AtkinsRéalis

GC3M Assessment

Gloucestershire County Council

16 May 2024

WEST OF CHELTENHAM & ELMS PARK DEVELOPMENT IMPACT

Notice

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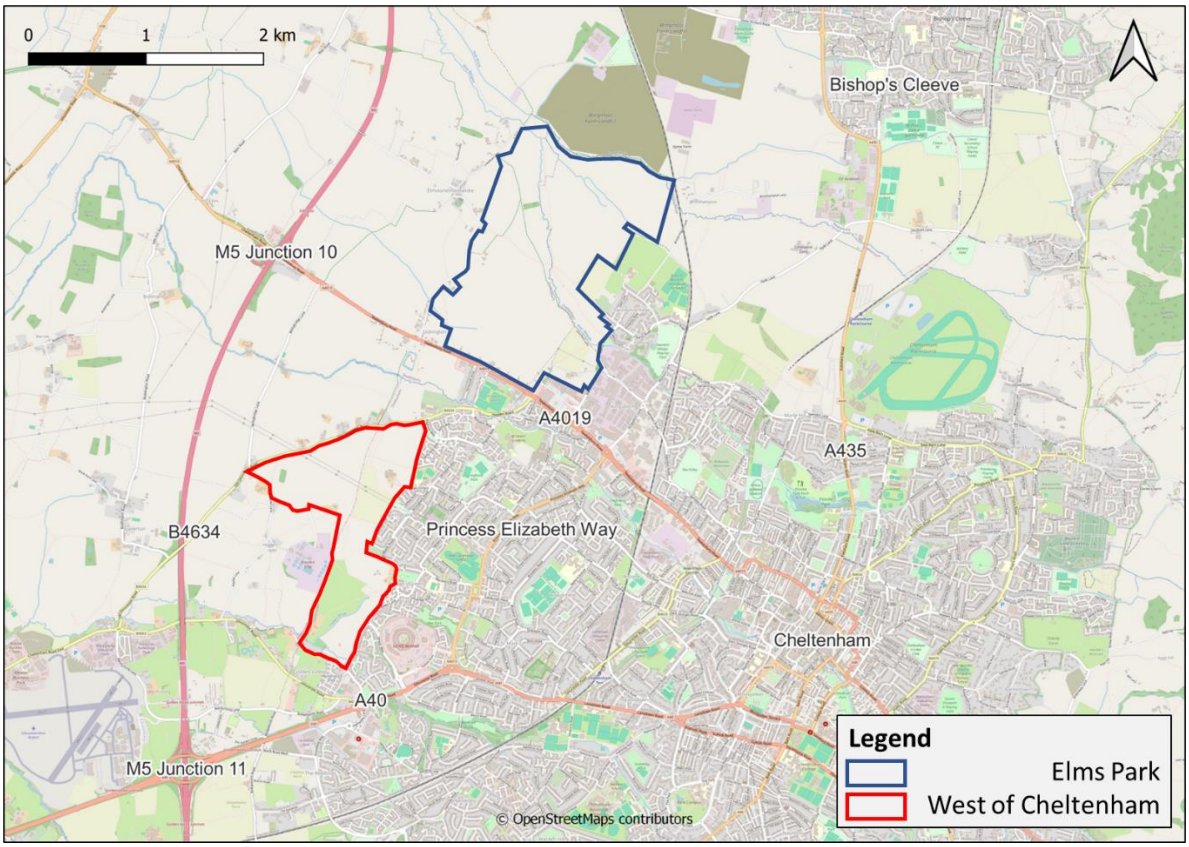
1. Introduction

1.1 Overview

Gloucestershire Country Council (GCC) Highways Development Management (HDM) has commissioned AtkinsRéalis to undertake an updated study which will establish the traffic impact of different levels of development associated with the West of Cheltenham and Elms Park sites on the surrounding road network in the absence of the proposed M5 Junction 10 Improvements Scheme.

Figure 1-1 shows the location of the two sites in relation to the existing highway network and Cheltenham Town Centre.

Figure 1-1 – Site Boundaries of Elms Park and West of Cheltenham



The Elms Park development site proposes to introduce up to 4,285 new homes, 40 hectares (ha) of employment land, a hotel, mixed use centres, a transport hub and public transport interchange, primary and secondary school education, new green infrastructure and four new accesses onto the existing highway network. The West of Cheltenham development will provide 2,509 dwellings, 17.5 ha of employment land, a primary school and three new accesses onto the existing highway network.

Both sites are named strategic allocations included within the Gloucester, Cheltenham and Tewkesbury Joint Core Strategy (JCS) 2011-2031, adopted in 2017[1]. The M5 Junction 10 Improvements Scheme was identified as a necessary large infrastructure scheme to facilitate the full-scale of development as part of the JCS Transport

[1] Adopted Joint Core Strategy — Joint Core Strategy

Strategy. The application for a Development Consent Order (DCO) to deliver the scheme was accepted on 16 January 2024, with the scheme now in pre-examination stage. The Transport Strategy was underpinned by the now retired Central Severn Vale (CSV) strategic model.

1.2 Purpose of this study

The aim of this study is to re-confirm whether the existing network has any sufficient residual capacity to allow at least some development at the two strategic allocations to be delivered prior to the M5 Junction 10 Improvements Scheme (hereafter referred to as the M5 J10 Scheme) being in place. This assessment is based on updated strategic modelling undertaken using the newly developed Gloucestershire Multi-Modal Model (GC3M). This will provide the GCC HDM team with an up-to-date, informed position regarding any future planning applications linked to the two sites.

The magnitude of potential development at the sites is such that it requires a strategic model assessment in order to understand the potential impact on wider route choice and not simply development related traffic. As such, the 2041 Gloucestershire Multi Modal Model (GC3M) represents the most appropriate tool for this assessment, with the existing Foundation Case forecast scenarios being used as the starting point for developing the evidence base. Information on these scenarios (and the underlying assumptions) are detailed within the Foundation Case Transport Forecasting Report (20 December 2023).

Note that earlier assessments regarding the impact of the two strategic sites undertaken for the JCS and the M5 Junction 10 Improvements Scheme Outline Business Case (OBC) made use of the Central Severn Vale (CSV) model which due to its relative age is no longer in use.

1.3 Structure of this document

The structure of this report is as follows:

- Section 2: provides details of the modelling approach and key assumptions applied in developing the various scenarios considered.
- Section 3: demonstrates the high-level impact of the full-scale of development in terms of routeing, traffic flow and journey times.
- Section 4: provides results of incremental testing, considering both full-scale and lower levels of development.
- Section 5: provides overall conclusions drawn from the transport modelling assessment.

2. Model Approach and Updates

2.1 Overview

This section details the approach taken to modify the existing GC3M Foundation Case scenarios for the purposes of this study. This includes:

- An overview of the scenarios considered.
- Model network updates, including removal of the M5 J10 Scheme and refinements to the forecast networks including detailed development access arrangements.
- Changes to future land use assumptions noted since the development of the GC3M Uncertainty Log.
- Trip rate assumptions – applied for the strategic allocation sites.

2.2 Scenarios

All model testing has been based on a consistent future forecast year (2041), at which point it is expected that both the Elms Park and West of Cheltenham sites could feasibly be fully delivered (in line with the plan period for the adopted JCS). This means that all scenarios include a consistent level of background growth up to 2041, enabling like-for-like comparison.

A total of 7 scenarios have been produced. This includes a reference case (without development) used as the comparator for the assessment of development impacts and then scenarios with a range of development levels both with and without mitigation identified for the Elms Park site (explained in 2.3.4) as summarised in Table 2-1. Note that at the time of writing, no known mitigation measures have been identified for the West of Cheltenham site.

Table 2-1 – Scenarios tested

Scenario	Network	Land use
Reference case	No access arrangements or mitigation	**West of Cheltenham:** no development **Elms Park:** 260 dwellings (Swindon Farm)
Full development without mitigation	Access points only	**West of Cheltenham:** 2,509 dwellings, 175,000 sqm employment (GEA) **Elms Park:** 4,285 dwellings, 40,000 sqm employment (GFA)
Full development with mitigation	Access points and Elms Park mitigation schemes	
50% development without mitigation	Access points only	**West of Cheltenham:** 1,255 dwellings, 87,500 sqm employment **Elms Park:** 2,143 dwellings, 20,000 sqm employment
50% development with mitigation	Access points and Elms Park mitigation schemes	
Deadweight* without mitigation	Access points only	**West of Cheltenham:** 481 dwellings, 34,845 sqm employment **Elms Park:** 1,230 dwellings, 23,435 sqm employment
Deadweight* with mitigation	Access points and Elms Park mitigation schemes	

**NB: Deadweight is a reference to level of development originally considered to be deliverable in the absence of the M5 J10 scheme according to the scheme OBC.*

The full development with mitigation scenario has been developed as the starting point for the assessment by making adjustments to the existing GC3M 2041 Foundation Case scenario, with all other scenarios developed subsequently. This is because the full level of development for the two sites has been included within the overall growth assumptions used to develop the initial 2041 forecast using the GC3M Variable Demand Model (VDM) setup, where total growth for Gloucestershire is constrained in line with NTEM Version 8. Trip levels from the two sites are then adjusted in line with defined trip rate assumptions as explained in section 2.6. Following this – the other scenarios (with lower levels of development) are produced by adjusting the level of trips for the two sites accordingly (in line with the same trip rate assumptions).

2.3 Network updates

Several amendments to the GC3M 2041 Foundation Case network were required to produce networks for each of the scenarios listed in Table 2-1 as detailed in the following sub-sections.

2.3.1 Foundation Case network amendments

Before considering the individual scenarios required, several initial amendments to the existing Foundation Case network were required. This included:

- Removal of the M5 J10 Scheme coding, reverting back to the existing arrangement at M5 Junction 10 (north-facing slips) and the A4019 and removing the new link road between the A4019 and Old Gloucester Road.
- The short missing section of Hayden Road between Village Road and the B4634 (Hayden Road/Old Gloucester Road) was added to the network – recognising the potential significance of this route for NW Cheltenham development traffic.

Following initial assignments of the full development scenarios, minor adjustments were also made to the surrounding local network to better reflect the routeing of development traffic. This included:

- Optimisation of traffic signals along Princess Elizabeth Way.
- Adjusting the speed-flow curve applied along the B4063 to better reflect the perceived impact of the Gloucester/Cheltenham cycle spine on link capacity and subsequent route choice for development traffic.

2.3.2 Reference Case network

With amendments to the Foundation Case network complete, an equivalent 2041 Reference Case network was created by simply adding an access point to the Elms Park development site to accommodate trips from the consented Swindon Farm site. This access point is defined as Access D and is explained in more detail, alongside the other development access sites, in section 2.3.3.

2.3.3 Development site access representation

For scenarios including development, the development access arrangements in the GC3M Foundation Case were reviewed and refined to better reflect details from available Transport Assessment documentation.

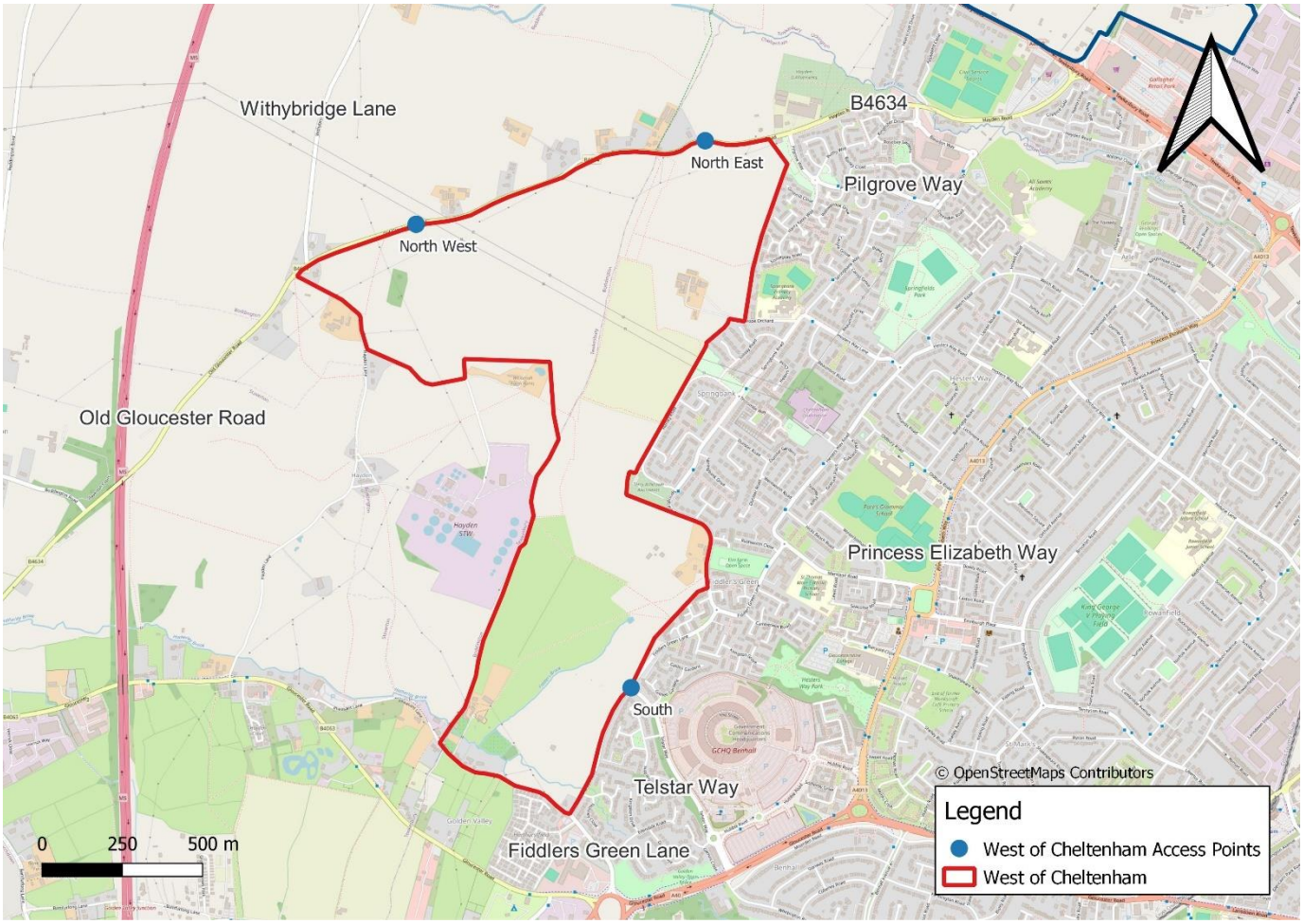
West of Cheltenham access arrangements

The West of Cheltenham development site is proposed to connect to the existing road network in three locations as follows:

- North west access – A new three-armed roundabout along the B4634, approximately 700m east of the Withybridge Lane,
- North east access- A new three-armed roundabout along the B4634 Old Gloucester Road, approximately 300m west of Pilgrove Way (and 600m east of the Northwest access); and
- South access – Via an existing three-armed roundabout (converting to a four-armed roundabout for the purpose of the development) between Telstar Way and Fiddler's Green Lane.

The three accesses, relative to the West of Cheltenham site, are shown in Figure 2-1 below.

Figure 2-1 - West of Cheltenham Access Points



The GC3M Foundation Case only assumed two access points – one to the south and one to the north (the north west access point) which connected to the new link road as part the M5 Junction 10 scheme - hence it was necessary to add the further north east access.

A further difference to be noted is that the Foundation Case assumes all car traffic from the site can access the existing network via the northern and southern access points. GCC have since advised that the northern and southern parcels are likely to be linked only via a bus gate and so specific proportions of development traffic have been allocated to each of the three access points (rather than being allowed to use either the northern or southern access points which is the case in the Foundation Case scenarios).

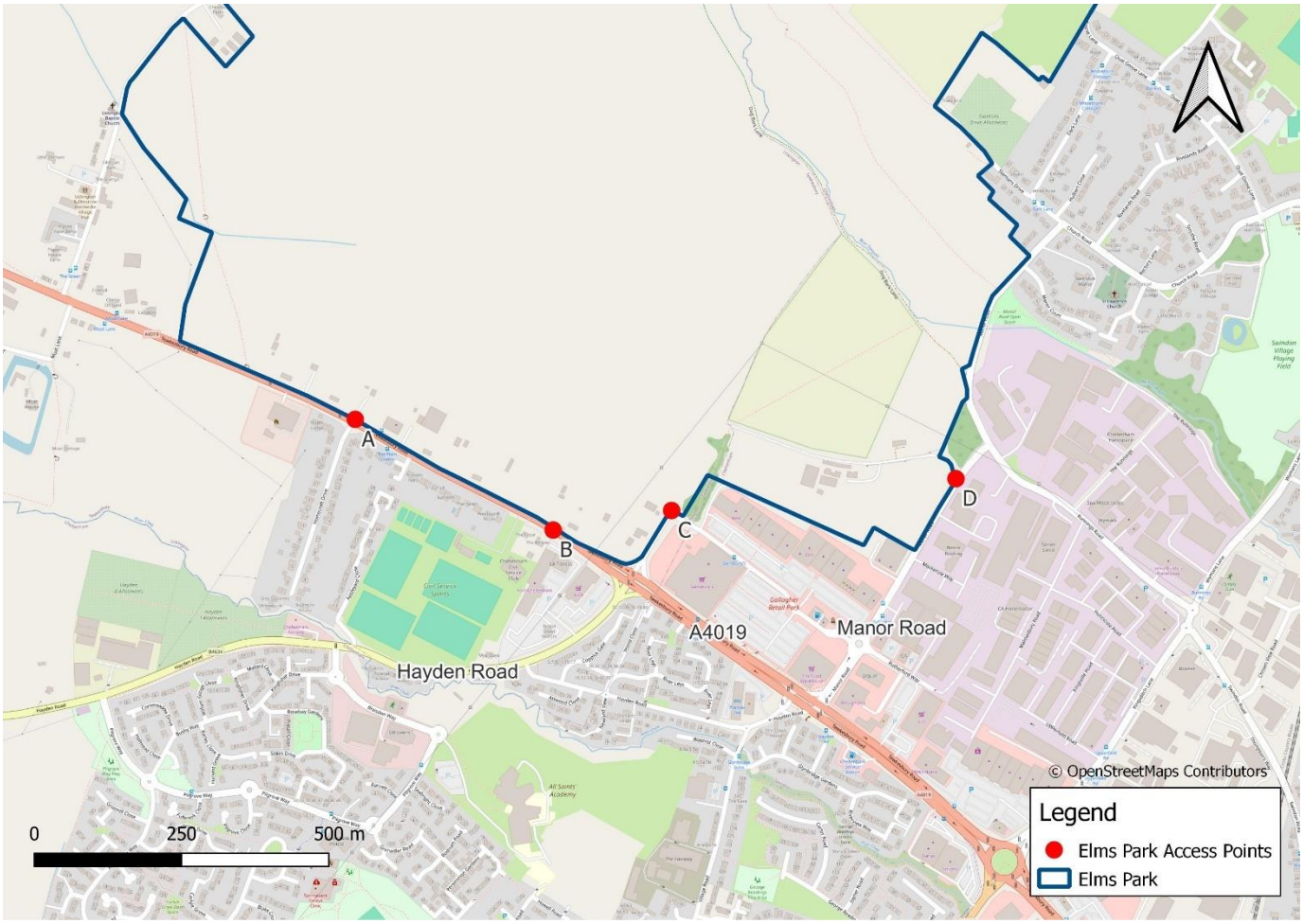
Elms Park access arrangements

The Elms Park development is proposed to connect to the existing road network in four locations. For simplicity, the four accesses have been assigned a letter (to which they will be referred from this point onwards), from west to east and are as follows:

- Access A – A four-armed traffic signalised junction along the A4019 Tewkesbury Road, opposite to Homecroft Drive, which includes a new toucan crossing approximately 50m east opposite Sandpiper Drive;
- Access B – A new three-armed traffic signalised junction along the A4019 Tewkesbury Road, approximately 150m west of the B4634 signalised junction;
- Access C – A four-armed roundabout on the B4634 Stub End / Gallagher Retail Park junction; and
- Access D – A new three-armed roundabout on Manor Road, which will be developed as part of the Swindon Farm consented development. Also included in the Reference Case network.

The locations of these four accesses, relative to the Elms Park development site, is shown in Figure 2-2.

Figure 2-2 - Elms Park Access Points



Similar to the West of Cheltenham site, rather than having one zone which allows all development traffic to choose which of the four accesses, proportions of development traffic have been split between the access points as explained in section 2.4.2. This avoids a situation where all traffic travelling towards M5 Junction 10 would use access A for example which is unrealistic.

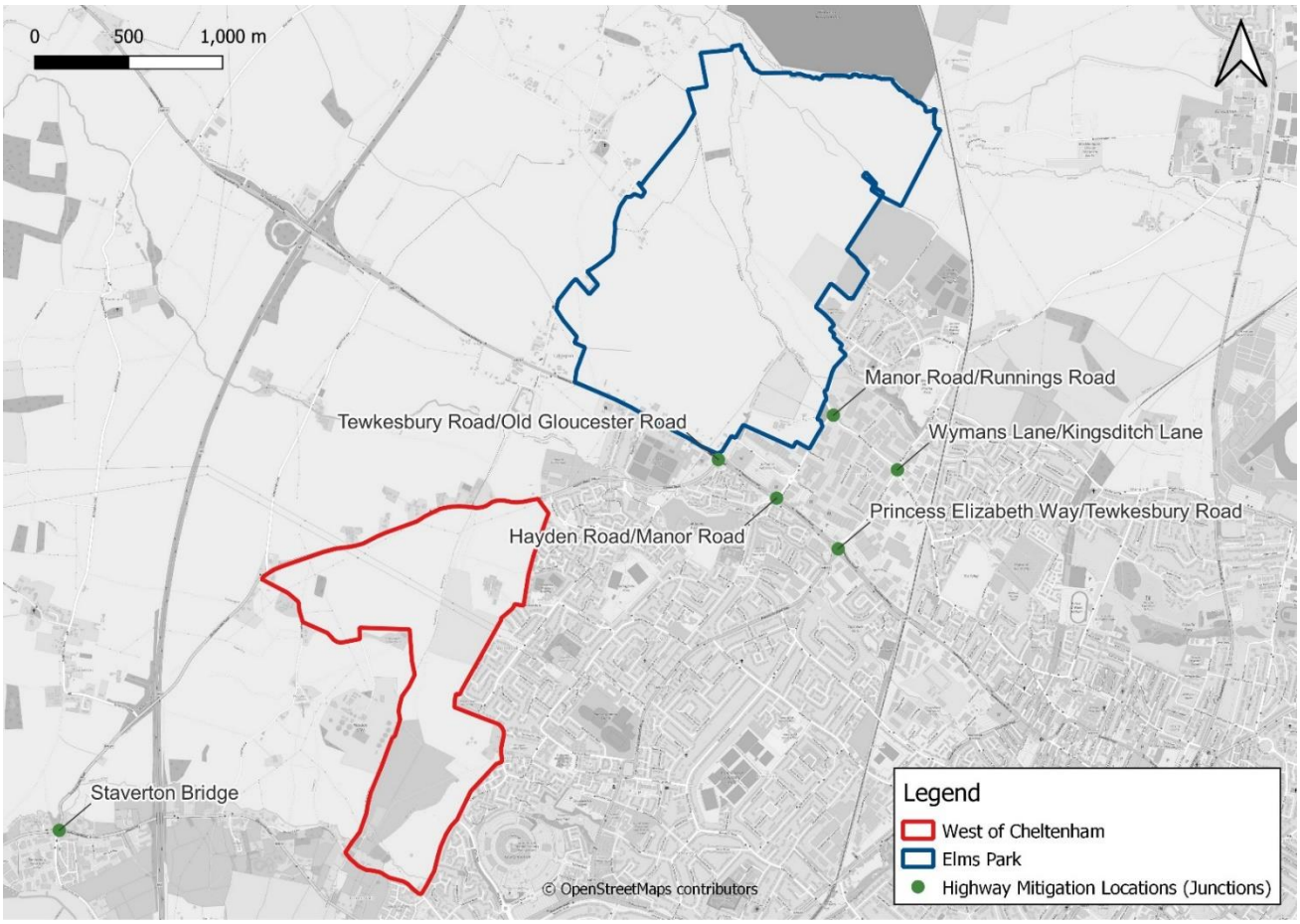
2.3.4 Elms Park – Other highway mitigations

Additional highway mitigations, not contained within the development site itself, were detailed in a Transport Assessment, prepared by Phil Jones Associates (PJA) and submitted to GCC in May 2022. The proposals of the off-site highway infrastructure improvements are as follows:

- Capacity improvements at the signalised junction of Tewkesbury Road / Old Gloucester Road incorporating bus priority measures;
- Capacity improvements to the Hayden Road / Manor Road signalised junction, with bus priority measures on the eastbound and westbound approaches;
- Replacement of the Princess Elizabeth Way / Tewkesbury Road roundabout with a signalised junction, incorporating bus priority measures on the eastbound approach;
- Widening and introduction of cycling infrastructure and bus priority measures on Tewkesbury Road into Cheltenham town centre;
- Replacement of the Wymans Lane / Kinsditch Lane mini-roundabouts with a new four-arm signalised junction;
- Replacement of the Staverton Bridge signals with a new four-arm roundabout; and
- Signalisation of the Manor Road/Runnings Road priority junction.

An image showing the locations of these highway mitigations, relative to the two development sites, can be found in Figure 2-3 below. Tewkesbury Road is not labelled specifically as the cycling infrastructure and bus priority measures are implemented across numerous locations, from Elms Park Access A in the west, to Princess Elizabeth Way/Tewkesbury Road junction in the east.

Figure 2-3 - Other Highway Mitigations



At this stage, no additional mitigations in relation to the West of Cheltenham have been proposed. As such, as set out in Table 2-1, scenarios have been developed both with and without the Elms Park development mitigations to understand the impact of these proposals.

2.4 Full development demand assumptions

Vehicle demand associated with the two development sites was calculated initially for the full development scenario, with the methodology for each site explained in more detail below. Trip rates were agreed with GCC based on available existing information to ensure a level of consistency with previous assessments undertaken for transport assessments.

2.4.1 West of Cheltenham

The agreed trip rates that were used to calculate demand for residential and employment based traffic for West of Cheltenham can be found in Table 2-2 below. Residential trip rates were calculated through traffic surveys undertaken in March 2023 across 12 sites near to the West of Cheltenham site. These surveys were commissioned by SLR on behalf of GCC, with the average of the results being used to represent a typical residential trip rate, as presented in Table 31 of the 'Residential Trip Generation Approach' Technical Note submitted to GCC by SLR in October 2023 for the West of Cheltenham site. The commercial vehicle trip rates were derived from a National Highways response to the 'Vision and Validate Approach Note' produced by SLR in October 2023. This provided a 'Core Scenario' commercial vehicle trip rate (Table 2 of the aforementioned Planning Response) which are not reduced by the result of local non-car journey alternatives The commercial trip rates presented have been calculated as per 100 square meters (sqm) gross external area (GEA).

Table 2-2 - Agreed trip rates

Trip Rate	Unit	AM Peak			PM Peak		
		Arrival	Departure	Two-Way	Arrival	Departure	Two-Way
Residential	Per dwelling	0.198	0.314	0.512	0.297	0.196	0.493
Commercial	Per 100sqm GEA	1.385	0.131	1.516	0.074	0.999	1.073

The number of vehicles associated with the sites can therefore be calculated by multiplying the agreed trip rates with the level of development at the site. A summary of the trip generation for West of Cheltenham demand (separated by access points displayed in Figure 2-1) can be found in Table 2-3. Note that the site includes new school provision – but all of these trips are assumed to be internalised within the site (in line with assumptions from the TA documentation). For dwellings, the number of units associated with each access was confirmed by GCC.

Table 2-3 - West of Cheltenham - Trip Generation

Land Parcel	Trip Source	Quanta and units	AM Peak			PM Peak		
			Arrival	Departure	2-Way	Arrival	Departure	2-Way
North east Parcel	Residential	496 dwellings	98	156	254	147	97	244
North west Parcel	Residential	1,107 dwellings	219	348	567	329	217	546
Southern Parcel	Residential	906 dwellings	179	284	464	269	178	447
	Employment	175,000 sqm (Site area)	2,374	222	2,600	130	1,714	1,844

2.4.2 Elms Park

The level of development at Elms Park was initially sourced from a Transport Assessment Addendum for the site submitted in May 2022 by PJA. Having reviewed the car trip generation, it was identified that the trip rate for residential traffic was higher for Elms Park than the trip rates shown in Table 2-2. As such, the residential trip generation for 4,285 dwellings was revised to match with the rate assumed for West of Cheltenham for the purposes of consistency. All other car trip generation numbers were retained from the PJA Transport Assessment Addendum. The total trip generation for the site is shown in Table 2-4

Table 2-4 - Elms Park – Vehicle Trip Generation

Trip source	Quanta and units	AM Peak			PM Peak		
		Arrivals	Departures	2-Way	Arrivals	Departures	2-Way
Residential	4,285 dwellings	848	1,345	2,194	1,273	840	2,113
Employment	40,000 sqm (Site area)	647	71	718	59	504	563
Hotel	100 beds	24	32	56	20	17	38
Primary School	1,200 pupils	91	67	158	25	43	68
Secondary School	1,000 pupils	37	24	61	18	31	49

The proportion of trips using the four individual access points has been determined through consideration of the site layout (from an illustrative masterplan shared by GCC). These proportions were confirmed with GCC and are outlined in Table 2-5. Note that where a proportion is applied to two or more points of access (e.g. C/D 50% of residential trips), the model assignment process decides which of these accesses is used for this proportion of trips (dependent on the specific destination/origin of each trip).

Table 2-5 - Elms Park - Trip generation access split

Trip source	Proportion of traffic	Justification
Residential	A: 50% B: 0% C/D: 50%	Site B has a bus gate for right turning traffic into the site. Traffic on western side of the site is most likely to use Access A, traffic located to the east more likely to use C/D.
Employment	A: 0% B/C/D: 100%	Employment land is located close to Access B and C – but Access D is a potential option for traffic travelling to/from the north of the site
Hotel	A: 0% B/C: 100%	Hotel is located close to Access B and C
Primary School	A: 33% B: 0% C/D: 66%	Access B unlikely to be used as schools are located further within the site with more direct access available from the other points of access.
Secondary School	A: 33% B: 0% C/D: 66%	

2.4.3 Reference Case Demand

As identified in section 2.3.2, Swindon Park is a consented development that is part of the wider Elms Park potential development, meaning that trips associated with this site needed to be included within the Reference Case scenario. Vehicle trips associated with the Swindon Park development (260 of the 4,285 dwellings only) have been calculated using the agreed trip rates presented in Table 2-2 and are presented in Table 2-6. All of these trips are allocated to Elms Park Access D.

Table 2-6 - Swindon Park Trip Generation

Trip Source	Quanta and units	AM Peak			PM Peak		
		Arrivals	Departures	Two-Way	Arrivals	Departures	Two-Way
Residential	260 dwellings	51	82	133	77	51	128

2.5 Variable Demand Model (VDM) assignment

In order to develop the 2041 future year scenarios, the first step of the process involves utilising the GC3M VDM setup to produce an initial 2041 future year assignment for the full development scenario (including the Elms Park mitigation). This provides the distribution patterns for the two developments as part of the wider forecast assignment, taking into account the future changes in productions and attractions (rather than relying solely on existing trip patterns).

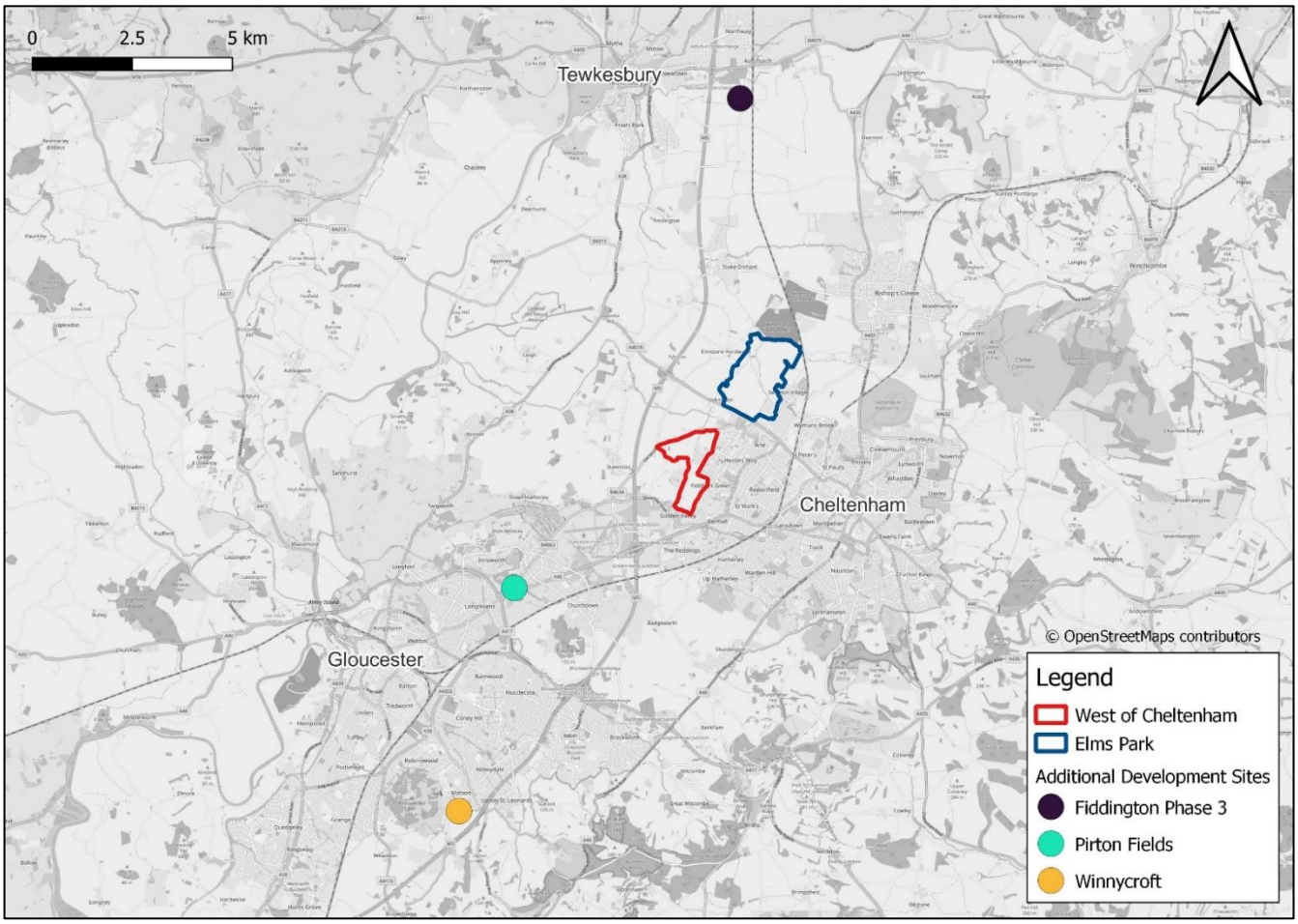
Prior to running the model, the GC3M Uncertainty Log (Version 1.0, February 2023) was reviewed by GCC to identify any sites in the surrounding area not originally included In the development of the GC3M Foundation Case scenarios. This review identified the following additional sites:

- Pirton Fields site – 145 dwellings.

- Fiddington Phase 3 – 120 dwellings.
- Winnycroft – an additional 217 dwellings.

As such, these sites were incorporated within appropriate zones for their respective locations (shown in Figure 2-4)

Figure 2-4 – Additional development site locations



Note that whilst these sites were incorporated, the overall level of housing growth across the districts of Cheltenham, Gloucester and Tewkesbury remained controlled to the overall level of growth in households between 2019 and 2041 as defined in NTEM Version 8.0 (and so the overall level of household growth is consistent with the original GC3M Foundation Case scenario assumptions).

2.6 Trip generation adjustment

Following the VDM assignment process, the level of trips generated by the GC3M for the two development sites was reviewed against the target level of trip generation presented in section 2.4. A comparison for the two sites is set out in Table 2-7. Note that education trips are included within the residential land use.

Table 2-7 – Trip generation comparison

Site	Land use	GC3M Arrival	Target Arrival	GC3M vs Target	GC3M Departure	Target Departure	GC3M vs Target
AM Peak							
West of Cheltenham	Residential	504	497	7	747	789	-42
	Employment	1,022	2,374	-1,352	321	222	99
Elms Park	Residential	1,071	848	223	1,103	1,436	-334
	Employment	103	671	-568	32	103	-71
PM Peak							
West of Cheltenham	Residential	996	745	251	538	492	46
	Employment	377	130	247	984	1,714	-730
Elms Park	Residential	1,472	1,316	157	833	914	-80
	Employment	41	79	-38	113	521	-408

Comparing the GC3M trip generation versus the target levels shows that In the case of residential trips, during the AM peak, there is generally a good match for West of Cheltenham (in terms of arrivals and departures) whilst trips for Elms Park are slightly underestimated compared to the target trip rates derived from the TA information. During the PM peak, GC3M car trip levels are generally higher than the target level – with the exception of departures from Elms Park (which are again slightly underestimated).

In the case of employment trips, as would be expected given the level of uncertainty associated with types of employment land being delivered, more difference is seen compared to the target levels. For both sites, the level of car trip generation is substantially underestimated for arrivals in the AM peak and departures in the PM peak. The main reason for these differences is related to the assumed site composition and associated level and type of jobs generated. In the current uncertainty log assumptions, the land use composition is assumed to be contain a range of employment types (B1, B2 and B8) – resulting in a relatively low number of jobs whereas the trip levels derived from Transport Assessment information is more representative of office-based employment.

Following this comparison, the level of trip generation in the GC3M model scenarios is factored to match with the target levels identified in Table 2-7 – but retaining the distribution generated by the GC3M VDM process. The distribution of traffic travelling to/from the sites is presented in Chapter 3. The distribution is assumed to be consistent across the subsequent levels of development tested – with the level of trips being scaled accordingly.

3. Impacts of development traffic

3.1 Overview and methodology

To provide an understanding of the key impacts of development-related traffic, this chapter provides analysis of the full development with Elms Park mitigation scenario compared with the reference case scenario in both the AM and PM peak. The analysis focuses on demonstrating the distribution of traffic (in the absence of the M5 Junction 10 Improvements scheme) to understand which parts of the network are likely to experience the greatest impact from new development trips. Analysis of the full development scenario formed the basis of more detailed analysis set out in Chapter 4, which covers road traffic analysis for all of the scenarios set out in Table 2-1.

3.2 Select link analysis

In the first instance, select link analysis was undertaken to understand where additional vehicle trips associated with the developments were being dissipated across the surrounding road network. Figure 3-1 and Figure 3-2 shows this analysis for Elms Park, whereas Figure 3-3 and Figure 3-4 displays the select link analysis for the West of Cheltenham development, for the AM Peak and PM peak respectively (showing all vehicles in PCUs).

Elms Park

Figure 3-1 - Select Link Analysis - Elms Park - AM Peak

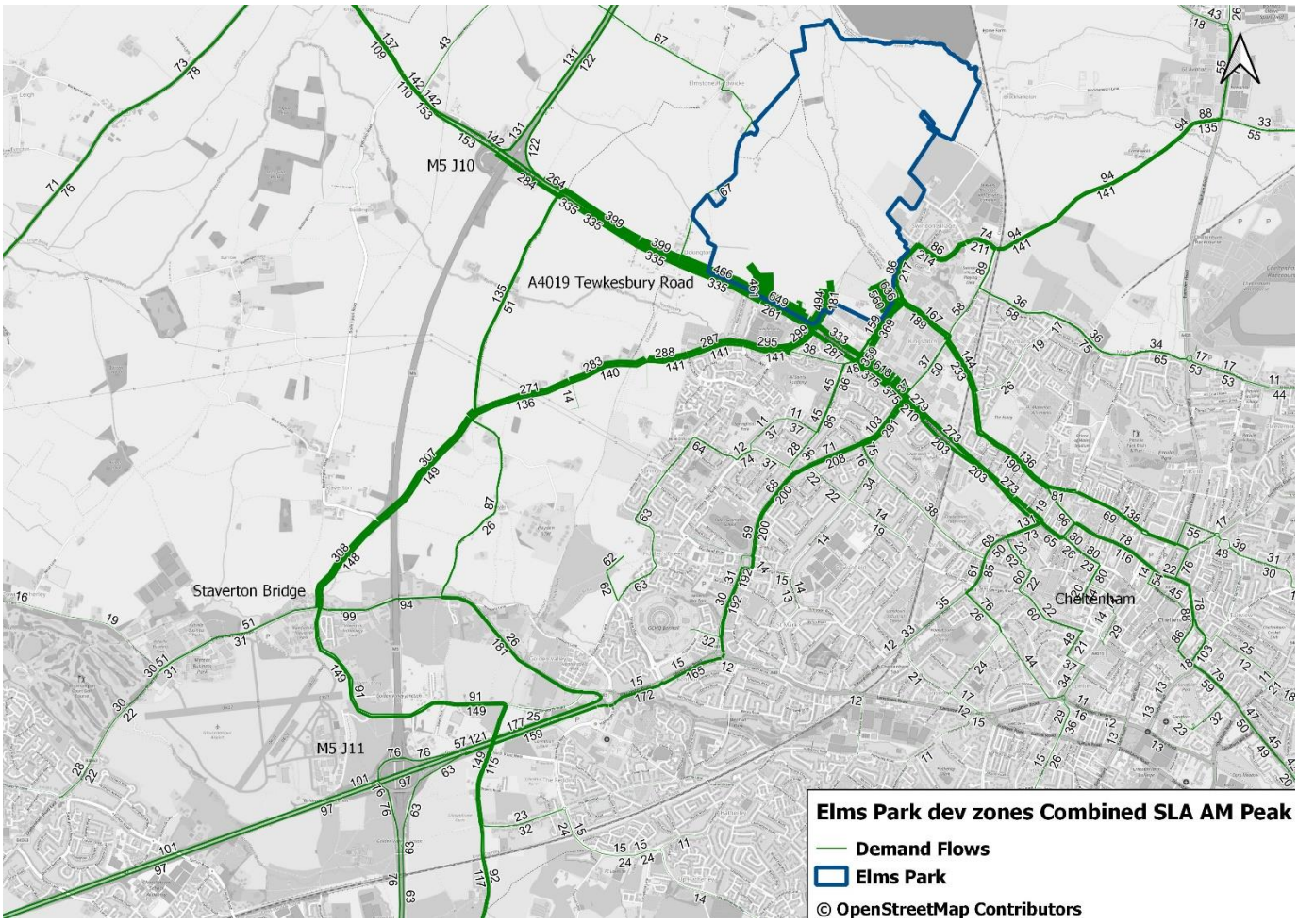
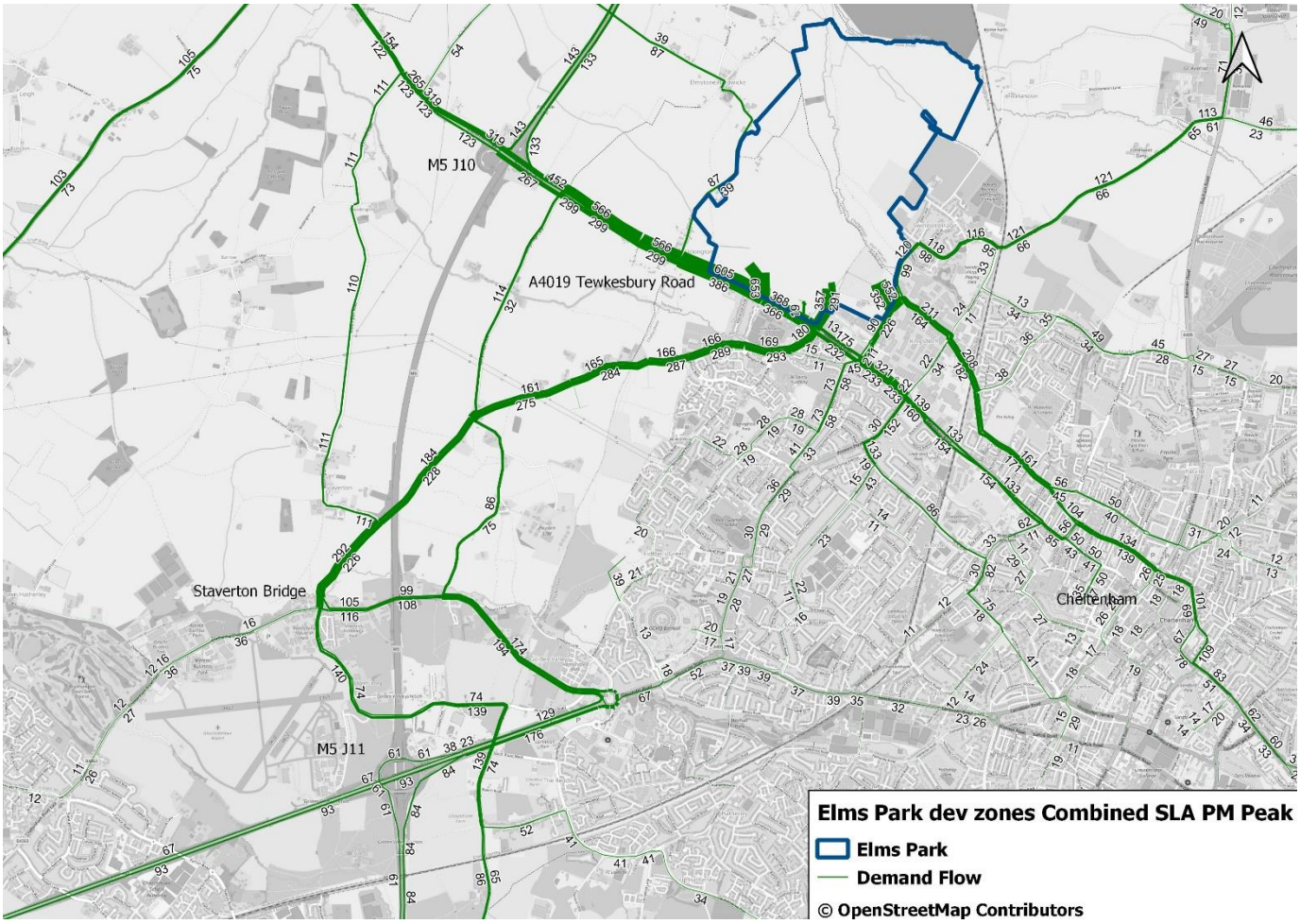


Figure 3-2 - Select Link Analysis - Elms Park - PM Peak



Key observations

- Increases in traffic flows are largely consistent across both the AM and PM peak, both in terms of geographical coverage and volume.
- The A4019 Tewkesbury Road is subject to the largest increase in traffic flows, between M5 Junction 10 and Cheltenham Town Centre, which is to be expected given the proximity of the Elms Park development. The A4019 acts as the main arterial route for trips to/from the development site, given that two of the four accesses are directly linked to the road.
- Considering the comment above, there is a large increase in vehicles travelling via the B4634 Old Gloucester Road, between the A4019 and Staverton Bridge. In the AM peak, more vehicles are routing northbound along this route, whereas the opposite is true in the PM peak. This pattern can be attributed to employment-based traffic originating south of Cheltenham again not being able to utilise the existing M5 Junction 10 arrangement.
- In the AM peak, it is notable that traffic travelling to/from Gloucester is split between the Princess Elizabeth Way/A40 route and via the A38 (travelling through the Coombe Hill junction). However, in the PM peak, the volume of traffic travelling via Princess Elizabeth Way is notably lower – which is attributed to congestion associated with the West of Cheltenham site around the A40. Instead, more traffic appears to be using the B4063 to reach the Arle Court junction to avoid this route.
- Traffic north of Elms Park (primarily using Access D) routes via Manor Road, Church Road and Hyde Road to move between the development site and Bishops Cleeve (and the A435). Similarly to the flows observed along the B4634 Old Gloucester Road, in the AM peak southbound flows are greater (travelling towards Elms Park) than northbound flows, contrary to what is observed in the PM peak. This pattern is also consistent along Runnings Road and Swindon Road, which essentially runs parallel to the A4019 and appears to be used as an alternative to this road.

West of Cheltenham

Figure 3-3 - Select Link Analysis - West of Cheltenham - AM Peak

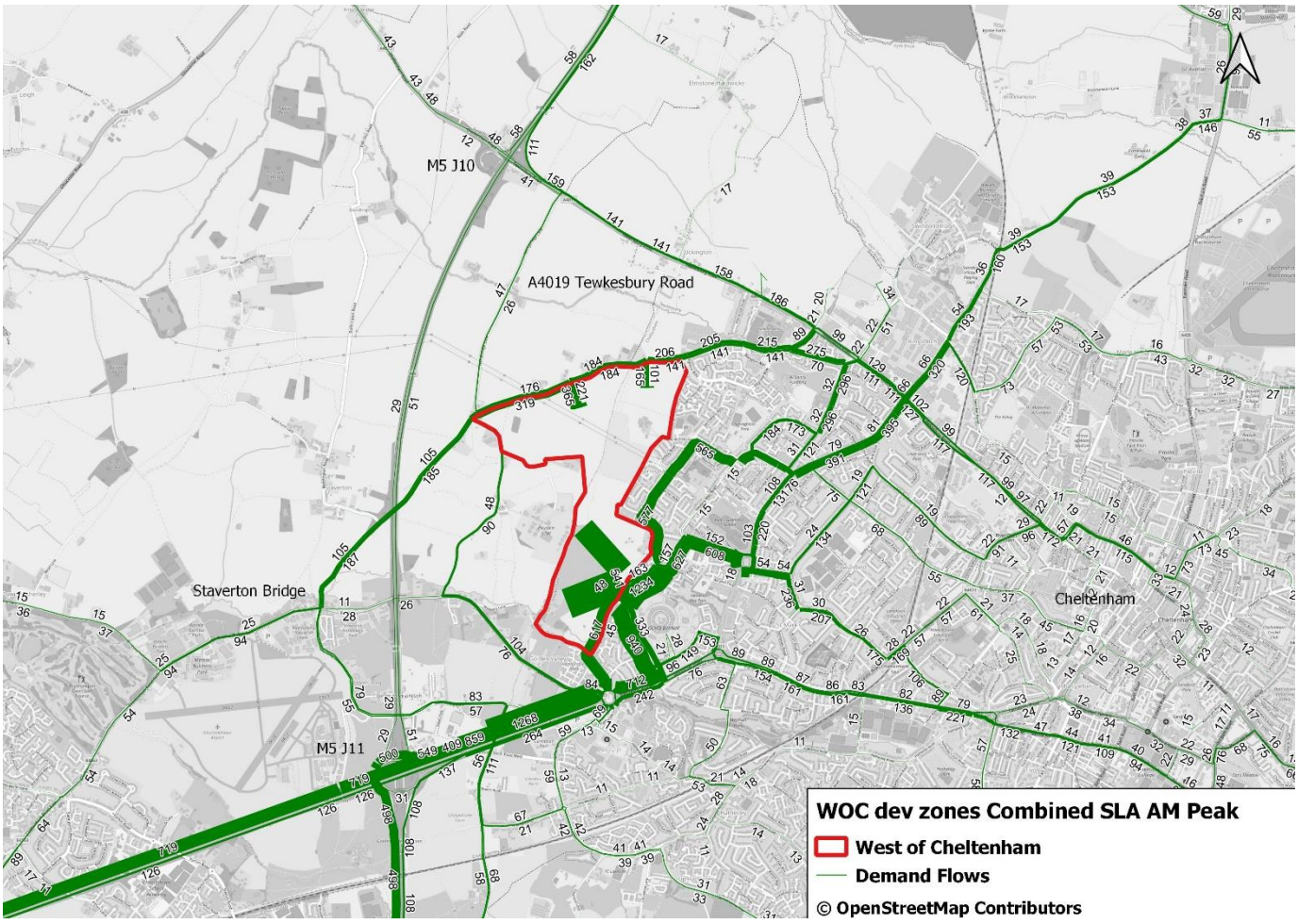
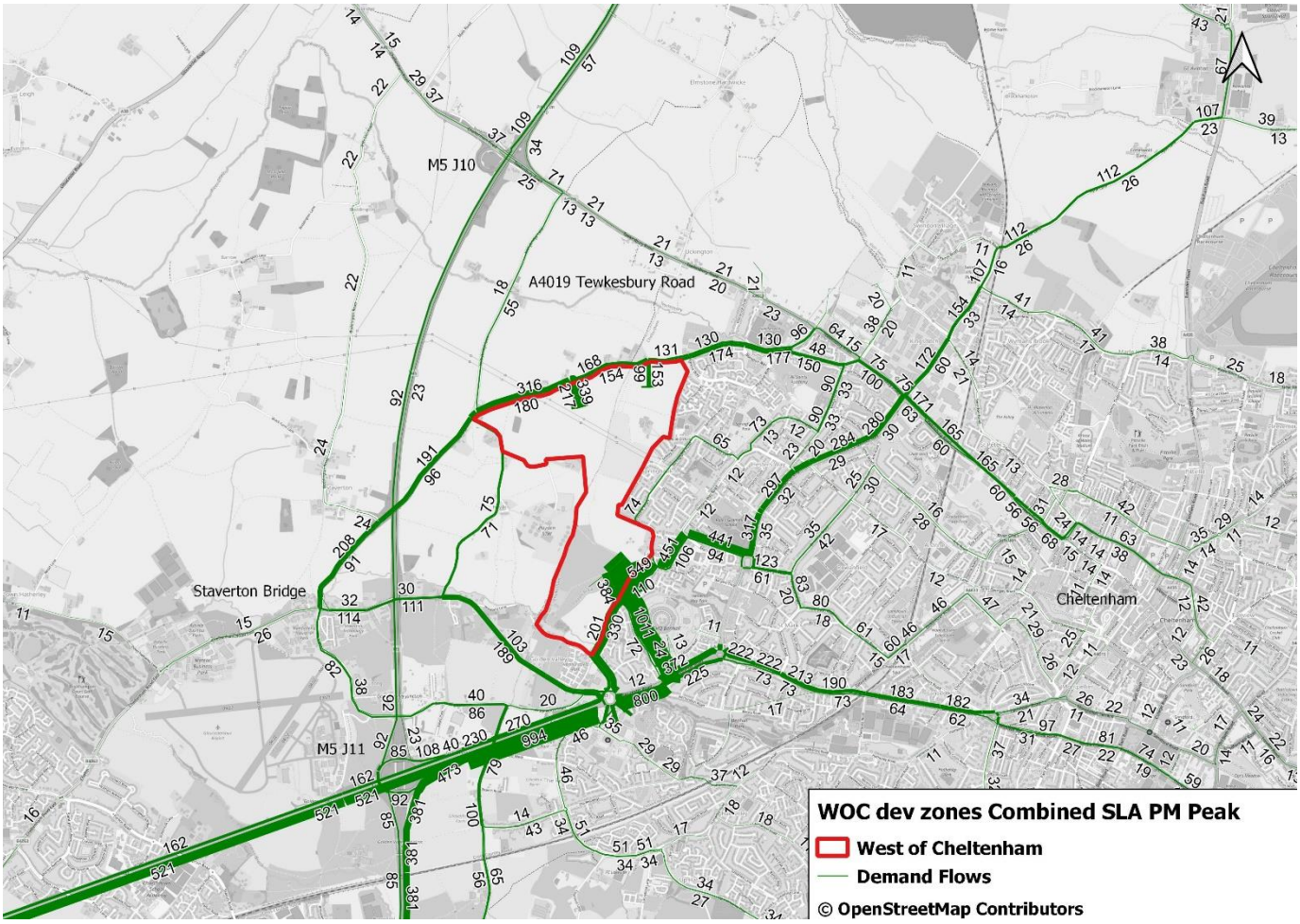


Figure 3-4 -Select Link Analysis - West of Cheltenham - PM Peak



Key observations

- In both the AM and PM peak, a large volume of development traffic is seen to use both Telstar Way and Fiddler's Green Lane. Flows are generally greater heading into the southern side of site (rather than leaving) via these two routes in the AM peak and vice versa in the PM peak, owing to the employment land located in this area. Most of the traffic using the southern access then uses the A40 corridor to the west of the Arle Court, travelling either to/from Gloucester or the M5 to the south via Junction 11.
- Notably, some southern development traffic travelling to/from central and north Cheltenham also travels through the residential area of Marsland Road to reach Princess Elizabeth Way. In the AM peak period, there is also high level of traffic routing via Springbank Road as an alternative to Marsland Road. This highlights a potential rat-running issue, with traffic avoiding congestion around the A40/Princess Elizabeth Way junction.
- As anticipated, accessing or egressing via the northern access points is seen to use either side of the B4634 Old Gloucester Road before dispersing across the wider network, routing by either Withybridge Lane, junctions with the A4019, Hayden Lane or the Staverton Bridge junction.

3.3 Flow difference analysis

To supplement select link analysis, further analysis was undertaken to understand the change in traffic flows for the Full Development with mitigation scenario relative to the Reference Case scenario on the local road network around Cheltenham in both the AM and PM peak periods. In general, flow difference plots would typically show increases which mirror the select link analysis distribution – but can also show where there is wider reassignment of existing traffic in response to congestion generated by development traffic. Results of these comparisons is displayed in Figure 3-5 and Figure 3-6 for the AM and PM peak respectively. Units are demand flows and in terms of PCUs.

Figure 3-5 - Flow Difference - AM Peak

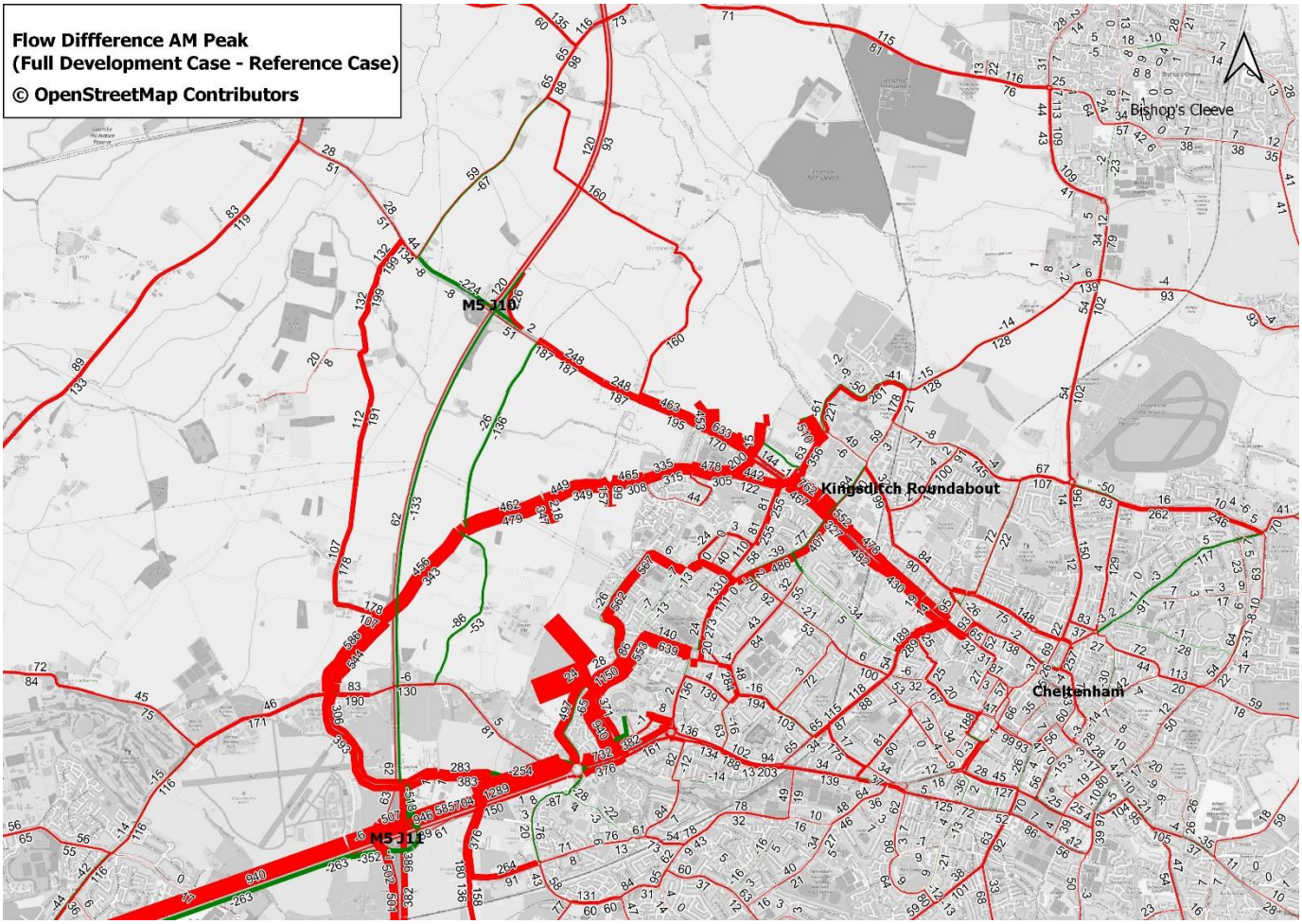
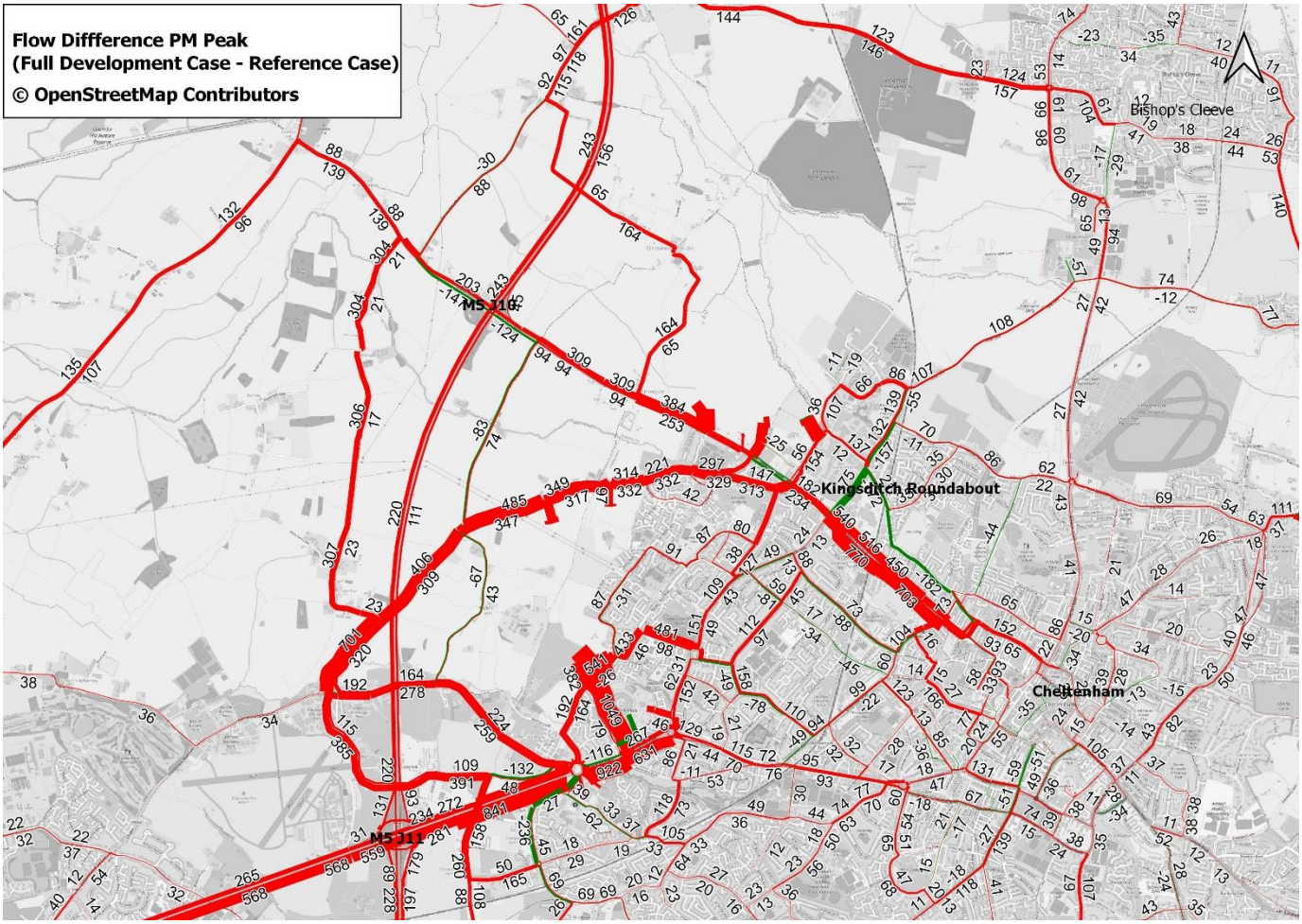


Figure 3-6 - Flow Difference - PM Peak



Key observations

- As expected given the scale of development, the introduction of the sites causes widespread increases in traffic flows across the west and north west areas of the Cheltenham local road network, as well as an increase in traffic on the M5. The largest increase in traffic flows is observed near the access of the two development sites, specifically along the B4634 Old Gloucester Road, Telstar Way, the A40 and A4019. There is also a large increase in flows in both directions on the road network directly east of the Kingsditch roundabout (converted to a signalised junction), which indicates that the Elms Park development improvement (implementation of a signalised junction, replacing the existing roundabout) is having a beneficial impact on traffic flow as more vehicles are utilising this segment of the network.
- There are some differences observed between the two peak hour periods. The most notable of these is that in the AM peak, traffic using the M5 mainline southbound between Junction 10 and Junction 11 and also the A40 westbound from Junction 11 shows a decrease in flow (whereas there is an increase in the PM peak). This is owing to delays on the M5 Junction 11 southbound off-slip (an unsignalised approach) with traffic having to give way to a large increase in traffic from the A40 (from Gloucester) and the M5 northbound off-slip. As such, some traffic which would use the M5 mainline is rerouting onto the local road network (such as the A38).
- The minor roads of Withybridge Lane and Hayden Lane also see a decrease in both directions during the AM peak whilst during the PM peak there is only decrease in the southbound direction. This is linked to delays present at either end of the junctions due to higher levels of traffic on the major roads connecting these routes – making it harder for traffic to turn out of the priority junctions, thus causing traffic to find alternative routes.
- Linked to the above point, in the AM peak, there is also a decrease in traffic flows observed on the eastbound carriageway on the A4019, just to the west of the M5 whilst in the PM peak there is a decrease in the

westbound direction. These decreases can be attributed to the large increase in flows on the unnamed road, running through the settlements of Staverton and Boddington, with traffic avoiding Withybridge Lane.

- In the PM peak, there are areas adjacent to the Arle Court roundabout, on the A40 near the southern access of the West of Cheltenham site, which see a decrease in traffic flows. Again, this decrease can be attributed to exacerbated delay and congestion within the area caused by development traffic, which will influence vehicles to utilise alternative routes.

In summary, in both peak hours, as would be expected both sites have a widespread impact that places significant additional demand on the local and strategic road network on the western side of Cheltenham. In the absence of the M5 Junction 10 Improvements scheme, there is clear evidence of traffic using less suitable rural roads in order to reach destinations outside of Cheltenham. More locally, there also potential issues with rat-running through residential areas, particularly to the west of Princess Elizabeth Way.

4. Detailed Traffic Analysis

4.1 Overview

Having demonstrated the broad impact of the two sites in terms of the distribution of development traffic based on the full level of development, this chapter presents more detailed analysis of the impact on the road network in based on three different levels of development build out. The levels of development include:

- 100% of the two sites – totalling 6,794 dwellings and 215,000 sqm of employment.
- 50% of the sites – totalling 3,397 dwellings and 107,500 sqm of employment
- The pre-defined 'deadweight' level – totalling 1,711 dwellings and 58,298 sqm of employment

Each level of development has been tested with and without the identified mitigation for Elms Park and is compared against the reference case scenario (which includes 260 dwellings for the already consented Swindon Farm site). The analysis focuses on changes in journey time for key routes and junction performance at key locations impacted by development traffic (based on the analysis of trip distribution presented in Chapter 3).

4.2 Journey time analysis

Analysis of the change in journey times for five strategic routes across Cheltenham was undertaken for each of the six modelled development scenarios, compared against the Reference Case scenario. These routes were selected based on the analysis of traffic flow distribution from the full development (including Elms Park mitigation) scenario. Journey time analysis was conducted in both directions and for both the AM and PM peak.

The routes are defined as follows:

- Red: A38 Coombe Hill Junction and A4019/High Street junction (Cheltenham Town Centre),
- Dark Blue: B4063 Cheltenham Road/Old Cheltenham Road and A4019/B4634 junction,
- Light Blue: Badgeworth Lane/Brookfield Road and A4019/B4634 junction,
- Yellow: Wymans Lane/Swindon Lane and B4063 Cheltenham Road/Old Cheltenham Road,
- Green: A4015/Lansdown Road/Montpellier Terrace (Cheltenham Town Centre) and M5 J11 Southbound off-slip/NB on-slip.

The routes are shown in Figure 4-1 with the results of the analysis presented in Table 4-1and Table 4-2 below (AM and PM peaks respectively). Cells highlighted red indicate a journey time increase of greater than 30 seconds (in comparison to the Reference case scenario). Cells highlighted green show a journey time saving. A breakdown of the results by section is provided in Appendix A.

Figure 4-1 - Journey Time Routes

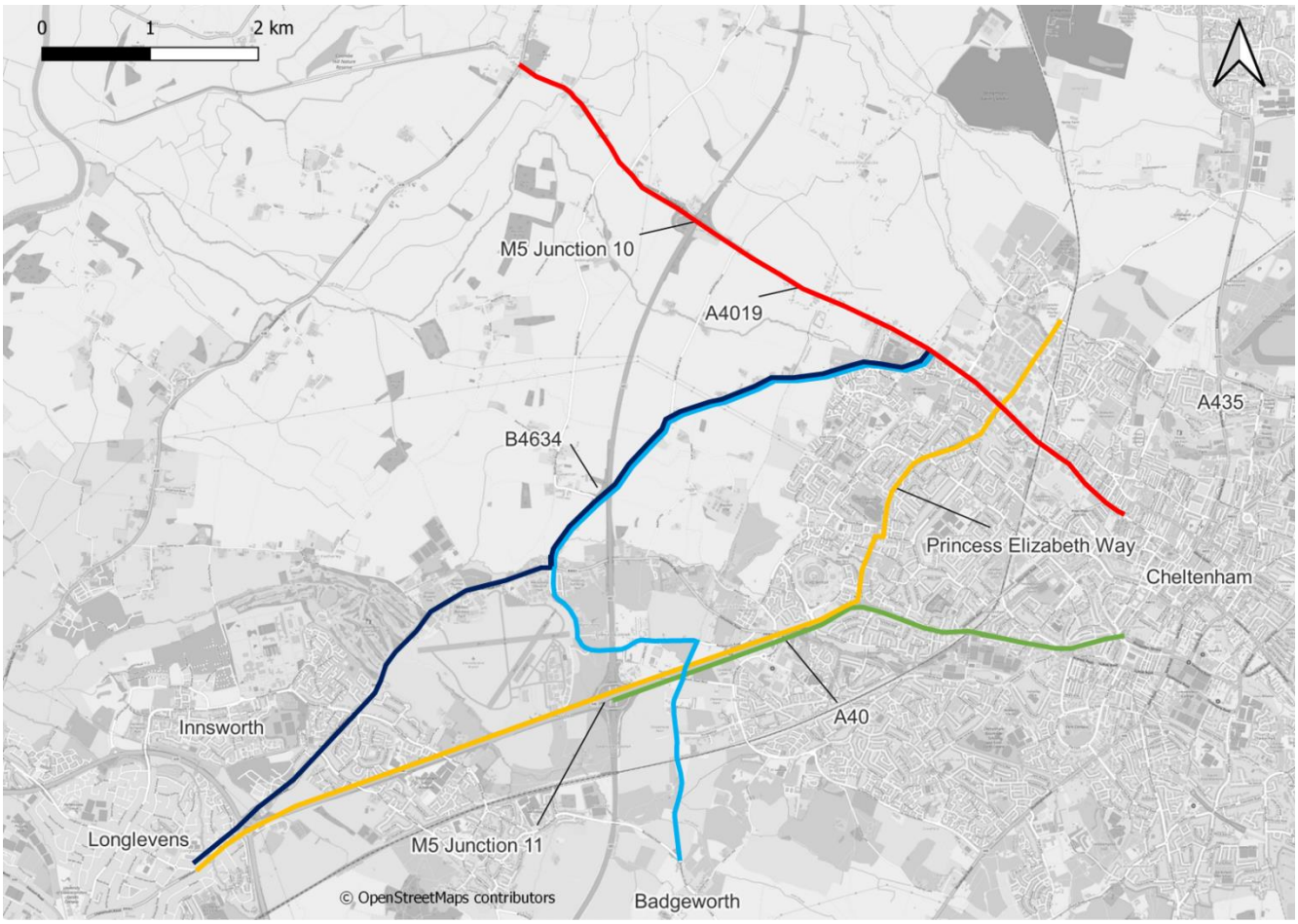


Table 4-1 – Journey time difference for AM Peak

Route Colour	Direction	Reference case	Deadweight with mitigation	Deadweight without mitigation	50% development with mitigation	50% development without mitigation	Full development with mitigation	Full development without mitigation
Red	Eastbound	09:17	+01:51	+01:30	+02:15	+02:06	+04:48	+05:19
	Westbound	11:06	+00:45	+01:22	+01:27	+02:27	+03:13	+05:34
Dark Blue	Eastbound	16:39	+00:22	+00:42	+00:45	+01:02	+03:04	+03:06
	Westbound	16:38	-00:08	+00:31	+00:21	+01:09	+01:10	+02:37
Light Blue	Southbound	09:10	-00:14	+00:29	+00:22	+01:02	+01:05	+02:41
	Northbound	10:45	-00:54	+00:44	-00:32	+00:59	+01:45	+03:27
Yellow	Southbound	15:16	+01:13	+00:27	+02:12	+01:18	+04:00	+02:52
	Northbound	14:54	+00:36	+00:31	+00:58	+01:03	+03:00	+02:50
Green	Westbound	09:30	+00:11	+00:17	+00:34	+00:46	+01:05	+01:53
	Eastbound	10:29	+02:23	+02:13	+04:09	+03:52	+07:49	+07:24

Table 4-2 – Journey time difference for PM Peak

Route Colour	Direction	Reference case	Deadweight with mitigation	Deadweight without mitigation	50% development with mitigation	50% development without mitigation	Full development with mitigation	Full development without mitigation
Red	Eastbound	08:43	+01:33	+01:10	+01:46	+01:23	+02:20	+01:54
	Westbound	14:52	-00:26	+01:08	+00:19	+02:08	+02:42	+05:28
Dark Blue	Eastbound	16:13	+00:12	+00:37	+00:25	+00:49	+00:56	+01:19
	Westbound	16:48	+00:17	+00:26	+00:40	+00:45	+02:02	+01:51
Light Blue	Southbound	08:57	+00:03	+00:24	+00:22	+00:39	+01:52	+01:46
	Northbound	10:25	-00:46	+00:48	-00:32	+01:15	+00:03	+03:18
Yellow	Southbound	16:03	+00:44	+00:27	+01:17	+01:04	+03:02	+02:45
	Northbound	14:48	+00:36	+00:19	+00:59	+00:46	+02:01	+01:45
Green	Westbound	10:06	+00:11	+00:43	+00:53	+01:37	+02:58	+03:44
	Eastbound	09:06	+00:14	+00:10	+00:29	+00:26	+00:47	+00:57

Key Observations

- In general, an increase in journey times is observed across both time periods as the level of development increases, in comparison to the observed Reference Case conditions. This trend is also matched broadly when comparing scenarios with the same level of development but with and without mitigation.
- In the case of the deadweight scenarios, the increases in journey time are generally less than a minute both with and without mitigation during both of the peak hour periods. The first exception to this is the red route – which shows increases of over one minute largely due to the introduction of two new signalised access points for the Elms Park site which inevitably introduces an element of delay. The green route eastbound direction also shows a large increase in delay during the AM peak – owing to large delays on the M5 J11 southbound off-slip The with mitigation scenario shows some journey time savings relative to the reference case – the largest of which are observed for the light blue route in the northbound direction which runs from Bamfurlong Lane to the Old Gloucester Road through the Staverton Bridge junction (where the mitigation improvement provides a beneficial impact).
- With 50% of development delivered, without mitigation several of the routes demonstrate increases in journey time of more than a minute during both peak hours. In addition to the increases seen with the deadweight level of development (which are exacerbated with more development), the green route in the westbound direction shows a particularly large increase during the PM peak – where a large level of employment traffic from the West of Cheltenham site uses the A40 to head towards M5 Junction 11. With Elms Park mitigation, some of the routes show a level of improvement (e.g. the red route in the westbound direction which benefits from the junction design change at the Princess Elizabeth Way/Kingsditch Lane junction) but this is offset to some level by increases in delay for other routes.
- With full development, journey times increase even further, with the majority of routes showing increases of at least two minutes without mitigation (and some routes showing delays of more than five minutes). Even with mitigation, all journey times are substantially higher than the reference case scenario, showing the Elms Park mitigation alone is not enough to address the widespread impact of development traffic on key routes.

4.3 Volume over capacity analysis

Having considered the distribution of traffic, as with the selection of journey time routes, 20 key junctions were selected for demand flow and capacity analysis – considering the Volume/Capacity (V/C) ratio for approach arms to the junctions. The V/C ratio acts as an indicator of congestion. Values have been categorised in bands as per Table 4-3.

Table 4-3 – V/C banding definitions

V/C Ratio (%)	Definition
0-70	Low levels of traffic for available capacity, congestion issues very unlikely.
70-85	Moderate levels of traffic for available capacity, congestion relatively unlikely.
85-100	High levels of traffic for available capacity, congestion likely.
>100	Traffic levels above available road capacity, heavily congestion and significant delays.

The selected junction locations are shown in Figure 4-2 and detailed in Table 4-4. The junctions are categorised according to their status either as development access points, other local road network junctions (LRN) or part of the strategic road network (SRN).

Figure 4-2 – Junctions identified for V/C analysis

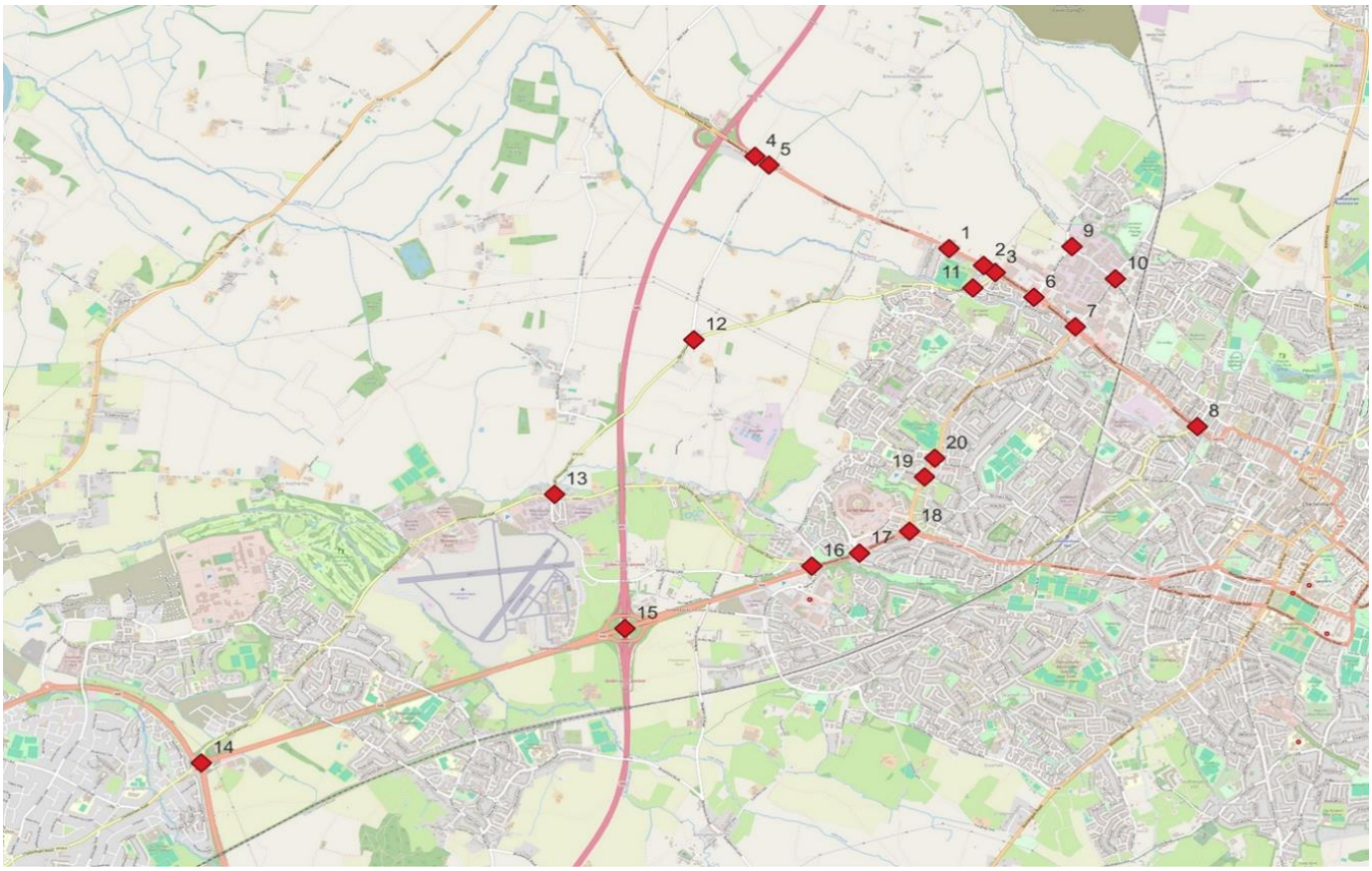


Table 4-4 - Critical Junction Description

Junction ID	Description	Class
1	Elms Park Development Access A	New
2	Elms Park Development Access B	New
3	Elms Park Development Access C (Gallagher Retail Park Junction)	LRN
4	M5 Junction 10	SRN
5	Withybridge Lane	LRN
6	Manor Road	LRN
7	Kingsditch Junction	LRN
8	Junction of Gloucester Road and A4019	LRN
9	Junction of Manor Road and Runnings Road	LRN
10	Junction of Wymans Lane and Swindon Road	LRN
11	Hayden Road Junction	LRN
12	Junction of Old Gloucester Road and Withybridge Lane	LRN
13	Staverton Bridge Junction	LRN
14	Elmbridge Court Roundabout	SRN
15	M5 Junction 11	SRN

Junction ID	Description	Class
16	Arle Court Roundabout	LRN
17	Junction of Telstar Way and A40	LRN
18	Benhall Roundabout	LRN
19	Junction of Princess Elizabeth Way and Shakespeare Road	LRN
20	Coronation Square	LRN

Table 4-5 and Table 4-6 display the overall findings of the V/C analysis for the AM and PM peaks respectively. They present the weighted average and maximum V/C recorded for each of the approach arms to the junction. Detailed results for each approach arm are displayed in Appendix B.

Key observations

- **Reference Case:** In the reference case scenario, it is notable that by 2041 there are already several junctions with approach arms operating near to or over capacity in the absence of development. There are seven junctions where this is the case in the AM peak and six in the PM peak. In the AM Peak period, the southbound off slip at M5 Junction 11 is found to have a V/C ratio of over 100, indicating significant delays at this location. Furthermore, there are several approaches to the Arle Court junction with V/C ratios of more than 85% (including the B4063, Fiddler's Green Lane and the A40 westbound approach). Generally speaking, conditions at key junctions are consistent across both time periods in the reference case scenario, with junctions that struggle in the AM Peak, also struggling in the PM Peak. An exception to this is the Withybridge junction with the A4019, which only suffers congestion in the PM Peak. The Kingsditch Junction is also found to have a V/C ratio of over 100 in the PM Peak, which is not the case in the AM Peak (although, still congested at 88%). With this said, the weighted average V/C value at the majority of key junctions in both the AM and PM Peak period are found to be below 70, reflecting that congestion issues are mostly related to certain approach arms rather than junctions as a whole.
- **Deadweight without mitigation:** in this scenario, conditions at the already over capacity/reaching maximum capacity junctions in the reference case scenario are exacerbated. In some cases such as the Arle Court junction, this results in some approach arms that were reaching their full capacity now being over-capacity with the relatively low level of development. The Princess Elizabeth Way approaches to the Coronation Square junction are also over capacity (both arms in the AM peak, northbound only in the PM peak), as is the High Street approach to the Gloucester Road/A4019 junction in the PM peak. Otherwise, there are no additional junctions where are approach arms are congested.
- **Deadweight with mitigation:** the situation with the Elms Park mitigation schemes is similar to the deadweight without mitigation. Where junctions had approach arms above 85% capacity without mitigation, this is still the case with mitigation - with the exception of the Kingsditch junction and Staverton Bridge junction which directly benefit from mitigation. In the PM peak, some junctions show poorer performance when the mitigation is included. This includes the now signalised Manor Road/Runnings Road junction to the north east Elms Park Access D (but noting that signalisation may potentially not be required with this level of development, whilst performance could potentially be improved through reviewing signal operation) and the B4364 Hayden Road junction where there is an increase in traffic on the opposed arm.
- **50% without mitigation:** with half of the two sites delivered, the existing capacity issues are exacerbated with a higher level of development. That said, the Wymans Lane/Swindon Road junction in the AM peak is the only new location where congestion is observed (where the Swindon Road westbound approach has a V/C of greater than 85%). **With mitigation included**, the impact of highway changes compared to equivalent situation without mitigation is similar to that observed for the deadweight situation. It is also noted that in the AM Peak, the maximum V/C ratio at M5 junction 10 is found to be over 85% in the 'with mitigation' scenario, which is not the case in the 'without mitigation scenario' suggesting this measure is not effective.

- **Full development:** In the full development scenarios, both with and without mitigation and across both time periods, the maximum V/C at the majority of the key junctions indicate that there is heavy congestion likely. In the AM Peak, the Full Development without mitigation scenario, the maximum V/C is found to be over 85% for 13 of the 20 junctions considered. This number actually increases to 15 with mitigation included. Similarly in the PM Peak, there are again 13 junctions with a maximum V/C of more than 85% in the without mitigation scenario and 14 in the with mitigation scenario. In the AM peak there are also several junctions where the weighted average V/C is greater than 85% - suggesting there is widespread congestion across the junctions. Most notably this includes the Arle Court junction and M5 Junction 11.

Table 4-5 - AM Peak weighted V/C ratio and maximum link V/C ratio

ID	Name	Reference case		Deadweight no mitigation		Deadweight with mitigation		50% no mitigation		50% with mitigation		Full development no mitigation		Full development with mitigation	
		Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max
1	Elms Park Access A	46	65	55	77	54	75	61	84	59	82	76	97	77	100
2	Elms Park Access B	54	65	45	58	43	56	52	67	51	67	60	78	62	80
3	Elms Park Access C	37	46	54	70	54	75	60	79	61	82	69	101	71	101
4	M5 Junction 10	33	43	36	47	69	78	41	53	75	87	43	54	76	90
5	Withybridge Lane	47	52	47	51	45	56	50	66	49	73	51	103	52	106
6	Manor Road	34	40	34	40	40	53	36	43	45	60	41	83	55	89
7	Kingsditch Junction	68	88	71	91	62	67	76	94	69	73	82	105	81	88
8	Gloucester Road / A4019	54	64	56	67	59	71	60	72	64	75	67	80	72	83
9	Manor Road / Runnings Road	22	27	32	37	71	84	42	47	80	90	63	74	93	98
10	Wymans Lane / Swindon Road	56	61	65	72	49	55	72	87	50	57	86	106	53	58
11	Hayden Road	29	37	34	43	41	53	41	52	51	66	62	85	70	97
12	Old Gloucester Road / Withybridge Lane	54	91	60	101	62	102	61	103	64	104	66	109	69	112
13	Staverton Bridge	64	86	68	92	33	40	72	96	40	50	84	103	45	55
14	Elmbridge Court	62	79	65	81	64	81	67	84	66	89	71	88	71	87
15	M5 Junction 11	74	101	77	108	77	108	80	113	80	113	85	118	85	119
16	Arle Court	72	98	77	102	76	101	80	105	80	105	86	110	86	108
17	Telstar Way / A40	61	71	63	75	62	74	63	77	61	75	71	77	70	76
18	Benhall Roundabout	64	86	67	93	66	91	70	98	68	97	75	102	73	100
19	Princess Elizabeth Way / Shakespeare Road	80	92	83	96	80	94	84	97	82	96	81	101	86	93
20	Coronation Square	71	79	83	92	76	82	94	100	87	93	98	108	96	104

Table 4-6 - PM Peak weighted V/C ratio and maximum link V/C ratio

ID	Name	Reference case		Deadweight no mitigation		Deadweight with mitigation		50% no mitigation		50% with mitigation		Full development no mitigation		Full development with mitigation	
		Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max
1	Elms Park Access A	41	50	54	57	54	60	59	63	57	61	67	78	66	72
2	Elms Park Access B	63	70	38	39	39	42	40	41	40	43	43	44	44	55
3	Elms Park Access C	42	48	56	70	59	78	60	72	63	82	67	78	71	89
4	M5 Junction 10	23	31	22	30	43	49	24	32	47	53	26	34	56	56
5	Withybridge Lane	68	96	70	96	74	101	73	100	75	102	74	113	74	113
6	Manor Road	34	41	32	36	41	46	34	41	43	49	37	60	46	54
7	Kingsditch Junction	73	102	74	102	67	75	77	104	70	76	83	108	76	79
8	Gloucester Road / A4019	58	81	59	83	69	91	63	86	71	93	68	96	75	96
9	Manor Road / Runnings Road	21	35	31	48	74	89	38	56	83	93	52	64	94	96
10	Wymans Lane / Swindon Road	66	71	68	76	50	64	74	82	52	68	86	92	61	93
11	Hayden Road	30	44	42	71	55	91	49	85	58	96	55	99	62	102
12	Old Gloucester Road / Withybridge Lane	36	42	42	53	47	57	51	66	56	72	55	84	63	89
13	Staverton Bridge	55	69	56	74	25	38	65	86	28	39	77	101	33	39
14	Elmbridge Court	63	95	63	95	63	94	65	95	64	95	65	95	65	94
15	M5 Junction 11	68	91	74	99	72	96	76	102	76	101	81	105	80	104
16	Arle Court	65	101	71	103	69	102	76	104	75	104	82	115	82	115
17	Telstar Way / A40	56	75	61	81	58	76	65	85	64	82	77	97	77	97
18	Benhall Roundabout	60	83	64	90	61	84	67	92	64	86	71	93	69	90
19	Princess Elizabeth Way / Shakespeare Road	73	87	77	92	75	90	80	94	77	93	82	94	80	96
20	Coronation Square	74	81	78	85	68	73	86	92	73	77	96	101	85	96

5. Summary and Conclusions

5.1 Summary

This report has presented a strategic modelling assessment of the West of Cheltenham and Elms Park development sites – establishing the impact on the surrounding network in the absence of the proposed M5 Junction 10 Improvements Scheme.

The assessment has been undertaken using the Gloucestershire County Multi Modal Model (GC3M) – a strategic model capable of demonstrating the widespread impacts on the two large-scale developments. Scenarios have been developed from the existing 2041 Foundation Case scenario – removing the M5 Junction 10 Improvement scheme and updating development assumptions for the surrounding area as set out by GCC.

Scenarios developed include:

- Full development – 6,794 dwellings, 215,000 sqm employment
- 50% development – 3,398 dwellings, 107,500 sqm employment
- 'Deadweight' development – 1,711 dwellings, 58,280 sqm employment – the level of development originally identified as deliverable in the absence of the M5 Junction 10 Improvement Scheme (as part of the scheme OBC appraisal).
- A reference case – 260 dwellings at Elms Park (Swindon Farm) already consented.

Separate scenarios have been developed for the full, 50% and deadweight scenarios – with one set including mitigation already identified for the Elms Park site, and the other set assuming the network is consistent with the reference case network (with the exception of development access points). Mitigation for the West of Cheltenham site has not been established.

Trip distribution is derived from the GC3M VDM process (run for the full development scenario). Following the VDM process, trip generation has been adjusted to match with trip rates for the two sites confirmed by GCC and the level of development associated with each test scenario..

5.2 Conclusions

As would be expected, the results presented in Chapter 4 show that as the level of development is increased, the level of impact on the surrounding road network becomes more severe. Based on the model results, the following conclusions are made:

- The 2041 reference case shows that already parts on the network with capacity issues at several junctions in the absence of further development.
- The Elms Park mitigation proposals do show some positive impacts across all of the scenarios including development. However, even with the deadweight level of development, there remain residual capacity issues at several junctions.
- In the deadweight scenarios, the capacity issues at the already congested junctions increase but for the most part, other key junctions are relatively unaffected (exceptions include the Coronation Square junction, High Street approach to the Gloucester Road/A4019/ junction). This suggests that the 'deadweight' position is potentially achievable in the absence of the M5 Junction 10 Improvements Scheme – but there may be some isolated junction improvements (above the identified Elms Park mitigation) required to ensure emerging capacity issues seen in the reference case are not exacerbated by new development.
- With 50% of development delivered, again problems are exacerbated where congestion issues were already observed in the reference case. Some of the biggest impacts are seen along the A40 corridor (particularly the

Arle Court junction and M5 Junction 11) but other locations such as the Withybridge Lane junctions are also shown to be far above their available capacity. This increases the need for further mitigation (that identified for the Elms Park site) in order to resolve the issues identified.

- With 100% development, there are widespread congestion issues across almost all of the junctions analysed (both with and without the Elms Park mitigation). This provides a clear indication that this level of development cannot be accommodated in the absence of major scheme intervention.

APPENDICES

Appendix A. Journey time differences by section

Figure A-1 - Sectored Journey Time Routes

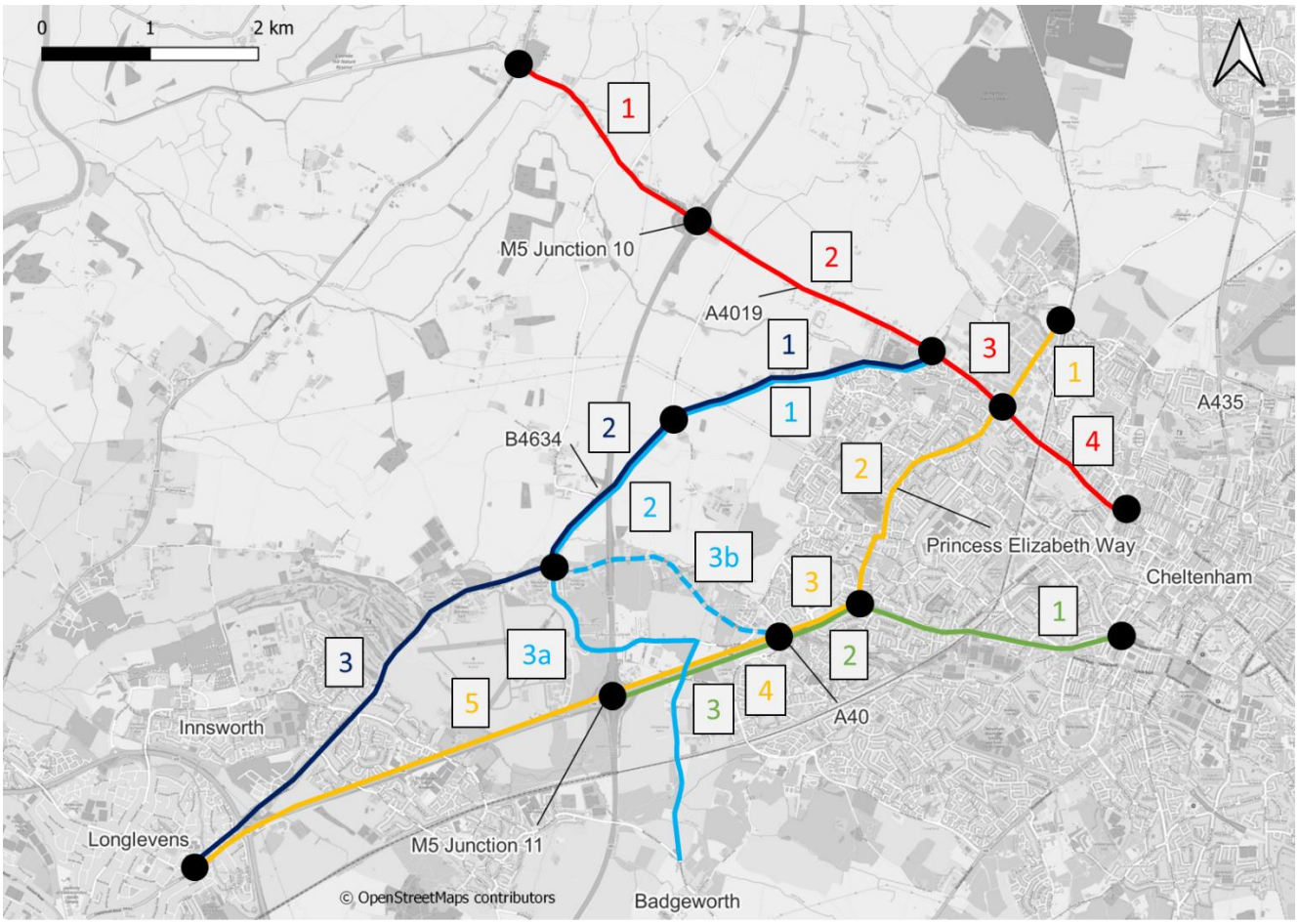


Table A-1 - Sectored Journey time difference for AM Peak

Route Colour	Sector Number	Direction	Reference case	Deadweight with mitigation	Deadweight without mitigation	50% development with mitigation	50% development without mitigation	Full development with mitigation	Full development without mitigation
Red	1	Eastbound	02:21	00:00	+00:22	+00:21	00:00	+00:21	00:00
		Westbound	04:02	+00:18	+00:18	+00:50	+00:49	+01:49	+01:38
	2	Eastbound	02:07	+01:29	+01:19	+01:33	+01:49	+03:40	+03:52
		Westbound	01:39	+00:34	+00:35	+00:36	+00:35	+00:42	+00:39
	3	Eastbound	02:03	00:00	+00:07	+00:12	+00:11	+00:24	+01:11
		Westbound	01:35	+00:18	+00:21	+00:23	+00:21	+00:28	+00:20
	4	Eastbound	02:46	+00:01	+00:03	+00:09	+00:06	+00:23	+00:16
		Westbound	03:50	+00:12	-00:29	-00:22	+00:42	+00:14	+02:57
Dark Blue	1	Westbound	02:36	+00:17	+00:18	+00:26	+00:20	+00:40	+00:25
		Eastbound	03:32	+00:40	+00:32	+00:48	+00:48	+02:52	+02:26
	2	Westbound	02:31	+00:07	-00:41	-00:35	+00:30	-00:31	+01:44
		Eastbound	01:27	+00:01	+00:11	+00:14	+00:03	+00:19	+00:05
	3	Westbound	11:31	+00:07	+00:15	+00:30	+00:19	+01:01	+00:28
		Eastbound	11:40	+00:01	-00:21	-00:17	+00:11	-00:07	+00:35
Light Blue	1	Westbound	02:36	+00:17	+00:18	+00:26	+00:20	+00:40	+00:25
		Eastbound	03:33	+00:39	+00:31	+00:46	+00:47	+02:50	+02:26
	2	Westbound	02:31	+00:07	-00:44	-00:38	+00:30	-00:34	+01:44
		Eastbound	01:27	+00:01	+00:11	+00:14	+00:03	+00:19	+00:05
	3a	Southbound	04:03	+00:05	+00:12	+00:34	+00:12	+00:59	+00:32

Route Colour	Sector Number	Direction	Reference case	Deadweight with mitigation	Deadweight without mitigation	50% development with mitigation	50% development without mitigation	Full development with mitigation	Full development without mitigation
		Northbound	05:45	+00:04	-01:36	-01:32	+00:09	-01:24	+00:56
	3b	Southbound	02:48	+01:07	+01:03	+02:16	+02:31	+03:48	+04:37
		Northbound	03:04	+00:06	-00:40	-00:39	+00:11	-00:34	+01:02
Yellow	1	Southbound	02:21	+00:03	+01:14	+01:46	+00:11	+03:04	+00:43
		Northbound	02:09	+00:03	-00:06	-00:03	+00:05	-00:03	+00:02
	2	Southbound	06:04	+00:23	00:00	+00:27	+01:06	+00:58	+02:08
		Northbound	05:44	+00:16	+00:32	+00:40	+00:37	+02:09	+01:57
	3	Westbound	01:44	+00:03	00:00	+00:02	+00:03	+00:03	+00:05
		Eastbound	01:39	+00:02	00:00	00:00	00:00	+00:07	+00:07
	4	Westbound	01:16	00:00	+00:01	+00:01	+00:01	+00:01	+00:01
		Eastbound	01:20	+00:02	+00:02	+00:06	+00:06	+00:14	+00:12
	5	Westbound	03:51	-00:02	-00:02	-00:04	-00:03	-00:06	-00:05
		Eastbound	04:02	+00:08	+00:08	+00:15	+00:15	+00:33	+00:32
Green	1	Westbound	05:08	+00:14	+00:09	+00:32	+00:42	+01:01	+01:47
		Eastbound	05:54	+00:04	+00:03	+00:09	+00:12	+00:25	+00:36
	2	Westbound	01:44	+00:02	+00:01	+00:02	+00:03	+00:03	+00:05
		Eastbound	01:39	+00:01	00:00	00:00	+00:01	+00:07	+00:07
	3	Westbound	02:38	+00:01	+00:01	00:00	+00:01	+00:01	+00:01
		Eastbound	02:56	+02:08	+02:03	+03:43	+03:54	+07:17	+06:41

Table A-2 - Sectored Journey time difference for PM Peak

Route Colour	Sector Number	Direction	Reference case	Deadweight with mitigation	Deadweight without mitigation	50% development with mitigation	50% development without mitigation	Full development with mitigation	Full development without mitigation
Red	1	Eastbound	02:14	00:00	+00:20	+00:21	+00:01	+00:27	+00:04
		Westbound	04:28	00:00	-00:04	-00:06	+00:03	-00:01	+00:08
	2	Eastbound	01:56	+01:10	+01:03	+01:10	+01:17	+01:22	+01:36
		Westbound	02:33	+00:40	+00:55	+01:19	+00:49	+02:26	+01:58
	3	Eastbound	01:56	-00:01	+00:06	+00:07	+00:01	+00:12	+00:05
		Westbound	02:00	+00:25	+00:39	+00:50	+00:30	+01:43	+00:50
	4	Eastbound	02:37	+00:01	+00:04	+00:08	+00:04	+00:19	+00:09
		Westbound	05:51	+00:03	-01:56	-01:44	+00:46	-01:26	+02:32
Dark Blue	1	Westbound	02:43	+00:19	+00:27	+00:40	+00:25	+01:50	+01:05
		Eastbound	03:29	+00:39	+00:31	+00:35	+00:40	+00:54	+00:52
	2	Westbound	02:10	+00:02	-00:25	-00:23	+00:06	-00:19	+00:16
		Eastbound	01:27	+00:01	+00:09	+00:15	+00:03	+00:22	+00:03
	3	Westbound	11:55	+00:05	+00:15	+00:23	+00:14	+00:31	+00:30
		Eastbound	11:17	-00:03	-00:28	-00:25	+00:06	-00:20	+00:24
Light Blue	1	Westbound	02:43	+00:19	+00:27	+00:40	+00:25	+01:50	+01:05
		Eastbound	03:29	+00:38	+00:31	+00:35	+00:39	+00:54	+00:52
	2	Westbound	02:10	+00:02	-00:27	-00:25	+00:06	-00:22	+00:16
		Eastbound	01:27	+00:01	+00:09	+00:14	+00:03	+00:22	+00:03
	3a	Southbound	04:04	+00:03	+00:03	+00:07	+00:08	+00:24	+00:25

Route Colour	Sector Number	Direction	Reference case	Deadweight with mitigation	Deadweight without mitigation	50% development with mitigation	50% development without mitigation	Full development with mitigation	Full development without mitigation
		Northbound	05:29	+00:09	-01:26	-01:21	+00:33	-01:13	+02:23
	3b	Southbound	02:15	+00:04	+00:07	+00:11	+00:06	-02:15	+00:15
		Northbound	03:02	+00:05	-00:42	-00:38	+00:20	-03:02	+01:25
Yellow	1	Southbound	02:47	-00:06	+00:36	+00:39	+00:01	+00:43	+00:09
		Northbound	02:20	+00:04	+00:02	+00:05	+00:07	+00:27	+00:14
	2	Southbound	06:04	+00:17	-00:02	+00:08	+00:28	+00:38	+00:44
		Northbound	05:47	+00:11	+00:31	+00:49	+00:33	+01:25	+01:22
	3	Westbound	01:48	+00:06	+00:02	+00:09	+00:14	+00:49	+00:55
		Eastbound	01:32	+00:02	+00:01	+00:01	+00:02	+00:01	+00:02
	4	Westbound	01:17	+00:04	+00:03	+00:07	+00:08	+00:24	+00:28
		Eastbound	01:16	00:00	00:00	+00:01	+00:01	+00:02	+00:02
	5	Westbound	04:07	+00:06	+00:05	+00:14	+00:13	+00:28	+00:29
		Eastbound	03:53	+00:02	+00:02	+00:03	+00:03	+00:06	+00:05
Green	1	Westbound	05:31	+00:18	+00:01	+00:09	+00:26	+00:17	+00:38
		Eastbound	05:38	+00:08	+00:13	+00:27	+00:24	+00:43	+00:53
	2	Westbound	01:48	+00:06	+00:02	+00:09	+00:14	+00:50	+00:55
		Eastbound	01:33	+00:01	00:00	00:00	00:00	00:00	+00:01
	3	Westbound	02:47	+00:19	+00:08	+00:35	+00:57	+01:51	+02:11
		Eastbound	01:55	+00:01	+00:01	+00:02	+00:02	+00:04	+00:03

Appendix B. V/C ratio for individual approach arms

Table B-1 - AM Demand Flow and VC Ratios

ID	Name	Road Name	Dir	Demand Flow							V/C Ratio						
				Ref case	DW no mitigation	DW with mitigation	50% with mitigation	50% no mitigation	Full with mitigation	Full no mitigation	Ref case	DW no mitigation	DW with mitigation	50% with mitigation	50% no mitigation	Full with mitigation	Full no mitigation
1	Elms Park Access A	A4019 Tewkesbury Road - West	EB	1068	1132	1096	1204	1239	1522	1489	65	77	75	82	84	100	97
		Development link	SB	0	152	152	351	351	690	690	0	18	18	41	41	81	81
		A4019 Tewkesbury Road - East	WB	765	716	723	803	788	931	852	19	29	30	33	32	38	33
2	Elms Park Access B	A4019 Tewkesbury Road - West	EB	1111	1210	1172	1393	1407	1735	1679	65	58	56	67	67	80	78
		Development link	SB	0	3	7	9	4	15	7	0	1	2	3	1	4	2
		A4019 Tewkesbury Road - East	WB	765	713	716	794	784	917	845	38	22	22	25	24	28	25
3	Elms Park Access C	Gallagher Retail Park Stub Road	SB	6	55	50	87	99	176	156	1	15	14	24	27	48	42
		A4019 Tewkesbury Road - West	WB	932	840	864	941	897	1099	961	29	47	48	52	50	60	50
		A4019 Tewkesbury Road – East	NB	513	566	613	665	632	711	680	31	70	75	82	79	101	101
		B4634 Hayden Road	EB	1111	1177	1088	1317	1377	1580	1619	46	53	49	59	61	67	69
4	M5 J10	Off-slip	SB	837	919	909	1020	1026	1055	1068	43	47	78	87	53	90	54
		A4019	EB	683	635	553	499	576	454	459	21	20	54	48	19	44	15
5	Withybridge Junction	A4019 Tewkesbury Road - West	EB	1520	1554	1462	1519	1602	1509	1527	52	51	45	47	51	42	43
		A4019 Tewkesbury Road - East	WB	763	738	748	778	783	946	904	40	38	39	41	41	54	49
		Withybridge Lane	NB	254	306	355	382	332	226	288	43	51	56	73	66	106	103
6	Manor Road Junction	Manor Road	SB	53	33	152	273	44	450	49	26	23	31	46	25	68	26
		A4019 Tewkesbury Road – West	WB	987	927	985	1092	972	1449	1060	26	25	29	32	26	42	27
		A4019 Tewkesbury Road – East	NB	73	90	233	262	100	391	195	32	39	53	60	43	89	83
		Hayden Road	EB	1391	1399	1268	1387	1504	1525	1646	40	40	48	53	43	56	46
7	Kingsditch Junction	A4019 Tewkesbury Road - West	EB	1173	1198	1255	1508	1309	1943	1442	68	69	58	70	76	88	81
		Kingsditch Lane	SB	1057	1140	902	969	1325	1106	1581	55	59	64	68	69	77	80
		A4019 Tewkesbury Road - East	WB	664	681	734	807	711	989	793	88	91	67	73	94	88	105
		Princess Elizabeth Way	NB	1166	1214	1007	1016	1214	1081	1263	69	72	63	64	71	64	72

ID	Name	Road Name	Dir	Demand Flow							V/C Ratio						
				Ref case	DW no mitigation	DW with mitigation	50% with mitigation	50% no mitigation	Full with mitigation	Full no mitigation	Ref case	DW no mitigation	DW with mitigation	50% with mitigation	50% no mitigation	Full with mitigation	Full no mitigation
8	Junction of Gloucester Road and A4019	A4019 Tewkesbury Road	EB	919	953	1025	1137	1067	1340	1208	52	54	58	64	60	73	65
		High Street	WB	840	858	966	1033	901	1120	1026	64	67	71	75	72	83	80
		B4633 Gloucester Road	NB	760	790	844	889	817	1044	937	44	46	48	51	47	60	54
9	Junction of Manor Road and Runnings Road	Manor Road - North	SB	126	189	184	225	202	346	278	23	37	54	63	42	87	67
		Runnings Road	WB	291	516	243	261	604	283	874	16	29	84	90	35	98	48
		Manor Road - South	NB	465	541	458	529	755	600	1103	27	33	71	82	47	94	74
10	Junction of Wymans Lane and Swindon Road	Runnings Road	EB	165	254	94	136	400	214	704	19	26	14	17	37	23	59
		Wymans Lane	SB	828	875	781	797	944	820	1096	57	62	55	57	71	58	92
		Swindon Road	WB	651	772	635	699	855	847	808	58	72	45	47	87	55	106
		Kingsditch Lane	NB	835	929	702	734	939	746	1020	61	72	49	52	75	53	81
11	Hayden Road Junction	Hayden Road - North	SB	262	304	348	495	437	603	569	16	18	21	29	26	35	32
		Hayden Road - East	WB	94	110	150	176	117	216	111	21	25	37	47	27	43	23
		Hayden Road - West	EB	555	622	689	776	715	1031	948	37	43	53	66	52	97	85
12	Junction of Old Gloucester Road and Withybridge	B4634 Old Gloucester Road - West	EB	530	623	745	828	707	896	846	40	46	55	61	52	66	62
		Withybridge Lane	SB	427	447	413	367	408	288	350	91	101	102	104	103	112	109
		B4634 Old Gloucester Road - East	WB	225	270	315	479	384	703	528	20	23	27	39	32	56	42
13	Staverton Bridge Junction	B4634 Old Gloucester Road - North	SB	470	508	635	805	530	905	576	86	92	40	50	96	55	103
		B4063 Gloucester Road - East	WB	173	212	264	286	234	361	264	38	43	21	25	50	32	90
		Bamfurlong Way	NB	49	49	322	366	53	442	60	76	78	28	33	84	42	92
		B4063 Cheltenham Road East	EB	222	221	229	243	257	267	322	34	34	35	36	37	37	43
14	Elmbridge Court roundabout	A40 - East	WB	2400	2340	2325	2229	2249	2116	2177	44	43	42	40	40	37	38
		A417	NB	1976	2043	2030	2101	2119	2196	2222	79	81	81	83	84	87	88
		B4063 Cheltenham Road	EB	700	765	766	823	821	943	935	48	53	53	56	56	65	64
		A40 - North	SB	2185	2264	2260	2324	2317	2448	2441	77	79	79	81	80	84	83
		B4063 Cheltenham Road East	WB	762	793	794	829	820	917	866	50	57	56	64	64	84	79
15	M5 J11	A40 - West	EB	565	557	558	550	552	549	551	54	62	60	69	70	82	83

ID	Name	Road Name	Dir	Demand Flow							V/C Ratio						
				Ref case	DW no mitigation	DW with mitigation	50% with mitigation	50% no mitigation	Full with mitigation	Full no mitigation	Ref case	DW no mitigation	DW with mitigation	50% with mitigation	50% no mitigation	Full with mitigation	Full no mitigation
		M5 North	SB	961	817	830	639	630	433	440	101	108	108	113	113	119	118
		A40 - East	WB	1125	1152	1138	1146	1162	1178	1194	62	58	58	53	54	51	51
		M5 - South	NB	1160	1311	1300	1458	1467	1646	1644	72	82	81	91	91	102	102
16	Arle Court Roundabout	B4063 Gloucester Road	EB	424	341	349	259	254	172	165	92	102	101	105	105	108	110
		Fiddlers Green Lane	SB	157	175	178	234	226	124	117	87	91	91	95	95	91	90
		A40 - East	WB	2228	2347	2281	2351	2436	2592	2675	63	66	64	66	68	72	73
		Hatherley Lane	NB	700	675	697	677	639	684	673	98	101	101	103	103	104	107
		A40 - West	EB	3631	3998	3979	4305	4312	4857	4815	70	76	76	81	82	91	90
17	Junction of Telstar Way and A40	Telstar Way	SB	270	344	317	399	418	637	650	19	24	22	28	29	44	45
		A40 - East	WB	1977	2088	2042	2075	2154	2126	2204	71	75	74	75	77	76	77
		A40 - West	EB	2650	2682	2648	2581	2615	3343	3381	58	58	57	56	56	71	72
18	Benhall Roundabout	Princess Elizabeth Way	SB	986	1034	995	1039	1105	1101	1179	41	43	41	43	46	45	47
		A40 - East	WB	1365	1469	1437	1536	1558	1598	1640	86	93	91	97	98	100	102
		A40 - West	EB	2041	2119	2060	2062	2116	2394	2434	60	62	60	60	61	69	70
19	Junction of Princess Elizabeth Way and Shakespeare Road	Princess Elizabeth Way - North	SB	1042	1081	1055	1087	1102	1021	1052	92	96	94	96	97	88	88
		Shakespeare Road	WB	86	94	90	122	157	225	264	57	60	59	69	79	93	101
		Princess Elizabeth Way - South	NB	842	905	843	834	883	834	860	67	71	66	65	69	82	66
20	Coronation Square	Princess Elizabeth Way	a - NB	893	949	888	874	921	854	875	79	92	82	92	100	102	104
		Edinburgh Place	a - WB	378	455	410	476	482	518	532	55	75	64	88	95	104	108
		Princess Elizabeth Way	a - SB	890	985	947	1071	1129	1139	1173	77	86	82	93	98	99	100
		Marsland Road	a - EB	146	167	169	209	203	286	283	32	38	34	39	42	47	47

Table B-2 - PM Demand Flow and VC Ratios

ID	Name	Road Name	Dir	Demand Flow							V/C Ratio						
				Ref case	DW no mitigation	DW with mitigation	50% with mitigation	50% no mitigation	Full with mitigation	Full no mitigation	Ref case	DW no mitigation	DW with mitigation	50% with mitigation	50% no mitigation	Full with mitigation	Full no mitigation
1	Elms Park Access A	A4019 Tewkesbury Road - West	EB	805	787	755	897	787	1,183	1,187	50	54	47	56	63	72	78
		Development link	SB	-	94	94	219	94	431	431	-	11	12	29	26	56	51
		A4019 Tewkesbury Road - East	WB	1,415	1,402	1,491	1,527	1,402	1,628	1,585	35	57	60	61	60	64	63
2	Elms Park Access B	A4019 Tewkesbury Road - West	EB	850	796	763	847	796	988	1,011	50	35	34	37	39	43	44
		Development link	SB	-	25	64	57	25	131	47	-	11	27	24	10	55	20
		A4019 Tewkesbury Road - East	WB	1,415	1,377	1,428	1,470	1,377	1,519	1,538	70	39	42	43	41	43	43
3	Elms Park Access C	Gallagher Retail Park Stub Road	SB	270	453	373	453	453	559	559	35	55	45	55	58	67	67
		A4019 Tewkesbury Road - West	WB	1,428	1,006	1,098	1,149	1,006	1,243	1,145	48	70	78	82	72	89	78
		A4019 Tewkesbury Road – East	NB	460	438	475	531	438	647	650	30	62	64	67	66	77	77
		B4634 Hayden Road	EB	850	793	755	839	793	992	1,004	38	37	35	39	41	46	47
4	M5 J10	Off-slip	SB	600	582	569	610	582	643	659	31	30	49	53	32	55	34
		A4019	EB	391	376	350	401	376	589	649	11	11	34	38	12	56	19
5	Withybridge Junction	A4019 Tewkesbury Road - West	EB	991	958	919	1,011	958	1,231	1,308	29	29	28	32	32	40	42
		A4019 Tewkesbury Road - East	WB	1,327	1,323	1,326	1,343	1,323	1,398	1,403	96	96	99	100	97	100	100
		Withybridge Lane	NB	246	301	310	335	301	161	138	75	86	101	102	100	113	113
6	Manor Road Junction	Manor Road	SB	11	18	167	144	18	256	154	41	36	42	40	41	50	60
		A4019 Tewkesbury Road – West	WB	1,420	1,303	1,476	1,557	1,303	1,619	1,484	37	34	46	49	36	51	38
		A4019 Tewkesbury Road – East	NB	43	45	139	176	45	244	99	19	20	31	39	25	54	43
		Hayden Road	EB	1,099	1,031	942	990	1,031	1,024	1,196	31	29	33	34	31	35	34

ID	Name	Road Name	Dir	Demand Flow							V/C Ratio						
				Ref case	DW no mitigation	DW with mitigation	50% with mitigation	50% no mitigation	Full with mitigation	Full no mitigation	Ref case	DW no mitigation	DW with mitigation	50% with mitigation	50% no mitigation	Full with mitigation	Full no mitigation
7	Kingsditch Junction	A4019 Tewkesbury Road - West	EB	1,052	1,012	955	1,029	1,012	1,244	1,259	61	59	56	60	64	72	72
		Kingsditch Lane	SB	1,342	1,346	915	945	1,346	987	1,439	71	71	73	76	71	79	75
		A4019 Tewkesbury Road - East	WB	764	765	1,224	1,258	765	1,286	812	102	102	75	76	104	78	108
		Princess Elizabeth Way	NB	1,143	1,201	971	1,040	1,201	1,158	1,469	68	71	64	69	77	77	86
8	Junction of Gloucester Road and A4019	A4019 Tewkesbury Road	EB	818	844	946	1,018	844	1,209	1,082	46	47	53	56	52	66	60
		High Street	WB	955	968	1,223	1,234	968	1,201	876	81	83	91	93	86	96	96
		B4633 Gloucester Road	NB	718	725	978	1,003	725	1,034	847	42	43	57	58	45	60	50
9	Junction of Manor Road and Runnings Road	Manor Road - North	SB	102	166	116	158	166	209	189	35	48	65	75	56	86	64
		Runnings Road	WB	238	307	171	196	307	250	566	19	23	89	93	30	96	38
		Manor Road - South	NB	302	494	451	512	494	605	882	17	32	71	81	38	96	59
10	Junction of Wymans Lane and Swindon Road	Runnings Road	EB	205	371	232	268	371	341	645	38	54	31	33	59	42	82
		Wymans Lane	SB	772	729	664	648	729	610	782	60	61	48	46	64	42	77
		Swindon Road	WB	771	759	484	534	759	596	906	71	72	38	41	78	42	89
		Kingsditch Lane	NB	1,027	1,078	824	860	1,078	944	1,233	71	76	64	68	82	93	92
11	Hayden Road Junction	Hayden Road - North	SB	441	247	221	292	247	501	417	26	15	13	17	16	30	24
		Hayden Road - East	WB	178	426	558	559	426	490	523	44	71	91	96	85	102	99
		Hayden Road - West	EB	406	414	467	552	414	702	608	29	28	33	41	31	57	39
12	Junction of Old Gloucester Road and Withybridge	B4634 Old Gloucester Road - West	EB	537	613	680	815	613	872	708	40	46	51	61	55	65	52
		Withybridge Lane	SB	185	229	223	251	229	258	282	42	53	57	72	66	89	84
		B4634 Old Gloucester Road - East	WB	300	340	425	506	340	642	553	25	28	35	41	33	50	44

ID	Name	Road Name	Dir	Demand Flow							V/C Ratio						
				Ref case	DW no mitigation	DW with mitigation	50% with mitigation	50% no mitigation	Full with mitigation	Full no mitigation	Ref case	DW no mitigation	DW with mitigation	50% with mitigation	50% no mitigation	Full with mitigation	Full no mitigation
13	Staverton Bridge Junction	B4634 Old Gloucester Road - North	SB	405	419	431	451	419	480	516	67	69	28	29	75	30	84
		B4063 Gloucester Road - East	WB	71	96	187	252	96	407	127	20	25	14	19	52	30	87
		Bamfurlong Way	NB	39	43	245	316	43	423	86	69	74	21	27	86	38	101
		B4063 Cheltenham Road East	EB	178	169	167	176	169	178	242	39	38	38	39	41	39	46
14	Elmbridge Court roundabout	A40 - East	WB	2,169	2,298	2,275	2,418	2,298	2,721	2,731	40	43	42	45	45	50	50
		A417	NB	2,394	2,400	2,391	2,399	2,400	2,401	2,425	95	95	94	95	95	94	95
		B4063 Cheltenham Road	EB	680	692	700	712	692	743	741	46	47	48	48	48	50	50
		A40 - North	SB	1,772	1,787	1,794	1,805	1,787	1,804	1,774	63	63	63	64	63	63	62
		B4063 Cheltenham Road East	WB	742	768	759	769	768	799	777	43	44	44	45	45	47	46
15	M5 J11	A40 - West	EB	616	615	623	619	615	635	637	47	51	49	51	53	56	59
		M5 North	SB	865	900	910	920	900	956	939	59	63	64	66	65	72	71
		A40 - East	WB	1,608	1,753	1,701	1,792	1,753	1,878	1,897	91	99	96	101	102	104	105
		M5 - South	NB	759	791	798	831	791	886	891	47	49	50	52	51	55	55
16	Arle Court Roundabout	B4063 Gloucester Road	EB	504	566	559	608	566	682	678	54	65	63	71	71	80	84
		Fiddlers Green Lane	SB	232	326	333	339	326	372	358	65	100	100	104	104	115	115
		A40 - East	WB	2,588	2,865	2,722	3,058	2,865	3,500	3,520	73	81	77	86	88	96	97
		Hatherley Lane	NB	543	382	426	301	382	178	186	101	103	102	104	104	106	106
		A40 - West	EB	2,757	2,913	2,902	3,013	2,913	3,172	3,128	53	56	56	58	58	60	59
17	Junction of Telstar Way and A40	Telstar Way	SB	534	700	680	941	700	1,258	1,261	38	50	48	67	67	88	89
		A40 - East	WB	2,064	2,231	2,107	2,277	2,231	2,685	2,707	75	81	76	82	85	97	97

ID	Name	Road Name	Dir	Demand Flow							V/C Ratio						
				Ref case	DW no mitigation	DW with mitigation	50% with mitigation	50% no mitigation	Full with mitigation	Full no mitigation	Ref case	DW no mitigation	DW with mitigation	50% with mitigation	50% no mitigation	Full with mitigation	Full no mitigation
		A40 - West	EB	1,891	1,921	1,894	1,856	1,921	1,751	1,816	41	42	41	40	41	37	39
18	Benhall Roundabout	Princess Elizabeth Way	SB	1,153	1,237	1,196	1,330	1,237	1,542	1,546	48	52	50	55	56	64	64
		A40 - East	WB	1,320	1,420	1,324	1,368	1,420	1,425	1,487	83	90	84	86	92	90	93
		A40 - West	EB	1,720	1,802	1,774	1,813	1,802	1,965	2,034	51	53	52	53	55	57	59
19	Junction of Princess Elizabeth Way and Shakespeare Road	Princess Elizabeth Way - North	SB	968	1,021	999	1,029	1,021	1,072	1,054	87	92	90	93	94	96	94
		Shakespeare Road	WB	70	94	82	98	94	112	131	56	63	54	60	66	64	75
		Princess Elizabeth Way - South	NB	757	806	761	773	806	812	916	57	61	58	58	63	61	68
		Princess Elizabeth Way	a - NB	806	847	786	800	847	830	921	81	85	73	76	92	80	100
20	Coronation Square	Edinburgh Place	a - WB	563	557	447	463	557	464	611	78	82	64	69	92	75	99
		Princess Elizabeth Way	a - SB	833	879	845	854	879	876	923	71	76	73	77	81	87	87
		Marsland Road	a - EB	95	194	195	338	194	576	444	24	42	35	60	72	96	101

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