Oxford Trial Traffic Filters

Transport and Traffic Forecasting

Oxfordshire County Council

October 2022

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Acronyms and Glossary of Terminology

Acronym	Description
ATC	Automatic Traffic Counts
DfT	Department for Transport
LMVR	Local Model Validation Report
OCC	Oxfordshire County Council
OD	Origin - Destination
OSM	Oxfordshire Strategic Model
P&R	Park and Ride
PCU	Passenger Car Unit
TAG	Transport Analysis Guidance

1. Introduction

1.1. Purpose of Report

This report provides details of transport modelling carried out on the trial traffic filters proposal which was recently subject to a pre-Experimental Traffic Regulation Order consultation (5th September to 13th October).

The modelling includes the six proposed traffic filters in place at the following locations operating between 7am and 7pm:

- Thames Street
- Hythe Bridge Street
- St Cross Road
- St Clements
- Marston Ferry Road
- Hollow Way

The modelling also takes account of proposed filter exemptions and permits including resident day passes.

The report sets out the approach to produce forecasts in 2024 for a Do Minimum (without traffic filters) and a Do Something (with traffic filters) scenario, including key assumptions adopted, and details the estimated impacts of introducing the filters.

1.2. Interpretation of results - caveats and limitations

Traffic filters, and the exemptions that form part of the scheme, will lead to a complex range of behavioural responses besides changing route, such as changing destination or mode for example. The modelling approach has been developed to best represent and forecast these responses. However, there are inherent uncertainties in any forecasting exercise. The complex nature of the traffic filter proposals from a modelling and ‘real world’ perspective, in which a variety of behavioural responses are possible, means that the modelling results should be used to support an understanding of the likely impacts of the proposals at a strategic level, but should not be seen as a precise forecast of impacts. The model itself is a strategic model – representing the whole of Oxfordshire and beyond – and is therefore more reliable in terms of its forecast impacts at a strategic level e.g. impacts on overall car demand, and less reliable at more granular levels of detail.

It should also be noted that the modelling does not take full account of the potentially lasting behavioural changes resulting from the COIVD-19 pandemic. While the nature of these changes is clear for certain trips e.g. more working from home, the scale of any lasting impacts remain uncertain. In broad terms[1], traffic levels in the morning peak remain around 10% below their pre-pandemic levels, whereas trips in the inter-peak and evening peak are closer to the pre-pandemic level.

The impact of COVID-19 on bus demand has been more significant. Overall bus demand in Oxford (within the SmartZone area) remains at less than 85% of its 2019 pre-pandemic level. and, within this figure, the shortfall in park & ride demand compared to 2019 is greater. The reduction in bus demand (and hence revenues), combined with slow and unreliable journey times (which increase the costs of bus operation) combine to threaten the long-term viability of the commercial bus network. A key objective of traffic filters is to address this threat by improving bus journey times (through a reduction of car traffic in the City) resulting in increased trips by bus.

1.3. The Oxfordshire Strategic Model

The Oxfordshire Strategic Model (OSM) has been used to help develop and estimate impacts of the traffic filters. OSM covers Oxfordshire in some detail and extends to the rest of Great Britain. The model consists of three key elements:

- a Highway Assignment Model (HAM) in SATURN representing vehicle-based movements within and across the Oxfordshire County for a 2018 October weekday morning peak hour (08:00 – 09:00), an average inter-peak hour (10:00 – 16:00) and an evening peak hour (17:00 – 18:00)
- a Public Transport Assignment Model (PTAM) in EMME representing bus and rail-based movements across the same area and for the same time periods, month and year; and
- a multi-modal pivot incremental Variable Demand Model (VDM), coded in EMME, that estimates frequency choice, main mode choice, time period choice, destination choice, and sub-mode choice in response to changes in generalised costs of travel across the 24-hour period (07:00 – 07:00).

Further details of OSM including the model development, and the model updates carried out in Oxford city, are described in the "Oxfordshire Strategic Model - Local Update for Oxford Transport Schemes Local Model Validation Report" dated September 2022.

1.4. Modelled scenarios

The OSM modelling system was developed to represent a 2018 base year (BY) and a 2024 forecast year. The forecast year of 2024 was chosen to be able to take account of both the traffic filters and the A40 Science Transit Phase 2 scheme. For the forecast year, there are two scenarios: Do Minimum (DM) and Do Something (identified as TF1). The DM scenario includes only schemes that are independent from the traffic filters, while the TF1 scenario, which was the basis of the recent pre-Experimental Traffic Regulation Order consultation,

[1] This is based on a weighted average of count sites across the city and the A34, comparing May to September 2022 traffic count data with the same period in 2019, on an equivalent week-by-week basis.

includes the six traffic filters and the associated exemptions, residential day permits and also public transport improvements.

Several other traffic filter options were also modelled using OSM, with a summary of the transport model assumptions and forecast results provided in Appendix A.

1.5. Scope of Report

This report is structured as follows:

- Chapter 2 discusses the modelling assumptions considered for forecast year scenarios.
- Chapter 3 presents the 2024 Do Minimum scenario.
- Chapter 4 presents the 2024 TF1 Do Something scenario.

2. Model Forecasting

2.1. Forecasting Approach

Methodology

The OSM forecasting methodology closely follows the current version of the Department for Transport's Transport Analysis Guidance (TAG), in particular TAG Unit M1.1 – Principles of Modelling and Forecasting.

The general approach is summarised in Figure 2-1 whereby the forecasting process commences with the development of the reference case by updating demand factors to the forecast year being appraised and producing a forecast based on unchanged costs from base year. The supply-side factors are then updated (i.e. network changes and different cost assumptions) and the reference case forecast is modified iteratively through the VDM until demand and cost are consistent. Once achieved, there is a sound basis for the 'Without-Intervention' (or 'Do Minimum') scenario to be tested. A similar process is undertaken to produce the Do Something forecasts by using the network interventions defined for the Do Something.

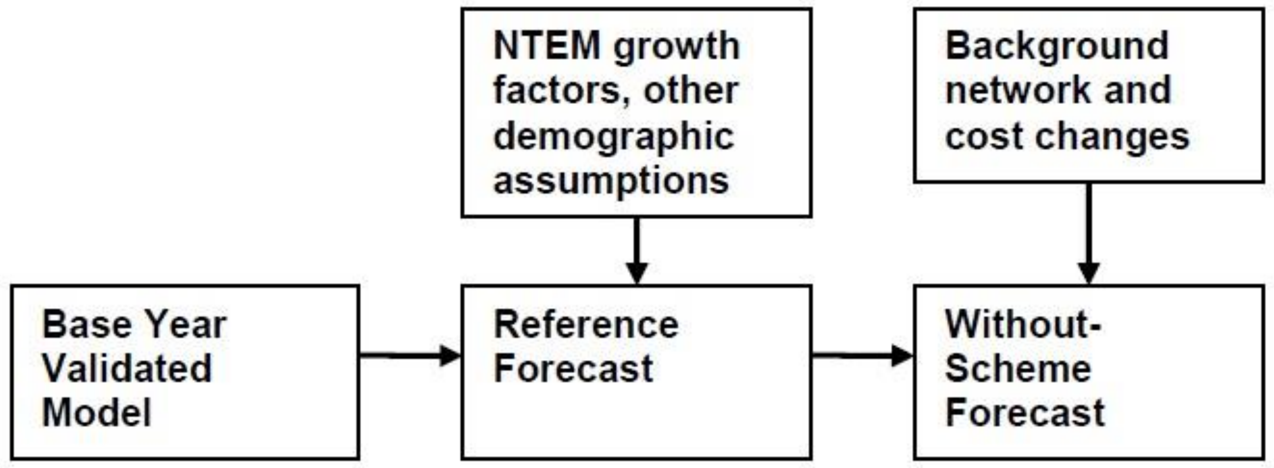

Figure 2-1 - Without Scheme Forecasting Methodology

Source: TAG Unit M4 Figure 1

Description of the Variable Demand Model

The VDM has a hierarchical logit choice structure as shown in Figure 2-2. Following TAG, it has a pivot incremental demand modelling approach where the change in demand responds to changes in travel cost between the Base Year and the Forecast Year scenario. The process passes through different iterations until it converges.

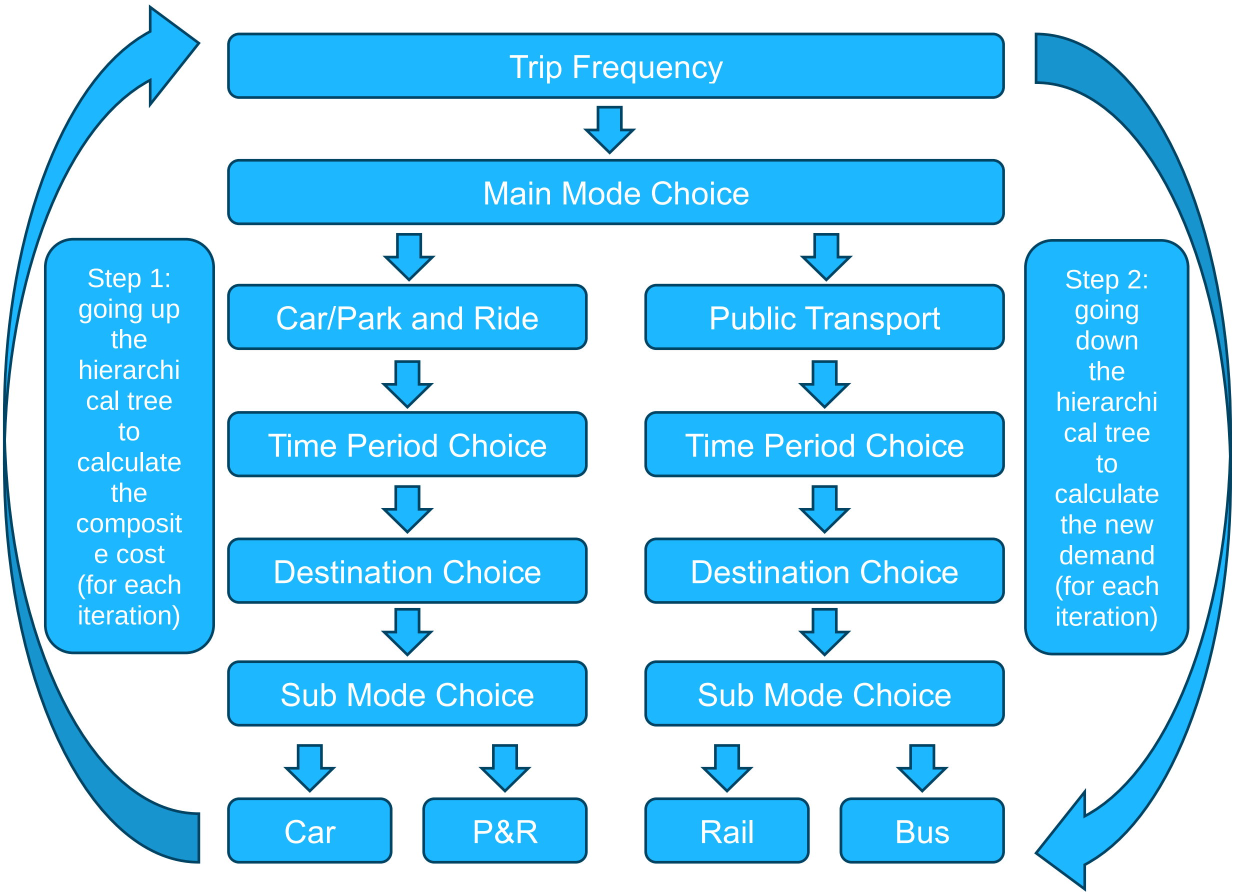

Figure 2-2 - Variable Demand Model Hierarchy

2.2. Transport Model Growth Assumptions

Oxford Traffic and Bus Passenger Observed Growth

Analysis of traffic count data in Oxford was carried out to understand actual changes in traffic levels in Oxford between 2013 and 2019, and how this compares with modelled results forecast by earlier versions of OSM. Traffic count data was made available by OCC and bus passenger data was obtained from bus operators. Due to commercial sensitivity, more disaggregated bus journey information was not available.

Table 2-1 shows the changes in car flows in Oxford City (based on a cordon located just inside the ring road). This data shows a small decrease of 2% between 2013 and 2019.

Table 2-2 shows the changes in bus passenger journeys in Oxfordshire. This data shows a small decrease of 3% between 2013 and 2019 in Oxfordshire. Based on these trends, it was agreed to apply no growth for car or public transport (bus or rail trips) to/from Oxford City between 2018 and 2024.

Table 2-1 - Changes in car traffic in Oxford City between 2013 and 2019

	08:00 – 09:00	11:00 – 12:00	17:00 – 18:00	07:00 – 19:00
Total flow 2013	17,359	14,930	18,377	197,806
Total flow 2019	17,202	14,605	17,682	193,341
Change	-157	-325	-695	-4,465
% change	-1%	-2%	-4%	-2%

Table 2-2 - Bus passenger journeys in Oxfordshire, and England, between 2013 and 2019 (million trips per annum)

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Oxfordshire	35.8	36.3	39.2	40.8	43.2	42.4	42.1	41.3	40.6	41.9	40.8
England	4,613	4,618	4,640	4,570	4,672	4,627	4,511	4,440	4,348	4,307	4,069

In 2022, traffic counts within the ring road show that AM peak hour traffic is about 8% lower than in 2019, and PM peak traffic and daily traffic each about 5% lower. As travel behaviour may not have fully settled down following the pandemic, the base year was not updated to 2022.

2018 to 2024 Growth Assumptions and Forecasts

Both DM and TF1 scenarios have the same growth assumptions in the forecast year 2024. The single source for the growth factors of car and public transport between 2018 and 2024 is NTEM v7.2, which is the DfT's 'National Trip End Model' and is underpinned by the DfT's planning assumptions on the future level of population and employment growth, and associated travel demand by mode.

Based on the analysis of the observed trends presented above, no growth was applied for trips to/from Oxford City, so overwriting the NTEM forecasts.

Table 2-3 summarises the growth in travel demand across the whole model, from the 2018 BY to the 2024 DM, as estimated after the application of the VDM.

Table 2-3 - Growth in Travel by Mode over a 12-hour period (2018 BY to 2024 DM)

Mode	Percentage Growth Entire model	
	Origin	Destination
Reg car (veh.)	5%	5%
P&R (veh.)	30%	30%
Bus only (pass.)	0%	0%
Rail (pass.)	4%	4%
TOTAL (persons)	**4%**	**4%**
LGV	8%	8%
HGV	2%	2%

The growth across the entire model takes account of assumed future growth across the five Districts of the County. At the County level, the overall increase in demand between 2018 and 2024 is approximately 4%. This is a consequence of assuming NTEM growth for all other districts in Oxfordshire and the rest of Great Britain. The total weekday vehicle car trips in Oxfordshire are expected to increase by about 5%.

Between 2018 BY and the 2024 DM, the new Park & Ride site at Eynsham is the reason for a significant increase in trips using Park & Ride.

There is also growth assumed for goods vehicles, which is based on Road Traffic Forecasts 2018, published by the Department for Transport. The growth factors between 2018 and 2024 were 1.084 for Light Goods Vehicles (i.e. an 8.4% increase) and 1.020 for Heavy Goods Vehicles (2% increase). For goods vehicles, the same percentage increase was applied everywhere, so there is no difference between Oxford City and the other districts.

The growth levels to and within Oxford City are lower than that of the model as a whole, reflecting the ‘no growth‘ assumption for the city based on historical trends, as outlined above. The changes in demand, by mode and movement, at the Oxford City level are summarised in Table 3-1.

2.3. Network Assumptions

The list of highway and public transport schemes considered in the model has been developed and agreed with OCC. These are summarised for each mode below, setting out what is represented in both the Do Minimum and TF1 networks.

2.3.1. Highway Network Assumptions

Some examples of key highway infrastructure schemes in and around Oxford included within both the Do Minimum and Do Something scenarios are:

- Oxford North Development
- HIF 1 including Didcot to Culham River Crossing and A4130 Widening

- Cowley area LTN
- East Oxford area LTN
- A44 Corridor Improvement Schemes
- A40 (HIF 2) Package including Eynsham to Witney dualling, east and westbound bus lanes and Eynsham Park & Ride

2.3.2. Highway Network Assumptions – TF1 Do Something

The only difference between the two scenarios, DM and TF1, in terms of highway network, is the inclusion of six traffic filters, whose location is shown in Figure 2-3. The traffic filters prevent access to motorised traffic, with some notable exceptions. The exemptions which are modelled are:

- Light Goods Vehicles
- Heavy Goods Vehicles
- Buses
- Holders of Resident Day Passes (explained in more detail in section 2.4)
- Taxis
- Blue Badge holders.

The OSM does not consider taxis or blue badges as separate user classes of the car traffic. For this study, a general factor of 5% for taxis based on traffic counts and 6% for blue badges based on published information on the percentage of blue badge holders.

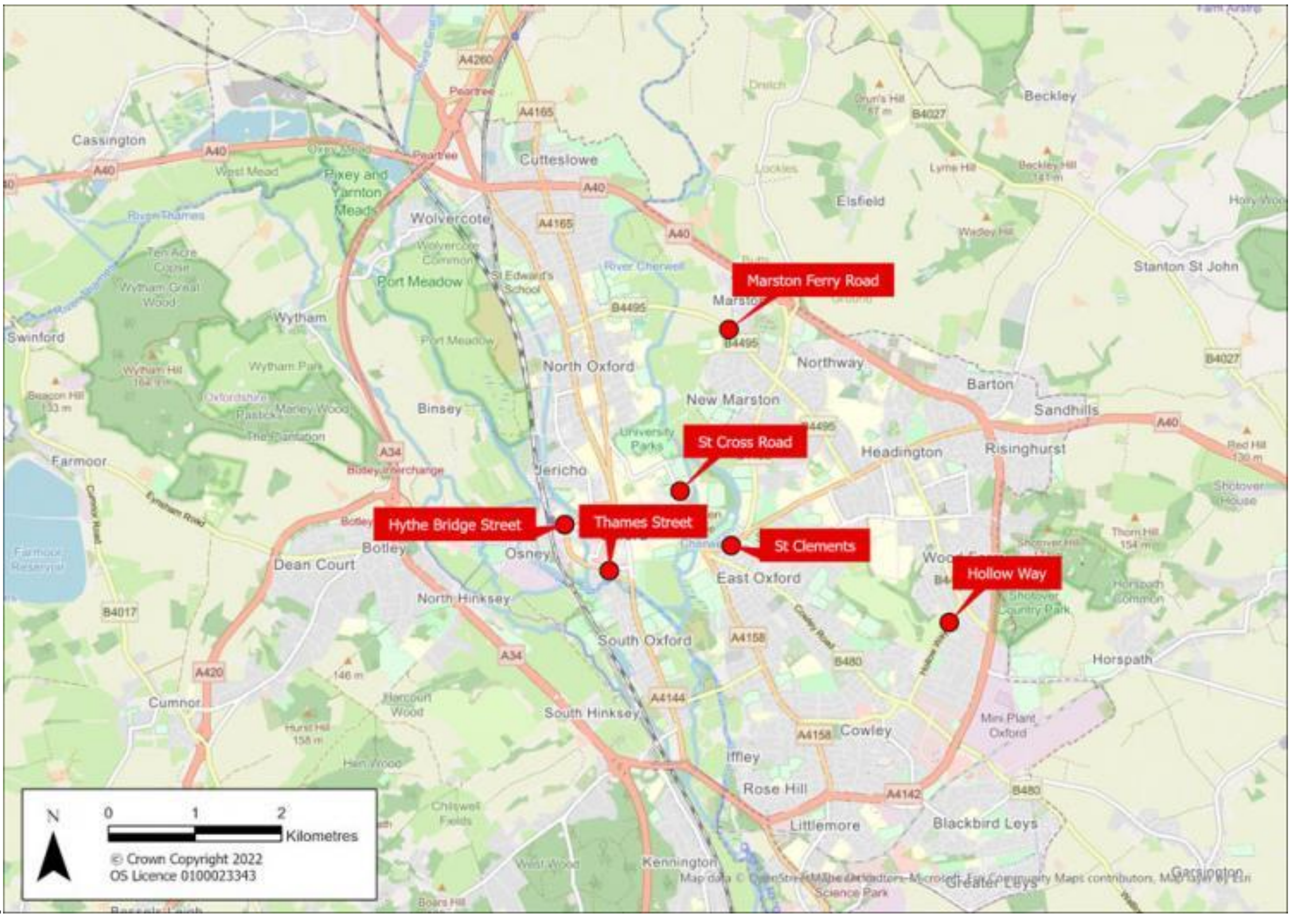

Figure 2-3 - Location of the six traffic filters

Source: https://www.oxfordshire.gov.uk/residents/roads-and-transport/connecting-oxfordshire/traffic-filters

2.3.3. Resident Day Pass Boundary

For the TF1 scenario only, all residential properties within the colour shaded areas in Figure 2-4 would be eligible for day passes:

- Oxford district (green area)
- Parishes outside Oxford district but partly within the ring road and part of the Cumnor parish (blue area).

It was assumed that all the residents in this area would receive 100 day passes per year which allow them to use all six traffic filters on the days when the pass is used. It was assumed that the pass would be used by residents on 2 weekdays during a week on average. For modelling, 40% of weekday car tips made by residents are allowed to pass through the filters (equivalent to car trips using a 'pass' for of 2 of 5 weekdays on average).

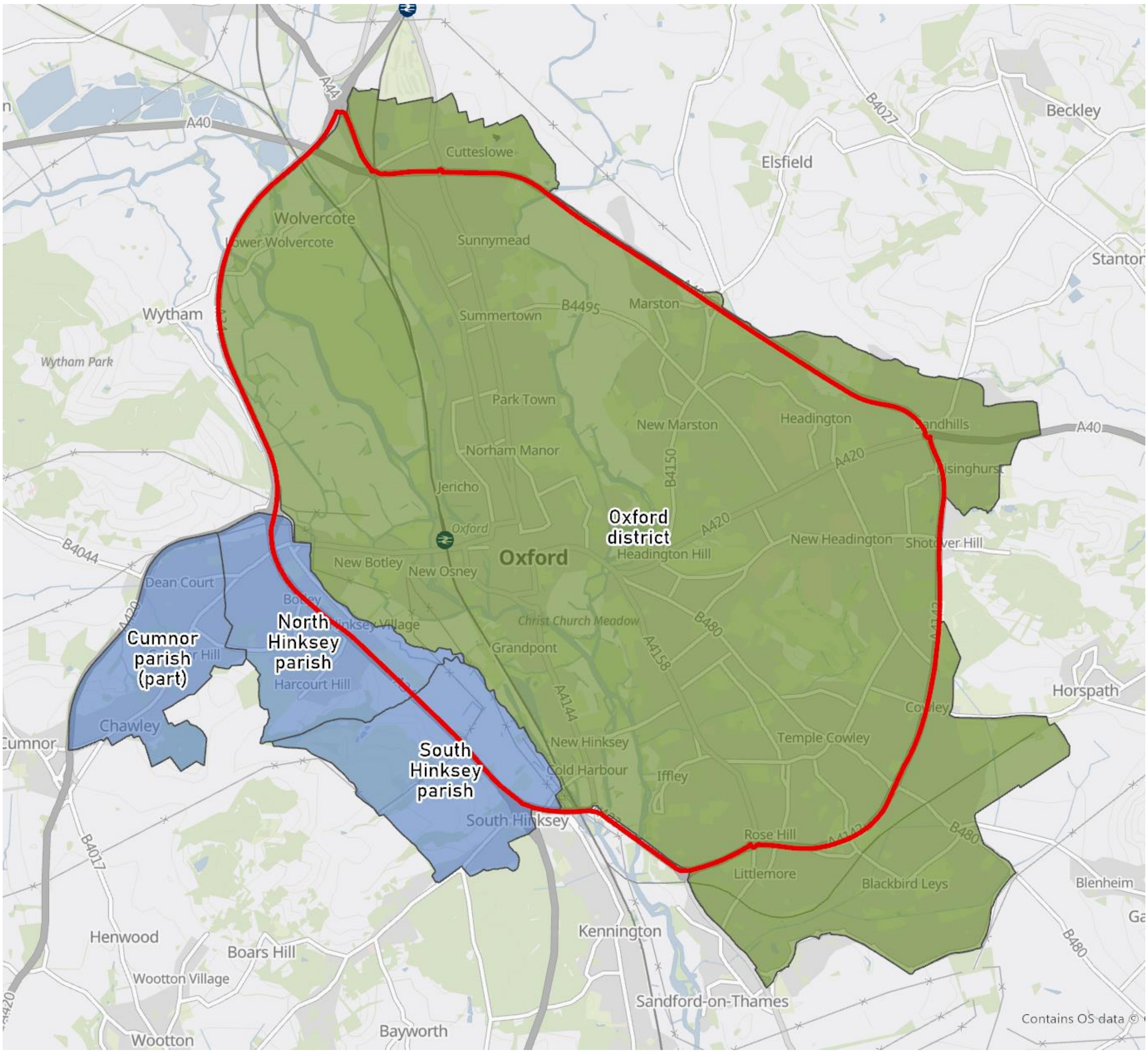

Figure 2-4 – Boundary of the area receiving resident day passes

Source: Oxfordshire County Council

2.3.4. Park and Ride assumptions

In the DM and TF1 scenarios, there is one new P&R site included in the model at Eynsham on the A40 (assumed opening year of 2024) in comparison with the base year. The overall charge at the Eynsham P&R site, taking account of bus fare and parking charge, is commensurate with that of existing sites[2].

2.3.5. Rail assumptions

The forecast year changes to the rail assumptions reflect planned and committed service and timetable changes. There are no differences between DM and TF1.

[2] For Eynsham the bus fare is higher, reflecting the longer distance from Eynsham to the city centre compared to other P&R sites, but there would be no parking charge.

2.3.6. Bus assumptions

The A40 corridor enhancements, including additional bus services, are included in both the Do Minimum and TF1 scenarios. In addition, the TF1 scenario also includes:

- Removal of the existing bus lane Southbound on Woodstock Road (bus lane starts 50m south of the Woodstock Road stop line at Wolvercote roundabout, and ends at Beechcroft Road) and addition of a Northbound bus lane over the same segment of road;
- New service connecting North of Oxford to Eastern Arc area, with a frequency of 4 buses per hour: Oxford Parkway – Summertown – Marston Ferry Road – John Radcliffe hospital (West Wing roundabout only) – Brookes University – Old Road – The Slade – Hollow Way – Cowley Centre – Church Cowley Road – Donnington Bridge Road – Redbridge P&R (black service in Figure 2-5);
- Reduction of the frequency of bus service 3 (Oxford City Centre – Rose Hill) from 6 to 3 buses per hour, due to the overlap with the new service;
- Merge of two existing services to create a west-north through service, with a frequency of 4 buses per hour (blue service in Figure 2-5);
- An average 10% bus journey time reduction in Oxford city improvements on inner radial routes, based on the expected improvement in bus journey times from traffic filters (described from paragraph 4.6).

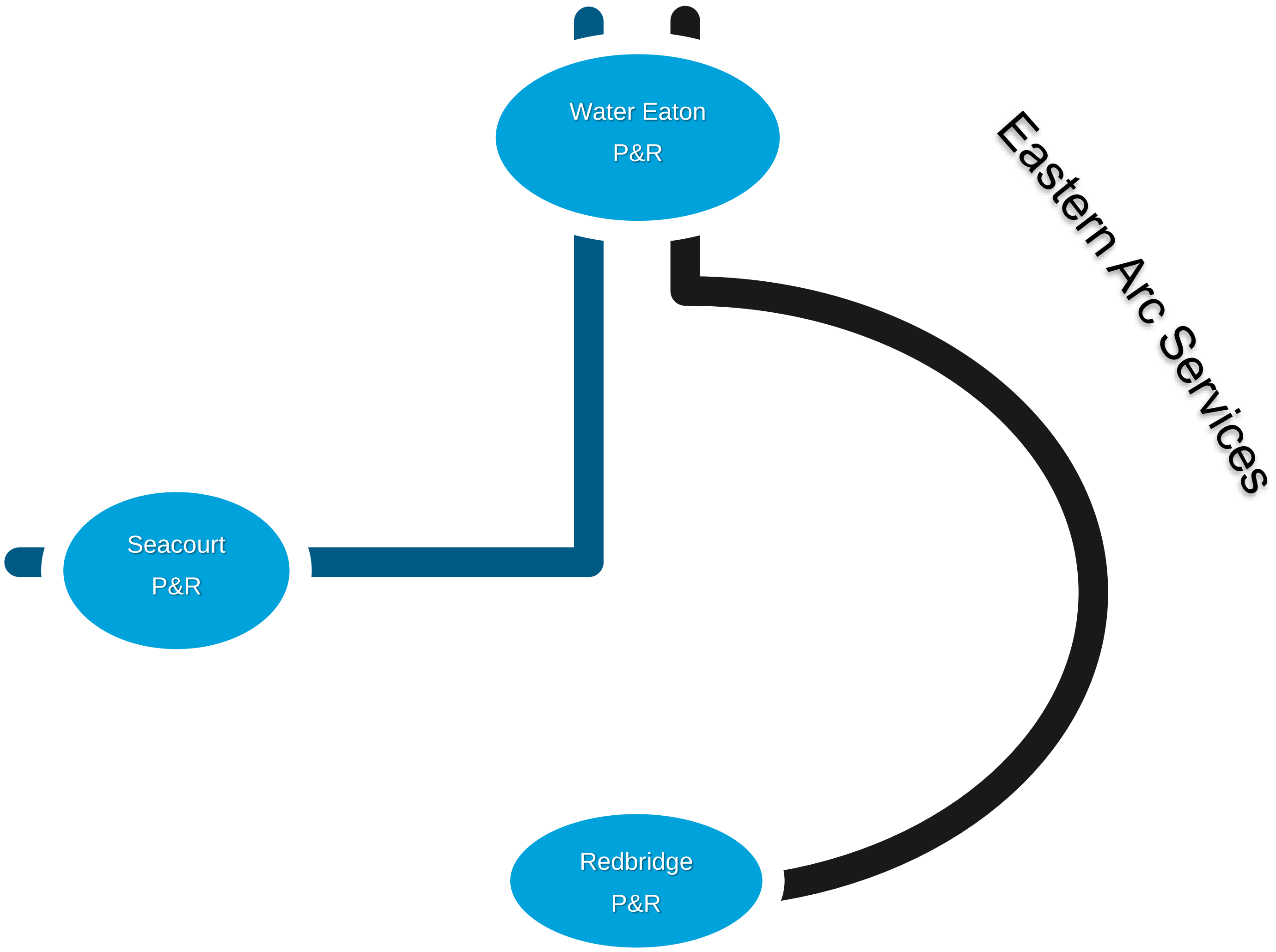

Figure 2-5 - New bus services in TF1 scenario

Source: Oxfordshire County Council

3. 2024 Do Minimum Scenario Results

3.1. Introduction

The standard set of model outputs was produced to assess the impact of the growth in the demand for travel between 2018 Base Year and 2024 Do Minimum. The forecast growth in overall travel demand is summarised in Table 2-3. This chapter shows how the overall changes in demand manifest themselves in terms of changes in traffic flows across the network, which are influenced by the change in the transport network between the BY and DM scenarios.

3.2. Change in Overall Demand

3.2.1. Changes in Demand by Mode, by Sector movement

The change in demand by mode and sector is summarised in Table 3-1.

Table 3-1 - Sectorised demand by mode (12-hour period, 2018 BY vs 2024 DM)

Mode/ Sectors	2018 BY	2024 DM	Change	Change %
Car (person trips)				
Within city	130,675	123,307	- 7,368	-6%
To / from city	159,323	164,909	5,586	4%
Combined	**289,998**	**287,785**	**- 2,213**	**-1%**
Bus (person trips)				
Within city	52,011	49,975	- 2,036	-4%
To / from city	30,184	32,163	1,979	7%
Combined	**82,195**	**82,138**	**- 57**	**0%**
Rail (person trips)				
Within city	-	-	-	-
To / from city	13,213	14,182	969	7%
Combined	**13,213**	**14,182**	**969**	**7%**
P&R (person trips)				
Within city	684	730	46	7%
To / from city	8,400	11,048	2,648	32%
Combined	**9,084**	**11,778**	**2,694**	**30%**

3.3. Change in Traffic Flows

Figure 4-1 to Figure 4-3 present the highway flow difference plots between 2024 Do Minimum scenario and the 2018 Base Year scenario.

The main changes in the City are a result of re-routing due to the inclusion of six Low Traffic Neighbourhood schemes (St. Mary's, Divinity Road, St. Clement's, Church Cowley, Florence Park and Temple Cowley). Elsewhere there is generally no change in traffic, or even small increases, which means existing challenges including slow bus speeds, poor air quality, and cycle and pedestrian safety and poor facilities cannot be addressed.

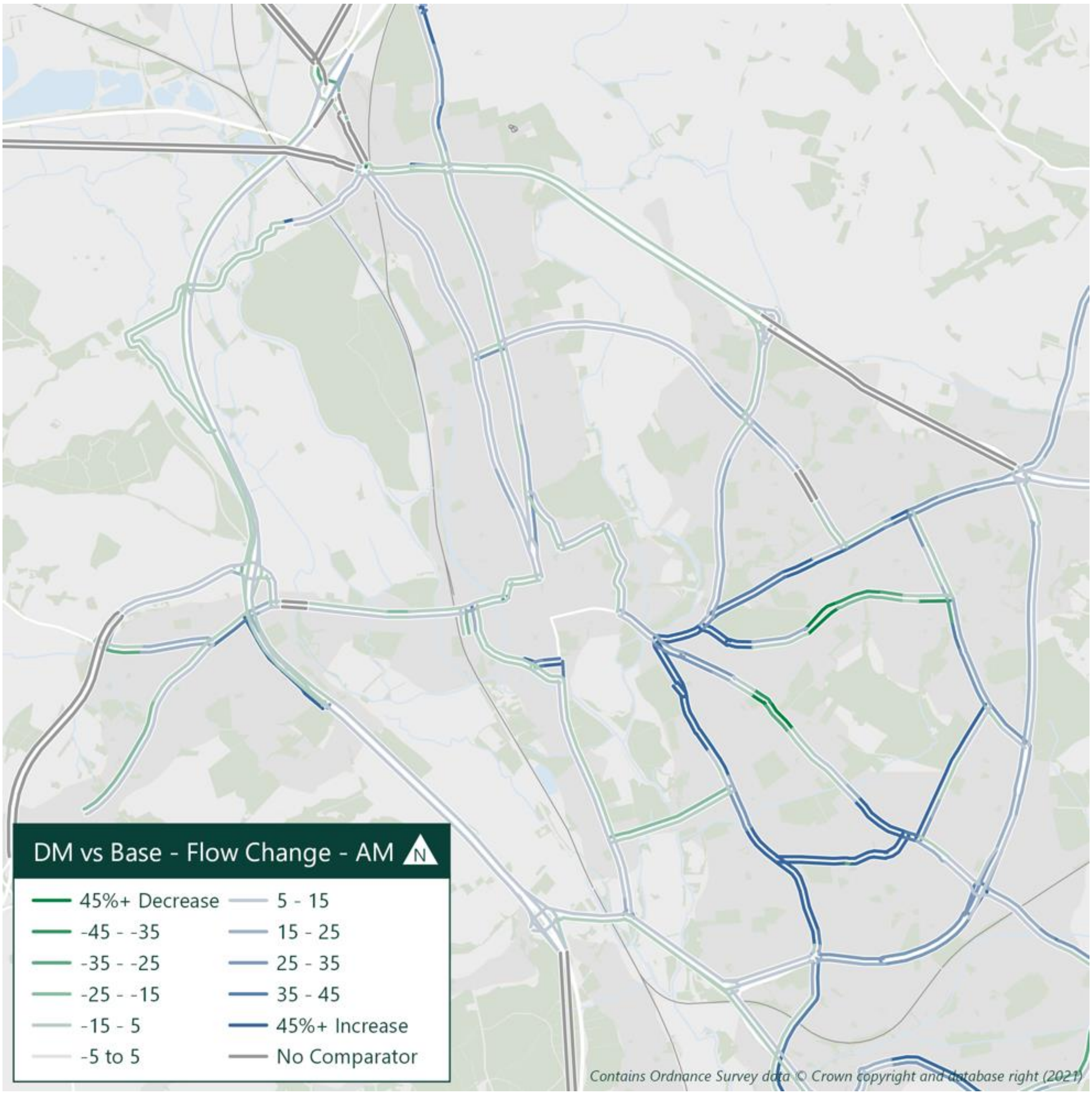

Figure 3-1 - Highway Flow Percentage Change Difference in PCU's (2024 DM– 2018 Base) AM peak hour

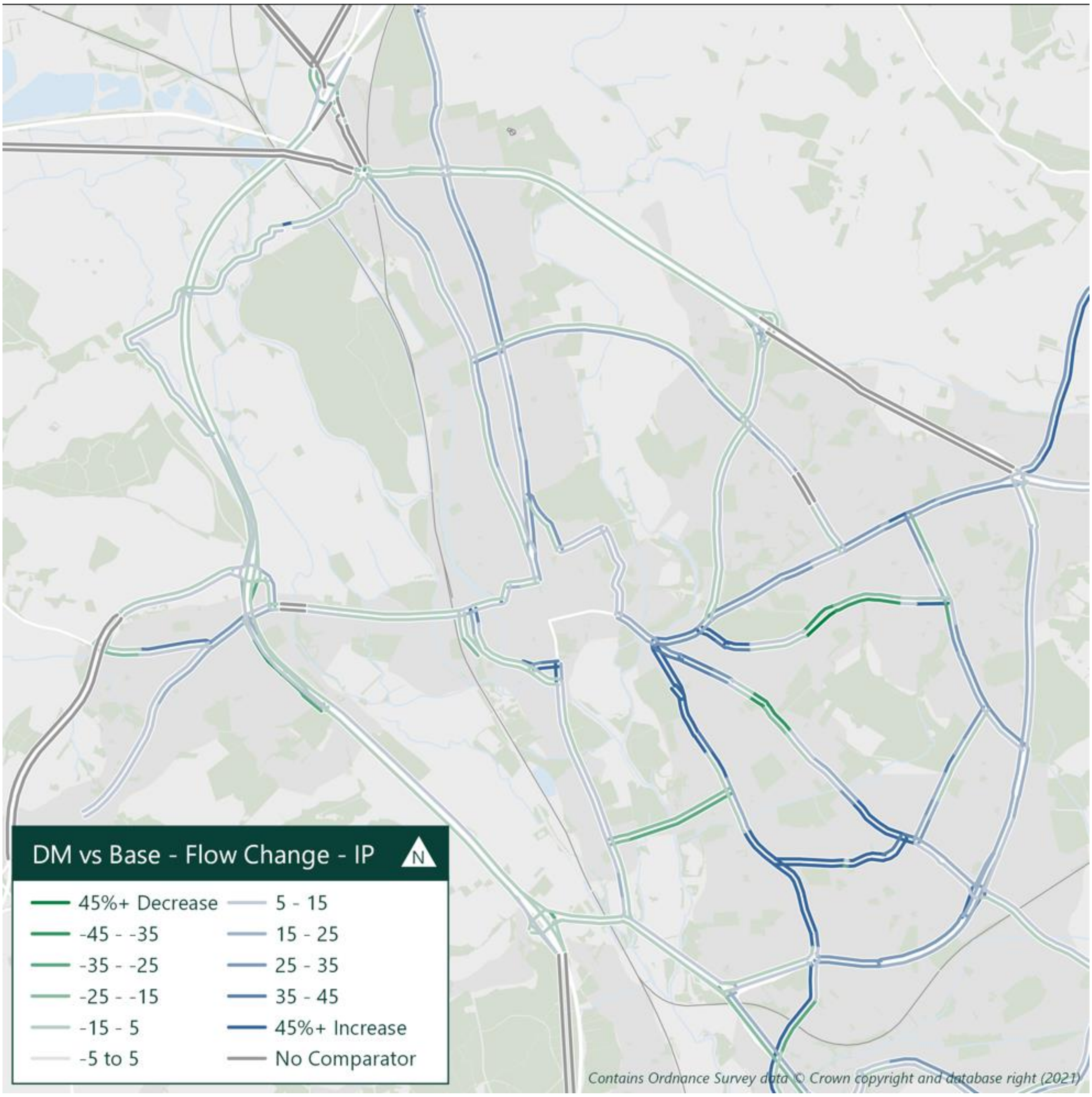

Figure 3-2 - Highway Flow Percentage Change Difference in PCU's (2024 DM– 2018 Base) Inter-peak hour

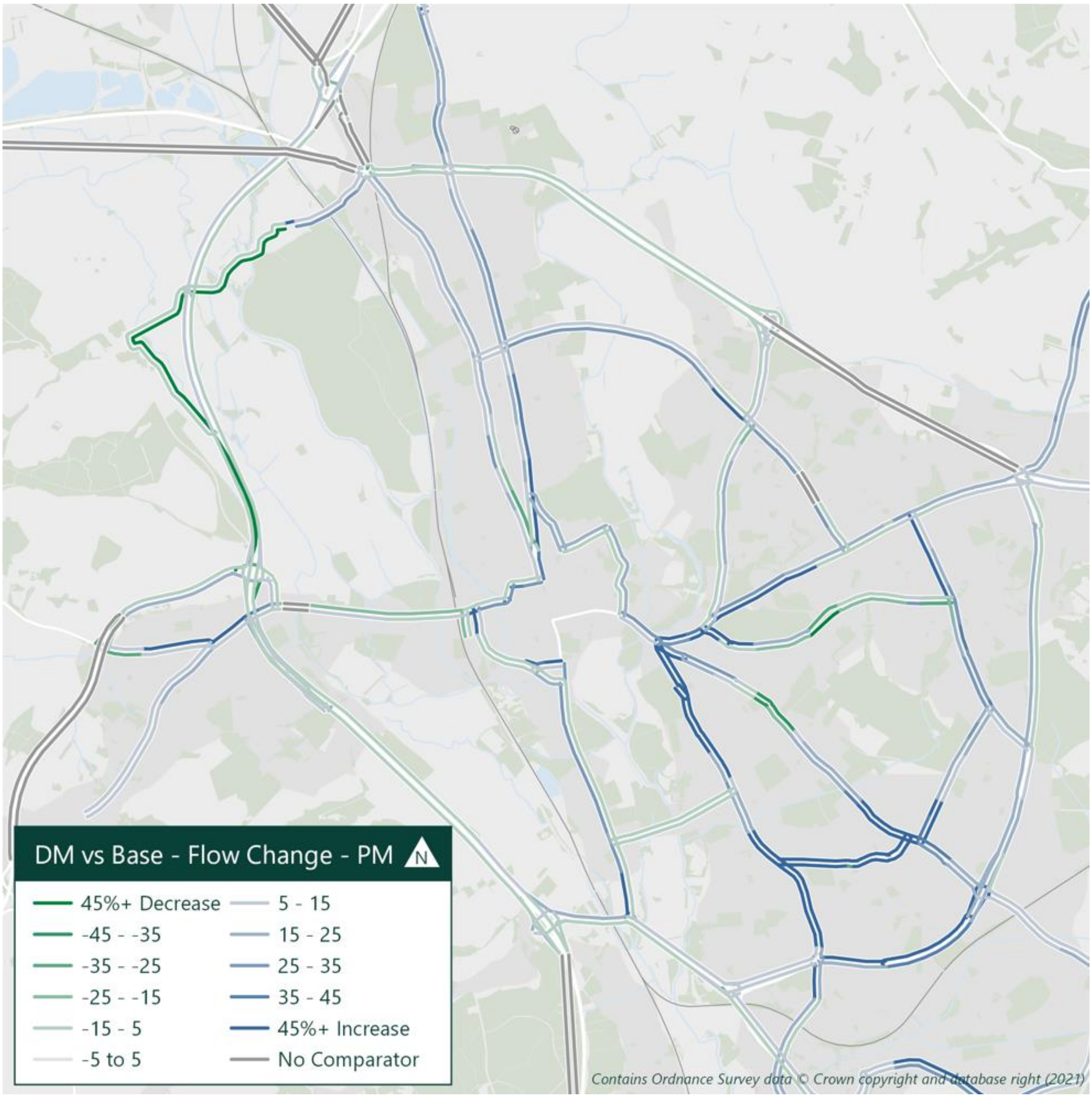

Figure 3-3 - Highway Flow Percentage Change Difference in PCU's (2024 DM– 2018 Base) PM peak hour

4. 2024 TF1 Do Something Traffic Filter Scenario Results

4.1. Introduction

This section presents the forecasts for the Do Something scenario (with the traffic filters), which is identified as TF1. The TF1 scenario includes all assumptions represented in the 2024 Do Minimum scenario, with the Do Something additionally having the traffic filters.

The TF1 scenario includes the specific transport elements that are part of the scheme, taking account of the traffic filters and the modelled exemptions described in Section 2.3.2.

There are no changes in land use assumptions between the DM scenario and the TF1 scenarios. The details can be found in section 2.2.

4.2. Interpretation of results - caveats and limitation

The modelling approach has been developed to best represent and forecast these responses. However, there are inherent uncertainties in any forecasting exercise and especially for the traffic filter proposals given the complex nature of the traffic filter proposals and variety of potential behavioural responses.

The results should therefore be viewed as providing a best understanding and indication of potential impacts and effects, and not as a firm prediction of impacts. The model itself is a strategic model – representing the whole of Oxfordshire and beyond – and is therefore more reliable in terms of its forecast impacts at a strategic level e.g. impacts on overall car demand, and less reliable at more granular levels of detail.

The other caveats set out in the introduction – including the uncertain medium-term impacts from the pandemic are also relevant in this context.

4.3. Change in Overall Demand

4.3.1. Changes in Demand by Mode, by Sector movement

The traffic filters have an impact primarily on trips within and to/ from the city of Oxford, with negligible impacts for trips made totally outside of the city.

Table 4-1 shows the disaggregation of 12-hour demand by mode, area, and scenario, highlighting the impact of the scheme.

Table 4-1 – Sectorised demand by mode (12-hour period, 2024 DM vs TF1)

Mode/ Sectors	2024 DM	2024 DS	Change	Change %
Car (person trips)				
Within city	123,307	98,541	-24,766	-20%
To / from city	164,909	162,973	-1,936	-1%
Combined	**287,785**	**261,514**	**-26,271**	**-9%**

Mode/ Sectors	2024 DM	2024 DS	Change	Change %
Bus (person trips)				
Within city	49,975	51,825	1,851	4%
To / from city	32,163	32,691	528	2%
Combined	**82,138**	**84,516**	**2,378**	**3%**
Rail (person trips)				
Within city	0	0	0	0%
To / from city	14,182	15,084	902	6%
Combined	**14,182**	**15,084**	**902**	**6%**
P&R (person trips)				
Within city	730	790	60	8%
To / from city	11,048	11,645	598	5%
Combined	**11,778**	**12,436**	**658**	**6%**
Walking and cycling				
Within city			17,258	
To / from city			2,684	
Combined			**19,942**	
Car demand re-distributed to alternative destinations, or reduced frequency				
Within city			5597	
To / from city			-2776	
Combined			**2391**	

The overall demand effects from TF1 have therefore been summarised for the following movements:

- Those wholly within the city, defined as the Oxford city administrative boundary. These trips have an origin and destination within the city.
- Those travelling to or from the city i.e. with either an origin or destination in the city.

Car person trips wholly *within the city* reduce by 20% overall as a result of the scheme, equivalent to 24,800 fewer trips across the average 12-hour weekday (07:00 to 19:00). The reduction in total, including trips to or from the city, is around 26,300, which represents a reduction of 9% in total car trips *to from and within the city*.

The total increase in bus trips is around 2,400 trips with a further 650 increase in P&R. Total rail trips increase by around 900 trips - all of which are either to or from the city.

Walking and cycling trips increase by almost 20,000, the majority of which (17,500) are wholly within the city.

There is some re-distribution of trips within the city, with the remaining 5,600 either re-routing (to alternative origins or destinations outside the city) or no longer taking place (suppressed demand). Some of these re-distributed trips show up as increases in trips to/ from the city (2,700).

4.4. Change in Traffic Flows

4.4.1. Changes on the Highway Network

Figure 4-1 to Figure 4-3 present the highway flow difference plots between TF1 scenario and the DM scenario. Traffic flows experience an overall reduction throughout the city of Oxford due to the implementation of the traffic filters, as they restrict the movements of some categories of vehicles, mainly affecting routes between areas of the city (North, East, South, West).

As a result of these route restrictions, car journeys through the city are discouraged, resulting in a clear reduction of traffic volumes in the city centre and on the main roads within the B4495 arc. On the other hand, traffic filters mean that some vehicles choose to divert via the ring road, increasing the flows on the outer sections of some radial roads within the city and on the ring road (A34, Eastern By-Pass Road and A40).

Note that the forecasts of increased traffic on the A4144 Woodstock Road (as shown by the blue line in the figure that follow) are taken from the Strategic Model. Further analysis of detailed lane allocations at the entry to the Wolvercote roundabout (which the Strategic Model cannot represent), and existing delays, has shown that there is insufficient capacity to achieve these increased traffic forecasts. The proposed northbound bus lane on Woodstock Rd will protect buses from any increases in delay on this section.

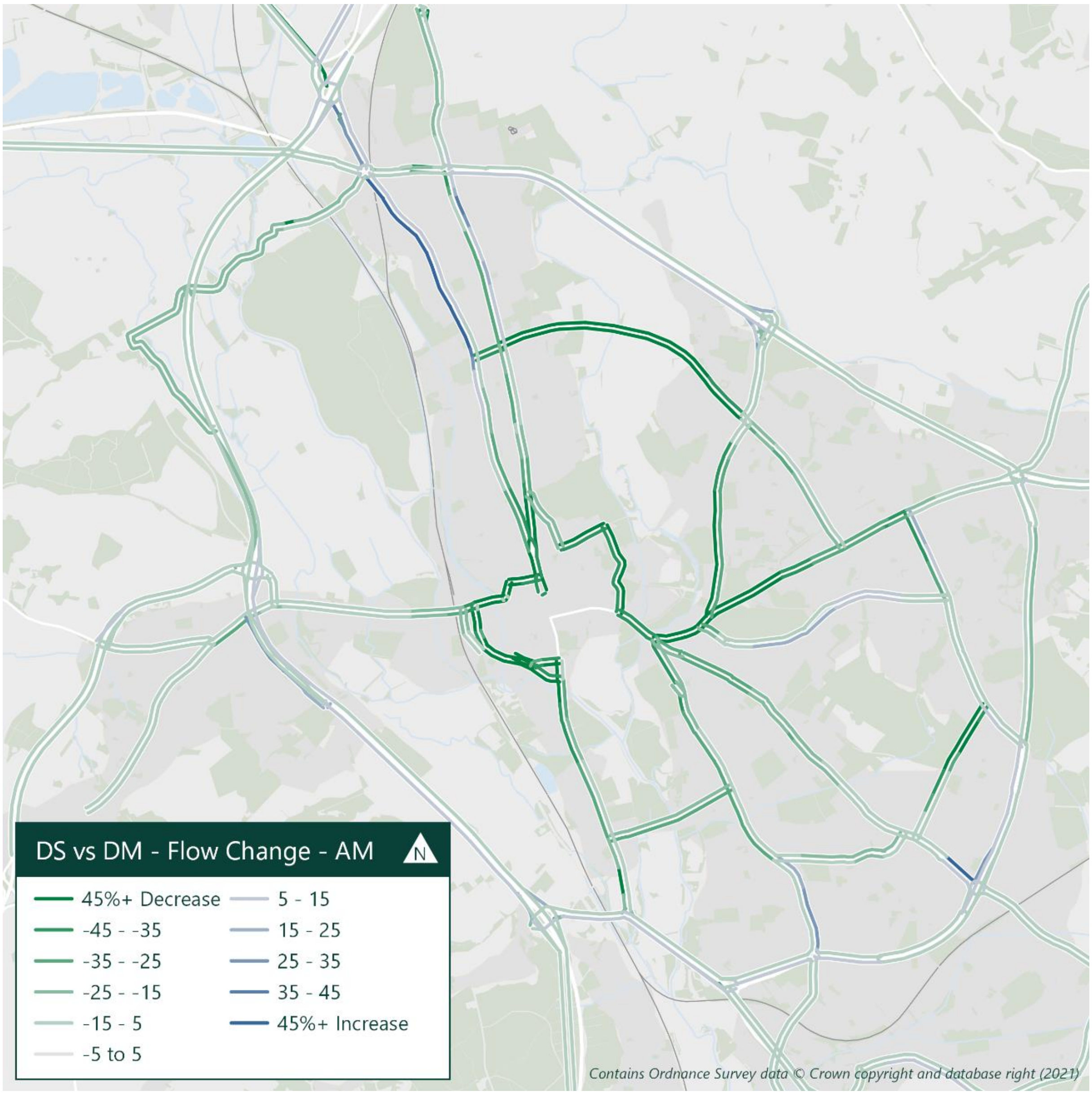

Figure 4-1 - Highway Flow Percentage Change Difference in PCU's (2024 TF1 – 2024 DM) AM peak hour

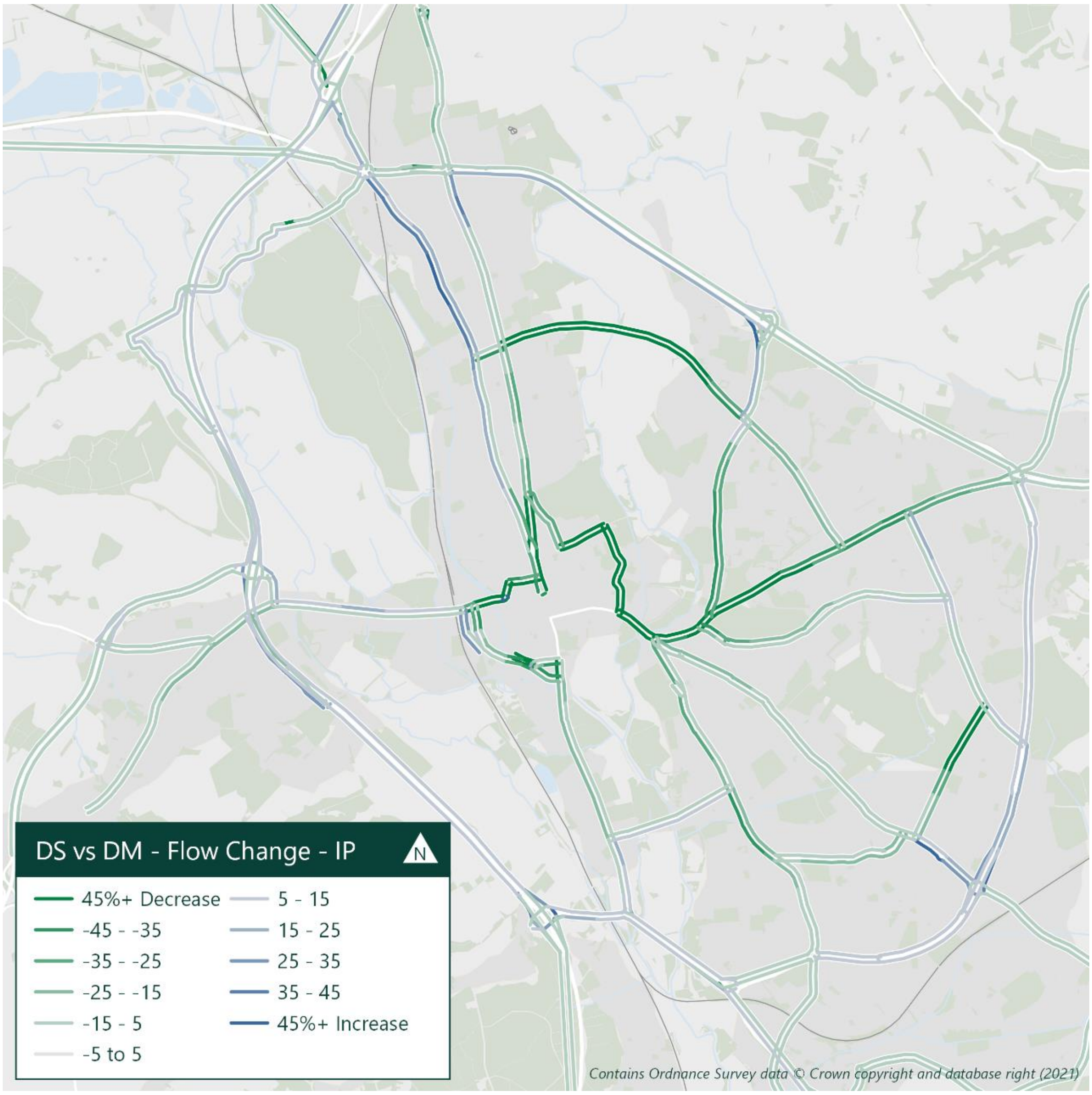

Figure 4-2 - Highway Flow Percentage Change Difference in PCU's (2024 TF1 – 2024 DM) Inter-peak hour

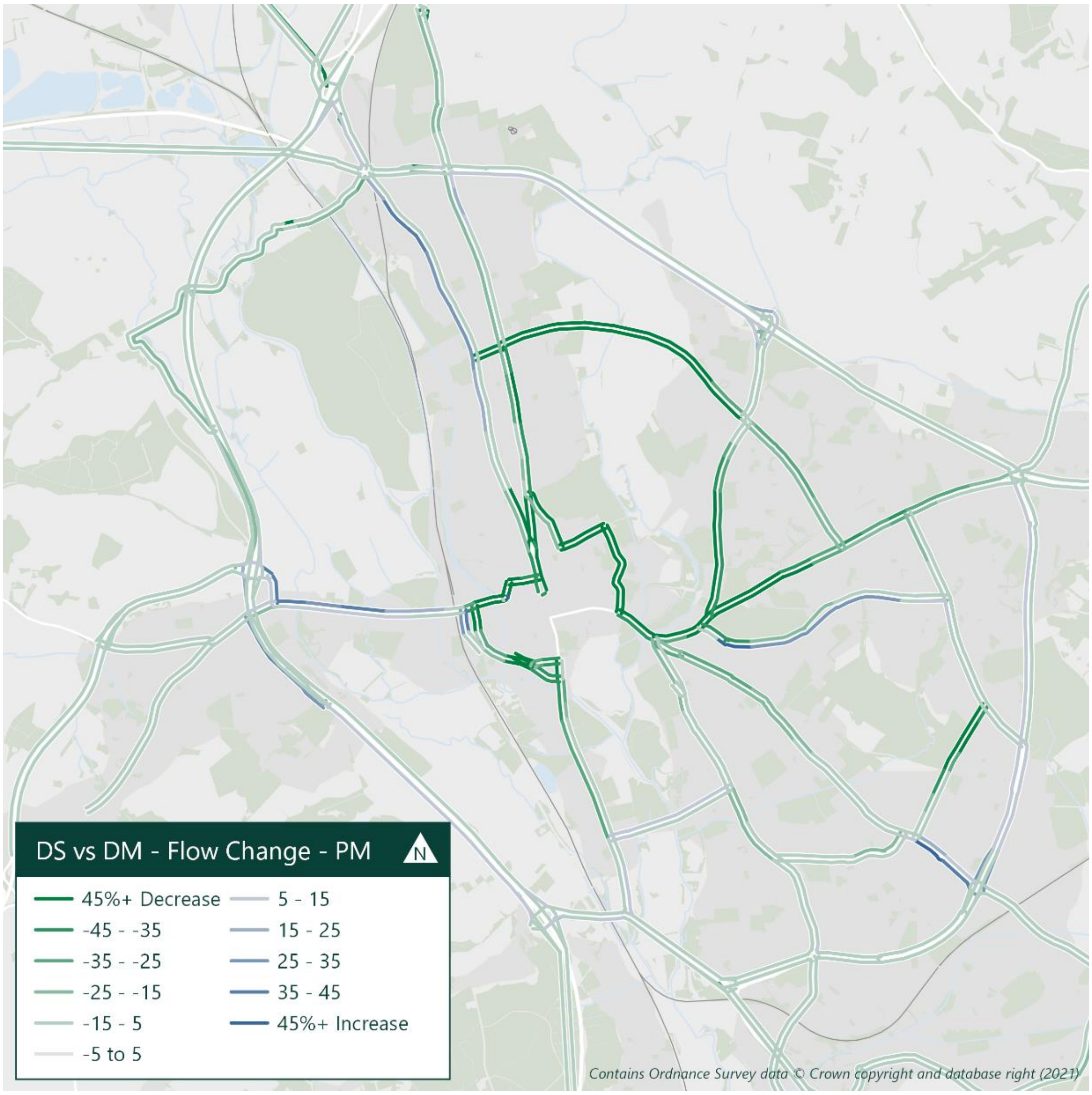

Figure 4-3 - Highway Flow Percentage Change Difference in PCU's (2024 TF1 – 2024 DM) PM peak hour

4.4.2. Change in Traffic Flows at Key Locations

The LMVR[3] defined three concentric cordons within Oxford, for traffic data analysis purposes. Traffic count sites on these cordons used for the model calibration are shown in Figure 4-4.

- City Centre Cordon
- Inner Cordon: Folly Bridge, Magdalen Bridge, Osney Bridge and Banbury Rd (w/ St Margaret's Rd)
- Outer Cordon: approximately along the B4495 arc.

[3] OSM - Local Update for Oxford Transport Schemes. Local Model Validation Report (September 2022, Atkins)

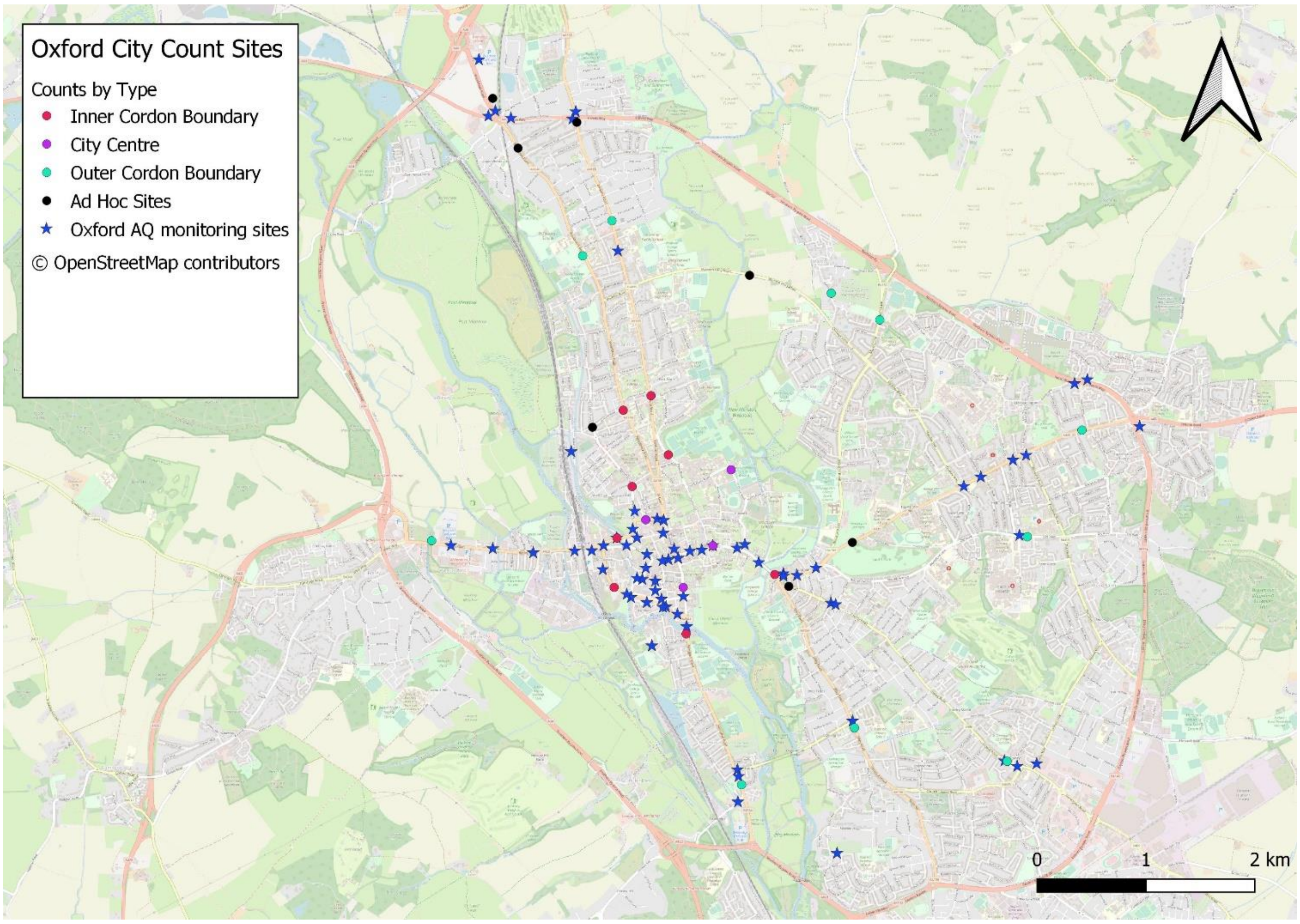

Figure 4-4 - Traffic Counts Locations

Table 4-2 summarises the change in vehicular traffic (cars and all vehicles) as a result of the scheme, for the three cordons described earlier, by time period. The overall reduction in car trips is around 20% for all time periods for trips within the city, and 9% for trips to, from and within the city, as shown in Table 4-1 and also the bottom rows of Table 4-2. This reduction is not uniform, as the traffic filters significantly reduce flows in the inner parts of the city, while re-routing effects moderate and counter-balance these effects further out.

The estimated reduction in traffic across the city centre cordon and inner cordon boundary is significant, with peak reductions of over 40% across the city centre and around 35% for inner cordons. The reduction in the inter-peak is slightly lower but remains significant (38% and 26% reductions respectively).

The reductions in all traffic are driven by an even greater reduction in car traffic (as all other vehicles are exempt from the filters). The peak reduction in car traffic is around 50% across the city centre cordon and 40% in the inner cordon.

Table 4-2 - Change in vehicular traffic flows by location and time period

Location	AM Peak	Inter-Peak	PM Peak
All vehicles (Car, LGV and HGV)			
City Centre cordon	-41%	-38%	-44%
Inner cordon boundary	-35%	-26%	-36%
Outer cordon boundary	-5%	-1%	0%
Cars only			
City Centre cordon	-51%	-54%	-50%
Inner cordon boundary	-43%	-37%	-40%
Outer cordon boundary	-5%	-1%	-1%
Oxford – all trips within the city	-20%	-19%	-21%
Oxford – all trips to / from / within the city (12 hours)		9%	

The changes in traffic flow on the outer cordon boundary are modest, with a 5% reduction in the AM peak and a broadly neutral impact in other time periods.

In broad terms traffic filters are estimated to lead to:

- A 20% reduction in overall car trips within the city and 9% for trips to from and within the city.
- A reduction of 50% in car traffic across the city centre cordon, and 40% on the inner cordon.

The reduction in the car traffic in the city centre reflects two main responses:

- First, there would be some change in behaviour by car drivers who will change mode (to bus, rail, Park and Ride, walk or cycle). These changes are included in the modelling.
- Changes in travel time (e.g. to outside traffic filter operational hours, or to consolidate car trips into days in which they choose to use a 'day pass') and location (away from destinations that become less accessible, in relative terms, as a result of filters). These further changes are not included in the modelling.
- Second, many car drivers would choose to continue to drive (to the same location and the same time) but would be required to re-route typically via the ring road.

The effect in the outer cordon is that the impact of the overall reduction in car trips is counter-balanced by the increase in re-routed car trips, such that the overall impact on traffic levels is broadly neutral across this cordon.

4.5. Change in Highway Network Performance

As a result of the reduction in traffic flows, there is a forecast reduction in delays within the city centre and approaching the city centre in all modelled time periods.

However, there is uncertainty about how many car trips will be made by other modes, how many car drivers will continue to use their car despite potentially longer journey times and distances, and how many resident passes will be used at weekends rather than weekdays. This will affect traffic flows on and approaching the ring road with a risk of increased congestion at these locations.

Forecast changes in volume over capacity on roads in Oxford were reviewed in the Do Minimum and TF1 scenarios across the different time periods modelled (AM, Interpeak and PM peak hours). The review showed that most roads in the city are forecast to operate within capacity (85% or less) in both scenarios and across all time periods. However, given the model is strategic it is not able to pick up all sources of reduced capacity such as traffic allowed to enter slow moving main roads from side roads, bus stops, and as a result of pedestrian and cycle activity including crossings.

Notwithstanding the above, as a result of the reduction in traffic flows, the percentage of capacity used on roads reduces with the traffic filters within and on the approaches to the city centre. Journey times will also reduce at these locations as a result of the scheme as confirmed by the separate analysis of bus journey times reported in Section 4.6.

The changes in actual travel behaviour will be closely monitored following introduction of the filters, and changes can be made if the objectives of the scheme are not being achieved.

4.6. Impact on Bus Demand and Performance

A key objective of traffic filters is to reduce congestion in the city centre and on key bus radials to help improve bus journey times and journey time reliability. The efficiency savings that improved journey times will deliver will help support the introduction of new bus services, including the indicative 'Eastern Arc' route described in paragraph 2.3.6, i.e. the number of buses 'saved' on existing routes can be re-deployed to support new services. In essence, the journey time savings will allow the 'Do Minimum' bus fleet to operate more routes or services without a corresponding impact on bus operating costs.

Overall, the journey time reduction within the inner sections of the city, where traffic flows reduce significantly, is expected to be around 15% in the AM and PM peak periods, and around half that level in the inter-peak (when congestion levels ore typically lower). This equates to an average journey time reduction of around 10% over the day, as a result of traffic filters.

The estimated reduction in journey time has been informed by analysis examining the change in observed journey times between corresponding pre (Feb 2020) and mid-pandemic (Feb 2021) months. The level of observed traffic reduction, based on OCC traffic count data, between February 2020 and 2021 was of a similar order of magnitude compared to estimated traffic reductions from the transport modelling. While the cause of the reduced traffic is clearly different (the observed being a result of Government restrictions, whereas the forecast impacts result from the traffic filters), the similar scale of traffic reduction provides a reasonable basis upon which the expected impacts on bus journey times can be inferred.

These assumed reductions in journey times have informed the forecasts of bus demand. However, there are other factors that are not modelled which would be expected to have an additional positive impact on bus demand. First, the modelling does not capture bus reliability benefits –the modelling reflects only ‘average’ journey times whereas for many bus users the unreliability of journey times is a key issue, and one directly caused by the variable impact of traffic congestion. Traffic filters will reduce both average journey times and journey time variability. Second, the traffic filters will enable the implementation of a new fleet of zero-emission buses. These new buses will be more modern, electrically powered and have many quality features that will make them more attractive than the existing vehicle fleet. These benefits are also not reflected in the transport modelling. For the reasons above the forecast increase in bus patronage, based on the transport modelling alone, is likely to be understated.

4.7. Impact on P&R Demand and Performance/ Capacity

Park and Ride has a vital role to play in providing a viable and attractive alternative to car users, for whom accessing the city centre and other parts of the city may require longer routing with traffic filters in place.

Overall modelled P&R demand is forecast to increase by around 6% as a result of traffic filters, and the improvement in journey times and service improvements to buses that this will deliver. However, the same factors as described under bus impacts will serve to understate the potential increase in P&R demand as a result of the traffic filters.

As a result of the pandemic and the lasting behavioural impacts (e.g. more home working) P&R demand remains significantly below the levels seen pre-pandemic. The lower bus and P&R demand post-pandemic threatens the viability of the overall commercial bus network and addressing the decline in bus demand (as well as improving bus journey times) are the two key elements towards the objective to tackle the decline in the post-COVID bus network. The increase in P&R as a result of traffic filters will help ameliorate the negative impact that the pandemic has had on P&R demand.

The reduction in P&R demand post-pandemic does, however, means that there is sufficient P&R capacity across the existing strategic P&R sites (and the planned 850 capacity site at Eynsham) to comfortably accommodate the forecast increase in P&R demand from traffic filters and wider policy initiatives.

4.8. Impact on Rail Demand and Performance

The is no difference to the rail network between the Do Minimum and TF1 scenarios. However, traffic filters will have a positive impact on rail demand, as some car trips (those unable to travel through filters for specific movements) will be attracted to rail.

While the rail leg of any journey will be unaffected by the traffic filters, any 'leg' of a trip undertaken by bus, walk or cycle will be more attractive as a result of the reduction in traffic levels in the city centre and inner parts of the city. The traffic filters will therefore serve to make rail more attractive overall.

4.9. Impact on Walking & Cycling

Oxford has among the highest cycle mode shares of any UK city. In 2011 the cycle mode share of journeys to work within the district was 23.8%, similar to the level for waking (23.6%). Its size, demographic profile and topography make the city and its near hinterland inherently attractive for cyclists.

The county has an objective to increase cycle usage by at least 60%, to support its wider objectives around supporting healthier lifestyles and its transport objectives to facilitate more efficient management of the network by encouraging more people to travel by sustainable modes which make more effective use of limited road capacity.

However, traffic in the city and in particular the city centre and inner radials make cycling less enjoyable for current cyclists and serves as a deterrent to use for many others – in particular more vulnerable users – for whom cycling would otherwise be a viable and attractive option.

Traffic filters would serve to significantly reduce traffic levels in the city, and hence improve the quality of environment and safety (real and perceived) that will, in its own terms, encourage increased cycle demand.

The traffic filters will also require existing private car trips (those not exempt or using a resident day pass) to consider alternatives. For many, this will involve re-routing but the improvement in the cycling environment will encourage others to transfer from car to cycle.

The impact of traffic filters on cycling has been modelled through the methodology based on the DfT's TAG Unit A5.1 Active Mode Appraisal[4], which summarises the possible approaches to forecast demand for new cycling and walking facilities outside of a formal model scenario. The approach adopted for this exercise was based on that employed for previous studies, including the A40 Corridor Business Case which was approved and funded by DfT.

4 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/712970/tag-unit-a5-1-active-mode-appraisal-may-2018.pdf

The disaggregated mode choice model approach was used to forecast changes in the attractiveness of cycling trips, resulting from improvements in cycle provision within Oxford as a result of filters[5]. Filters will deliver transformation in the attractiveness and quality of cycling in Oxford, through significant reductions in traffic, reduced collision risk (and increases perception of safety) and improved air quality. This will benefit existing cycle users, which represent around a quarter of all trips within the city.

The model applies changes in the generalised utility of cycling and assumes that the utility of all modes except cycling remains unchanged. The approach was used to forecast the transfer of cycle trips from car, based on the 'do something' car demand matrix from the OSM model (i.e. after other behavioural responses, such as mode shift to bus, had been accounted for).

The traffic filters will have a similar effect on the attractiveness of walking, whereby people's experience of Oxford's historic and attractive city centre environment, and those of local/ district centres, is undermined by the impact of traffic and its pollution. Walking will also be a viable behavioural response to traffic filters, though typically for shorter-distance trips than cycling. Traffic filters would transform the attractiveness and quality of the urban environment for pedestrians in Oxford.

For the transfer to walking, only trips of less than 5 miles were considered, with lower proportions of transfer with increased journey length. The overall impact of the estimate is to reduce car trips with an origin and/or destination within Oxford city by about 5% as a result of transfer to cycling, and a further 2% as a result of transfer to walking.

Based on the approach above we estimate that the potential increase in walk and cycle demand of just under 20,000 trips per 12-hour day (as set out in Table 4-1) which, if the existing cycle and walk mode share for all trips was at its 2011 level (each accounting for just under 24% of trips), would represent an increase in combined cycle and walk mode share of around 10%.

Within this, the expected transfer to cycle as a 'main mode' would be higher in absolute and proportionate terms. While the estimated increase in pedestrian usage as a 'main mode' is correspondingly lower, the estimate only takes account to existing car trips that are estimated to 'transfer' to walk. The enhancement of the city centre environment, combined with improved accessibility by public transport and cycle, will make the city a more attractive location for many.

[5] The TAG 5.1 approach is based on the impact an assumed enhancement in cycle infrastructure provision could have on cycle usage. TAG does not have an equivalent approach to specifically look at cycle benefits that accrue from large-scale reduction in traffic. The TAG approach has therefore been used as a reasonable proxy for the scale of benefits that infrastructure enhancement could provide.

Appendix A. Oxford Traffic Filters Options

Introduction

This annex provides a summary of the traffic filter options considered and their potential effects based on transport modelling using the Oxfordshire Strategic Transport Model (OSM).

The Local Transport and Connectivity Plan (LTCP) adopted earlier this year outlines a clear long-term vision for travel and transport in the county. The vision is ambitious, and to achieve it requires walking, cycling and public transport to become the natural first choice whilst car travel needs to reduce.

The introduction of traffic filters is seen as an important part of this vision because their purpose is to change how people travel – specifically to make walking, cycling and public transport more attractive relative to car travel, particularly for journeys within the city, and therefore reduce car use overall. This will help to:

- Make bus journeys faster
- Increase bus and Park and Ride use
- Enable new and improved bus routes
- Reduce accidents
- Improve air quality
- Increase walking and cycling
- Support investment in modern buses

Transport Modelling Assumptions

The transport model has been used to produce forecasts in 2024 for a Do Minimum (without traffic filters) and several Do Something scenarios (with traffic filters). The transport model represents AM peak and PM peak hours and an average inter-peak hour during an average weekday, and has not been used to forecast travel behaviour during weekends. The assumptions adopted were (including for all Do Something scenarios):

Do-Minimum Assumptions

- 2024 Forecast Year
- Traffic growth based on NTEM 7.2 (trip forecasts based on DfT's national model) outside Oxford, with no traffic growth assumed in Oxford city between 2018 and 2024
- East Oxford and Cowley Low Traffic Neighbourhoods in place
- No workplace parking levy or zero emission zone in place
- Committed transport schemes including A40 integrated bus lane and Eynsham Park & Ride and associated bus service improvements from the new Park & Ride to Oxford's Eastern Arc

Do Something Assumptions

As Do Minimum plus:

- Woodstock Rd southbound bus lane replaced by new northbound bus lane
- Additional Eastern Arc and west to north Oxford bus services
- 10% bus journey time reduction in Oxford city
- Estimate of transfers to cycling
- Estimate of transfers to walking
- The following traffic filter exemptions and permits were assumed (although not all could be modelled):
  - Buses
  - Coaches
  - Taxis
  - Private hire vehicles
  - Mopeds
  - Motorbikes
  - Vans
  - HGVs
  - Special vehicles such as emergency services
  - Blue badge holders (either driving the car or being driven in the car) and disabled tax class vehicles
  - Non-professional carers (in receipt of carer's allowance)
  - Professional health and care workers (for operational journeys, not commuting)
  - Community transport vehicles
  - Those in receipt of mobility-related benefits
  - Those in receipt of direct travel payments
  - Businesses within the permit area using a private car as a goods vehicle

Traffic Filters Options

Table A1 below provides a summary of the different traffic filters options considered and main differences between these options in terms of the location and timing of traffic filter operation and whether resident day permits were assumed or not. All other assumptions, as set out above, remained the same for all options.

Table A1: Do Something Options

Option Number	Traffic Filter Locations	Traffic Filter Timing	Resident day permits
Option 1 (preferred option for consultation)	Thames Street Hythe Bridge Street St Cross Road St Clements Marston Ferry Road Hollow Way	7am to 7pm	Yes (100 day passes per vehicle per year)
Option 2	Thames Street Hythe Bridge Street St Cross Road St Clements	7am to 7pm	Yes (100 day passes per vehicle per year)
Option 3	Thames Street Hythe Bridge Street St Cross Road St Clements Marston Ferry Road Hollow Way	Morning and evening peak period operation only	No
Option 4	Thames Street Hythe Bridge Street St Cross Road St Clements Marston Ferry Road Hollow Way	7am to 7pm	No
Option 5	Thames Street Hythe Bridge Street St Cross Road St Clements Marston Ferry Road Hollow Way	7am to 7pm	All residents allowed to pass through the filters at all times

Option Number	Traffic Filter Locations	Traffic Filter Timing	Resident day permits
Option 6	Thames Street Hythe Bridge Street St Cross Road St Clements Marston Ferry Road Hollow Way	All 7am to 7pm except for Marston Ferry Road and Hollow Way which are peak period operation only	Yes (100 day passes per vehicle per year)

Different Effects of Traffic Filter Options

Changes in Traffic Flows

Tables A2 and A3 show a summary of forecast changes in total car traffic at different areas within Oxford city for Options 1 to 6, for the AM and Inter Peak periods respectively.

Table A2: Total Changes in Car Traffic in Oxford City – AM Peak

Area	Option 1 - Preferred option for consultation	Option 2 - Four filters (No Marston Ferry Road or Hollow Way)	Option 3 - Six filters peak period only, no day passes	Option 4 - Six filters, no resident day passes	Option 5 - Six filters, all residents exempt	Option 6 – Six filters Marston Ferry Road & Hollow Way Peak periods only, resident day passes
Inside city centre	-51%	-52%	-74%	-74%	-21%	-51%
City centre boundary	-43%	-39%	-61%	-60%	-20%	-43%
Within Ring Road boundary	-5%	-7%	-4%	-3%	-8%	-6%

Area	Option 1 - Preferred option for consultation	Option 2 - Four filters (No Marston Ferry Road or Hollow Way)	Option 3 - Six filters peak period only, no day passes	Option 4 - Six filters, no resident day passes	Option 5 - Six filters, all residents exempt	Option 6 – Six filters Marston Ferry Road & Hollow Way Peak periods only, resident day passes
Marston Ferry Road	-69%	+17%	-91%	-91%	-23%	-69%
Hollow Way	-66%	+2%	-89%	-89%	-20%	-67%

Table A3: Total Changes in Car Traffic in Oxford City – Inter Peak

Area	Option 1 - Preferred option for consultation	Option 2 - Four filters (No Marston Ferry Road or Hollow Way)	Option 3 - Six filters peak period only, no day passes	Option 4 - Six filters, no resident day passes	Option 5 - Six filters, all residents exempt	Option 6 – Six filters Marston Ferry Road & Hollow Way Peak periods only, resident day passes
Inside city centre	-54%	-57%	-4%	-65%	-37%	-55%
City centre boundary	-37%	-37%	-2%	-47%	-25%	-36%
Within Ring Road boundary	-1%	+1%	+4%	0%	-2%	-1%

Area	Option 1 - Preferred option for consultation	Option 2 - Four filters (No Marston Ferry Road or Hollow Way)	Option 3 - Six filters peak period only, no day passes	Option 4 - Six filters, no resident day passes	Option 5 - Six filters, all residents exempt	Option 6 – Six filters Marston Ferry Road & Hollow Way Peak periods only, resident day passes
Marston Ferry Road	-72%	+7%	-10%	-91%	-14%	+5%
Hollow Way	-76%	+9%	-7%	-90%	-13%	+10%

Transport modelling confirms that Options 1 and 2 would have very similar effects in terms of significant traffic reductions in the city centre; this is to be expected given both options include filters on Hythe Bridge Street, Thames Street and St Cross Road – and with these operating at the same time (all day) and with resident permits in place.

Option 2 modelling shows an increase in eastbound Marston Ferry Road traffic compared with the Do Minimum and during all periods assessed (morning, inter peak and evening peak). Similarly, traffic levels on Hollow Way are also forecast to increase albeit more modestly. Increases in these and other nearby locations would prevent a reduction in bus journey times to the 'Eastern Arc' (undermining efforts to improve bus services in the area) and inhibit re-allocation of road space to pedestrians, cyclists and buses – including at the junction of Marston Ferry Road/Banbury Road and Moreton Road. The results therefore demonstrate the need for all six traffic filters to achieve the project objectives.

Of all options considered, Options 3 and 4 are forecast to have the greatest impact in terms of traffic reductions in the city centre, especially during the morning and evening peaks. Again, this is to be expected as both options do not include resident day permits, so less traffic can pass through the filters.

Option 3 modelling forecasts traffic levels in the inter-peak period similar to the Do Minimum because all filters would be open to all traffic at this time. As a significant traffic reduction on roads is required, maintaining the status quo, or even a modest reduction, would not be sufficient to deliver bus journey time improvements and enable re-allocation of road space.

The results therefore demonstrate the need for all traffic filters to operate throughout the day. This is further supported by the comparison between morning, inter peak and evening peak traffic levels during a typical weekday in June 2022 on various roads where traffic counters are situated within the city, as shown in Table A4.

Table A4: Comparison of Inter Peak with Peak Traffic Flows (Weekday)

Traffic Count Site	AM peak*	Inter Peak*	PM Peak*	Interpeak as % of AM Peak	Interpeak as % of PM Peak
Hythe Bridge Street	952	962	964	101%	100%
Osney Bridge	950	1079	1042	114%	104%
Folly Bridge	831	951	1027	115%	93%
Windmill Road	650	636	677	98%	94%
Magdalen Bridge	832	865	911	104%	95%
Marston Ferry Road	741	714	702	96%	102%

*Average Hourly Traffic Flow (2-Way), June 2022

Table A4 confirms that achieving no traffic reduction during the weekday inter-peaks would limit the potential for major road space reallocation or junction capacity reductions/reallocations, because the current capacity (or close to it) would still be needed during the inter-peaks to avoid creating congestion.

Under Option 4, significant traffic reductions would be maintained even during the inter-peak with filters operating all day (7am to 7pm). However, this option does not include resident day passes which are proposed to maintain some ‘essential’ car access for residents most affected by the filters. Also, day passes are a more general exemption that mitigates the impact on some Protected Characteristic Groups (Disability and Age in particular).

Of all options considered, Option 5 would have the least impact in terms of traffic reductions in the city centre (and elsewhere). This is not unexpected given all residents are assumed to be exempt from the filters. Again, as a significant reduction in traffic is required to achieve the project objectives, this option was rejected.

Option 6, all six filters and resident day passes, but with Marston Ferry Road and Hollow Way only operating during the morning and evening peaks, forecasts an increase on both these links during the inter-peak period and because of the effect of other traffic filters displacing traffic to these roads. Again, these traffic increases would undermine project objectives by preventing a reduction in bus journey times to the ‘Eastern Arc’ and limiting re-allocation of road space to pedestrians, cyclists and buses.

All options have similar effects on the ring road and approaches to the ring road from within the city.