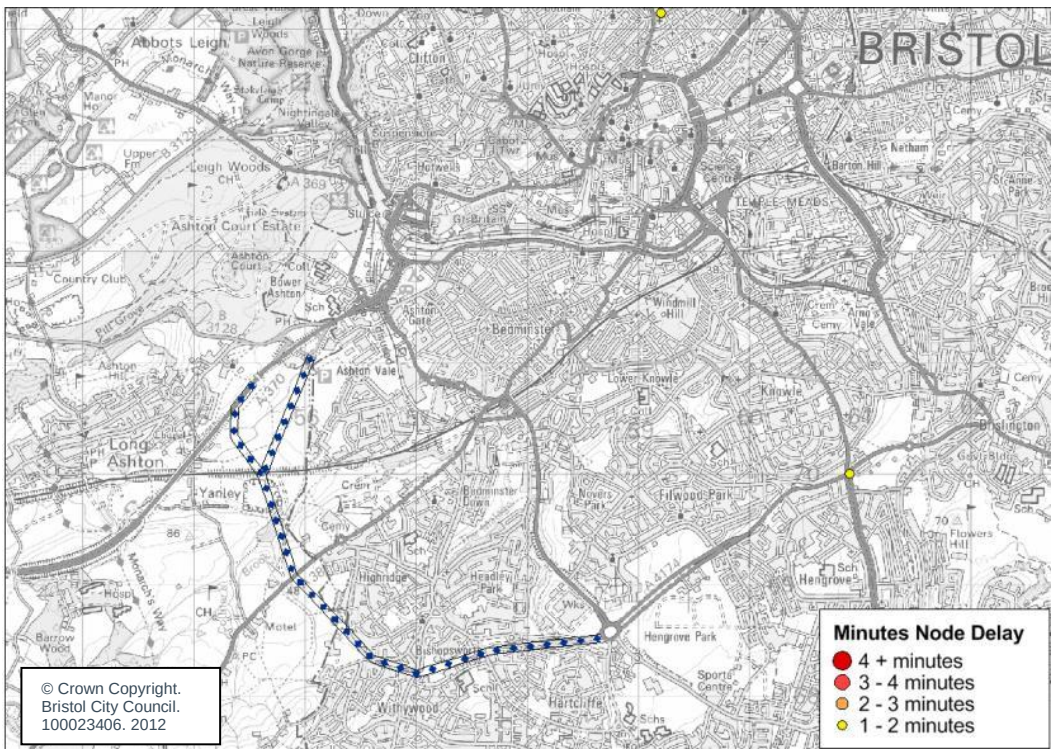
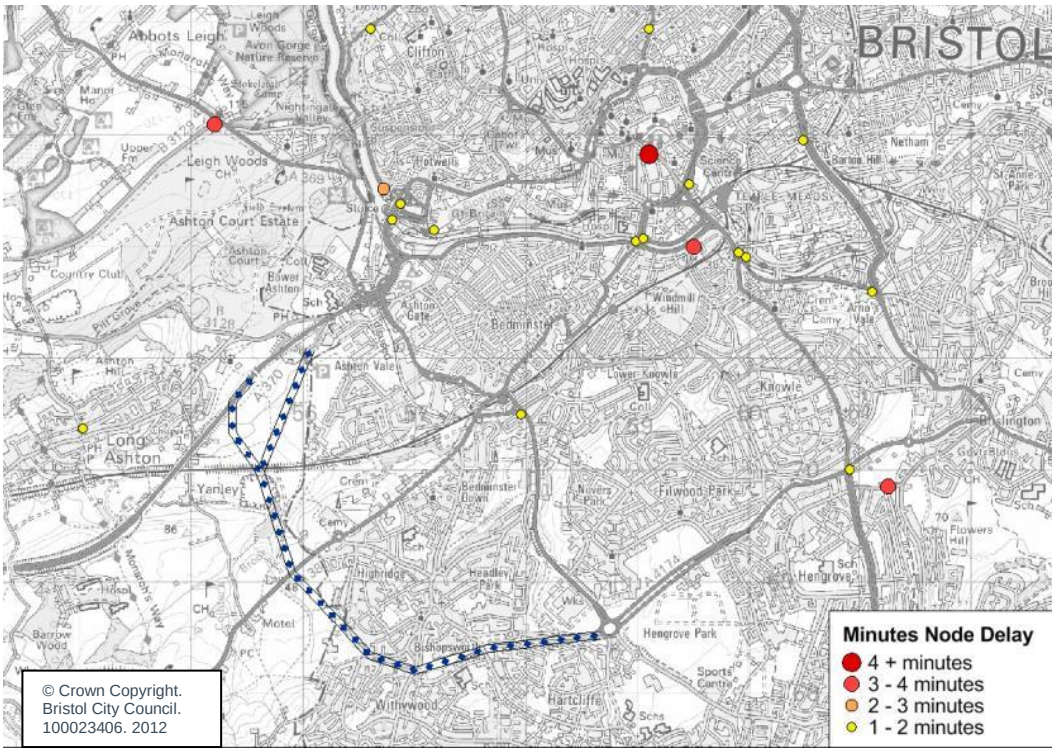


Figure 30 - Junction Delays on the Highway Network (2016 PM Peak)



Public Transport Mode

5.4.6. The impact of the SBL scheme on the Public Transport mode for the 2016 forecast year is summarised below by comparisons for each time period of the:

- overall network performance in terms of the number of boardings, travel distance and travel by bus and Metro Bus services;
- RT flow volumes along the SBL route;

Overall Network Performance

5.4.7. **Error! Reference source not found.**0 summarises the overall performance on the public ransport network in the 2016 forecast year. There is no change in the number of boardings in any of the three time periods. The total distance travelled increases by less than 1% across all three time periods, and travel time increases by just under 2% in the AM and PM peaks.

Table 20. Travel by Public Transport (2016 With Intervention Case)

	Without Intervention	With Intervention	Difference	%Difference
AM Peak				
Boardings	21,300	21,300	0	0.0%
Passenger-kms	115,300	115,800	500	0.4%
Passenger-hours	6,300	6,400	100	1.6%
Inter-Peak				
Boardings	13,600	13,600	0	0.0%
Passenger-kms	79,000	79,000	0	0.0%
Passenger-hours	4,000	4,000	0	0.0%

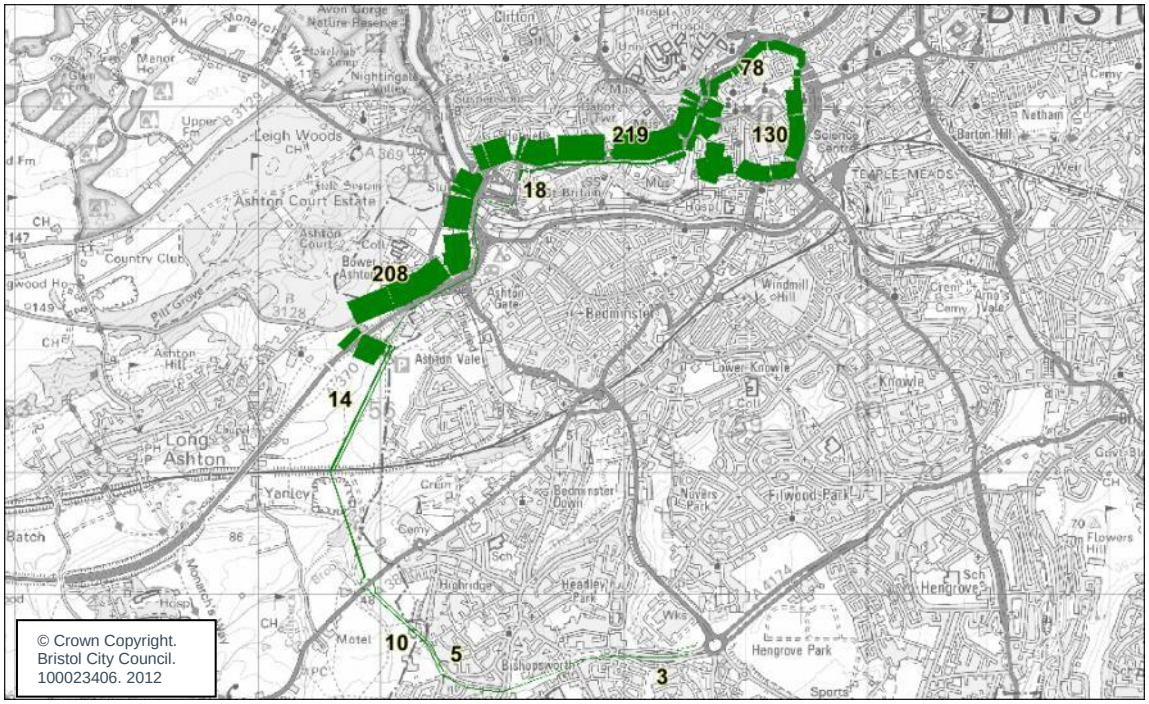
	Without Intervention	With Intervention	Difference	%Difference
PM Peak				
Boardings	17,700	17,700	0	0.0%
Passenger-kms	96,200	96,700	500	0.5%
Passenger-hours	5,300	5,400	100	1.9%

Note: (i) Numbers may not sum due to rounding; (ii) Local rail services only

SBL Bus Route Flows

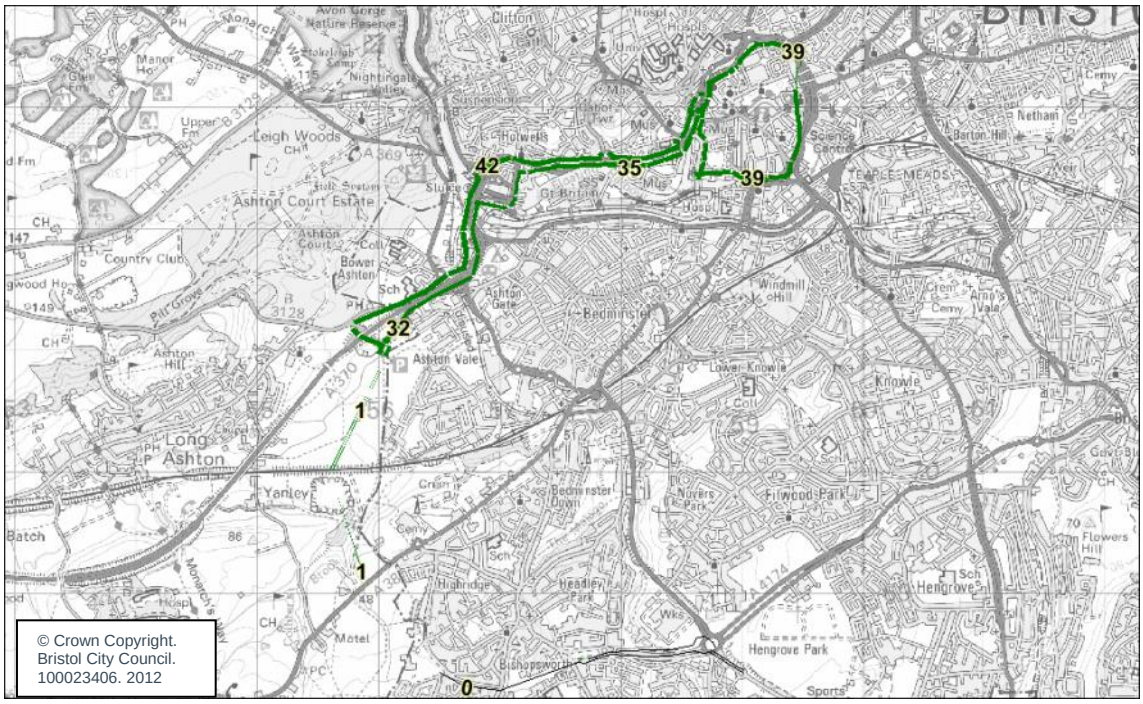
5.4.8. Figures 22 to 24 shows the hourly volume of passengers on the bus service in each time period. Most passengers use the SBL section of the Metro Bus route in the AM peak hour, with only a couple in the Inter-peak hour and a similar volume to the AM peak in the PM peak hour.

Figure 22 - Metro Bus Peak Hour Passenger Volume (2016 AM Peak Hour)



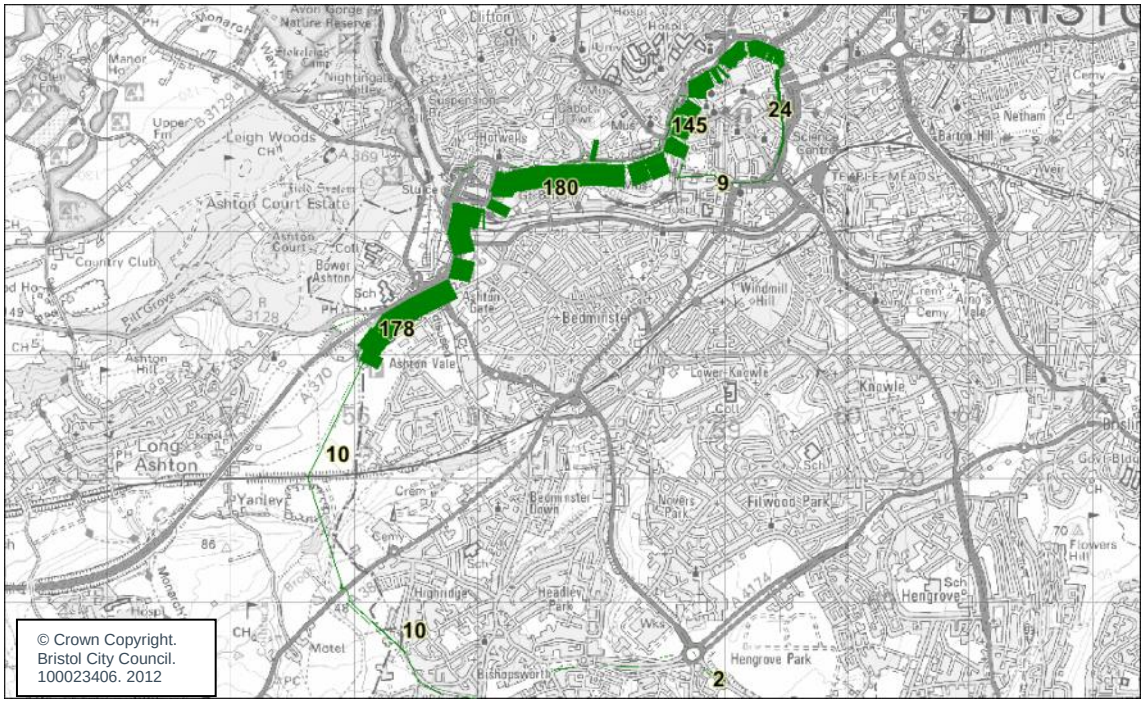
Units: persons per hour

Figure 23 - Metro Bus Peak Hour Passenger Volume (2016 Inter Peak Hour)



Units: persons per hour

Figure 24 - Metro Bus Peak Hour Passenger Volume (2016 PM Peak Hour)



Units: persons per hour

Other Outputs

Model Convergence

5.4.9. The model convergence for the Demand model and highway assignment sub-model for the With Intervention scenario are summarised in Appendix C. All the forecasts achieved the recommended convergence targets.

5.5. 2031 Forecast Year

Demand Model

Overall Mode Share

5.5.1. For 2031, there is very little shift in overall mode shares (across the large modelled area), shown in Table 21 below.

Table 21. Travel by Mode (2031 With Intervention Case)

	Without Intervention		With Intervention		Change in	
	Trips	Mode Share	Trips	Mode Share	Trips	Mode* Share
AM Peak						
Car	154,100	87.4%	154,200	87.4%	100	0.02%
Park and Ride	1,200	0.7%	1,200	0.7%	-	0.01%
Bus	14,300	8.1%	14,300	8.1%	-	-0.01%
Rail	6,700	3.8%	6,700	3.8%	-	-0.02%
Total	176,300	100.0%	176,300	100.0%	-	0.00%
Inter-peak						
Car	137,600	91.2%	137,400	91.2%	-200	-0.01%
Park and Ride	400	0.3%	400	0.3%	-	0.00%
Bus	10,800	7.2%	10,800	7.2%	-	0.00%
Rail	2,000	1.3%	2,000	1.3%	-	0.01%
Total	150,800	100.0%	150,600	100.0%	-200	0.00%
PM Peak						
Car	164,500	88.5%	164,600	88.5%	100	0.01%
Park and Ride	1,000	0.5%	1,000	0.5%	-	0.00%
Bus	12,900	6.9%	12,900	6.9%	-	-0.02%
Rail	7,400	4.0%	7,400	4.0%	-	0.00%
Total	185,900	100.0%	186,000	100.0%	100	0.00%

Note: (i) Numbers may not sum to 100%due to rounding; (ii) * change in percentage points

Highway Mode

5.5.2. The impact of the SBL scheme on the highway mode for the 2031 forecast year is summarised by comparisons of the:

- overall network performance in terms of the total number of trips, travel distance, travel time and delay; and
- changes in traffic volumes across the Fully Modelled Area.

The comparisons are presented below.

Overall Network Performance

5.5.3. Table 22 summarises the overall performance on the highway network in the 2031 forecast year. Across all three time periods, the overall change in total number of highway trips, travel distance and time are small with differences of less than 0.5% between the With and Without Intervention Cases. The reduction in travel delays is marginally higher with reductions of between 200 and 400 pcu-hours for the three time periods with the largest reduction of 2.2% in the PM peak hour.

Table 22. Travel by Road (2031 With Intervention Case)

	Without Intervention	With Intervention	Difference	%Difference
AM Peak				
Trips (pcus/hr)	152,200	152,300	100	0.1%
Travel Distance (pcu-kms)	5,217,200	5,218,200	1,000	0.0%
Travel Time (pcu-hrs)	82,600	82,400	-200	-0.2%
Delay (pcu-hrs)	18,300	18,100	-200	-1.1%
Inter-Peak				
Trips (pcus/hr)	129,700	129,700	0	0.0%
Travel Distance (pcu-kms)	4,973,700	4,976,100	2,400	0.0%
Travel Time (pcu-hrs)	68,000	67,900	-100	-0.1%
Delay (pcu-hrs)	8,900	8,800	-100	-1.1%
PM Peak				
Trips (pcus/hr)	141,600	141,700	100	0.1%
Travel Distance (pcu-kms)	4,999,200	5,000,500	1,300	0.0%
Travel Time (pcu-hrs)	80,300	80,000	-300	-0.4%
Delay (pcu-hrs)	18,600	18,200	-400	-2.2%

Flow Differences

5.5.4. Figures 37 to 39 show the forecast changes in traffic flows on the highway network occurring with the introduction of the SBL scheme in the 2031 forecast year. There are approximately 1500 pcus northbound on the SBL in the AM peak hour, rerouted from the surrounding roads with similar patterns in the Inter-peak and PM peak. The flows on SBL are greater in 2031 compared with 2016 as may be expected with higher traffic growth

Figure 37 - Changes in Traffic Flows on the Highway Network (2031 AM Peak)

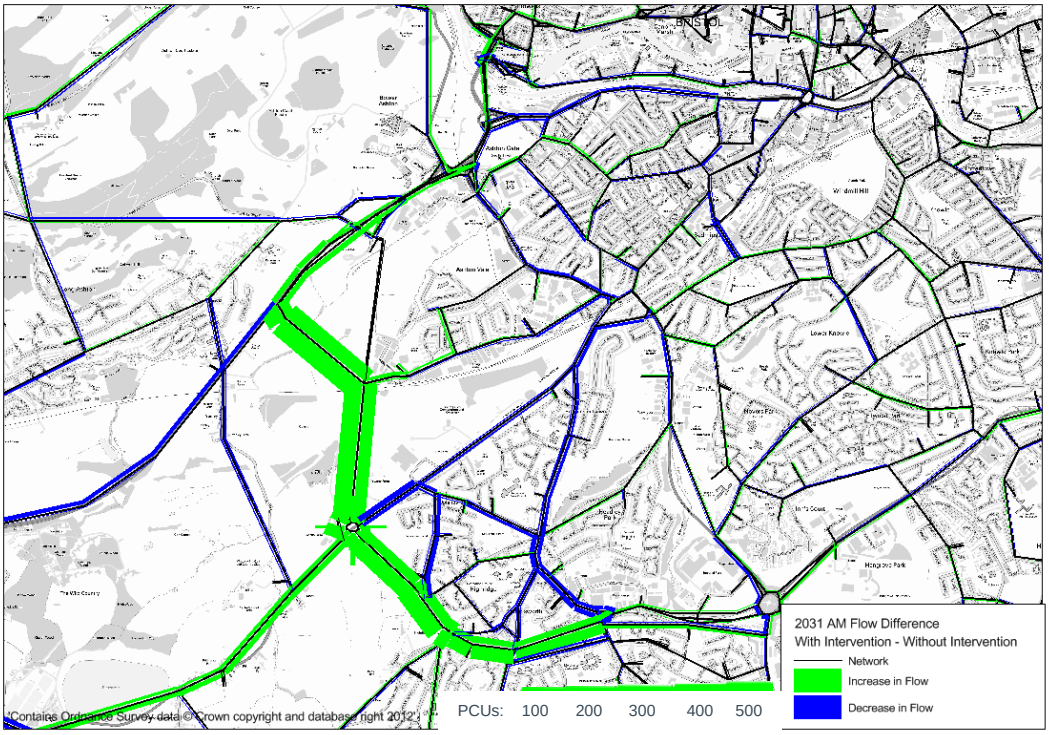


Figure 38 - Changes in Traffic Flows on the Highway Network (2031 Inter Peak)

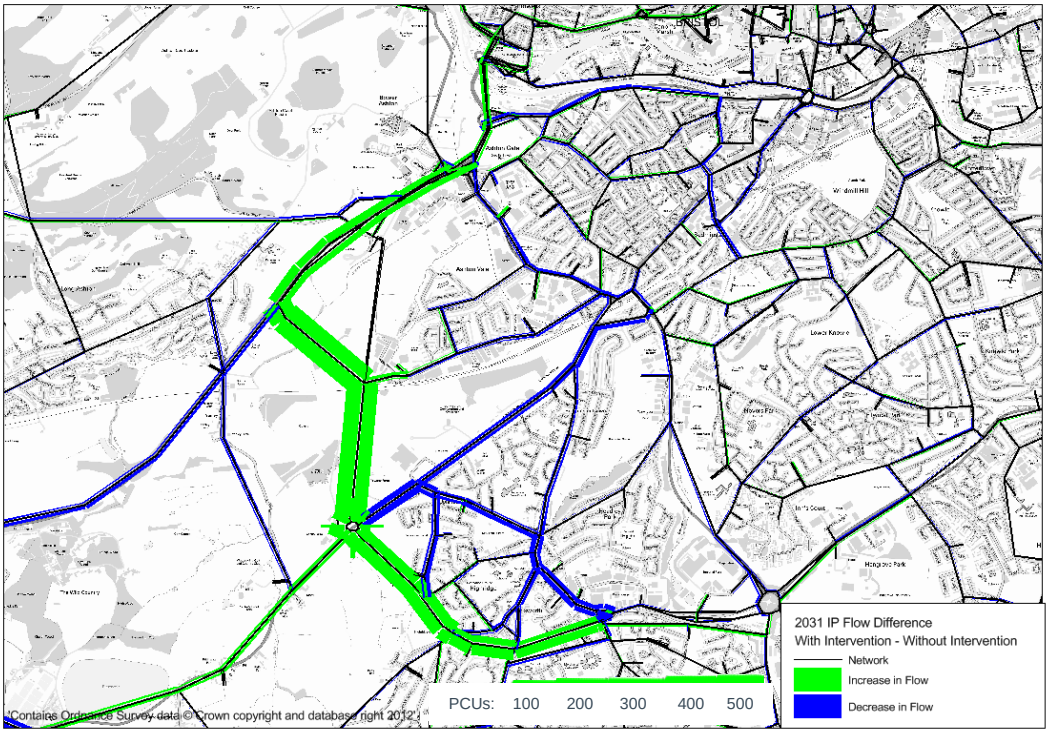
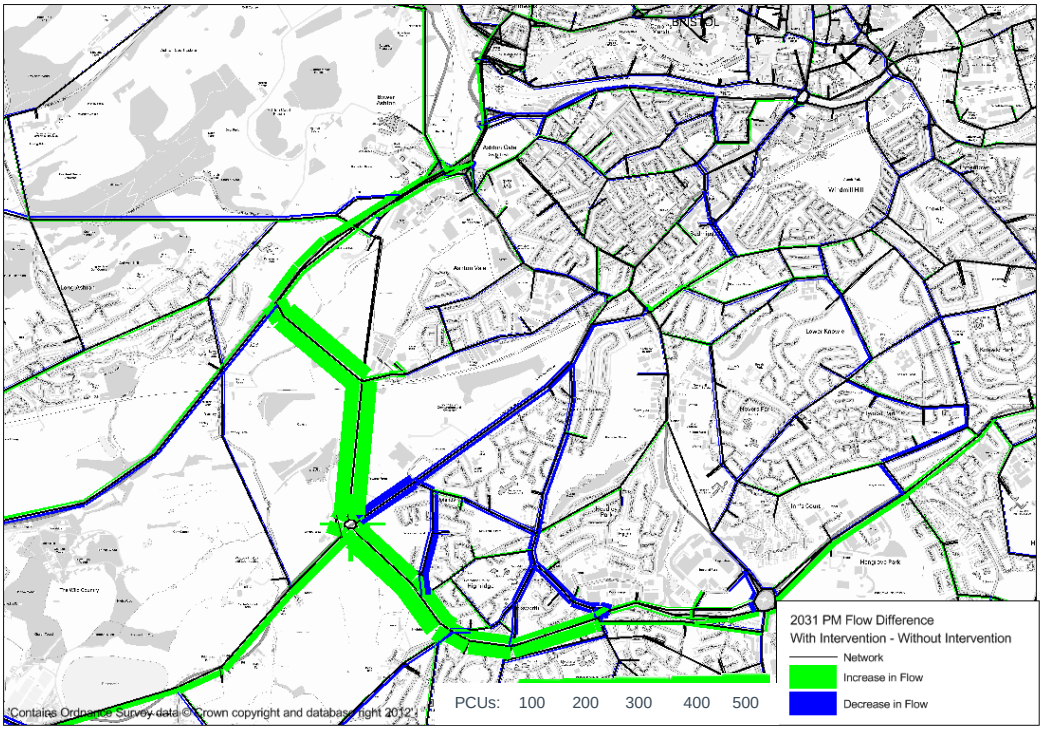


Figure 39 - Changes in Traffic Flows on the Highway Network (2031 PM Peak)



Junction Delays

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5.5.5. Figure 9 Figures 40 to 42 show the delays at junctions in each of the time periods within the vicinity of the SBL scheme. In line with the growth in traffic and increase congestion, the junction delays in 2031 are larger than 2016 and more common in all three time periods, with the PM peak in particular experiencing more delay around the city centre.

Figure 40 - Junction Delays on the Highway Network (2031 AM Peak)

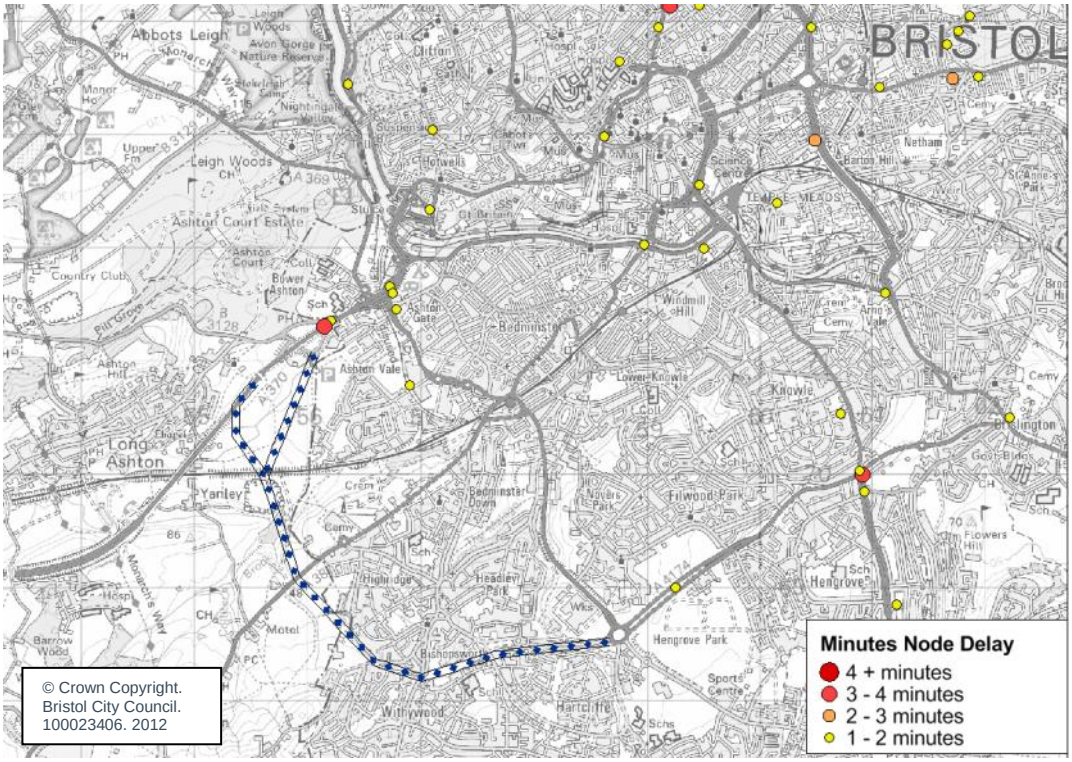


Figure 41 - Junction Delays on the Highway Network (2031 Inter Peak)

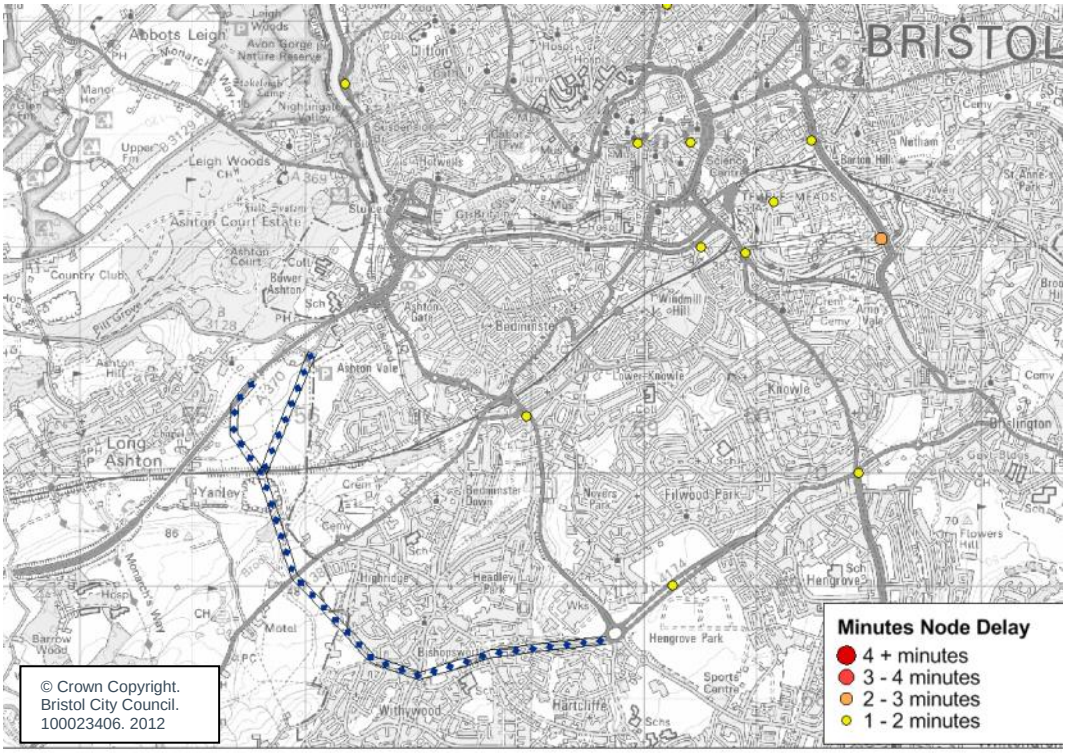
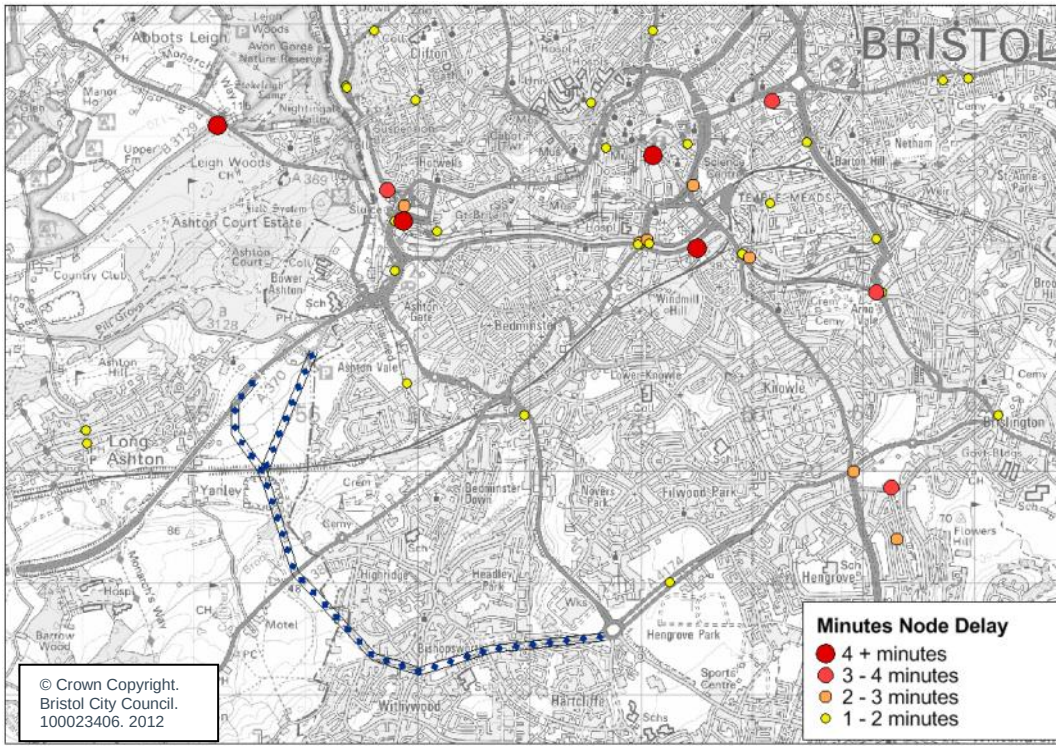


Figure 42 - Junction Delays on the Highway Network (2031 PM Peak)



Public Transport Mode

5.5.6. The impact of the SBL scheme on the Public Transport mode for the 2031 forecast year is summarised below by comparisons for each time period of the:

- overall network performance in terms of the number of boardings, travel distance and travel by bus and Metro Bus services;
- RT and Airport flow volumes along the SBL route;

Overall Network Performance

5.5.7. Table 23 summarises the overall performance on the public transport network in the 2031 forecast year. The total number of boardings doesn't change in any of the time periods. The total distance travelled increases across all three time periods with the largest change occurring in the AM Peak hour. The total passenger hours reduces in the Inter-peak by 6.3%.

Table 23. Travel by Public Transport (2031 With Intervention Case)

	Without Intervention	With Intervention	Difference	%Difference
AM Peak				
Boardings	22,900	22,900	0	0.0%
Passenger-kms	128,700	129,700	1,000	0.8%
Passenger-hours	7,200	7,200	0	0.0%
Inter-Peak				
Boardings	15,200	15,200	0	0.0%
Passenger-kms	94,100	94,200	100	0.1%
Passenger-hours	4,800	4,500	-300	-6.3%
PM Peak				
Boardings	20,400	20,400	0	0.0%
Passenger-kms	116,700	117,600	900	0.8%

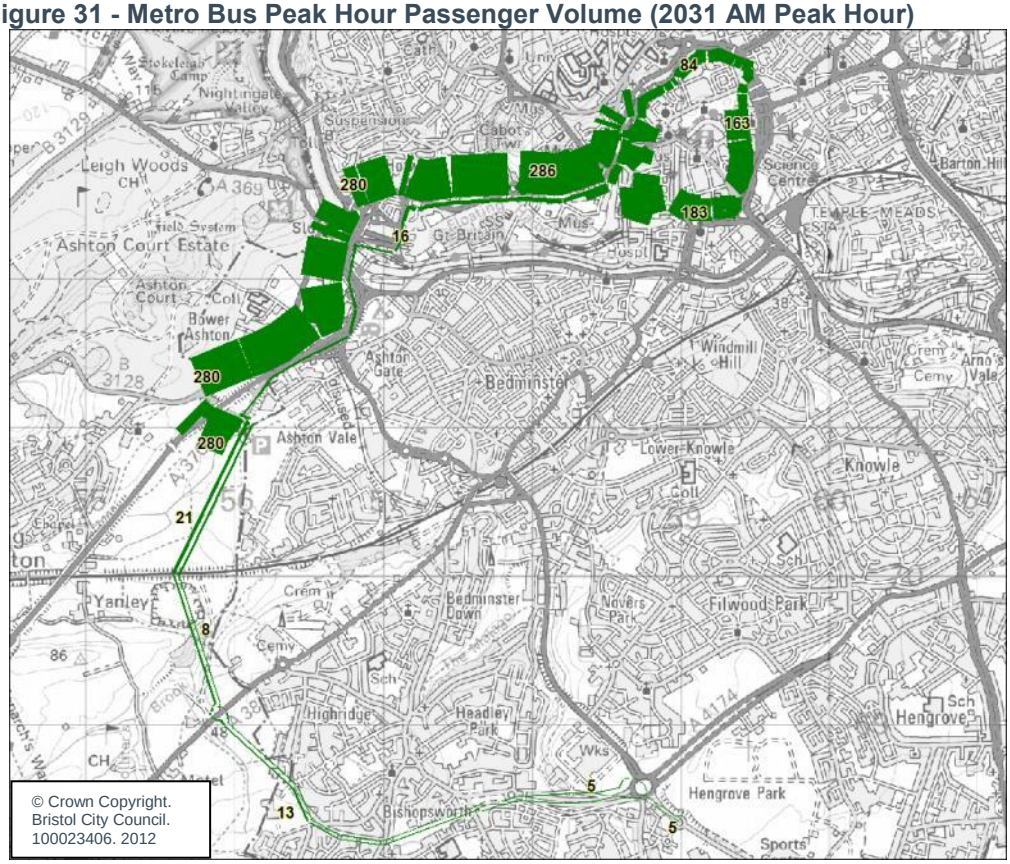
Passenger-hours	6,600	6,600	0	0.0%

Note: (i) Numbers may not sum to 100% due to rounding; (ii) Local rail services only

Metro Bus Route Flows

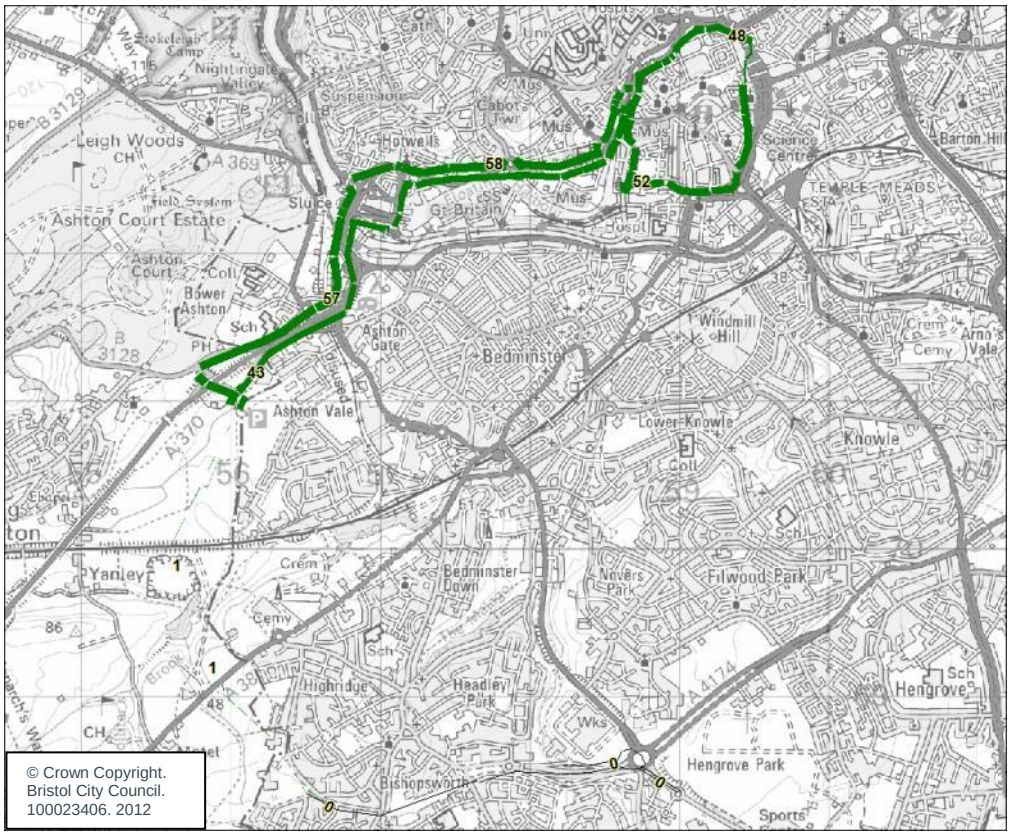
5.5.8. Figures 31 to 33 shows the hourly volume of passengers on the Metro Bus service in each time period. The AM peak hour has the highest patronage of the three time periods, with a significant proportion of passengers travelling from the Long Ashton Park and Ride site to Bristol City Centre. 32 passengers use the SBL section of the route in the AM peak hour and 39 passengers use it in the PM peak hour.

Figure 31 - Metro Bus Peak Hour Passenger Volume (2031 AM Peak Hour)



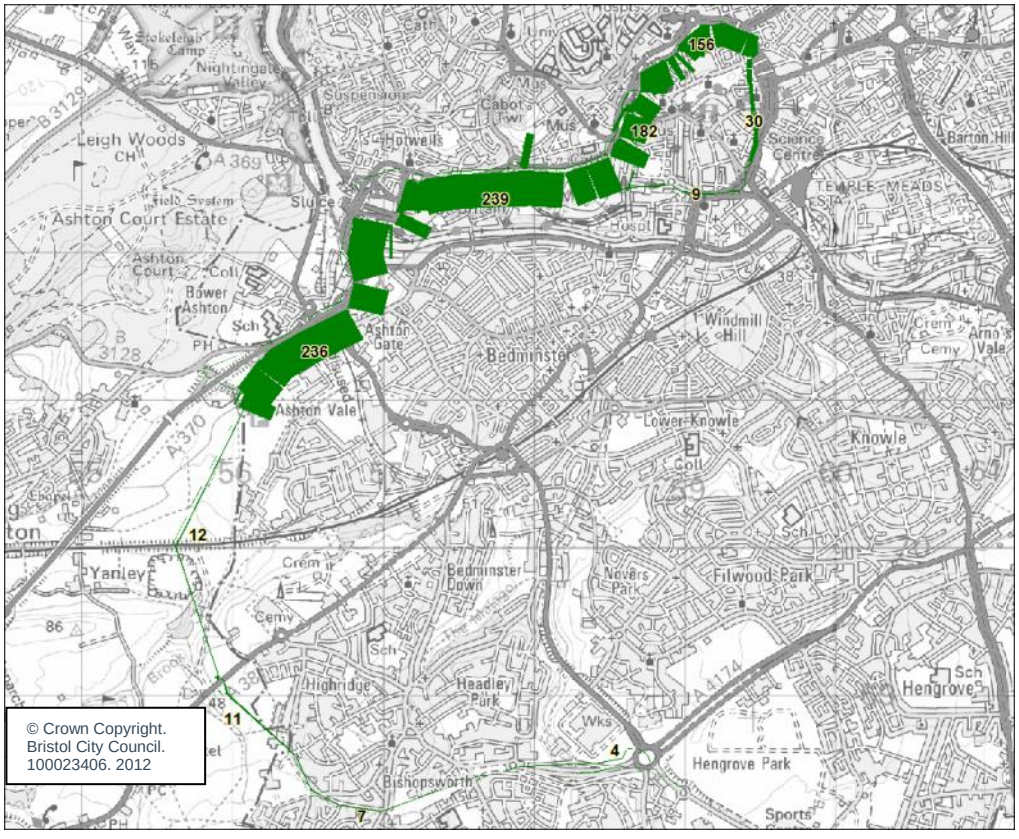
Units: persons per hour

Figure 32 - Metro Bus Peak Hour Passenger Volume (2031 Inter Peak Hour)



Units: persons per hour

Figure 33 - Metro Bus Peak Hour Passenger Volume (2031 PM Peak Hour)



Units: persons per hour

Other Outputs

Model Convergence

5.5.9. The model convergence for the Demand model and highway assignment sub-model for the With Intervention scenario are summarised in Appendix C. All the forecasts achieved the recommended convergence targets.

6. Summary

SBL Modelling System

6.1.1. The South Bristol Link (SBL) Model was developed to assess the transport impacts of the proposed SBL Highway and Metro Bus scheme. The model consists of three key elements:

- a Highway Assignment Model (HAM) representing vehicle-based movements across the Greater Bristol Area for a 2012 September weekday morning peak hour (08:00 – 09:00), an average inter-peak hour (10:00 – 16:00) and an evening peak hour (17:00 – 18:00);
- a Public Transport Assignment Model (PTAM) representing bus and rail-based movements across the same area and time periods, month and year; and
- a five-stage multi-modal Variable Demand Model that forecasts changes in trip frequency and choice of main mode, time period of travel, and destination, and sub-mode choice, in response to changes in generalised costs across the 24-hour period (07:00 – 07:00).

6.1.2. The model development took account of the Department for Transport's Transport Appraisal Guidance (TAG) Units as described in their respective Model Development Reports.

Forecasting Methodology

6.1.3. The SBL Model was used to assess the impacts of the Highway and Metro Bus scheme for two forecast years, namely 2016 to represent the Opening Year and 2031 for the Design Year.

6.1.4. The forecasting approach followed the methodology described in TAG Unit 3.15.1 'Forecasting Using Transport Models' and the other TAG Units referred to therein including TAG Unit 3.15.5 'The Treatment of Uncertainty in Model Forecasting'. The approach may be summarised as the development of:

- a reference case in which demands are forecast on the assumption of unchanged costs;
- a without-intervention case in which the reference case demands are modified so that they are consistent with the without-intervention forecast year networks and travel costs; and
- a with-intervention case in which the reference case demands are modified so that they are consistent with the with-intervention forecast year networks and travel costs;

Developing the Reference Case

6.1.5. The reference case was developed from the base year case by taking into account the growth in demand arising from changes in demographics and macro-economic factors between the 2012 base year and 2016/31 forecast years. The forecast growth in travel demand is described in more detail within this section.

6.1.6. The growth in demand between the base year and the two forecast years was derived using two datasets:

- Central Government forecasts provided by TEMPRO v6.2 dataset; and
- Local planning data provided in May 2011 by the West of England Partnership including the identified development sites within the sub-region.

6.1.7. The trip end growth was controlled to TEMPRO growth forecasts at the TEMPRO district level within the West of England sub-region but distributed on the basis of the more detailed local planning data provided by the West of England Partnership.

Generalised Cost Assumptions

6.1.8. The generalised cost assumptions were updated to reflect the changes in the model parameters between the 2012 base year and the 2016 and 2031 forecast years. The changes principally related to:

- Values of time;
- Vehicle occupancy;
- Vehicle operating costs;
- Public Transport Fares;
- Tolls and Road user charges; and
- Parking charges.

Without Intervention Case

6.1.9. There were a large number of proposed infrastructure improvements to the public transport and highway networks in the sub-region. A review undertaken by the West of England Partnership Organisation identified the proposed schemes that were either near certain or more than likely expected to be delivered by either the 2016 or 2031 forecast years. The Reference Case was updated with these infrastructure improvements and the SBL model used to develop the 'Without Intervention' Case for the 2016 and 2031 forecast years.

6.1.10. The SBL model was run using the Reference Case demand, the changes to the generalised cost assumptions and the revised highway and public transport networks to achieve equilibrium of the demand and the travel costs.

6.1.11. The model outputs from the 'Without Intervention' Case were reviewed with comparisons undertaken to understand how the existing travel conditions (as represented in the base case) changed over time. The review of the model outputs included the changes in the travel demand by mode and time period on the highway and public transport networks using a range of common performance indicators.

6.1.12. The review concluded that the performance of the highway and public transport networks in the 'Without Intervention' Case were credible and the model forecasts were robust.

With Intervention Case

6.1.13. The proposed Highway and Metro Bus scheme was added to the 2016 and 2031 'Without Intervention' case to create the 'With Intervention' case for each year. The changes to public transport and highway networks were as follows:

- the additional public transport links representing the new segregated alignment of the SBL scheme;
- changes to existing highway links to reflect the alterations in city centre priorities as part of the scheme;
- revisions to the existing walk links which connect zones to the SBL stops and link the SBL stops to others in the public transport network;
- a SBL service headways of 6 minutes in the peak periods and 10 minutes at other times were used in the model; and
- further optimisation of the traffic signals within the SBL corridor and the surrounding area in response to the revised traffic flows.

6.1.14. The SBL model was re-run using the Reference Case demand, the changes to the generalised cost assumptions and the revised highway and public transport networks to achieve equilibrium of the demand and the travel costs. The model outputs from the 'With Intervention' Case were reviewed with comparisons undertaken to understand how the existing travel conditions (as represented in the base case) changed over time. The review of the model outputs included the changes in the travel demand by mode and time period on the highway and public transport networks using a range of common performance indicators.

6.1.15. The review concluded that the performance of the highway and public transport networks in the 'With Intervention' Case were credible and robust.

6.1.16. The cumulative impacts of adding the Ashton Vale to Temple Meads (AVTM) scheme to the SBL scheme described in this report are contained in Appendix D, The AVTM scheme tested is consistent with that submitted for Public Inquiry in spring 2012.

Conclusions

6.1.17. The outputs from the assessment of the proposed South Bristol Link scheme using the SBL Model were suitable to be taken forward for use in the economic and environmental appraisal processes.