Brighton & Hove City Council

Brighton & Hove Bus Network Review 2018

Brighton and Hove City Council

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PROJECT CENTRE

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1.1.2 It has been undertaken to consider ways in which increasing pressures on bus journey times and punctuality might be addressed through a programme of bus related traffic management schemes.

Brighton & Hove's Bus Network

1.1.3 The core bus service operators are Brighton & Hove Buses (which includes Metrobus) and Stagecoach, both of which deliver commercial services within the city. The Big Lemon and Compass Bus deliver a network of subsidised bus services that are financially supported by the council (as they are deemed as being 'socially necessary') and provide links to communities in the city that might not otherwise be able to support a commercial service through passenger numbers alone.

1.1.4 This study has concentrated on several major routes in the City, those which accommodate the highest passenger numbers, and which form the core of the network.

1.1.5 Within Brighton & Hove passenger numbers are rising. Between 2011/12 and 2016/17 there has been a significant increase, with total passenger numbers having risen from just over 43m to 47m per year. Public satisfaction with bus services in the city is also high, with a satisfaction score of 72% in the National Highways & Transport 2017 survey (up from 69% in 2016). Transport Focus' most recent Bus Passenger Survey (published in March 2018) reported Brighton & Hove Buses' satisfaction score at 91%.

1.1.6 The overall trend is therefore very positive in terms of the usage, satisfaction and relative importance of bus travel within Brighton & Hove, with an increase of over 1.5 million passengers in the past year alone.

1.1.7 A significant number of individual routes carry over 3.5m passengers each year. Overall, there are clearly many very well used services within the City.

Traffic Conditions

1.1.8 Bus operators report operational problems, and some service timings have had to be changed to achieve a good level of punctuality and service reliability.

1.1.9 Traffic data from core bus routes shows a 5% reduction in car based trips over recent years, which indicates that there may be a transference from car to bus based trips or other forms of transport such as cycling, or that fewer trips are being made overall.

1.1.10 The city council does not routinely monitor, measure or report on levels of congestion in the city, so there is no historic evidence to suggest that congestion levels have increased over time. However, Brighton & Hove Council does propose to undertake a review of congestion using a large dataset being provided by DfT, but given the reduction in car based traffic on core bus routes, there is insufficient evidence to state whether issues with punctuality directly relate to an increase in congestion.

1.1.11 It is possible that increases in passenger numbers are impacting on bus journey times due to increased dwell times at bus stops, i.e. more passengers are boarding, leading to longer standing times.

1.1.12 In addition, Brighton & Hove is particularly susceptible to seasonal, and sometimes daily, variations in conditions. It has a restrictive highway network due to the coast to the south, which channels traffic through a small number of north-south and east-west corridors and restricts route choices. These very specific network problems in the City cause journey time reliability problems for buses and all general traffic.

Bus Operational Hotspots

1.1.13 The traffic data that is available, along with information from bus operators, have been used to identify locations and specific services that experience the highest levels of delay. 20 separate sites have been identified as "hotspots" on the network and each hotspot has been inspected to identify potential improvements that could feasibly be delivered.

1.1.14 The findings vary considerably in scope and nature, some recommending dedicated bus priority measures and others more general measures to address congestion for all traffic.

1.1.15 A prioritised list of bus priority and general traffic management has been identified which shows potential benefits of around £1.2m per year (up to 2.5 hours of total bus journey time savings per day) at a possible cost of around £2.2m.

Prioritisation of Improvements

1.1.16 To determine the relative benefits of each scheme, a prioritisation process has been applied. The approach has involved calculation of time savings for bus passengers compared to potential scheme costs.

1.1.17 Many of the schemes identified would benefit only a small number of passengers and would require significant investment. All potential schemes have therefore been prioritized and ranked in order of the benefits that would be gained.

1.1.18 One of the core issues with bus performance in the city centre is the very high volume of buses using North Street. This creates bus on bus congestion and has led to road safety issues.

1.1.19 Removing buses from North Street is not a simple matter. However, the level of bus operations has created a cluttered, unsafe and unattractive environment for vulnerable users. It also causes service delays that cannot be readily solved.

1.1.20 It is recommended that this issue is discussed with operators as part of regular BHCC Quality Partnership Scheme meetings.

1.1.21 For all identified schemes journey time benefits and costs have been estimated. More detailed investigations are required to confirm the assumed journey time benefits and infrastructure investment costs.

Strategic Interventions

1.1.22 A bus stop accessibility strategy is recommended, including provision of measures such as bus boarders, which allow buses to stop without pulling in to lay-bys, as well as providing passengers with accessible boarding platforms.

1.1.23 It is recommended that the prioritisation of future signal control strategies should be guided and prioritised by the high-frequency bus corridors identified within this report and that consideration be given to adopting bus based priority measures at specific traffic signal junctions.

1.1.24 Use of technology to improve advanced signing of car park availability is proposed to inform drivers and encourage or promote the use of alternative routes or destinations if city centre car parks are full.

1.1.25 Past Park and Ride (P&R) studies have identified possible suitable sites for a purpose-built facility and the City Plan includes a policy that would enable P&R to be developed under certain criteria. To date no sites have come forward and further exploratory work is recommended.

1.1.26 It is recommended that sites and improvement areas identified in this report are reviewed in conjunction with future and committed developments in the city in order that outcomes and funding streams are aligned.

1.1.27 The Valley Gardens and Gateway to the Sea projects are critical to the future operation of the highway network. This study does not seek to prescribe the design process but does set out the basic requirements for bus operations to form a "design guide" for scheme development.

Bus Operations Mitigation Measures

1.1.28 Dwell time is an important element of bus operations, and can be a major source of delay.

1.1.29 The most effective method of bringing down the time spent at bus stops is to reduce the transaction time for payment through off-bus ticketing or smartcard usage. These systems are already in place in the City and should continue to be further developed and encouraged. A system that reduces driver interaction with passengers even further could potentially reduce dwell times by more than half.

1.1.30 Removing conflicting movements of passengers boarding and alighting through the same doors is also helpful at reducing dwell time at stops. Brighton & Hove Buses have recently invested £11m in a significant number of new double door vehicles for the busiest routes in recent years, which is likely to be having a positive impact on dwell times.

2. BACKGROUND TO REVIEW

2.1.1 This report sets out the results of a review of the bus network managed by Brighton & Hove City Council (the 'Council'). It has been undertaken to consider ways in which increasing pressures on bus journey times and punctuality might be addressed through a programme of bus related traffic management schemes.

2.1.2 The review has sought to:

i. Identify where there are network constraints; and

ii. Identify potential opportunities for improving bus performance in both the short and long term.

2.1.3 There has been no specific assessment of issues relating to dwell time reduction and/or smart ticketing systems, or to ITS solutions such as journey planning apps etc. These issues are being considered by the bus operators and the council and have not been included within the network assessment.

2.1.4 Information regarding average journey speeds, peak time congestion, corridor bus frequencies, traffic flows and service performance has been obtained. This information has been analysed to understand how the network operates, and where operational problems are most challenging.

2.1.5 One of the most important sources of information on bus network performance and delays comes from the operators themselves. Consultations with bus operators have therefore been undertaken to identify problem routes and those locations ('hotspots') where significant issues in terms of journey time reliability are consistently observed.

2.1.6 After identifying these hotspots, each site has been investigated and proposals that may assist bus operations have been identified for each location.

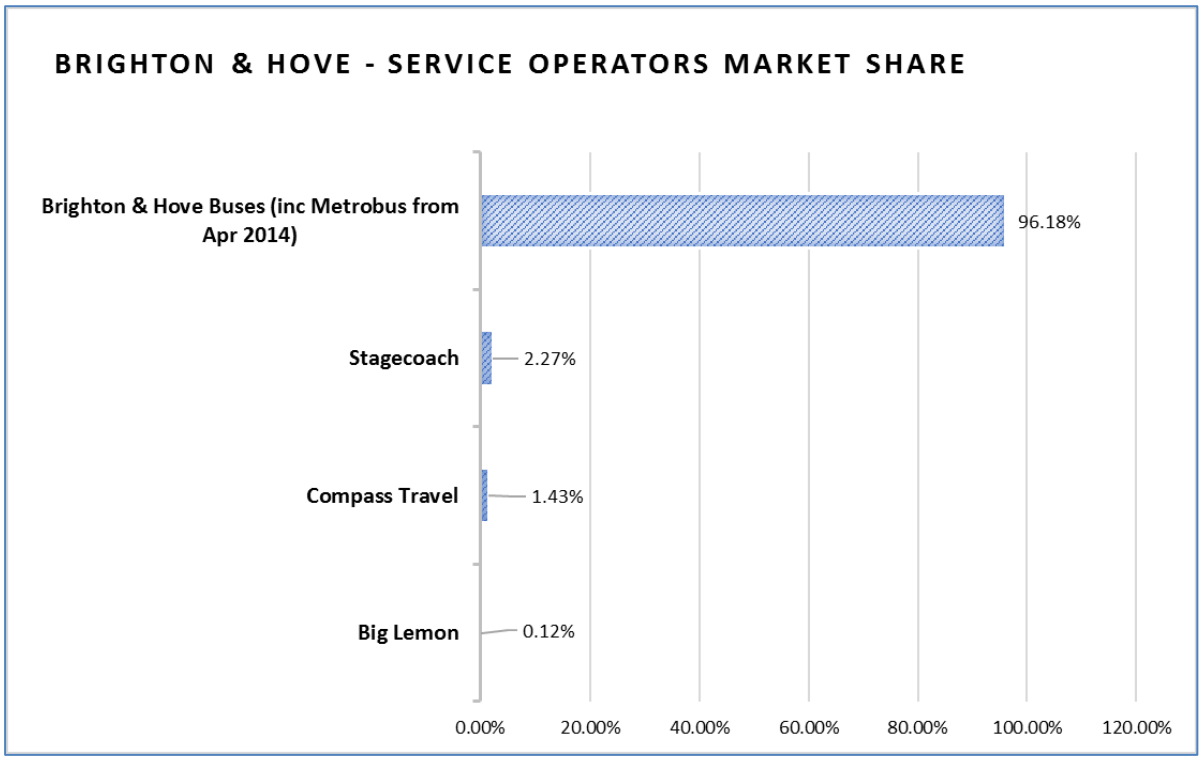
2.1.7 High-level interventions and recommendations have also been put forward where there are potential opportunities to improve bus performance, protect road space and/or reduce congestion.

3. THE BUS NETWORK

Bus Services

3.1.1 The bus market in the City is dominated by Brighton & Hove Bus Company, who carry over 96% of passenger journeys within the City.

Chart 1: Brighton and Hove Service Operators Market Share



3.1.2 The core operators are Brighton & Hove Buses and Stagecoach, who deliver commercial services within the City and, in the case of Stagecoach, a longer distance link along the south coast via their Coastliner service.

3.1.3 Compass Travel operates subsidised routes 37 and 37B, which serve several different areas within the city that are not served by commercial buses.

3.1.4 The Big Lemon deliver a network of other subsidised bus services that provide linkages to communities that might not otherwise be able to support a regular service through passenger numbers alone.

3.1.5 This study has concentrated on several major routes in the City, those which accommodate the highest passenger numbers, and which form the core of the network.

3.1.6 **Table 1** lists routes that have been specifically assessed. Many of these routes pass along the same corridors, therefore overall frequencies on individual routes and links vary considerably.

Table 1: Core Service Routes

Service No.	Description	*Approx. Service Frequency (per hour, per direction)		
		Peak	Inter Peak	Sat.
1	Whitehawk - County Hospital - City Centre - Hove - Portslade - Mile Oak	9	8	8
1A	Whitehawk - County Hospital - City Centre - Hove - Portslade - Mile Oak			
71A	Whitehawk - County Hospital - City Centre - Hove - Portslade - Mile Oak (School Bus)			
2	Rottingdean - Woodingdean - Brighton - Hove - Portslade - Southwick - Shoreham - Bramber - Steyning	4	3	3
5	Hangleton - Hove - Brighton - Patcham	6	6	6
5A	Hangleton - Hove - Brighton - Patcham			
5B	Hangleton - Hove - Brighton - Hollingbury (Sussex University peak times)	6	6	6
6	Sainsburys - Downs Park - Portslade - Hove - Brighton Station	6	6	6
7	(Portslade peak times) Hove - Brighton Station - County Hospital - Brighton Marina	10	8	8
12	Brighton - Rottingdean - Saltdean - Peacehaven - Newhaven - Seaford - Eastbourne	14	10	9
12A	Brighton - Rottingdean - Saltdean - Peacehaven - Newhaven - Seaford - Eastbourne			
12X	Brighton - Rottingdean - Saltdean - Peacehaven - Newhaven - Seaford - Eastbourne (Limited Stop)			
14	Brighton - Rottingdean - Saltdean - Peacehaven - Newhaven	4	4	4
14C	Brighton - Rottingdean - Saltdean - Peacehaven - Newhaven			
18	City Centre - Queens Park	4	4	4
21	Marina - Whitehawk - Queens Park - Open Market - Old Steine - Churchill Square - Hove - Goldstone Valley	5	5	5
21A	Marina - Whitehawk - Queens Park - Open Market - Old Steine - Churchill Square - Hove - Goldstone Valley			
22	Brighton Station - Woodingdean	4	4	4
22A	Brighton Station - Woodingdean			
24	Churchill Square - Coldean - Hollingbury	16	16	9
26	Hollingbury - Fiveways - Churchill Square			
46	Southwick - Portslade - Hove - Brighton - Fiveways - Hollingbury			
50	Hollingdean - Churchill Square			
50U	Brighton - Hollingdean - Universities			

25	(Portslade peak times) Palmeira Square - Lewes Road - Universities	16	16	4
25X	Portslade (peak Times) - Hove - city centre - Sussex University (limited stop)			
27	Westdene - Brighton Station - Rottingdean - Saltdean	3	3	4
28	Brighton - Lewes - Ringmer (Uckfield Crowborough Tunbridge Wells evenings and Sundays only)	6	6	6
29	Brighton - Lewes - Isfield - Uckfield - Crowborough - Tunbridge Wells			
29B	Brighton - Lewes - Ringmer - Uckfield - Crowborough (Certain journeys only)			
48	Lower Bevendean - Brighton Station	4	4	4
49	Portslade - Hove - Brighton - Open Market - East Moulsecoomb	6	6	7
17 (Stagecoach)	Brighton - Patcham - Horsham	2	2	2
700 (Stagecoach)	(Coastliner) Portsmouth - Chichester - Worthing - Brighton	6	6	6
47 (Big Lemon)	Brighton Station - County Hospital - Marina - Rottingdean - East Saltdean	1	1	1
16 (Big Lemon)	Portslade - Knoll Estate - Hangleton	1	1	1
52 (Big Lemon)	Brighton Station - Old Steine - County Hospital - Marina - Ovingdean - Woodingdean	1	1	1
56 (Big Lemon)	Knoll Estate - Hove - Brighton - Fiveways - Hollingbury - Patcham	1	1	1
57 (Big Lemon)	Brighton Station - County Hospital - Marina - Ovingdean - Rottingdean - East Saltdean	1	1	1
37 & 37B (Compass)	Bristol Estate - Kemp Town - Brighton - Queens Park - Meadowview	2	2	2

* Estimated from timetables published online

3.1.7 **Figure 1** illustrates the core bus network defined above. It does not include all services within the City, but shows those that have the highest service frequencies, and those which interact with corridors where multiple services combine to increase the total frequency.

3.1.8 Service frequencies on the core bus corridors vary depending on the convergence of routes. **Table 2** overleaf, provides estimates of the combined hourly frequencies of services on a selection of some of the main corridors within the study area. The figures shown represent hourly frequencies in one direction only.

Table 2: Service Frequencies by Route

Corridor	Peak	Inter Peak	Saturday
North St	129	121	103
Marlborough Place (Valley Gardens)	72	72	54
B2066 Western Rd	68	66	55

A23 London Rd/ Preston Rd	56	56	50
A270 Lewes Rd	48	48	30
Queens Rd	48	42	42
Portland Rd	38	35	24
Edward St/ Eastern Rd	30	26	26
A259 Marine Parade/Marine Dr	24	20	20
B2066 New Church Rd/Church Rd	22	21	22
A270 Old Shoreham Rd	18	17	17
Ditchling Rd	17	17	10
Whitehawk Rd	14	13	13
Queens Park Road	14	13	13
Elm Grove/ Warren Rd	13	12	12
A2023 Sackville Rd	12	12	12
Cromwell Rd	10	8	8
Dyke Rd	9	9	10

Note: Figures provided in Table 2 represent estimated number of services in one direction only

3.1.9 This analysis clearly shows the significant convergence of routes to North Street, leading to and from Old Steine in the Valley Gardens area. North Street carries up to 129 buses per hour in both directions (258 two-way) during weekday peaks, and over 100 buses per hour on Saturdays (200 two-way).

3.1.10 The B2066 Western Road, A23 London Road, A270 Lewes Road and Queens and Portland Roads all carry high numbers of bus services. However, the overall pattern of bus operations within the city revolves around the Valley Gardens and Old Steine area. This is a key Hub of the network, where most incoming passengers wish to be dropped, many outbound passengers require pick up, and where people change between buses.

Bus Patronage

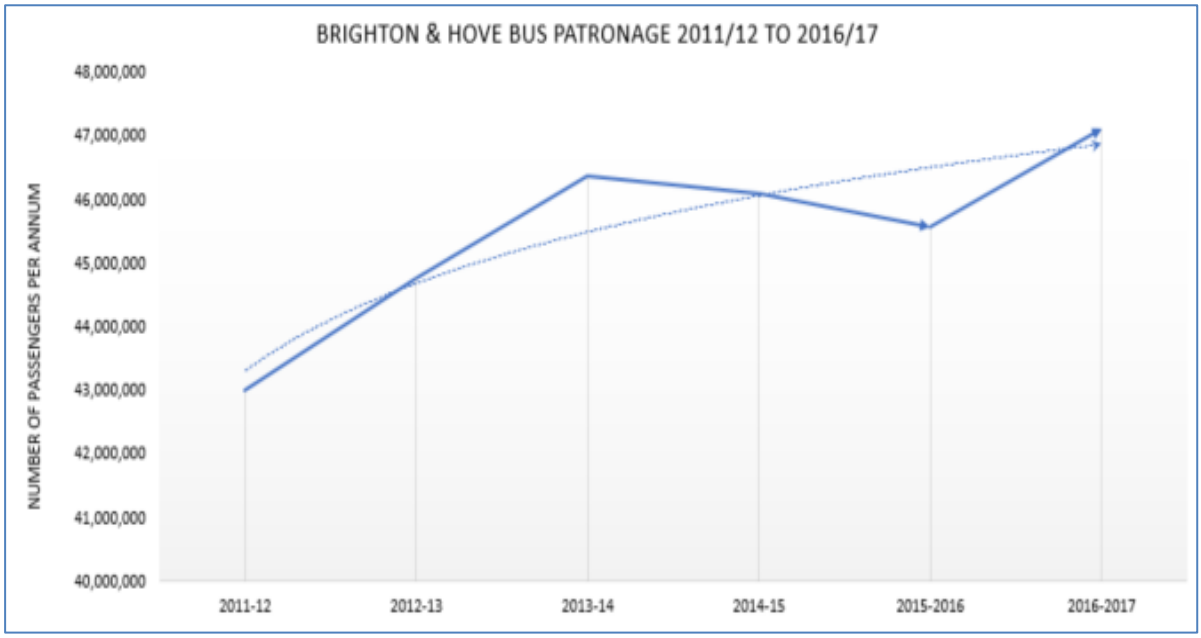
3.1.11 The average number of bus passenger journeys per head (bus journeys divided by population) in England outside London was 47 in 2016/17. Brighton & Hove were measured at 172 passenger journeys per head, over three times greater than the UK average, and the highest number of bus passenger journeys by head in the UK. [1]

[1] Annual Bus Statistics England 2016/17 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/666759/annual-bus-statistics-year-ending-march-2017.pdf

3.1.12 The relative importance of buses, and the capacity of this mode to carry huge numbers of people not only to the city centre, but between local centres and places of employment, has long been acknowledged in Brighton & Hove and is reflected through investment in network wide bus improvement and priority measures that have been progressively implemented since the 1990's.

3.1.13 Within Brighton & Hove, passenger numbers are rising, as illustrated in **Chart 2**.

Chart 2: Brighton and Hove Bus Patronage 2011/12 – 2016/17



3.1.14 Between 2013/14 and 2015/16 there was a downward trend in passenger numbers in the City, reducing from a high of 46.4m passengers per year to 45.6m passengers per year. In the most recent year that full data is available for (2016/17), there has been a significant resurgence, with total passenger numbers in 2016/17 increasing to 47.1m.

3.1.15 The downward trend to 2015/16 was likely to be due to several factors, including major schemes that were being delivered on the road network such as Seven Dials, Brighton Station, Edward Street better bus area, North Street, Lewes Road & Vogue gyratory improvements and; bus priority schemes such as Lewes Road. These schemes were for the long-term benefit of bus passengers and other sustainable travel modes, but they may have had a short term negative impact on traffic congestion and bus patronage.

3.1.16 In a recent document produced by the CIHT (Buses in Urban Developments – Jan 2018), Brighton and Hove ranked as having the highest bus use outside of London by mode share of all trips (15%) based on data from 2014-15.

3.1.17 The overall trend is therefore very positive in terms of the usage and relative importance of bus travel within Brighton & Hove. There are over 4 million more passengers using bus services in the City than there were just five years ago, along with an increase of over 1.5 million passengers in the past year alone.

Patronage by Service

3.1.18 Information on bus passenger numbers by route has been provided by the key operators, Stagecoach and Brighton & Hove Buses.

3.1.19 This information is commercially sensitive and cannot be published in detail. However, for the purposes of network analysis and route prioritisation, the relative numbers of passengers carried per year has been expressed in bands based on the total numbers of passenger per annum for the various services.

3.1.20 Table 3 illustrates this banding:

Table 3: Passenger numbers by service

Service Numbers	Passengers per annum	Band
5/5A/5B/55, 1/1A/71/73, 12/12A/12X/92, 7	>5m	A
25, 700, 49 24/26/46	>3.5m	B
2/2B/60 28/29/29B/29X 27/27B/27C, 6	>1.8m	C
14/14A/14B/14C 21/21B/21E 22/22A, 50/50U, 48	>1m	D

23 18 17	>300k	E
13X, 72, 94/94A, 95/95A, 77, 59/59A 76/76A, 74/75, 78, 79, 91, 93, 84, 70	<300k	F

3.1.21 A significant number of services carry over 3.5m passengers each year and overall, there are clearly many very well used services within the City.

3.1.22 Detailed information regarding passenger numbers per service has been used to assess the relative priority of proposed improvement measures (see Section 5). This information has, however, been combined and averaged across all affected services to protect commercial sensitivities.

4. TRAFFIC CONDITIONS

Bus Punctuality

4.1.1 Data provided by bus operators to the Traffic Commissioner each year provides an overall indication of service punctuality for Brighton & Hove buses (who operate 96% of all services in the City).

4.1.2 Service punctuality is measured as the % of the number of services that arrive or leave a timing stop between 1 minute early and 5 minutes late of their scheduled departure time. The overall figures for Brighton & Hove up to March 2017 are as follows:

- April 2013 – March 2014 – 89%
- April 2014 – March 2015 – 86%
- April 2015 – March 2016 – 80%
- April 2016 – March 2017 – 80%

4.1.3 A level of punctuality of 95% (within a window of tolerance) is the standard target required by the Traffic Commissioner. While an assessment of the DfT's annual bus statistics for England reveals Brighton & Hove's bus punctuality figures are by no means out of the ordinary when compared to places of a comparable size, it is clear that punctuality levels are lower than the Traffic Commissioner's target.

Traffic Levels

4.1.4 Bus operators have stated that congestion is creating operational problems, and that some service timings have had to be changed to achieve a good level of punctuality and service reliability.

4.1.5 The Council has a network of traffic counting sites on their roads with annual average daily traffic count (AADT) data available via their website. To gain a broad indication of the conditions on the bus network, traffic counts from six sites located on (or close to) the core bus corridors have been reviewed. AADT data from 2013 to 2017 has been obtained for the following routes:

- A270 Old Shoreham Road
- A23 Preston Road
- A23 London Road
- A270 Lewes Road
- A23 Beaconsfield Road

- A259 Marine Drive

4.1.6 Table 4 below, shows the change in traffic volumes over time on each corridor.

Table 4: Selected Count Sites (Core Bus Routes) - AADT 2013 – 2017

Site	Road	2013	2014	2015	2016	2017	Change
A270	Old Shoreham	28904	27385	27197	27133	26154	-9.51%
A23	Preston Road	9602	8534	8451	10237	10438	8.71%
A23	London Road	22950	23323	23514	23105	22550	-1.74%
A270	Lewes Road	22724	20698	19909	20048	19952	-12.20%
A23	Beaconsfield Road	14344	14634	14414	14106	14046	-2.07%
A259	Marine Drive	23134	22840	22974	23359	23002	-0.57%
	Total	**121657**	**117415**	**116459**	**117989**	**116142**	**-4.53%**

4.1.7 Combined traffic flows on these core bus corridors saw a 5% reduction overall.

4.1.8 Traffic levels did increase in 2016 from 2014 and 2015 lows, however, regular rail strikes during 2016 are likely to have had an impact on the increase in traffic volumes. It is also worth noting the synergy between this period of increased traffic volumes and the temporary decline in bus passenger numbers during this period (as highlighted earlier in this report).

4.1.9 Although the AADT figures summarised can't be taken to be a proxy for the whole Brighton network, the increasing pattern in bus patronage shown in Chart 1 indicates that public transport functionality may be closely linked to levels of demand, i.e. a transference of car based trips to bus based trips – the presence of such links is also referred to in the CIHT's, 'Buses in Urban Developments' (Jan 2018).

4.1.10 Problems with service punctuality may be linked to increases in passenger numbers, specifically the additional time required to pick up and set down passengers, and hence the increase in dwell times at stops. Options for reducing this impact are discussed in Section 8 of this report.

4.1.11 There is no historic evidence to suggest that congestion levels have increased over time. Brighton & Hove Council do propose to undertake a

review of congestion using a large dataset being provided by DfT, but given the reduction in car based traffic on core bus routes, there is insufficient evidence to state whether issues with punctuality directly relate to an increase in congestion.

4.1.12 A major concern that operators report is variability of journey times, leading to significant increases in journey times during peak hours. Journey time variability is also impacted by incidents, poor weather conditions and highway works.

4.1.13 The nature of Brighton & Hove (as a seasonal/tourist destination) means that traffic 'super-peaks' are frequently experienced relating to the leisure and 'out of town' trips generated during holiday periods - particularly the summer months. As a result, there are, on occasion, short-term congestion events that lead to bus timing problems across the network.

4.1.14 This is evidenced by a detrimental impact on air quality. **Figure 3** shows air quality monitoring data for Brighton & Hove plotted by the recorded NO_2 annual mean concentration ($\mu g/m^3$) for 2017. Particular issues with NO_2 levels exceeding the UK annual mean objective are evident in the busy City Centre areas of London Road, Valley Gardens, Preston Circus, Brighton Station, Clock Tower Junction/Churchill Square and Vogue Gyratory.

4.1.15 As noted previously, Brighton & Hove is particularly susceptible to seasonal, and sometimes daily, variations in conditions. It also has a restrictive highway network due to the coast to the south, which channels traffic through a small number of north-south corridors and restricts route choices.

4.1.16 Route restrictions and funnelling of traffic applies to both general traffic and bus services. East-west movements for bus services are funnelled through Old Steine and North Street. This is a key corridor for passenger set down and pick-up, linking to the city centre shopping areas and popular destinations on the sea front.

4.1.17 North Street has been dedicated for buses and taxis only and, although it can also be accessed by other traffic from side streets, it attracts over 250 buses per hour during peak times. The funnelling of services onto this route creates bus on bus congestion along with a complex series of stopping patterns and movements.

Traffic Management & Bus Priority

4.1.18 Locations of signalised junctions and those with MOVA (a traffic signal real-time capacity improvement system) currently installed or planned have been provided by BHCC. In addition, a list of Bus Lane Orders has been obtained and plotted onto the network. The locations of these are presented in **Figure 2**.

4.1.19 Bus lanes are not extensive or comprehensively present on the network. Generally, they are concentrated within the city centre, however there are existing provisions on some of the main arterial routes into the centre, namely;

a. London Road southbound between Carden Avenue and Preston Road, c. 1,000m

b. London Road northbound between Grange Close and South Road, c. 300m

c. Lewes Road southbound between Coldean Lane and Vogue gyratory, c. 3,000m

d. Lewes Road northbound between Hollingdean Road and Stony Mere Way, c. 3,500m

e. Marine Drive eastbound between Greenways and Park Road, c.750m

f. Marine Drive westbound between BHCC boundary and Newlands Road, c. 1,300m

4.1.20 Lewes Road has been provided with around 6.5km of bus lanes in both directions. This allows for a high level of bus priority for services linking to Sussex and Brighton Universities, including campuses on A27 Lewes Road, as well as the Brighton & Hove Albion FC's ground (Amex Community Stadium).

4.1.21 This corridor has experienced a 12% reduction in traffic volumes over the past 5 years, which indicates modal shift from car to bus or other forms of transport, but could also indicate a degree of traffic re-distribution due to road space reallocation. Elsewhere, there are only limited and short lengths of bus lane provision.

4.1.22 This cause and effect of road space re-allocation and traffic re-distribution is a key element of the management of a complex highway network such as Brighton & Hove.

4.1.23 It is an ever changing and dynamic system affected by the developing characteristics and needs of a modern city as well as the evolving policy that shapes it. Unfortunately, the expectations of stakeholders often remain static – that is to say journey times and congestion levels are expected to remain at constant levels regardless of this background of change.

4.1.24 'Buses in Urban Developments (2018) acknowledges that bus priority measures will often impact road space and car travel. However, such actions need to be promoted as 'positive tools' for creating attractive town centres with the environmental and economic gains outweighing the perceived impacts.

4.1.25 This is considered a two-way relationship and bus operators must also accept the need for change in some areas of the network (e.g. improved cycle provision for sustainability, improvements to air quality etc) even if this means that journey times may change with this. Rather than focus on fixed metrics/absolutes year on year, what is important is that the Highway Authority and bus operators work collaboratively to ensure a level of service that continues to provide for the excellent levels of bus patronage identified in Brighton and Hove as highlighted in this report.

5. BUS OPERATIONAL HOTSPOTS

Main Bus Route Corridors

5.1.1 Key services have been identified based on those which accommodate the most passenger numbers and operate with the highest service frequencies (see Section 2).

5.1.2 Several 'main bus corridors' have been identified, where multiple core services are routed either partially or in full.

Congestion Analysis

5.1.3 To provide a high-level review of network congestion at peak times, a RAG assessment was undertaken on the main corridors. The corridors were plotted using a GIS mapping system and split into sections by key junctions and / or changes in characteristics.

5.1.4 Each section was assigned a unique ID and a RAG category based on online average traffic congestion data;

- **Red:** Congested
- **Amber:** Slow moving
- **Green:** Free flowing

5.1.5 This process was undertaken for both inbound and outbound traffic during AM and PM peak weekday traffic, and an identified Saturday peak of 13:30. **Figures 4, 5 and 6** show the plotted RAG analysis for each time period.

5.1.6 Punctuality data was not available from the main service operators for analysis of routes most affected by congestion. In lieu of this, average speeds for each B&H bus service were provided to enable a high-level assessment of service operations, as summarised in **Table 5**.

Table 5: Average Route Speeds (mph)

Service	Average Speeds (mph)		Route Length (km)
	Average Speed (reported by bus operators)	Difference from Mean	
18	7.2	-5.0	5.7
49	7.7	-4.4	23.5
50	8.0	-4.2	16.3
50U			17.5
48	8.2	-3.9	16.1
1	8.7	-3.5	31.0
1A			31.2
71A			22.6

7	8.7	-3.4	19.8
21	9.0	-3.2	37.7
21A			39.4
5	9.2	-2.9	34.9
5A			34.8
5B			44.3
24	9.6	-2.6	19.3
26			13.8
46			38.9
25	9.6	-2.6	32.5
25X		-2.6	26.3
22	9.7	-2.4	20.1
22A			20.8
6	10.1	-2.0	18.4
2	10.9	-1.2	68.6
27	11.3	-0.9	38.1
14	15.7	3.5	42.8
14C			44.5
12	16.1	3.9	77.5
12A			81.6
12X			73.9
28	16.8	4.7	120.8
29			109.8
29B			88.8

5.1.7 The RAG data in figures 4 to 6, along with the average bus speed information in Table 5, provides an indication of where services are experiencing the highest levels of congestion. However average journey speeds are impacted by several factors, including presence of bus lanes, speed limits, lengths and natures of corridors and numbers of passengers (i.e. dwell time).

5.1.8 For example, congestion indicated on A270 Lewes Road in Figures 4,5 and 6 does not impact bus operations as much due to the presence of extensive bus lanes on this corridor.

5.1.9 The total route lengths (two-way) in Table 5 demonstrate a correlation between journey speeds and lengths, indicating that average speeds reduce as route proportions within the city centre increase.

5.1.10 This would indicate that much of delay is experienced within the city centre, however this is not necessarily an indicator of congestion. There are other influencing factors that may affect speeds (as noted in paragraphs 5.1.7 and 5.1.8) such as speed limits of roads, density of stops and passenger numbers increasing dwell times.

Bus Operator Consultation

5.1.11 Although journey speed data is a useful tool for assessing relative route performance, one of the most important sources of information regarding the day to day issues on the bus network comes from the operators themselves.

5.1.12 Consultations with B&H Buses, Stagecoach and The Big Lemon have therefore been undertaken to identify 'hotspots' and problem routes. Brighton Bus Watch (the local passenger 'watchdog') were also consulted due to their knowledge of the network from a user perspective.

5.1.13 Each consultation made use of plans produced through the initial high-level analyses. Meetings allowed the stakeholders to identify known areas of congestion or operational difficulty.

5.1.14 The identified hotspot areas showed some correlation to the network performance analyses, however additional problem areas were identified that were not necessarily related to (wider traffic) congestion, eg. bus-on-bus congestion, delays caused by obstructive parking, changes to signal phasing.

5.1.15 **Table 6** provides a summary of all identified hotspots referenced by time of day and affected services. The identified hotspot areas are also plotted on a location plan in **Figure 7**.

Table 6: Bus Operational and Congestion Hotspots

Ref.	Location	No. of services affected	Comments and Issues
C1	Boundary Road	7	Delay caused by a Network Rail level crossing on Boundary Rd. Parking/loading issues in Boundary Road/Station Road south of the level crossing. Installation of traffic islands north of level crossing to prevent cars driving on wrong side of the road to avoid level crossing queue and turn into Victoria Road has led to longer traffic queues which can reach as far as the Old Shoreham Road traffic lights. Off-peak generally functions well. Peak time issues lead to safety concerns; vehicles still using wrong side of road and air quality issue from increased congestion.

Ref.	Location	No. of services affected	Comments and Issues
C2	Sackville Road/Old Shoreham Road crossroads	4	Site identified as a 'hotspot'. However, junction improvement works undertaken in 2018 by BHCC (including installation of MOVA) have significantly improved flows/journey times through the junction. ***Site no longer considered a hotspot.***
C3	Blatchington Road/Sackville Road/Portland Road traffic lights	9	Traffic light sequence is very long. General impacts/changes in traffic patterns have resulted since amendments to signal timings (inc. ped phases). Efficiency of westbound approach is affected by illegal parking/loading activity. Parking in left turn lane causing blockage for left turners and other movements as left turners block right hand lane.
C4	Shirley Drive/Old Shoreham Road	3	Issue is on school days only. Volume of traffic connected with Cardinal Newman School and Cottesmore School. Worse since introduction of cycle lane on Old Shoreham Rd due to reduced capacity for right-turners (no filter). Eastbound queuing from The Upper Drive obstructs bus services on Shirley Drive.
C5a	Dyke Road Avenue northbound	1	Volume of traffic queuing to get onto roundabout at by-pass. Confusing signing for roundabout. There has been a 40% increase in JTs on the no' 27 route. Affects whole of Dyke Road - corridor issue. Valley Gardens will divert more traffic via Dyke Road from A23/Lewes Road.
C5b	Dyke Road Avenue southbound	1	
C6	A23 southbound between by-pass and Carden Avenue	4	Volume of traffic heading into the city. Sometimes difficulty in accessing the bus lane (Patcham). Possible scope elsewhere for carriageway re-designation to provide combined bus/cycle lane.
C7	Surrenden Road near Varndean College	1	Volume of traffic connected with Varndean College. School drop-off/pick traffic and parking. CPZ creep leading to parking affecting bus operations.
C8	Coldean Lane jw Ditchling Rd	4	Ditchling Rd / Coldean Ln junction an issue. Queuing right turners a problem.
C9	Lewes Road/Coldean Lane eastbound	2	Volume of traffic, and particularly sensitive to traffic incidents elsewhere on the network.

Ref.	Location	No. of services affected	Comments and Issues
C10	A27 Slip Road at Sussex University	8	Volume of traffic exiting Sussex University - right turners exiting block eastbound slip road preventing access to bus stop. Potential solution to relocate stop. ***Outside the City boundary - East Sussex County Council are the highway authority and works are beyond the control of BHCC. However, BHCC will continue to be proactive in lobbying ESCC for a solution.***
C11	Downs Hotel crossroads, Woodingdean	4	Amendments to signal timings have affected capacity. Lack of space for separate queues (e.g. southbound in Falmer Road). Insufficient capacity for right turners. Affected by school traffic/parking.
C12	A259 eastbound at Greenways	10	Caused by Longridge Avenue traffic lights and exacerbated by Rottingdean High Street traffic lights. Traffic queues prevent access into existing bus lane. Regular significant congestion on whole link. Knock-on effects of queuing at each set of lights - traffic can't get through lights due to queues for next lights
C13	Rottingdean Marine Drive / High Street White Horse Junction	9	Westbound approach has two lanes but too narrow and functions as one causing queuing behind right turners.
C14	Brighton Station	16	Taxi congestion - ongoing issue. Too many permits issued by rail company to access station area. Possible options for waiting areas to the rear of the station.
C15	Ditchling Road southbound approaching Fiveways and approaching the Open Market	4	Volume of traffic, especially on school mornings with Varndean School and Downs Junior School. School drop-off/parking issues. Queuing southbound near to St Peter's Church. Queues to Fiveways at AM peak linked to schools
C16	Lewes Road northbound between Elm Grove and Vogue	8	Volume of traffic, queuing to get onto Vogue. Lack of space for right turning traffic to wait without blocking northbound traffic lane. Traffic islands restrict carriageway space near to bus stop. Cycle lanes impact carriageway space available. Queues to Fiveways at AM peak linked to schools

Ref.	Location	No. of services affected	Comments and Issues
C17	Churchill Square to Clock Tower Junction	37	Issues caused by bus congestion and volume of pedestrians. Two separate junctions function as one. Long phasing causing queuing and preventing access to bus stops. Volume of buses and bus stop locations cause issues at Churchill Square. Also affected at weekends and during summer due to pedestrian traffic.
C18	Marine Parade westbound between Lower Rock Gardens and the Sea Life Centre	8	Volume of traffic queuing at roundabout and right-turners queuing westbound along sea front to get to Churchill Square car park (low price/privately owned). Weekends and December are worst.
C19	North Street	38	Extremely high volume of buses leads to congestion at junctions and difficulties accessing stops. Difficulties overtaking stationary buses at bus stops.
C20	Western Rd - Waitrose	16	Location of bus stops in narrow carriageway leads to congestion on westbound approach to Montpellier Rd junction. Conflict with eastbound and westbound bus stops as well as kerbside loading.

Note: Comments provided by bus operators – delays at hotspot locations may not be caused by traffic signals or highway layout alone – traffic volume is also likely to be a major factor.

5.1.16 The hotspots identified above are the most regular cause of delays and journey time variability for buses on the network.

5.1.17 Each hotspot location has been inspected at a time informed by the operators' information and the RAG traffic analysis described previously to identify potential improvements that could feasibly be delivered. The outcomes of this assessment are presented in Section 6.

6. HOTSPOT PROPOSALS

6.1.1 A report on each of the hotspot locations has been prepared and provided in a separate **Hotspot Site Reviews** appendix document.

6.1.2 Background information including site observations and identifiable issues has been documented for each site. In addition, each site was given a score (on a scale of 1-5) to provide The Council with a high-level framework for assessing the pros and cons of each site. The scoring system is summarised as follows:

- Journey Times – Based on an estimated time saving derived (in seconds per hour) for all services/frequencies affected. A score of 1-5 has been allocated based on the deviation from the mean of all sites assessed. A high score implies greater journey time savings;
- Impact – Based on the estimated passenger numbers expected to benefit from the measures proposed and is derived from annual passenger numbers for each route as provided by the operators. It relies on the assumption that all passengers on a given route will benefit from improvements to the general operation of a service even if they don't specifically travel through the hotspot site itself (from improved route reliability etc). A high impact score implies a greater number of passengers will benefit from any derived journey time savings. A score of 1-5 has been allocated based on the deviation from the mean of all sites assessed;
- Delivery – Complexity of delivery on a scale from 1: Complex/multi-disciplinary scheme to 5: Quick win/few barriers to progressing;
- Cost – High level estimated scheme costs; 1: £250k+, 2: £101-200k, 3: £51-100k, 4: £11-50k, 5: £0-10k.

6.1.3 **Table 7** below summarises the findings and provides recommendations and commentary regarding potential improvement measures at each location. These findings have also been informed by an officer workshop held with the City Council on 7th March 2018.

6.1.4 The proposals have not been comprehensively tested for feasibility, but are pragmatic options that merit further review and consideration. In some

cases, there are existing BHCC proposals in development that could address some or all the issues identified.

6.1.5 In all cases, to confirm feasibility, benefits and costs, more detailed site investigations, traffic modelling and consultation is required.

Table 7– Hotspot Recommendations

Location Reference	Location Services Affected Recommendations
C1	Boundary Road 1, 6, 16, 46, 49, 66, 71
	Recommendations / Review Outcomes ➢ Improve enforcement of parking/loading contraventions; ➢ Vehicles continue to drive down the wrong side of the c'way - merits investigation of widening the southbound approach to formalise/accommodate right turn flows to provide additional queuing capacity (Option 1), or providing a queue-jumping facility for buses (Option 2). ➢ Traffic surveys are required to determine the number of right turns to quantify space requirements/potential benefits. ➢ Investigate widening on the east side and narrowing of the northbound traffic lane (including relocation of bus stop) to accommodate an extended right turn lane (Option 1) or bus gate/lane (Option 2). Relocation of street infrastructure and statutory undertakers plant likely required. ➢ Probable issues with land ownership which could be a prohibitor (Option 2). ➢ Possible scope to amend southbound markings (south of the crossing) to reallocate more space to northbound traffic and provide increased space for vehicles turning into Portland Rd - adjacent loading arrangements to be reviewed; **Notes:** ➢ BHCC meetings with Network Rail indicate no scope for amending signalling/timings as they operating to the necessary standards. ➢ The BHCC LTP Shopping Area Project has allocated funding for this area in 2018/19.
C2	Sackville Road / Old Shoreham Road 5, 5A, 5B, 56
	Recommendations / Review Outcomes BHCC have delivered a junction improvement scheme in 2018 that has significantly improved journey times and flows – ***site no longer considered a hotspot.***
C3	Blatchington Rd/Sackville R/Portland Rd 2, 5, 5A, 5B, 7, 25, 46, 49
	Recommendations / Review Outcomes ➢ Review signal timings and investigate possible bus detection/priority on east/west arms to provide additional green time for buses when required. ➢ Investigation of traffic management measures at the junction (e.g. banned turns, one way orders) to be informed by traffic surveys. **Notes:**

Location Reference	Location Services Affected Recommendations
	➢ Key approach route to the King Alfred redevelopment site.
C4	Old Shoreham Rd/Shirley Drive 21,56
	Recommendations / Review Outcomes Provide queue detection on Old Shoreham Rd (jw The Upper Drive) to prevent exit blocking at Shirley Drive.
C5	Dyke Road/Dyke Road Avenue 27
	Recommendations / Review Outcomes ➢ Review loading/waiting arrangements around the Upper Drive junction. ➢ Review scope to realign lane markings on the approach to The Upper Drive. ➢ Review options for full/partial signalisation of roundabout j/w A27 and Mill Rd and/or making Mill Rd entry only. Signalisation would improve capacity and balance queues to enable northbound traffic to enter the junction. Signalisation could also have safety benefits as well as reducing circulatory speeds (observed to be high). **Notes:** ➢ Possible scope to investigate provision of a bus lane north of The Droveway if Valley Gardens works significantly impact the corridor in future- however unlikely to be sufficient justification considering limited number of services on the route. ➢ Mill Rd is currently used as a match day park and ride site. The commercial arm of B&H buses considering a business case for removal of general traffic on Mill Rd and use as a formal P&R site. ➢ A major development, Toads Hole Valley, is being planned next to this junction providing an opportunity to seek developer contributions to investigate and make the required improvements at this junction. ➢ Housing Infrastructure Fund (HIF) bid submitted and shortlisted for further consideration.
C6	A23 Southbound (A27 - Carden Avenue) 5, 5A, 17, 56
	Recommendations / Review Outcomes ➢ Undertake turning count surveys at junction with Carden Avenue and The Deneway to assess the feasibility of converting jw Carden Avenue to a priority give way. This would ensure right turners into Carden Avenue do not add to delay in the southbound direction. The volume of right turners needs to be considered to assess any safety risks associated with this - however, it is worth noting that existing priority junctions in the vicinity have performed as well as the existing mini-roundabout (though this may be flow dependent) - May result in delay to northbound services - to be assessed; ➢ Alternative to upgrade the roundabout to signals with bus detection if surveyed flows dictate a requirement; ➢ Scope to extend the existing bus lane northwards to Carden Avenue. Scope to extend further though most services do not extend beyond the Carden Avenue junction. **Notes:**

Location Reference	Location Services Affected Recommendations
	➢ This route does serve long distance and 'out of town' services and may be a consideration in relation to perceived benefits of the above measures.
C7	Surrenden Road near Vardean Road 5B
	Recommendations / Review Outcomes ➢ No notable issues observed on day of review. ➢ Parking restrictions could be upgraded to cover the area adjacent to the school to ensure that vehicles do not restrict bus movements; ➢ Parking Surveys and journey time surveys are recommended to understand and quantify the level of delay being caused by incorrectly parked vehicles; **Notes:** ➢ This area is due to be consulted on a resident parking scheme in Autumn 2019. Varndean College has also made a planning application to amend parking arrangements. BHCC to review/monitor in the context of the identified delay to buses in the area.
C8	Coldean Lane jw Ditchling Rd 5B,24,26,56
	Recommendations / Review Outcomes ➢ The right turn into Ditchling Road (northbound) could be prohibited, allowing for the creation of a larger right turn pocket for vehicles wishing to turn right on to Ditchling Road southbound (although it is noted this could affect flows off the A27 and right hand turns from Ditchling Road northbound so will need further investigation; ➢ This should reduce the number of vehicles blocking the ahead movement on Coldean Lane; ➢ Vehicles wishing to travel northbound can continue straight ahead and use the roundabout to turn around to facilitate the left turn. **Notes:** ➢ The adjacent junction A27 (Hollingbury) is due to be studied to improve ped/cycle access to The Downs. The proposed bus priority works to be considered alongside this study. ➢ HIF bid submitted and shortlisted for further consideration
C9	Lewes Road/Coldean Lane eastbound 5B, 24
	Recommendations / Review Outcomes ➢ Significant interventions not recommended now (few bus routes affected and intermittent issue). However, there is potential for use of land to north of Coldean Lane to widen carriageway and provide additional capacity on approach (subject to land ownership) if conditions worsen / congestion becomes consistent issue. **Notes:** ➢ Monitor conditions and review any occurrence of traffic displacement/rat running through Coldean.

Location Reference	Location Services Affected Recommendations
C10	A27 Slip Road at Sussex University 5B, 50,50U,25,25X, 28,29,29B
	Recommendations / Review Outcomes ➢ Need to alleviate queuing back on to the A27 slip road and within the University Campus. ➢ It is recommended that the A27 roundabout at the northern end of The Drove be upgraded to include traffic signals to create emerging gaps at this junction. **Notes:** ➢ Junction under the control of East Sussex CC – however, impacts BHCC network. Proposals have been worked up by ESCC in conjunction with BHCC. Funding available from Amex Stadium – HIF bid submitted. ***Note: East Sussex County Council are the highway authority, therefore planned works are beyond the control of BHCC. However, BHCC will continue to be proactive in lobbying ESCC for a solution***. ➢ HIF bid submitted and shortlisted for further consideration
C11	Downs Hotel Crossroads, Woodingdean 2,22,22A,52
	Recommendations / Review Outcomes ➢ It is recommended that a signal phasing review is undertaken to try to optimise the operation of the junction; ➢ Consider relocation of School Crossing Patrol Officer and creation of an informal crossing provision, this option will require relocation of Downs Hotel (eastbound) bus stop on Warren Road; ➢ Provide yellow box junction to prevent junction obstruction and removal of right turn slip from Warren Road into Falmer Road; ➢ Due to no issues being observed during PM peak, it is recommended that additional longer term traffic surveys are undertaken to understand if the issue at this site are a regular occurrence or are caused by congestion on other routes.
C12	Greenways to Rottingdean Marine Drive 12,12A,12X,14,14C,27,47,52,56,57
	Recommendations / Review Outcomes ➢ Although queuing was not observed past the Greenways roundabout on the day of the site visit it is understood through consultations that this is a regular occurrence. ➢ The queuing relates to narrowing of the carriageway to a single lane when the bus lane starts east of the roundabout. ➢ Buses are caught up in the queues of traffic and cannot access the bus lane due to congestion. ➢ It is recommended that the bus and cycle lane are extended back further west from the roundabout approach. ➢ This will allow for a more cohesive bus corridor to be created along the coastal route. ➢ Given that the dual carriageway narrows to a single lane on both the Greenways roundabout and Marine Drive approach to Brighton, it is debatable whether the four general traffic lanes add any value to network capacity. ➢ A more comprehensive scheme (above the extents proposed in this study) could be considered whereby the whole route is provided with bus and cycle lanes in both

Location Reference	Location Services Affected Recommendations
	directions. This would deliver a very high level of public transport priority as well as a safe coastal cycle route.
C13	Rottingdean Marine Drive, White Horse Junction 12,12A,12X,14,14C,27,47,52,56,57
	Recommendations / Review Outcomes ➢ Adjust the signals at the High Street/ Marine Drive junction to allow right turners a short early release. This will allow the right turn to clear and give buses sufficient room to use both lanes when tracking through; ➢ It is however recommended that further traffic surveys are undertaken to verify right turning movements/demand; ➢ Investigate any options for reallocation of c'way space to improve westbound swept paths (e.g relocating traffic island- eastbound swept paths dependent); It is also recommended to review the signals at the Longridge junction to see if there are any changes which could allow more efficient green time to Marine Drive - possible ESCC involvement.
C14	Brighton Station 6,7,12, 14,18,22,27,47, 48, 52, 57,12A,12X, 14A,14B,14C,22A,27B, 27C
	Recommendations / Review Outcomes ➢ Limit taxi numbers in station vicinity to prevent obstruction of bus facility. ➢ There is an option for a further, or replacement, taxi stand at rear of station. ➢ Lessening impact of taxis will improve conditions in immediate vicinity of the station and would reduce flows at the junction of Queens Rd/Gloucester Rd, improving journey times through the traffic signals (much of the flow is currently taxis); ➢ Consolidate bus stop at Surrey Street to serve ahead only services. Right-turning services required to stop at Queens Road only - review stop capacity on Queens Rd.
C15	Ditchling Road Southbound 26, 46, 50, 50U
	Recommendations / Review Outcomes ➢ Monitor activity on the corridor following Valley Gardens Ph1 & 2 implementation; ➢ Limited road space for bus lanes, and limited demand (c. 15 services per hour); ➢ Investigate adjustments to signal timings at Fiveways and Ditchling Road / A270 Upper Lewes Road junction during AM school peaks; ➢ If congestion increases, investigate provision of MOVA at Fiveways and Ditchling Road / A270 Upper Lewes Road junctions with bus detection; ➢ Possible scope to amend layout/kerb line of junction to make more accessible and reduce inter-green times - though unlikely to result in significant savings.
C16	Lewes Rd northbound (south of the Vogue Gyratory) 24,25,28,29,48,49

Location Reference	Location Services Affected Recommendations
	Recommendations / Review Outcomes ➢ Undertake traffic surveys to determine extent of any rat running (much of turning flow observed may be school related) and review scope for traffic management measures to deter any through traffic between Lewes Rd and Elm Grove; ➢ Investigate relocating existing northbound bus stop to south of Inverness Rd (bins relocated to Inverness Rd). This may introduce scope to extend the two lane approach to the Vogue Gyratory with removal of existing traffic island at the controlled crossing; ➢ Review existing crossing use to see whether the existing controlled facility south of Franklin Rd can be converted to a wide uncontrolled pedestrian refuge to minimise disruption to traffic flow (a similar facility provided close to Aberdeen Rd (no PICs recorded). **Note:** ➢ Significant collision history involving turning vehicles in the area. Provides additional justification for considering some of the measures above.
C17	Churchill Square to Clock Tower 1,2,5,6,12, 14,17,18,21,22,24,25,26,28,29,46,48,49,50,71,700
	Recommendations / Review Outcomes ➢ Investigate rationalisation/balancing of eastbound stops in terms of location and service numbers to ease 'bus on bus' delay at the stops and minimise impact on efficiency of adjacent junction approach; ➢ Investigate options for making junction of Dyke Rd a priority junction to minimise delay. High volume of uncontrolled pedestrian crossing movements already observed at this location and designing the layout to suit this behaviour should ensure the junction continues to operate safely - analysis of desire lines/ped volumes required to ensure viability of such an approach - though uncontrolled crossing may dissipate demand (i.e. pedestrians not grouping whilst waiting for green man); ➢ Provide a standalone pedestrian crossing on western arm (pedestrian detection and countdown) to maintain accessibility across Western Rd. Link to Clock Tower junction and provide queue detection to prevent queuing across Dyke Road; **Notes:** ➢ Additional benefits to site C19 (North St) if Clock Tower junction cycle time reduced; ➢ Potential for overlap with future aspirations for Churchill Sq/Gateway to the Sea.
C18	Marine Parade (Upper Rock Gardens to Sea Life Centre) 12, 14, 27, 47, 52, 57
	Recommendations / Review Outcomes ➢ Re-designation of c'way and provision of right turn pockets into Camelford Street and Madeira Place; ➢ Review lane markings and nearside kerb line on approach to Sea Life Roundabout - possible scope to improve/reduce pinch point/increase entry width; ➢ Marine Parade is very wide. Scope to provide a westbound bus lane between Upper Rock Gardens and Sea Life Centre (reducing eastbound lane width and/or in-setting westbound parking). **Note:** ➢ Valley Gardens Ph3 works include redesign of Sea Life Roundabout - any major improvement works e.g. provision of new bus lane to be incorporated into this major scheme.

Location Reference	Location Services Affected Recommendations
C19	North Street All
	Recommendations / Review Outcomes ➢ Scope to amend kerb lines to provide more passing space adjacent to the southbound stops; ➢ Consider relocation of northbound stops (or split some services) to north of Ship St. There is more footway width and some scope to amend northern kerb line in this area to provide more width for overtaking buses; ➢ Consider converting some of the off c'way loading areas for use as inset bus stops - providing loading on carriageway in off-peak hours. The current situation leads to buses continuously blocking flow. By switching the current use and if loading can be regulated, this may result in less frequent obstruction to the main c'way ➢ Consider rationalising the number of signalised crossings on the link. The volume of buses in North St with existing layout constraints is clearly difficult to manage. Queueing and filtering (because of signalised crossings and bus stops) results in poor inter-visibility for pedestrians and a significant collision history is evident. Splitting bus routes or rerouting via West St and Kings Road may need to be considered in the future. However, future schemes such as Valley Gardens Ph3 and Gateway to the Sea may offer alternative solutions/incentives to investigate such an approach further. It is also recommended that operators are consulted through the Quality Bus Partnership to request they consider options for removing services from North Street through revised termination and / or re-routing to alternative turn-arounds. This could include the Old Steine area for services from the east and north. Operators must be part of the solution for North Street as there can be no more provision of bus priority on a bus only street. A phased reduction should be considered, with operators tasked with developing and implementing targets for service level reduction on North Street.
C20	Western Rd - Waitrose 1, 1A, 2, 5, 5A, 5B, 6, 18, 21, 21A, 25, 25X, 46, 49, 700
	Recommendations / Review Outcomes ➢ Limited scope to improve without relocation of bus stops, which is complicated by existing street infrastructure and existing kerb levels; ➢ BHCC have proposed amendments to c'way markings to improve westbound lane widths which should help maximise capacity at adjacent junction; ➢ Loading restrictions to be reviewed and enforced to minimise impacts to traffic during bus operating hours.
Big lemon Routes	Knoll Estate, Hangleton, Hollingbury, Woodingdean, Ovingdean and Saltdean 16, 47, 52, 56, 57, 66
Subsidised routes via local estates	**Recommendations / Review Outcomes** ➢ Opportunities for parking restrictions limited - demand may be displaced locally; ➢ Implement bus cages more regularly to prevent obstructive parking; ➢ Instances of two buses requiring to pass in narrowed carriageway not expected to be very frequent (hourly bus services), but regular bus cages would allow unobstructed spaces to function as informal passing places.

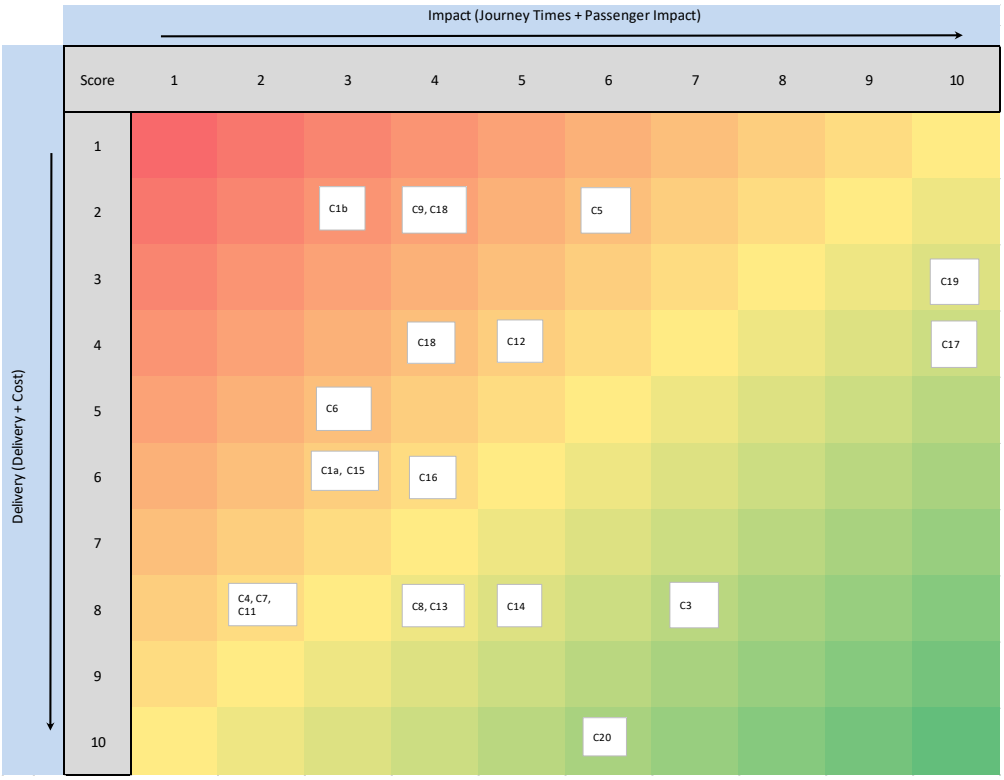
Summary

6.1.6 The recommendations vary considerably in scope and nature, some recommending dedicated bus priority measures and others more general measures to address congestion for all traffic.

6.1.7 Potentially high cost interventions have been identified that could deliver only modest predicted journey time savings, whereas other potential schemes could deliver better outcomes for a relatively modest investment.

6.1.8 The scoring system described earlier in this section allows a visual presentation of the relative merits of each site/scheme – indicating which schemes are weighted towards delivery (cost & implementation) and which deliver high impact interventions (journey times and passenger numbers). This information is illustrated in Chart 3 below and all the site assessment information is provided in full in a **Hotspot Site Reviews** appendix report.

Chart 3– Site Assessment Matrix



Note: Not including site C2 (scheme already implemented) & C10 (ESCC highways)

6.1.9 The information above provides a simple view of the individual pros and cons of each site. However, a more detailed economic appraisal and prioritisation exercise has also been undertaken. This is described within Section 7.

7. SCHEME PRIORITISATION

Methodology

7.1.1 The approach to prioritising individual schemes has involved calculation of an assumed rate of return from the estimated investment required to deliver the recommended improvements.

7.1.2 A benefit cost has been calculated for each scheme based on the predicted journey time savings for all services affected2. This has then been applied to the numbers of passengers that would be impacted within the various time periods that the journey time savings might be realised[3].

7.1.3 For example, an assumed saving of 10 seconds per bus might affect 10 services per hour during a peak period, with a total saving of 100 seconds for all services. The numbers of passengers on those services have been calculated using operator provided data on the annual service loadings[4]. These have been proportioned down to the potential numbers using affected services in each affected hour.

7.1.4 Time savings for buses have therefore been applied to assumed passenger numbers to provide an estimate of passenger journey time savings per individual passenger.

7.1.5 These time savings have then been multiplied by the average value of time per passenger based on WebTAG estimates, as shown in the following extract from WebTAG guidance documents.

7.1.6 A value of £7.73 per passenger hour has been used for weekday peak periods and £6.74 per passenger hour for weekend periods. Cost savings per passenger have been used to appraise each site for benefits to service users.

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[2] Target hours based upon comments from operators. They assume 2hrs per affected period (morning, evening or weekend peaks) multiplied by number of weekdays or weekends in a year as relevant. Assumed benefits for 'congested'/identified periods only (i.e. No benefits assumed in low traffic periods).

[3] Most timetables run a similar amount of services per hour in peak and interpeak/weekend. Savings only considered possible during 'congested' busy periods. These assumptions facilitate a generalised 'standard hour for JT savings for different periods of the day.

[4] Peak occupancy accounts for 27% of passenger numbers (73% interpeak). Peak occupancy periods have been assumed to be 4hrs on weekday and 2hrs on weekends. The assumed bus day is 18hrs (06:00-24:00) so off-peak occupancy hours assumed to be 18hrs - peak hrs (14hrs weekday, 16hrs weekend). Assumed 260 weekdays and 105 weekend days per year.

WebTAG Extract - value of time for bus passengers

Value Year:	2018

Table A 1.3.5: Market Price Values of Time per Vehicle based on distance travelled (£ per hour, 2010 prices and 2018 values)

Vehicle Type	Journey Purpose	Weekday					Weekend	All Week
		7am – 10am	10am – 4pm	4pm – 7pm	7pm – 7am	Average		
Car	Work	21.94	22.48	22.25	22.67	22.29	25.48	22.52
	Commuting	12.36	12.56	12.41	12.59	12.45	13.18	12.51
	Other	8.53	9.09	8.93	8.90	8.92	10.56	9.50
	Average Car	12.43	11.70	11.94	12.09	12.01	11.29	11.84
LGV	Work (freight)	16.03	16.03	16.03	16.03	16.03	16.83	16.03
	Commuting & Other	9.79	9.79	9.79	9.79	9.79	13.61	10.66
	Average LGV	15.28	15.28	15.28	15.28	15.28	16.45	15.39
OGV1	Working	15.74	15.74	15.74	15.74	15.74	15.74	15.74
OGV2	Working	15.74	15.74	15.74	15.74	15.74	15.74	15.74
PSV (Occupants	Work	17.94	18.30	19.15	19.13	18.45	16.80	18.04
	Commuting	24.55	8.61	34.53	47.20	21.31	8.07	18.04
	Other	48.74	55.86	43.64	37.86	49.99	56.78	51.67
	Total	91.23	82.76	97.32	104.20	89.75	81.65	87.75

Vehicle Occupancies (2000)

Vehicle Type	Journey Purpose	Weekday Average	Weekend Average	All Week Average
		Occupancy per Vehicle Kilometre travelled		
LGV	Work (freight)	1.20	1.26	1.20
	Non Work	1.46	2.03	1.59
	Average LGV	1.23	1.35	1.25
OGV1	Work only	1.00	1.00	1.00
OGV2	Work only	1.00	1.00	1.00
PSV	Driver	1.00	1.00	1.00
	Passenger	12.20	12.20	12.20

Average Cost of Time Per Passenger Used for Calculations Contained in this Report

Peak	£	7.73	average of morning and evening weekday peak values in Table A1.3.5 /average number of passengers per vehicle
Off Peak	£	6.74	average of weekend and weekday inter peak values in Table A1.3.5 /average number of passengers per vehicle

7.1.7 A sensitivity test has been applied to this calculation to factor how likely congestion occurs, i.e. benefits can be accrued. A sensitivity of 1.0 would assume every relevant period is affected during every peak, whereas 0.5 would mean the site is affected 50% of the time by congestion events.

7.1.8 For each scheme a total cost benefit has been calculated by calculating the financial value of benefits to passengers over time, as illustrated in the worked example below:

Cost Appraisal: Example Calculation

Site C3:

Annual passenger numbers affected	**25,337,704**	**(1)**	(data provided by operators)

Estimation of passengers carried per peak hour			
Peak period passengers carried per year	6,841,180		27% of total (estimate provided by operators)
Number of peak hours in year	1250		260 weekdays * 4hrs + 105 weekends * 2hrs
	5,473	**(2)**	Passengers/hours

Total peak hours targetted by measures			
Weekday Peaks	**1040**	**(3)**	260 weekday* 4hrs
Weekend Peaks	**210**	**(4)**	105 weekends* 2hrs

Estimated Annual Cost Saving per Passenger per Hou				
Seconds per bus	seconds	10		each passenger will benefit as per bus
	hrs	0.002777778	(5)	10s/3600
Total time savings	weekday	2.888888889	(6)	(3)*(5)
(hrs/per year)	weekend	0.583333333	(7)	(4)*(5)
Cost of time savings	weekday	£122,216.92	(8)	(6)*(2) * £7.73
	weekend	£21,517.79	(9)	(7)*(2)*£6.74
		£ 143,735	(10)	total time savings * passenger numbers * WEBTAG costs

7.1.9 To provide an overall indicator of the relative benefits of each proposal, and hence relative scheme priorities, a rate of return for different time periods has been calculated.

7.1.10 Detailed outcomes of this assessment are shown in Table 9 at the end of this section, and are summarised in Table 8 below.

Table 8– Hotspot Prioritisation Summary

Reference	Location	Budget Cost Estimate[5]	Year 1 Return (BCR)	Year 2 Return (BCR)	Year 3 Return (BCR)	Priority
C3	Blatchington Rd/Sackville R/Portland Rd	£35,000	4.1	20.5	41.1	**1**
C14	Brighton Station	£20,000	2.4	12.1	24.3	**2**
C19	North Street	£130,000	2.3	11.5	23.0	**3**
C17	Churchill Square to Clock Tower	£130,000	2.0	10.1	20.3	**4**
C20	Western Rd - Waitrose	£5,000	1.6	8.2	16.4	**5**
C8	Coldean Lane / Ditchling Rd	£20,000	0.3	1.6	3.3	**6**
C12	Greenways to Rottingdean Marine Drive	£200,000	0.3	1.5	3.0	**7**
C11	Downs Hotel Crossroads, Woodingdean	£35,000	0.3	1.3	2.6	**8**
C16	Lewes Rd northbound (south of the Vogue Gyratory)	£70,000	0.2	1.2	2.4	**9**
C13	Rottingdean Marine Drive, White Horse Junction	£25,000	0.2	1.0	2.0	**10**
C5	Dyke Road/Dyke Road Avenue	£500,000	0.2	1.0	1.9	**11**
C1 (option 1)	Boundary Road	£75,000	0.2	0.9	1.9	**12**
C2	Sackville Road / Old Shoreham Road	**Improvement scheme implemented in 2018**				
C10	A27 Slip Rd at Sussex University	**Not under BHCC control**				
C15	Ditchling Road Southbound	£75,000	0.1	0.5	1.1	**15**
C1(option 2)	Boundary Road	£250,000	0.1	0.5	0.9	**16**
C4	Old Shoreham Rd/Shirley Drive	£15,000	0.1	0.4	0.8	**17**
C18	Marine Parade (Upper Rock Gardens to Sea Life Centre)	£150,000	0	0.2	0.5	**18**

[5] Budget cost estimates have been estimated by applying knowledge and experience of similar types of schemes delivered elsewhere in the UK and locally. They are for budgeting only and will need to be reviewed and refined if schemes are brought forward.

C7	Surrenden Road near Vardean Road	£40,000	0	0.2	0.4	**19**
C9	Lewes Road/Coldean Lane eastbound	£300,000	0	0.1	0.2	**20**
C6	A23 Southbound (A27 - Carden Avenue)	£150,000	0	0.1	0.1	**21**
Big Lemon Routes	Knoll Estate, Hangleton, Hollingbury, Woodingdean, Ovingdean and Saltdean	£5,000	-	-	-	**22**
Total potential investment		**£2.225m**				

Summary

7.1.11 A review of the identified hotspots has indicated a potential programme of c£2.2m of bus priority and/or general traffic management improvements, which could deliver around £1.2m of passenger journey time savings per annum (see Table 9).

7.1.12 The five highest priority schemes are predicted to be cost-neutral in the first year of implementation, i.e. the value of savings to bus passengers would equal the financial investment in improved infrastructure in year 1.

7.1.13 It is worth noting that some of the measures proposed would yield a cost benefit in other areas (e.g. collision savings at site C16 and C19). However, for the purposes of this report each scheme is appraised in terms of bus passenger time savings only.

7.1.14 As stated in Table 7, one of the core issues with bus performance in the city centre is the very high volume of buses using North Street. This creates bus on bus congestion and has led to road safety issues.

7.1.15 Removing buses from North Street is not a simple matter as there are few alternative routes that would be suitable to accommodate the volumes, stopping patterns and passenger waiting facilities. Operators also note that this is a key location for pick up and set down, i.e. their passengers wish to be dropped off on North Street and they need to access this route to meet demand.

7.1.16 However, the level of bus operations is not sustainable and has created a cluttered and unattractive environment for vulnerable users and compromises road safety. It also causes service delays that cannot be readily solved.

7.1.17 It is recommended that this issue is discussed with operators as part of regular Quality Bus Partnership meetings. Operators should have ownership of the solution for North Street and should be challenged to develop a plan for a phased reduction in the numbers of services that use this route.

7.1.18 It is worth noting that the proposed scheme C12 could potentially be much more extensive than stated depending on the appetite for change on this route. The A259 Marine Parade / Marine Drive corridor is partly dual carriageway, but narrows to a single lane on both the Greenways roundabout and Marine Drive approach to Brighton. It is debatable whether the four general traffic lanes add any value to network capacity, but may conversely encourage higher speeds than are strictly necessary along this coastal route.

7.1.19 A more comprehensive scheme could be considered whereby the whole route is provided with bus and cycle lanes in both directions. This would deliver a very high level of public transport priority as well as a safe coastal cycle route. If this option is considered feasible, the estimated costs for this scheme could notably increase.

Table 9 – Scheme Cost Benefit Appraisal

Congestion Hotspot	Affected Time of Day (Hotspot List)			Approximate Annual Passenger Numbers Affected (combined no. from all affected services)	Hourly Bus Network Figures						Value of Time Appraisal			Cost Benefit Analysis******				
					Approx. No' of Buses Affected	Estimated Journey Time Savings			Approximate no' of Passengers (per hour)		Target Hours Total (per year)***		Estimated Value of Time Savings Per Year (2018 Prices)****	Estimated Cost of Scheme Implementation	Sensitivity*****	BCR (1 Year)	BCR (5Year)	BCR (10 Year)
	AM	PM	Week end		Peak Hour	Peak Hour Savings (seconds)	Estimated Peak Hour JT Saving Per Bus (seconds)	Total Bus Hours	During Peak Hour** (per hour)	During Off Peak** (per hour)	Weekday Peaks (total hrs)	Weekend Peaks (total hrs)						
C1 (Option 1)	Y	Y	Y	14,852,877	36	60	2	0.02	3208	2038	1040	210	£ 14,042.80	£ 75,000	1.00	0.2	0.9	1.9
C1 (Option 2)	Y	Y	Y	14,852,877	36	100	3	0.03	3208	2038	1040	210	£ 23,404.67	£ 250,000	1.00	0.1	0.5	0.9
C2	Scheme already implemented																	
C3	Y	Y	Y	25,337,704	56	560	10	0.16	5473	3477	1040	210	£ 143,734.71	£ 35,000	1.00	4.1	20.5	41.1
C4	Y			1,160,693	7	60	9	0.02	251	159	520	0	£ 2,399.41	£ 15,000	0.50	0.1	0.4	0.8
C5		Y	Y	1,983,039	5	1500	300	0.42	428	272	520	210	£ 194,000.71	£ 500,000	0.50	0.2	1.0	1.9
C6			Y	7,741,151	11	55	5	0.02	1672	1062	0	210	£ 3,287.05	£ 150,000	0.50	0.0	0.1	0.1
C7	Y			7,421,151	12	24	2	0.01	1603	1018	520	0	£ 3,579.61	£ 40,000	0.50	0.0	0.2	0.4
C8		Y		10,874,219	23	115	5	0.03	2349	1492	520	0	£ 13,113.00	£ 20,000	0.50	0.3	1.6	3.3
C9		Y		10,874,219	22	220	10	0.06	2349	1492	520	0	£ 26,226.01	£ 300,000	0.20	0.0	0.1	0.2
C10	ESCC highway - Not within BHCC control																	
C11	Y	Y		3,741,629	18	90	5	0.03	808	513	1040	0	£ 9,023.91	£ 35,000	1.00	0.3	1.3	2.6
C12		Y		8,292,192	25	750	30	0.21	1791	1138	520	0	£ 59,996.33	£ 200,000	1.00	0.3	1.5	3.0
C13	Y			8,292,192	25	125	5	0.03	1791	1138	520	0	£ 9,999.39	£ 25,000	0.50	0.2	1.0	2.0
C14	Y	Y	Y	17,108,325	70	350	5	0.10	3695	2348	1040	210	£ 48,525.71	£ 20,000	1.00	2.4	12.1	24.3
C15	Y			4,496,979	15	220	15	0.06	971	617	520	0	£ 15,906.93	£ 75,000	0.50	0.1	0.5	1.1
C16		Y		14,335,801	31	150	5	0.04	3097	1967	520	0	£ 16,729.60	£ 70,000	1.00	0.2	1.2	2.4
C17	Y	Y	Y	48,349,016	156	1500	10	0.42	10443	6634	1040	210	£ 263,723.43	£ 130,000	1.00	2.0	10.1	20.3
C18			Y	8,292,192	15	300	20	0.08	1791	1138	0	210	£ 14,084.12	£ 150,000	0.50	0.0	0.2	0.5
C19	Y	Y	Y	52,727,105	270	2700	10	0.75	11389	7235	1040	210	£ 299,108.21	£ 130,000	1.00	2.3	11.5	23.0
C20	Y	Y	Y	34,153,947	118	100	1	0.03	7377	4687	1040	210	£ 16,419.25	£ 5,000	0.50	1.6	8.2	16.4
Total					951			2.49					£ 1,177,304.85	£ 2,225,000.00				

* The majority of timetables run a similar amount of services per hour in peak and inter peak/weekend. Savings only considered possible during 'congested' busy periods. These assumptions facilitate a generalised 'standard hour for JT savings for different periods of the day.

** Operator data indicates that peak occupancy periods account for 27% of passenger numbers (73% inter peak). Peak occupancy periods assumed to be 4hrs on weekday and 2hrs on weekend. The assumed bus day is 18hrs (06:00-24:00) so off peak occupancy hours assumed to be 18hrs - peak hrs (14hrs weekday, 16hrs weekend). Assumed 260 weekdays and 105 weekend days per year.

*** Target hours based upon comments from operators (columns C-E). Assumed 2hrs per affected period multiplied by number of weekdays or weekends in a year as relevant. Assumed benefits for 'congested'/identified periods only (i.e. No benefits assumed in low traffic periods).

**** Average value of time per passenger (based on WEBTAG estimates)*estimated hourly passenger numbers * targeted hours total * average time savings per bus (hours).

***** Sensitivity to factor how likely congestion occurs/benefits can be accrued (a sensitivity of 1.0 would assume every relevant period is affected, 0.5 = congestion/benefits 50% of the time etc).

****** BCR - Benefit to Cost Ratio for different time periods (1, 5, 10 yrs). 1.5-20 = minor benefit, 2.0-4.0 = good benefit, 4.0> = very good benefit.

8. STRATEGIC NETWORK MANAGMENT AND FUTURE SCHEMES

Network Management Strategies

8.1.1 As noted previously in this report, there exists an unavoidable link between different modes and competing aspects of the road network and direct interventions in terms of bus priority will inevitably impact upon general traffic.

8.1.2 The reverse is also true. Efforts to manage and reduce traffic on the wider network will, by implication, likely result in improvements to bus journey times and reliability.

8.1.3 Some wider, strategic approaches are therefore discussed briefly below.

Bus Stop Accessibility

8.1.4 There are a variety of engineering measures that can be employed to reduce bus stop delays, including provision of bus boarders in areas of heavy on-street parking, removal of bus lay-bys and extension of clearway orders to prevent stop obstruction.

8.1.5 A bus stop accessibility strategy is recommended. This should consider the use of facilities such as bus boarders, where footway build-outs are provided on streets with heavy parking activity. These allow buses to stop without pulling in to lay-bys, as well as providing passengers with accessible boarding platforms. This will also overlap with the city council's interchange strategy that is to be developed.

Traffic Signals and Bus Priority

8.1.6 Highways officers have indicated that some traffic signal technology is already in place, including 'virtual loops' that utilise Stratos/Trapeze data and GIS technology. A programme of introducing MOVA technology to key junctions is also already underway.

8.1.7 Whilst some journey time benefits can be realised through adaptive traffic management, this approach is limited by the fact that giving more time to some bus services/directions will inevitably impact others.

8.1.8 However, it is recommended that the prioritisation of future signal control strategies should be guided and prioritised by the high-frequency bus corridors identified within this report. The benefits of those strategies would therefore be more significant due to the journey time impacts on the high

passenger numbers carried on public transport, as opposed to assessment of benefits for general traffic alone.

8.1.9 In addition, the introduction of bus based priority measures at specific traffic signal junctions should be considered. This would include use of bus detectors that trigger adjusted signal timings to increase green times on traffic signal arms that buses are approaching from. Although such systems are normally linked to real time data, so that only late running services are afforded signal priority, a full-time operating system can deliver consistent journey time savings and improve overall run times, increasing route efficiency and reducing service operating costs.

Congestion Charging and Low Emission Zones

8.1.10 Managing the network to reduce traffic can only improve the reliability and resilience of the bus network. However, the feasibility of a large scale implementation of a congestion charging zone such as in London will depend on the long term political landscape in the city and is beyond the consideration of this report.

8.1.11 Despite this, air quality issues are expected to continue to become a higher priority in the coming years – for all highway authorities. The implementation of low emission zones (LEZ or ULEZ) would have the effect of protecting the inner areas of the city (from out of town/long distance bus services for example). This could provide an interim/lighter touch solution to reducing traffic impacts on the most sensitive parts of the BHCC network.

Parking Management

8.1.12 Parking within the Central Brighton area can be difficult due to the limited supply available. However, there are several off-street car park locations, including Regency Square and The Lanes car parks which offer more affordable parking. These locations are also very popular with visitor and shoppers due to their proximity to the sea front and shops, along with the Churchill Square Car Park owned by NCP.

8.1.13 The popularity of the Churchill Square car park can lead to excessive queuing on busy days, with traffic standing on Grand Junction Road waiting for spaces to become available. This then impacts on the operation of the local network and causes delays for buses and other traffic approaching or leaving the Aquarium roundabout.

8.1.14 It also reduces the viability of this important link as a future potential bus route (if no other priority measures were introduced) and limits the available scope for reviewing the existing bus network should consideration be given to rerouting some services away from North Street in future years.

8.1.15 Churchill Square car parks are a private facility and charges are understandably set to attract shoppers. Anecdotal evidence (provided during consultation meetings) suggests that most shoppers using Churchill Square are residents yet most users of the car park are from out of town – this in some ways epitomises the challenges Brighton & Hove faces as a visitor destination.

8.1.16 Use of technology to improve advanced signing of car park availability should be considered. This can inform drivers and encourage or promote the use of other routes or destinations if these car parks are full. It may also encourage use of alternative transport options to help reduce traffic levels in the city centre, for example use of park and ride as described below.

8.1.17 It is worth noting that many of the hotspots identified within this report were exacerbated by a heavy use of private vehicles at school drop off and pick up times. As such any efforts to influence travel habits to minimise such behavior would be of great benefit to the network. Awareness of air quality and impacts on health are already recognized as being important tools in this respect.

Red routes

8.1.18 One of the common issues that affects bus operations in the City is obstructive on-street parking. On-street parking, particularly on two lane roads, reduces the capacity of the route by more than half because of merging and weaving movements by approaching traffic. Such behaviour was identified at sites such as Boundary Road, Western Road, Dyke Road, London Road, Lewes Road and North Street (albeit legally at this location where extensive areas for loading are provided).

8.1.19 Red routes are an optimum method of ensuring that the most effective use is made of road space to improve travel for both people and goods. The package of measures that can be introduced is not just designed to be a blanket 'No Stopping' restriction, it allows for the provision of improved parking and loading spaces to be created. The introduction of a red route

can provide benefit to all users. It helps improve journey times for all traffic and allows for the creation of new pedestrian facilities where they could not be provided before. There are also links to improved air quality in areas that red routes have been introduced as vehicles are moving more freely.

8.1.20 London's Red Route programme operates on only 5% of the network; however, this small section of the network carries over 30% of the capitals traffic. It has a high acceptance rate; recent surveys indicate that "there is a generally high level of support for traffic enforcement measures in the capital" with drivers accepting that one selfish driver can completely block a road/ junction.

8.1.21 Since being first introduced in London in 1991 there has been adoption by other authorities outside of the capital. Reading, Edinburgh Leicester and Birmingham have all introduced red routes (called Greenways in Edinburgh) to understand the impacts they have on their network.

8.1.22 A 2008 pilot scheme on A449 Stafford Road in Wolverhampton showed very positive results, with journey times falling by up to 22% and bus journey times reduced by 14%.

8.1.23 The introduction of red routes could assist in reducing this level of congestion and lower average journey times during peak hours.

8.1.24 The Council is currently investigating such approaches. However, this has been more difficult against the context of changing government legislation and resulting implications relating to enforcement.

Park & Ride

8.1.25 A small park and ride site is located at the Withdean Sports complex, but numbers of parking spaces are limited in this location and buses that service the site are indirect and infrequent.

8.1.26 There are temporary park and ride sites used for Brighton & Hove Albion match-day travel to and from the Amex Community Stadium, including Mill Road, Brighton Racecourse and University of Brighton. These sites are supported by an extensive network of bus lanes on Lewes Road. However, these facilities serve the Amex Stadium and do not offer significant traffic interception for day visitors and tourists coming from the north.

8.1.27 Past studies have concluded that the availability of space for park and ride facilities is limited by the City boundary and (to the north of the City)

by development restrictions within the South Downs national park. However, a tourist attractor City such as Brighton & Hove could benefit greatly from a visitor-based park and ride that could intercept traffic approaching from the A23 London Road. Any future park and ride sites will be subject to a formal explanatory study.

Service Review/Rerouting

8.1.28 The problems identified in North Street predominantly revolve around the inability to accommodate the volume of buses it currently serves (250+ per peak hour) whilst maintaining a safe and attractive environment for other users.

8.1.29 As such, a review of the service provision in terms of rationalising/rerouting of services would be of benefit to identify where efficiency could be improved at some of the main bottlenecks on the network (North St, Old Steine, London Rd, Churchill Square, Brighton Train Station etc).

8.1.30 This will involve significant contribution from the operators themselves. However, it is considered that they must be part of the solution – the highway only has finite capacity with many competing functions. If the bus services (as demonstrated in this report) continue to be successful and grow then ensuring this is done in a managed fashion is in part the service providers responsibility and will be to the benefit of passengers in the long term.

Committed/Planned Development

8.1.31 It is recommended that all of the sites and improvement areas identified in this report are reviewed in conjunction with future and committed developments in the city in order that outcomes and funding streams are aligned.

Planned Schemes

Valley Gardens Area

8.1.32 North Street and Old Steine experience the highest flows of buses within the City and are critical to the efficient operation of the bus network.

8.1.33 The Valley Gardens project seeks to deliver a continuous north-south general traffic route through this area of the City along with a continuous protected cycle route, bus priority and pedestrian linkages that can cope with very high flows in Summer time.

8.1.34 This study does not seek to prescribe the optioneering process relating to the final stage 3 of Valley Gardens, which incorporates the area from Old Steine to the Aquarium roundabout. Concept development for this final section of the project needs to allow design flexibility, and for innovative ideas to be brought forward.

8.1.35 However, it is appropriate to set out the basic requirements for bus operations to form a "design guide" for scheme development. In summary, the key design elements that must be incorporated within the design include:

i. Existing levels of bus priority should be maintained, with every opportunity sought to improve the extent of network that can be dedicated for buses only (e.g. bus lane provision, bus only streets, busways).
ii. Potential changes to circulatory routing and stopping patterns should be considered, but these must consider existing stopping patterns and frequencies to ensure that new or existing on-street stops will be able to cope with potential demand.
iii. The existing layover facilities on Old Steine take up a significant amount of carriageway space. Layover facilities for at least two buses must be provided on Old Steine, but these can be relocated from their existing location if directional access and egress is maintained.
iv. Proposals should account for the future growth, and potential complete replacement, of service fleets with all electric vehicles. The Big Lemon already operates several electric vehicles, although charging facilities for their services are not required in the central area. Future proofing for electric vehicle charging should be considered within the Valley Gardens area to ensure that the usage and growth of electric vehicles can be accommodated and encouraged.
v. The Aquarium roundabout is a critical junction in the network. Several options are likely to be considered for this location to ensure that pedestrians and cyclists are afforded equal priority to traffic movement, and that vulnerable users can cross the junction safely. If there is a potential reduction in traffic capacity, and hence increased delays on the junction approaches, the Marine Parade

arm should be provided with bus priority to ensure that services from the east are not disadvantaged (congestion hotspot C18 proposes a potential westbound bus lane).

Gateway to the Sea

8.1.36 There are future aspirations to improve the exiting link between Brighton Station and the sea front – Queen's Road and West Street. Redevelopment plans for the Churchill Square Shopping Centre and Brighton Centre sites sit alongside this. As a result, opportunities may result to consider some of the issues identified in this report, particularly:

- Rerouting of buses from North Street;
- Impacts associated with car parking at Churchill Square and viability of West Street and the sea front as a bus route.

8.1.37 Part of the design approach could be to incentivise rerouting of services by creating an attractive destination for passengers with appropriate bus interchange facility – lessening the burden on North Street.

8.1.38 The movement of buses (including existing turn around) through this area (between North Street, the station and eventually the sea front) is an integral part of the brief of Gateway to the Sea.

9. BUS OPERATIONS MITIGATION MEASURES

9.1.1 There has been no specific assessment of issues relating to dwell time reduction and/or smart ticketing systems. These issues are being considered by the bus operators and the council and have not been included within the network assessment.

9.1.2 However, data from elsewhere in the UK indicates that time spent standing at bus stops (dwell times), represents up to 20% of total bus journey times[6].

9.1.3 Dwell time is therefore an important element of bus operations, and can be a major source of delay. It is considered beneficial to provide information regarding the benefits and options available.

9.1.4 Corridor-wide the most effective method of reducing time spent at bus stops is to reduce the transaction time for payment. This is best achieved through off-bus ticketing, smartcard usage or mobile phone ticketing, which prevents the need for cash transactions on buses. A Smartcard system combined with off-bus ticket machines at key stops could potentially reduce the level of cash transactions considerably.

9.1.5 The degree to which off-bus ticketing could reduce dwell times, and hence improve overall bus journey times, was analysed during development of the Greater Manchester Quality Bus Corridor network. It was estimated that the following journey time savings could be achieved:

- Assuming all off-bus ticketing, individual boarding times for single passengers in the morning peak can be reduced from an average of 9.9 to 4.2 seconds per person, a saving of 5.7 secs/person.
- If up to 20 passengers are boarding at a busy stop, the total time savings could be nearly 2 minutes per stop.

9.1.6 Over a full route, time savings of this magnitude can considerably reduce overall journey times. These benefits will vary depending on the level of take-up, and are likely to be "best case". For example, 50% of passengers may choose to buy tickets off-bus, or to use smartcards, with 50% still choosing to pay in cash.

[6] Greater Manchester bus network analyses, GMTPE (now TfGM)

9.1.7 The level of take-up is critical, but overall even with a partial move towards cashless transactions with drivers, significant journey time, and hence punctuality benefits, could be gained.

9.1.8 Removing conflicting movements of passengers boarding and alighting through the same doors is also helpful at reducing dwell time at stops.

9.1.9 Brighton & Hove Buses have recently invested £11m in a significant number of new double door vehicles for the busiest routes in recent years, which is likely to be having a positive impact on dwell times.

10. GLOSSARY OF TERMS

- ATS – Automatic Traffic Signals;
- C'way – Carriageway;
- j/w – Junction With;
- KSI – Killed or Seriously Injured;
- PIC – Personal Injury Collision/Casualty
- RAB – Roundabout.

QUALITY

It is the policy of Project Centre to supply Services that meet or exceed our clients' expectations of Quality and Service. To this end, the Company's Quality Management System (QMS) has been structured to encompass all aspects of the Company's activities including such areas as Sales, Design and Client Service.

By adopting our QMS on all aspects of the Company, Project Centre aims to achieve the following objectives:

- Ensure a clear understanding of customer requirements;
- Ensure projects are completed to programme and within budget;
- Improve productivity by having consistent procedures;
- Increase flexibility of staff and systems through the adoption of a common approach to staff appraisal and training;
- Continually improve the standard of service we provide internally and externally;
- Achieve continuous and appropriate improvement in all aspects of the company;

Our Quality Management Manual is supported by detailed operational documentation. These relate to codes of practice, technical specifications, work instructions, Key Performance Indicators, and other relevant documentation to form a working set of documents governing the required work practices throughout the Company.

All employees are trained to understand and discharge their individual responsibilities to ensure the effective operation of the Quality Management System.

DOCUMENT CONTROL

Project Centre has prepared this report in accordance with instructions from Brighton & Hove City Council. Project Centre has based the information and findings contained herein on data and performance information provided by stakeholders and the client group.

Project Centre shall not be liable for the quality and accuracy of conceptual designs and supporting assessment data, or for use of any information contained herein for any purpose other than the sole and specific use for which it was prepared.

Job Number	Issue	Description	Originator	Checked
1000004288	V1	BHCC Bus Network Review	Ian Daly 27.03.18	Paul Chandler 29.03.18
1000004288	V2	Revised following BHCC initial comments		PAC 11.04.18
1000004288	V3	Revised following BHCC comments		PAC 02.05.18
1000004288	V4	Revised following BHCC comments		PAC 23.05.18
1000004288	V5	Revised following stakeholder comments		PAC 09.10.18
1000004288	FINAL	BHCC approved final version for issue		PAC 06.12.18

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british parking awards

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