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Technical note

Project	**York Northwest Masterplanning and Infrastructure Study**	**Date**	24th June 2013
Subject	Access Analysis v3	**Ref**	
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1 Introduction

The York North West Masterplanning & Infrastructure study (June 2011) established the engineering feasibility, cost and risks associated with the provision of major new access corridors into the York Central development site.

The report addressed the significant challenges presented by the anticipated scale of development, the limited available highway capacity and the presence of operational rail uses in the development corridors. It also discussed the cost of the new infrastructure to access the York Central site, including the junction improvement options, various bridge options, project risks, buildability assessments and the feasibility of removing the existing Queen Street bridge and associated infrastructure to the south east of York Rail Station.

At the start of 2013 City of York Council (CYC) commissioned Halcrow to examine the impact on buildability and cost of amending the access corridor proposals for the Holgate Park option, to accommodate a proposal by Network Rail to include a number of new sidings to the Thrall Works. A feasible option was subsequently developed for this access.

Further to this assessment CYC have commissioned Halcrow to undertake an access analysis study. This takes the form of multi-criteria analysis (MCA) of two proposed access points into the York Central site: the Holgate Park access discussed above; and an access via Chancery Rise.

The purpose of this note is to provide details of the traffic modelling undertaken to assess the relative transport impacts of the two options. The outputs of the modelling are presented in detail within this note with the key measures included in the MCA document.

Prepared by	David Preater	Date	24th June 2013
Checked by	Stewart Stamper	Date	24th June 2013
Approved by	Stewart Stamper	Date	24th June 2013

2 Scenario Details

The different scenarios that have been assessed within the model are discussed within this section.

2.1 Scenario Summary

Details of the five modelled scenarios are detailed in Table 2.1. These consist of a Do Minimum scenario to act as a comparison case and two levels of demand at York Central with the two access scenarios.

Table 2.1: Modelled Scenarios

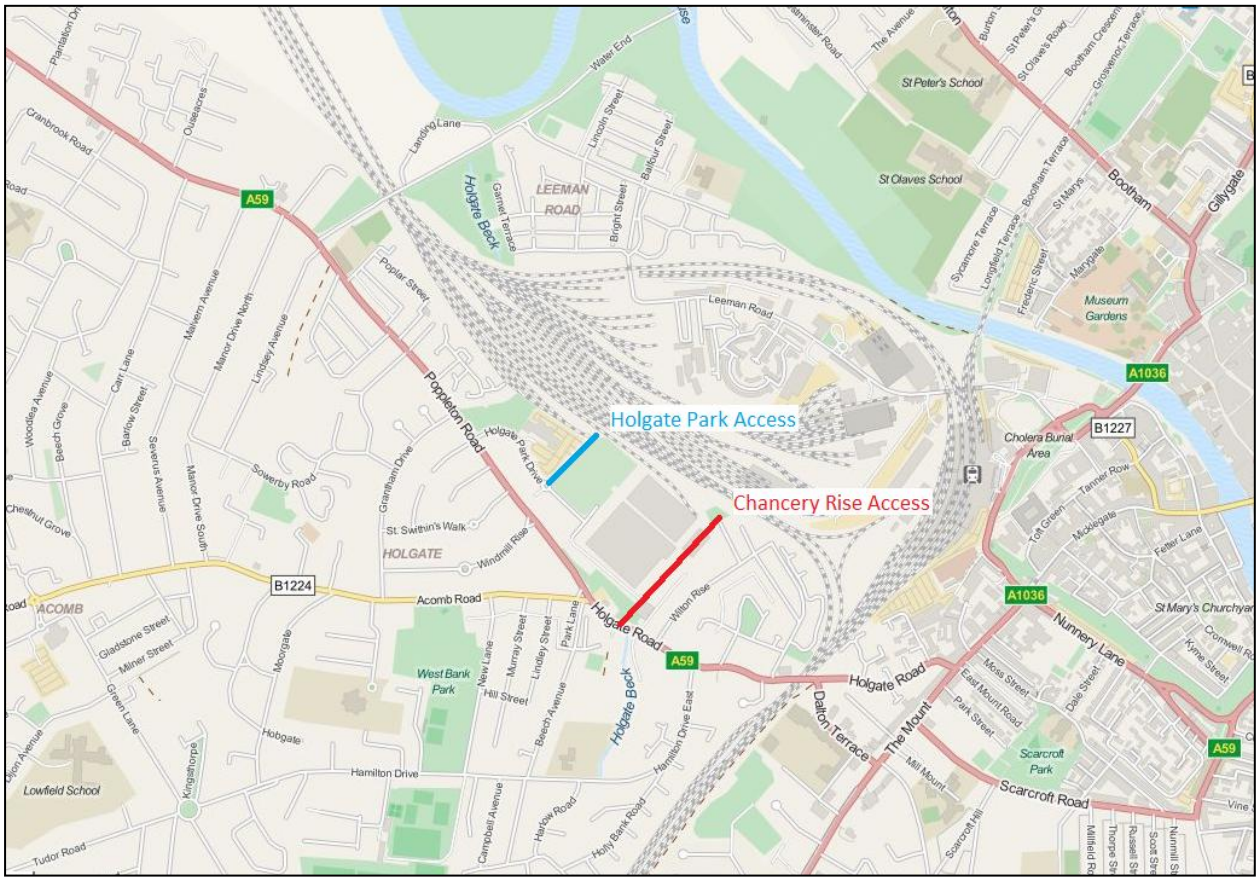
No.	Scenario	Details
1	Do Minimum	2016 traffic from committed developments constrained to TEMPRO Access York Phase 1 highways changes (A59 P&R site, A59 corridor improvements, A59/A1237 roundabout upgrade)
2	Holgate Park Drive Access (Low Demand)	Do Minimum + York Central access from Holgate Park Drive + ≈300 car trips at York Central
3	Holgate Park Drive Access (High Demand)	Do Minimum + York Central access from Holgate Park Drive + ≈500 car trips at York Central
4	Chancery Rise Access (Low Demand)	Do Minimum + York Central access using new signalised junction at Chancery Rise + ≈300 car trips at York Central
5	Chancery Rise Access (High Demand)	Do Minimum + York Central access using new signalised junction at Chancery Rise + ≈500 car trips at York Central

Two levels of development demand at York Central have been used in order to understand how the network and access options perform with different numbers of car trips at the development site.

2.2 Access Options

Figure 2.1 contains a plan showing the approximate location of the two access options. The Holgate Park Drive access connects into the existing highway within Holgate Business Park and includes a bridge over the live rail lines to enable access into the site. The Chancery Rise access involves a new signalised junction off the A59 located just to the south east of The Fox junction. A bridge over the rail lines is also required in this scenario.

Figure 2.1: Access Locations



Appendix A contains the design plans for the two access scenarios.

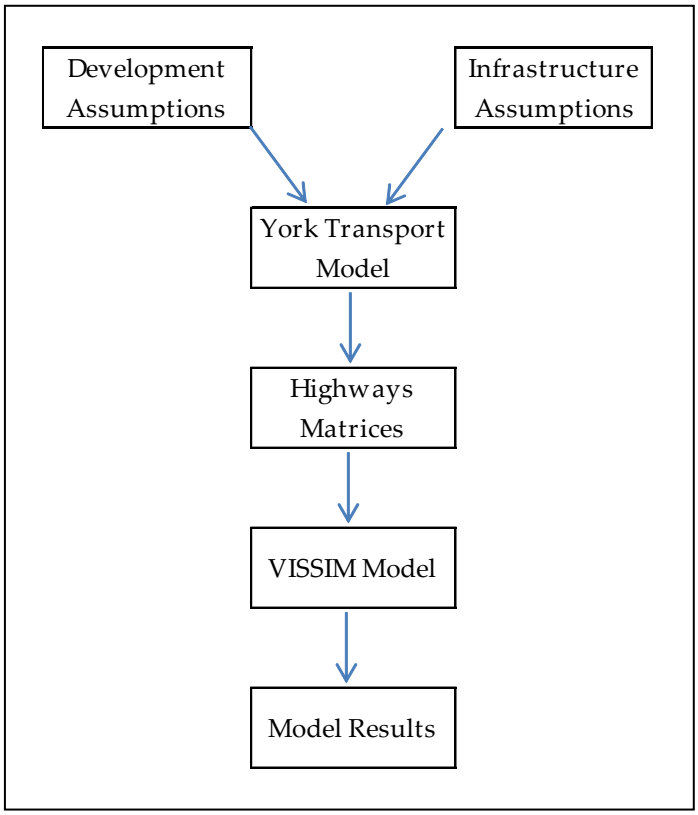
3 Modelling Assumptions

This section contains details of the methodology used to undertake the modelling as well as the assumptions made.

3.1 Methodology Overview

Figure 3.1 contains a flow chart of the methodology used to undertake the modelling assessment of the access options.

Figure 3.1: Modelling Methodology



3.2 York Transport Model

The York Transport Model covers the city of York and consists of a SATURN highways model and CUBE public transport (PT), demand forecasting and mode choice elements. This model is used to obtain assessment year (2016) highways demand matrices for use within the VISSIM micro-simulation model.

A series of assumptions concerning travel demand have been made as part of the development of the 2016 transport models as follows:

- Traffic is included from developments in the city proposed to be open by 2016. In accordance with WebTAG criteria just those sites which are categorised as 'near certain' and 'more than likely'. Note that this includes an element of development at the British Sugar site.
- Total trips in the matrices are constrained to TEMPRO (v6.2) totals.
- Table 3.1 contains the assumed car trips at York Central under the high and low scenarios. These trips are added to the matrices after the TEMPRO constraint has been applied.

Table 3.1: York Central Car Trips

Scenario	Arrivals at York Central	Departures from York Central
High AM Peak	392	107
High PM Peak	192	361
Low AM Peak	208	94
Low PM Peak	126	195

In addition to the demand assumptions highways changes are included in the model network which are proposed by 2016. These are as follows:

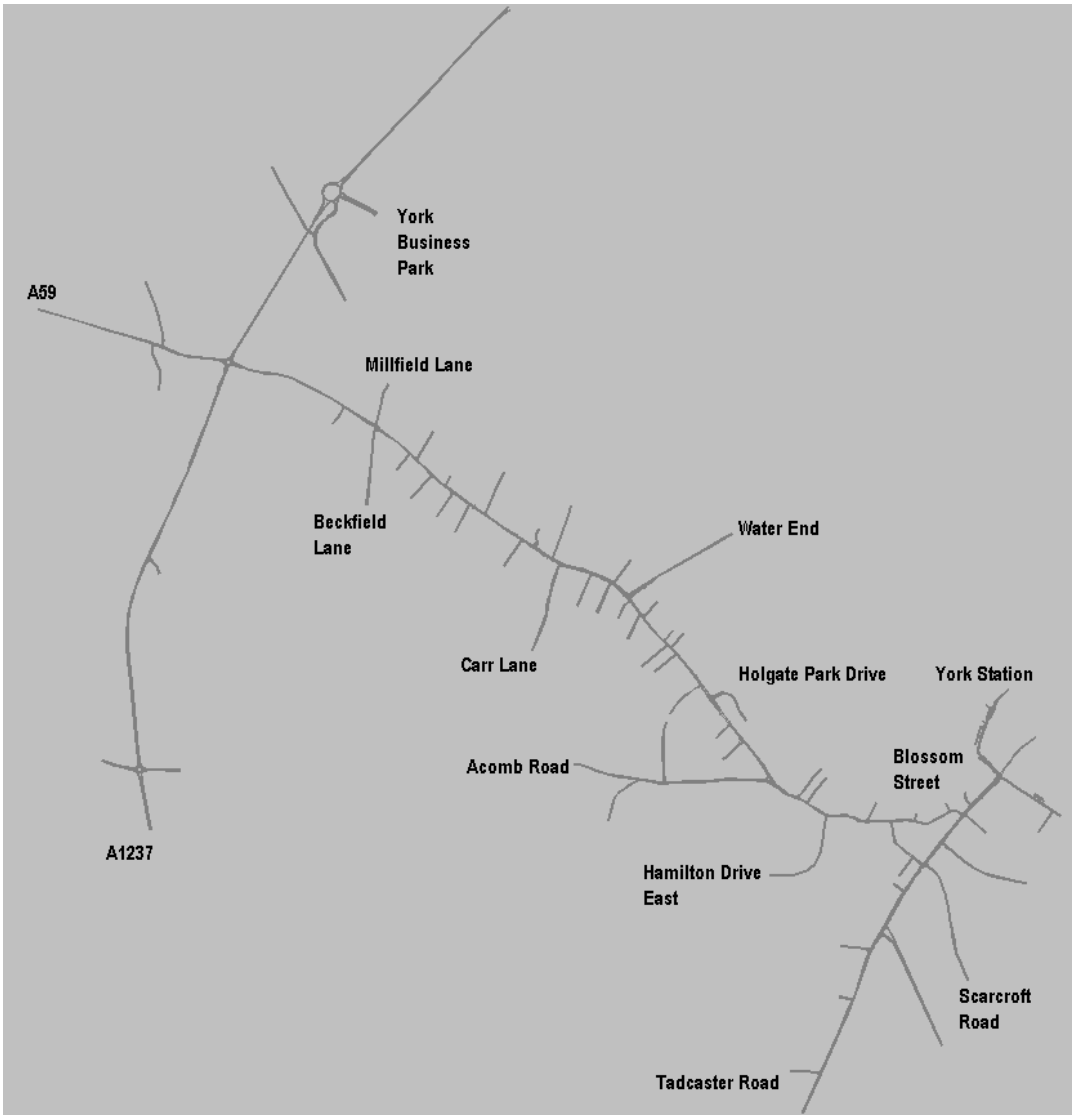
- Access York Phase 1 scheme. This consists of a new P&R site on the A59, an upgrade to the A59/A1237 roundabout, bus priority measures on the A59 corridor and expansion of the Askham Bar P&R site.
- Highways Agency scheme to part signalise the A19/A64 interchange.
- Access junctions into development sites where required (at British Sugar a signalised access junction has been assumed off the A59 at Manor School and the York Business Park roundabout is improved by adding additional entry and exit lanes).

Versions of the York Transport Model have been produced for each of the scenarios detailed in Section 2. The models are then run and highways matrices extracted for a cordoned down portion of the network covering the VISSIM model area.

3.3 VISSIM Modelling

In 2010 Halcrow developed a VISSIM micro-simulation model of the A59 corridor covering the area shown in Figure 3.2. This model was calibrated and validated for AM (8:00 – 9:00) and PM peak (17:00 – 18:00) hours using junction turning count and journey time data. The model was originally used to develop and assess bus priority measures on the corridor as part of Access York Phase 1.

Figure 3.2: VISSIM Model Area



The 2016 scenario models have been developed by coding the proposed network changes into the 2010 model. To produce VISSIM demand matrices the differences between the base SATURN highways matrix and the 2016 SATURN highways matrices have been taken and applied to the validated 2010 base VISSIM matrix.

Signal timings at junctions in the model area are manually refined where examination of model operation indicates that this is necessary.

It is assumed that the A59 P&R bus services get routed through the York Central site in the inbound direction. These services then exit onto Leeman Road via a bus only link. It has also been assumed that the streets linking Acomb Road with the A59 between the Fox junction and Carr Lane have all been closed to through traffic to eliminate 'rat-running' through this area.

4 Modelling Results

This section contains the results that have been output from the scenario models. Within micro-simulation models there is an element of randomness involved. Each run of a model (replication) is based upon a specified random seed and shows a possible outcome for the modelled system. To provide a statistically robust set of results a number of replications are required and the average of these replications taken. All model results presented here represent the average of ten replications undertaken with different random seeds.

4.1 Trip Distribution

To understand the routes vehicles are taking to and from the York Central site select link analysis is undertaken within the SATURN highways model. Figures 4.1 to 4.4 contain the resultant plots from the high demand models. The width of the green bands represents the number of vehicles on the link and the labels are in PCUs.

Figure 4.1: Chancery Rise AM Trip Distribution

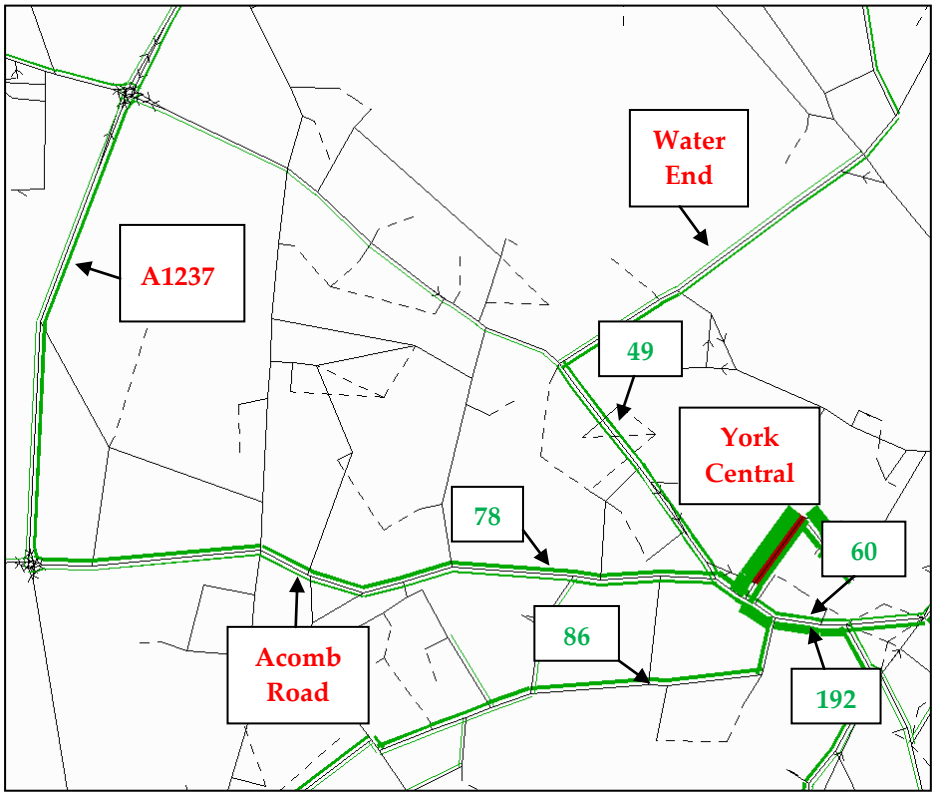


Figure 4.2: Chancery Rise PM Trip Distribution

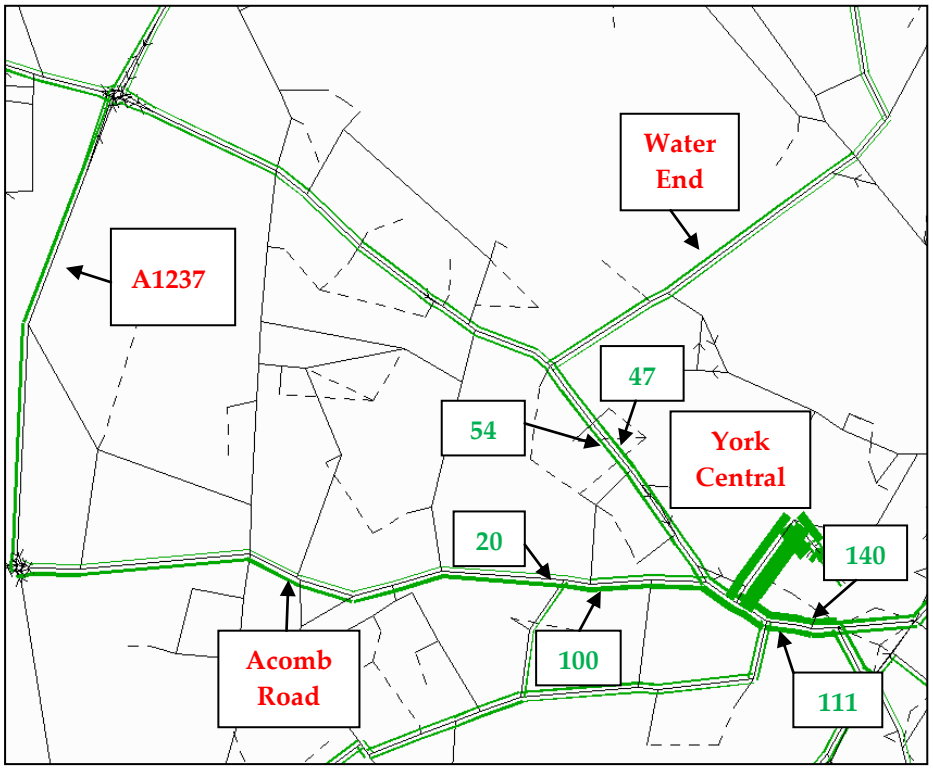


Figure 4.3: Holgate Park Drive AM Trip Distribution

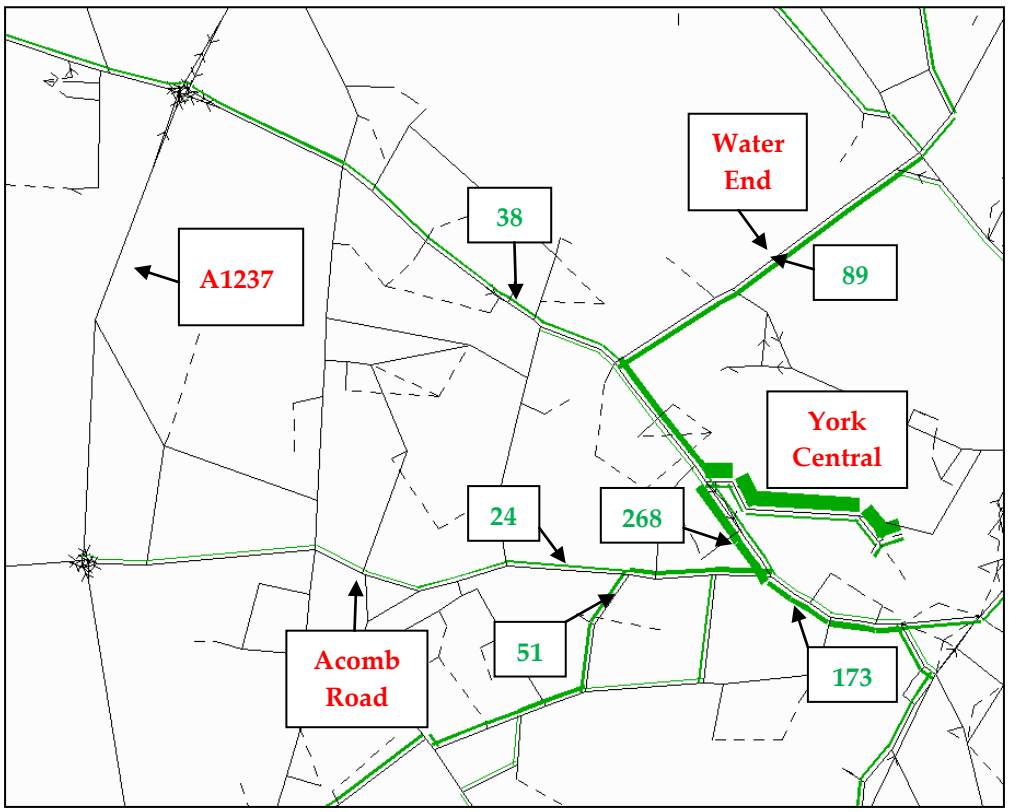
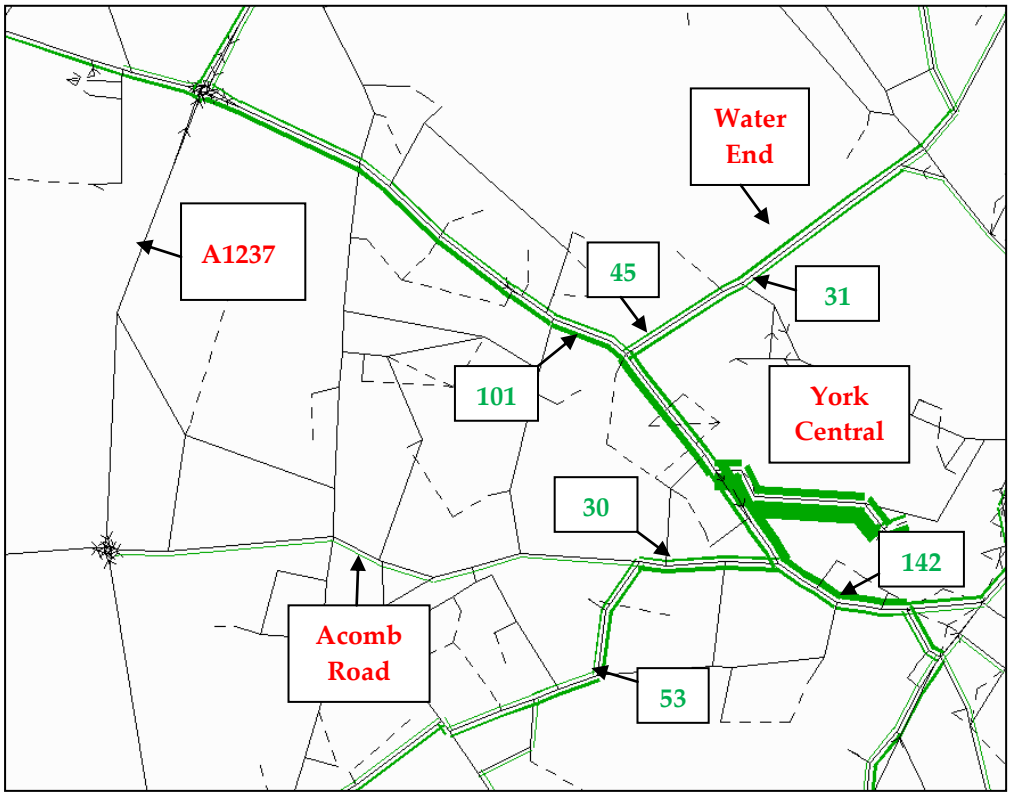


Figure 4.4: Holgate Park Drive PM Trip Distribution



With the Chancery Rise access point more York Central vehicles route via Acomb Road and Hamilton Drive East than with the Holgate Park Drive access where the A59 corridor and Water End are more heavily used. The Holgate Park Drive access option leads to a number of York Central vehicles routing via Grantham Drive which may be undesirable considering the residential nature of this route. However, with the Chancery Rise access more York Central traffic uses the already congested outer ring road.

4.2 Journey Times

The VISSIM model outputs journey times for specified sections across the network. The key route for comparison is the A59 inbound and outbound. However, other roads meeting the corridor are also important. Table 4.1 contains the end to end AM Peak journey time comparisons for cars along the specified routes with the PM peak results included in Table 4.2.

Table 4.1: AM Peak Car Journey Times (mins)

Route	Do Min	Chancery Rise High	Chancery Rise Low	Holgate Park High	Holgate Park Low
A59 Inbound (A59 P&R Access – Queen St)	23.4	19.3	19.2	19.8	20.1
A59 Outbound (Queen St – A59 P&R Access)	13.3	15.4	14.5	15.1	13.8
Carr Lane (towards A59)	1.2	1.2	1.1	1.1	1.1
Water End (towards A59)	1.3	1.4	1.3	1.3	1.3
Acomb Road (towards A59)	14.3	12.3	9.8	15.0	15.1

Table 4.2: PM Peak Car Journey Times (mins)

Route	Do Min	Chancery Rise High	Chancery Rise Low	Holgate Park High	Holgate Park Low
A59 Inbound (A59 P&R Access – Queen St)	13.9	13.8	13.7	14.2	13.8
A59 Outbound (Queen St – A59 P&R Access)	17.2	16.8	16.2	17.0	16.9
Carr Lane (towards A59)	1.4	1.4	1.4	1.4	1.4
Water End (towards A59)	1.3	1.3	1.3	1.3	1.3
Acomb Road (towards A59)	2.3	11.0	5.7	2.5	2.4

In the AM peak inbound journey times along the A59 are marginally faster with the Chancery Rise access point whereas in the outbound direction the Holgate Park Drive option leads to better journey times. However, along Acomb Road the difference in journey times is more noticeably three minutes lower in the Chancery Rise scenario. Little difference is observed on Carr Lane and Water End between the scenarios.

In the PM peak with high traffic levels the Chancery Rise access option leads to very slightly lower journey times on the A59 in both directions. However, there is a significant increase in journey times along Acomb Road (8.5 minutes) with Chancery Rise access in place due to the location of the York Central access junction adjacent to the Fox junction.

Note that the Do Minimum journey time is higher than the 'with development' scenarios in some cases. This is due partly to the changes in trip distributions brought about in the 'with development' scenarios. However, the main reason is that in the 'with development' scenarios there is no need for the more stringent queue relocation measures required in the Do Minimum to keep Holgate Road (downstream of The Fox junction) relatively free from traffic for the purpose of speeding up the A59 P&R service as the bus is routed away from this section through the York Central site in the 'with development' scenarios.

4.3 Public Transport

To understand which of the access scenarios provides the most benefit to the A59 P&R service, journey times along the route are compared in Table 4.3.

Table 4.3: A59 P&R Journey Times (mins)

Time Period	Route	Do Min	Chancery Rise High	Chancery Rise Low	Holgate Park High	Holgate Park Low
AM Peak	A59 Inbound (P&R – Station)	20.8	12.6	12.2	11.9	11.8
	A59 Outbound (Station – P&R)	17.2	19.3	18.1	18.7	17.3
PM Peak	A59 Inbound (P&R – Station)	16.8	12.2	12.1	12.1	11.9
	A59 Outbound (Station – P&R)	21.2	20.7	19.9	21.0	20.5

The Holgate Park Drive access option appears to be most beneficial to the AM peak A59 P&R bus journey times. In the inbound direction there is around one minute saving in the AM peak compared with the Chancery Rise option and outbound savings are slightly lower. In the PM peak the difference is less noticeable in the inbound direction, in the outbound direction Chancery Rise has the lower journey time (though only by around 30 seconds).

The main reason for the better AM peak P&R service journey times with Holgate Park Drive is that this option allows the bus to bypass a larger portion of the congested A59 corridor.

4.4 Access Junction Operation

Queue length data has been extracted from the VISSIM model for the access junction in order to provide an indicator of how well the junction operates. These queue lengths take the form of average length and average max length (taken in 15 minute intervals). Table 4.4 contains the results for the Chancery Rise access option and the Holgate Park Drive access results are in Table 4.5. Figures 4.5 and 4.6 contain drawings of the access junctions with the arms labelled in the same manner as the results in the tables.

Figure 4.5: Chancery Rise Access Junction Labels

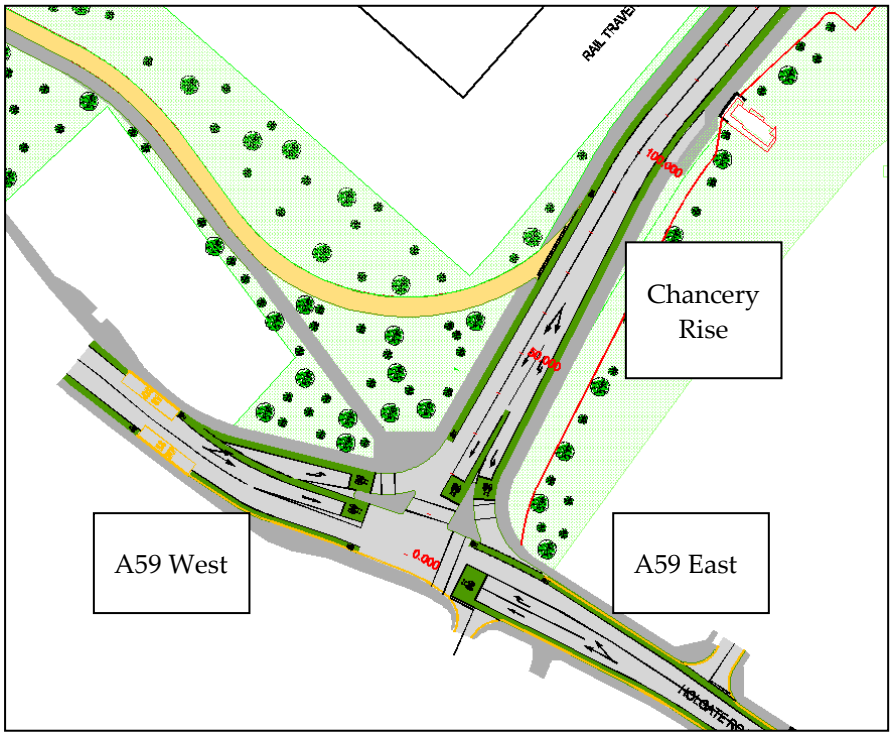


Table 4.4: Chancery Rise Access Queue Lengths (m)

Queue Length	Start Link	End Link	AM Peak		PM Peak	
			High	Low	High	Low
Average	A59 East	A59 West	11	12	1	1
	A59 East	Chancery Rise	7	7	5	4
	A59 West	A59 East	10	9	1	1
	A59 West	Chancery Rise	2	2	13	13
	Chancery Rise	A59 East	132	77	40	37
	Chancery Rise	A59 West	10	9	1	1
Average max	A59 East	A59 West	36	39	6	6
	A59 East	Chancery Rise	74	81	74	68
	A59 West	A59 East	79	68	21	19
	A59 West	Chancery Rise	16	16	55	56
	Chancery Rise	A59 East	261	192	173	155
	Chancery Rise	A59 West	79	68	21	19

Figure 4.6: Holgate Park Drive Access Junction Labels

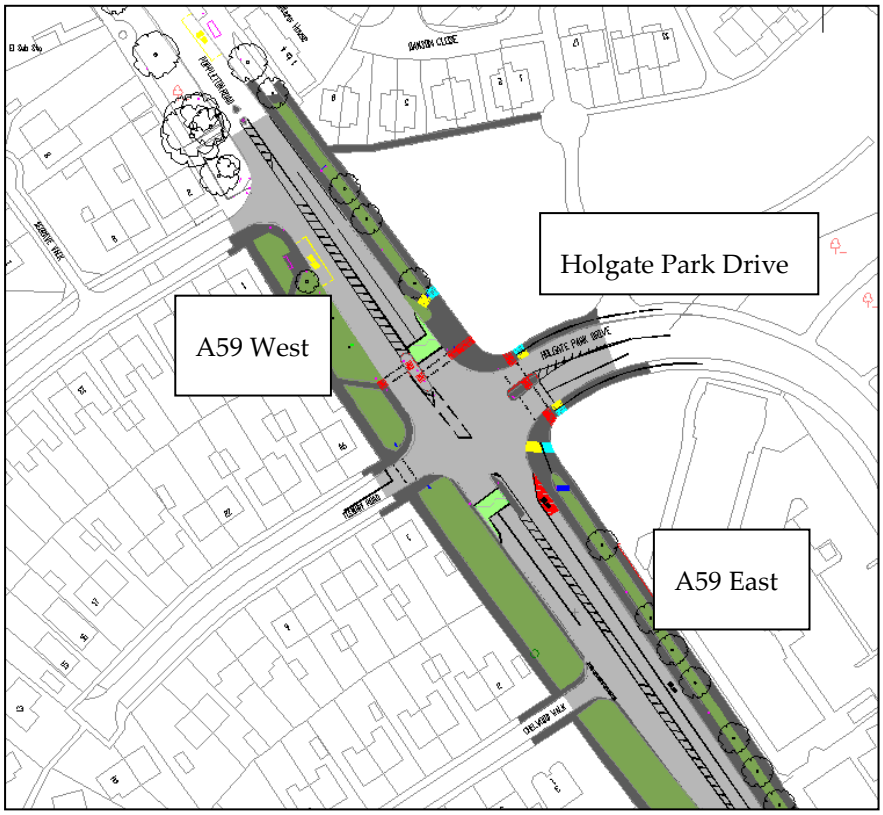


Table 4.4: Holgate Park Drive Access Queue Lengths (m)

Queue Length	Start Link	End Link	AM Peak			PM Peak		
			High	Low	Do Min	High	Low	Do Min
Average	A59 East	Holgate Park Drive	21	21	14	4	3	1
	A59 East	A59 West	2	2	3	2	3	1
	A59 West	A59 East	46	71	167	31	42	42
	A59 West	Holgate Park Drive	26	22	8	5	4	1
	Holgate Park Drive	A59 West	5	13	2	74	23	13
	Holgate Park Drive	A59 East	2	3	1	91	10	5
Average max	A59 East	Holgate Park Drive	60	64	48	22	18	7
	A59 East	A59 West	49	53	67	56	60	36
	A59 West	A59 East	116	183	291	123	170	167
	A59 West	Holgate Park Drive	114	117	56	37	31	21
	Holgate Park Drive	A59 West	23	42	15	183	88	53
	Holgate Park Drive	A59 East	16	17	10	202	62	30

Smaller queues are observed on the exit from the York Central site with Holgate Park Drive rather than with Chancery Rise in the AM peak. However in the PM peak a smaller exit queue is observed at Chancery Rise. This is due in part to the presence of traffic from Holgate Business Park also exiting the same junction in the Holgate Park Drive access option.

In comparison with the Do Minimum the queues at the Holgate Park Drive junction are larger on the Holgate Park Drive arm but the queues on the other arms are comparable or even lower in some cases due to the revised signal timings.

It should also be noted that with the bus priority strategy along the A59 there is an element of queue relocation at the Holgate Park Drive junction and so the inbound queues are artificially high in this location.

4.5 Network Statistics

VISSIM also produces statistics covering all vehicles across the network. These provide an overall measure of traffic conditions in the network. Table 4.5 contains the AM peak hour statistics and the PM peak results are contained in Table 4.6. Note that delay time is defined to be the difference between the actual travel time and the travel time under free flow conditions (i.e. if no other vehicles were present on the network).

Table 4.5: AM Peak Network Statistics

Parameter	Do Minimum	Chancery Rise High	Chancery Rise Low	Holgate Park High	Holgate Park Low
Average Speed [km/h]	26.1	23.2	25.1	24.0	24.6
Average Distance Travelled [km]	2.0	2.0	2.0	2.0	2.0
Average Travel Time [s]	281	311	290	302	295
Average Delay Time [s]	151	183	161	173	166
Total Vehicles	13,321	13,875	13,721	13,897	13,832
Total Travel Time (hr)[1]	1,041	1,197	1,105	1,167	1,134
Total Delay Time (hr)	560	704	612	669	637

Table 4.6: PM Peak Network Statistics

Parameter	Do Minimum	Chancery Rise High	Chancery Rise Low	Holgate Park High	Holgate Park Low
Average Speed [km/h]	28.9	27.0	30.7	29.8	30.4
Average Distance Travelled [km]	2.1	2.1	2.2	2.2	2.2
Average Travel Time [s]	267	282	253	260	257
Average Delay Time [s]	131	148	117	123	119
Total Vehicles	12,843	13,359	13,039	13,484	13,109
Total Travel Time (hr)	953	1,045	916	976	934
Total Delay Time (hr)	469	549	423	460	433

[1] Note: total travel time & delay is slightly different to the average multiplied by the number of vehicles due to rounding and the way that VISSIM treats vehicles generated during the 'warm-up' period before the modelled peak hour and vehicles still in the network at the end of the peak hour.

The network statistics indicate that with high levels of traffic at the York Central development the network operates most efficiently with the Holgate Park Drive access. This options leads to lower delays and higher average speeds in the network. With lower traffic levels at the site the Chancery Rise option appears to operate better in the AM peak but worse in the PM peak.

4.6 Economic Appraisal

In order to understand the difference between the two options in economic terms the travel times across the whole network are monetised and then compared against construction cost estimates for the two accesses. This is a very basic economic appraisal which only looks at the construction costs and travel time differences.

The costs of the two access options have been obtained from previous studies and are in 2011 prices. These are presented in Table 4.7.

Table 4.7: Access Scenario Costs

Cost Item	Chancery Rise	Holgate Park
Junction improvement costs	£0.6m	£0.4m
Access corridor costs	£3.9m	£2.9m
Bridge structure costs	£1.8m	£8.7m
Other costs (incl. optimism bias)	£2.8m	£5.5m
Total scheme costs	**£9.1m**	**£17.5m**

To convert the travel time totals into monetary values the WebTAG value of time has been applied for the average car in 2011 values and prices (£14.65 / hr). Furthermore ATC data on the A59 corridor is used to produce annualisation factors for expanding the AM and PM peak hour travel times to an estimate of the annual value. It should be noted that there are limitations to this annualisation process as no inter peak or off peak model is available to inform levels of delay in less busy time periods. Table 4.8 contains the resultant annual cost of the travel and delay time from the VISSIM network.

Table 4.8: Annual Cost of Travel Time & Delay (2011 prices)

Cost Category	Do Minimum	Chancery Rise High	Chancery Rise Low	Holgate Park High	Holgate Park Low
Annual Cost of Travel Time (£)	£48.1m	£54.1m	£48.8m	£51.7m	£49.9m
Annual Cost of Delay Time (£)	£24.8m	£30.3m	£25.0m	£27.3m	£25.9m

With a high level of development the Chancery Rise access option is shown to have a higher cost of travel time than the Holgate Park option. However, with low development quanta, Holgate Park is the option with the higher cost of travel time.

If a low level of development was planned the economic analysis would suggest that the Chancery Rise access is the better of the two options from a monetary perspective as it has the lower construction cost and the lower cost of travel time. However, with a higher level of development it is more complex as the Holgate Park access leads to a lower travel time cost but higher construction cost. In order to understand how many years of operation are required before the additional construction cost for Holgate Park is offset by the travel time benefits of this option compared to Chancery Rise a 10 year appraisal has been undertaken.

In accordance with guidance a discount rate of 3.5% per annum is applied to costs and benefits to take account of the fact that costs and benefits occurring sooner in the appraisal period should be weighted

higher than those towards the end. It is assumed that the construction cost would occur in 2015 and that the full traffic levels would be generated at the site in 2016. Table 4.9 contains the results of this appraisal for the difference between the Chancery Rise & Holgate Park Drive access options (Holgate Park Drive minus Chancery Rise). A positive value indicates that lower costs at Chancery Rise than at Holgate Park Drive and vice versa.

Table 4.9: Appraisal of the difference between Holgate Park Drive and Chancery Rise Options (high development)

Year	Holgate Park Drive minus Chancery Rise
2015	£7,029,361
2016	-£1,912,545
2017	-£1,845,606
2018	-£1,781,010
2019	-£1,718,674
2020	-£1,658,521
2021	-£1,600,473
2022	-£1,544,456
2023	-£1,490,400
2024	-£1,438,236
2025	-£1,387,898

Examination of the table indicates that by 2019 the higher Holgate Park Drive construction cost is offset by the lower travel time costs.

4.7 Air Quality

An estimate of the quantity of emissions produced by vehicles in the micro-simulation model network is produced by VISSIM. These represent a high level estimate rather than detailed emissions modelling results. Within VISSIM these data is collected on a junction by junction ("node") basis. Twelve key nodes have been used to generate the emissions as shown in Figure 4.5. The total emissions are then contained within Table 4.10.

Figure 4.5: Nodes used for Emissions Outputs

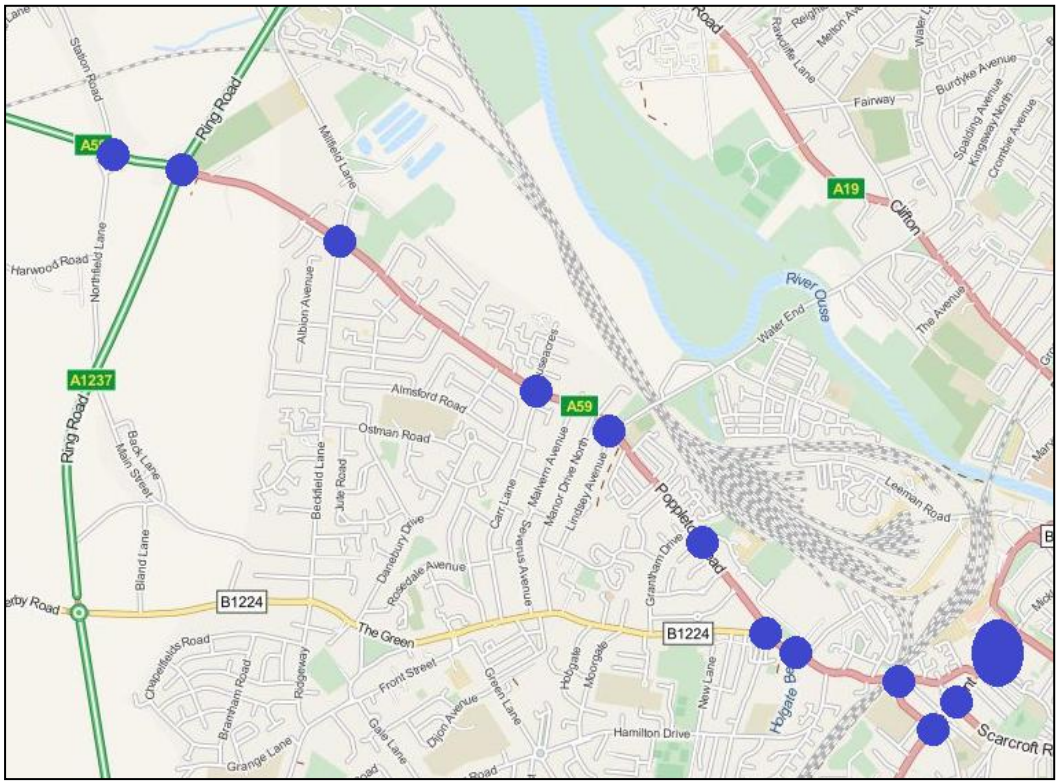


Table 4.10: Peak Hour Emissions (kg)

Peak Period	Emission	Do Min	Chancery Rise High	Chancery Rise Low	Holgate Park High	Holgate Park Low
AM Peak	CO	93.6	95.4	91.9	101.4	99.9
	NOx	18.2	18.6	17.9	19.7	19.4
	VOC	21.7	22.1	21.3	23.5	23.1
PM Peak	CO	97.6	94.3	88.2	104.1	99.8
	NOx	19.0	18.3	17.2	20.3	19.4
	VOC	22.6	21.8	20.4	24.1	23.1

Summing emissions across all the nodes indicates that the Holgate Park Drive access option leads to a higher total level of emissions than the Chancery Rise access option including in the city centre nodes where air quality is considered to be more of an issue.

5 Summary & Conclusions

VISSIM modelling has been undertaken to assess the operation of the A59 corridor with either an access into York Central via Holgate Park Drive or via a new signalised junction at Chancery Rise. The assessment has been undertaken with two traffic levels at York Central in the AM and PM peak hours.

The results of the modelling indicate that both of the access options have some positives and some negatives. However, the network wide statistics indicate that the Holgate Park Drive option leads to better overall network performance than the Chancery Rise option with a high level of development at York Central. Furthermore, greater benefits are provided to A59 P&R bus services with the Holgate Park Drive option as services divert off the congested A59 corridor earlier than with the Chancery Rise option.

The economic analysis indicates that with a low level of development at the York Central site Chancery Rise represents the best value for money. However, with a high level of development at the site Holgate Park Drive represents the best value for money over a 10 year appraisal period with the additional construction costs being offset five years after site opening by lower travel times.

These results are taken forward into the multi-criteria analysis used to compare the two access points.

Appendix A

A.1 Holgate Park Drive Access

A.2 Chancery Rise Access

Appendix B

B.1 AM Peak CO Emissions (kg)

Location	Do Min	Chancery Rise High	Chancery Rise Low	Holgate Park High	Holgate Park Low
Blossom St	8.3	7.9	8.3	8.7	8.4
Holgate Rd / Dalton Tr	6.3	6.5	6.6	7.0	6.5
Scarcroft Rd	1.2	1.3	1.3	1.2	1.3
Albemarle Rd	7.3	8.1	7.9	7.5	7.4
The Fox	4.4	4.0	3.8	4.9	4.9
Chancery Rise	2.9	6.2	4.6	3.9	3.4
Holgate Park Drive	4.8	4.9	4.7	5.3	5.6
Beckfield Lane	5.8	5.8	6.2	6.1	6.1
Water End	5.7	5.8	5.9	6.1	6.0
Carr Lane	5.2	5.1	5.2	5.6	5.5
A59/A1237	38.9	38.7	36.5	42.2	41.9
P&R Access	2.7	1.1	1.1	2.9	2.9
Total	93.6	95.4	91.9	101.4	99.9

B.2 AM Peak NOx Emissions (kg)

Location	Do Min	Chancery Rise High	Chancery Rise Low	Holgate Park High	Holgate Park Low
Blossom St	1.6	1.5	1.6	1.7	1.6
Holgate Rd / Dalton Tr	1.2	1.3	1.3	1.4	1.3
Scarcroft Rd	0.2	0.2	0.2	0.2	0.2
Albemarle Rd	1.4	1.6	1.5	1.5	1.4
The Fox	0.8	0.8	0.7	0.9	1.0
Chancery Rise	0.6	1.2	0.9	0.8	0.7
Holgate Park Drive	0.9	1.0	0.9	1.0	1.1
Beckfield Lane	1.1	1.1	1.2	1.2	1.2
Water End	1.1	1.1	1.1	1.2	1.2
Carr Lane	1.0	1.0	1.0	1.1	1.1
A59/A1237	7.6	7.5	7.1	8.2	8.2
P&R Access	0.5	0.2	0.2	0.6	0.6
Total	18.2	18.6	17.9	19.7	19.4

B.3 AM Peak VOC Emissions (kg)

Location	Do Min	Chancery Rise High	Chancery Rise Low	Holgate Park High	Holgate Park Low
Blossom St	1.9	1.8	1.9	2.0	2.0
Holgate Rd / Dalton Tr	1.5	1.5	1.5	1.6	1.5
Scarcroft Rd	0.3	0.3	0.3	0.3	0.3
Albemarle Rd	1.7	1.9	1.8	1.7	1.7
The Fox	1.0	0.9	0.9	1.1	1.1
Chancery Rise	0.7	1.4	1.1	0.9	0.8
Holgate Park Drive	1.1	1.1	1.1	1.2	1.3
Beckfield Lane	1.3	1.3	1.4	1.4	1.4
Water End	1.3	1.3	1.4	1.4	1.4
Carr Lane	1.2	1.2	1.2	1.3	1.3
A59/A1237	9.0	9.0	8.5	9.8	9.7
P&R Access	0.6	0.3	0.3	0.7	0.7
Total	21.7	22.1	21.3	23.5	23.1

B.4 PM Peak CO Emissions (kg)

Location	Do Min	Chancery Rise High	Chancery Rise Low	Holgate Park High	Holgate Park Low
Blossom St	6.6	6.5	6.4	7.0	6.7
Holgate Rd / Dalton Tr	4.4	4.6	4.4	4.9	4.6
Scarcroft Rd	1.0	0.9	1.0	1.0	1.0
Albemarle Rd	6.8	7.1	6.7	7.1	6.9
The Fox	4.9	3.7	3.5	5.2	4.4
Chancery Rise	3.0	5.6	4.1	2.9	2.9
Holgate Park Drive	3.0	3.1	2.9	5.8	4.3
Beckfield Lane	9.7	9.7	9.6	9.9	9.9
Water End	5.4	5.6	5.3	6.3	5.9
Carr Lane	8.1	8.0	7.9	8.0	8.3
A59/A1237	40.6	37.8	35.1	42.2	41.2
P&R Access	4.1	1.5	1.3	3.7	3.7
Total	97.6	94.3	88.2	104.1	99.8

B.5 PM Peak NOx Emissions (kg)

Location	Do Min	Chancery Rise High	Chancery Rise Low	Holgate Park High	Holgate Park Low
Blossom St	1.3	1.3	1.3	1.4	1.3
Holgate Rd / Dalton Tr	0.9	0.9	0.8	0.9	0.9
Scarcroft Rd	0.2	0.2	0.2	0.2	0.2
Albemarle Rd	1.3	1.4	1.3	1.4	1.3
The Fox	1.0	0.7	0.7	1.0	0.9
Chancery Rise	0.6	1.1	0.8	0.6	0.6
Holgate Park Drive	0.6	0.6	0.6	1.1	0.8
Beckfield Lane	1.9	1.9	1.9	1.9	1.9
Water End	1.0	1.1	1.0	1.2	1.1
Carr Lane	1.6	1.6	1.5	1.6	1.6
A59/A1237	7.9	7.4	6.8	8.2	8.0
P&R Access	0.8	0.3	0.3	0.7	0.7
Total	19.0	18.3	17.2	20.3	19.4

B.6 PM Peak VOC Emissions (kg)

Location	Do Min	Chancery Rise High	Chancery Rise Low	Holgate Park High	Holgate Park Low
Blossom St	1.5	1.5	1.5	1.6	1.5
Holgate Rd / Dalton Tr	1.0	1.1	1.0	1.1	1.1
Scarcroft Rd	0.2	0.2	0.2	0.2	0.2
Albemarle Rd	1.6	1.6	1.6	1.6	1.6
The Fox	1.1	0.9	0.8	1.2	1.0
Chancery Rise	0.7	1.3	0.9	0.7	0.7
Holgate Park Drive	0.7	0.7	0.7	1.3	1.0
Beckfield Lane	2.3	2.3	2.2	2.3	2.3
Water End	1.2	1.3	1.2	1.5	1.4
Carr Lane	1.9	1.9	1.8	1.9	1.9
A59/A1237	9.4	8.8	8.1	9.8	9.6
P&R Access	0.9	0.4	0.3	0.9	0.8
Total	22.6	21.8	20.4	24.1	23.1